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Nutritional Adequacy, Diversity and Choice Among Primary School Children

Policy and Practice in India

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The actual implementation of the study was a team effort; over time several team members joined the team, while some left it for various reasons. We would particularly like to acknowledge Professor Shubhada Kanani, from the MS University, Baroda, who (as visiting faculty at Azim Premji University) was instrumental in developing the study tools and training of the first field team. Along with her were Kalyani Subbiah and Rajveer Sangha, who contributed significantly in the early phase of data collection. Later, the management of the project was taken over by Nilanjan Bhor; and he along with the team at GRAAM (Mysuru) completed the difficult task of collecting, cleaning, organizing, and completing the initial analysis of the data collected from the tribal areas of HD Kote, Mysuru. Here we would also like to thank Latha N, who provided invaluable support in the field, in all three study locations. Her knowledge of Kannada, as well as her ability to establish an easy rapport with the community, made her the natural choice for conducting and transcribing the Focus Group Discussions and interviews, both of which have added rich qualitative insights to our work. Suraj Parab led the data analysis and helped

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Shreelata Rao Seshadri, Ph.D.
Jyoti Ramakrishna, MD, MPH

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Abbreviations

ANM	Auxiliary Nurse Mid-wife
APL	Above Poverty Line
ASHA	Accredited Social Health Activist
AWC	Anganwadi Center
AWW	Anganwadi Worker
BMI	Body Mass Index
BPL	Below Poverty Line
CDC	Centers for Disease Control
CED	Chronic Energy Deficiency
CSE	Center for Science and Environment
DLHS	District Level Household and Facility Survey
EAG	Extended Action Group
ECD	Early Childhood Development
EFA	Education for All
FFQ	Food Frequency Questionnaire
FGD	Focus Group Discussion
FRESH	Focusing Resources on Effective School Health
GoI	Government of India
HDI	Human Development Index
IAP	Indian Academy of Pediatrics
ICDS	Integrated Child Development Scheme
ICMR	Indian Council of Medical Research
IDI	In-Depth Interview
IFPRI	International Food Policy Research Institute
IMR	Infant Mortality Rate
IOTF	International Obesity Task Force
ISKCON	International Society for Krishna Consciousness
Kg	Kilogramme
LEB	Life Expectancy at Birth
LMS	Lambda-Mu-Sigma Method

LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goal
MDMS/MDM	Mid-Day Meal Scheme/Programme
MMR	Maternal Mortality Ratio
MNREGS	Mahatma Gandhi Rural Employment Guarantee Scheme
MoHFW	Ministry of Health and Family Welfare
MYRADA	Mysore Resettlement and Development Agency
NCHS	National Center for Health Statistics
NFHS	National Family Health Survey
NGO	Non-Governmental Organisation
NHANES	National Health, Nutrition Examination Survey
NHES	National Health Examination Survey
NHM	National Health Mission
NIN	National Institute of Nutrition
NNMB	National Nutrition Monitoring Bureau
NOBC	Non-Backward Caste
Non-ST (NST)	Non-Scheduled Tribe
NPAN	National Plan of Action on Nutrition
NRHM	National Rural Health Mission
NSS (O)	National Sample Survey (Organisation)
OBC	Other Backward Caste
PDS	Public Distribution System
PEM	Protein Energy Malnutrition
RBSK	Rashtriya Bal Swasthya Karyakram
RDA	Recommended Dietary Allowances
RSoC	Rapid Survey on Children
RUTF	Ready to Eat Foods
SAC	Suvarna Arogya Chaitanya
SC	Scheduled Caste
SD	Standard Deviation
SDMC	School Development and Monitoring Committee
SECC	Socio Economic and Caste Census
SES	Socio-Economic Status
SHG	Self-Help Group
SHP	School Health Programme
SSA	Sarva Shisksha Abhiyan
ST	Scheduled Tribe
TFR	Total Fertility Rate
TPDS	Targeted Public Distribution System
TV	Television
UK	United Kingdom
UEE	Universalization of Elementary Education
UNDP	United Nations Development Programme
UNESCO	United Nation Educational Scientific and Cultural Organization

UNICEF	United Nations Children's Fund (formerly United Nations International Children's Emergency Fund)
US/USA	United States of America
WHO	World Health Organization

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Chapter 1
Nutritional Status of School-Going Children: What Do We Know?

Abstract India continues to face an epidemic of malnutrition: data from national surveys are a constant reminder of the unacceptably high levels of underweight, stunting, and wasting among children aged 0–5 years of age. Despite the well-known impacts of malnutrition on the cognitive, psycho-motor and social development of children, the tracking and monitoring of common indicators of malnutrition has been done only intermittently, and has been confined to the under 5-year age group. Information on the nutritional status of older children of primary school-going age is dependent on data generated by small research studies and provides a patchy picture of the nutritional needs of children in a critical age group, where nutritional deficits might have a seriously deleterious impact on their ability to learn and benefit from schooling. This book arose out of a primary research study conducted in three districts of Karnataka, India: Do we know what they eat, and why? A Study on Dietary Adequacy and Impact of Cultural Beliefs on Dietary Choice of Primary School Children in Rural Karnataka, India. We bring together the available evidence in the literature, along with additional information and insights gleaned from the study, to analyze the problem of nutritional deficiencies among school-going children. The book explores some of the complexities of measuring and assessing both nutritional deficiency and dietary choice, and offers insights on how some of the complexities can be resolved in the Indian context. The book ends by making recommendations to address the challenges of enhancing nutritional outcomes for school-going children at various levels—the family, school, community, programs, and policies - to confront this serious issue.

1.1 Setting the Context

Anthropometric indicators of malnutrition among adults and children in India are amongst the worst in the world (Deaton and Dreze 2008). National Family Health Survey, Round 4 (NFHS-4 2015–2016) data tell us that about 31% of children <5 years of age are chronically malnourished—as a result of which they are too short for their age or stunted; 20% of children <5 years of age are wasted, or too thin for

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their height; and about 30% are underweight, or too thin for their age. 55.9% of children 6–59 months old are anemic. The reality that such a large proportion of children in this country are malnourished is a matter that demands an urgent response. The devastating impact of malnutrition and undernutrition on the child's (and later the adult's) ability to reach their full potential is well documented. Developing effective strategies to address this problem requires action at several levels: policy-makers need to design their large-scale interventions to reduce child and adult malnutrition better, based on robust empirical evidence of what works; systems, particularly the education and health systems, need to put in place stronger mechanisms to monitor and support the nutritional levels of children at risk; and communities and households need to understand the importance of using available resources to provide the best possible dietary choices for a growing child.

Low weight-for-age has been found to raise the relative risk of dying due to several disease conditions, and a significant proportion of mortality among young children is due to malnutrition (Bryce et al. 2005). The long-term physiological impacts of childhood malnutrition range from changes in the autonomic nervous system to higher risk of hypertension and insulin-resistance in adulthood; it can adversely impact brain development, cognitive ability, and school achievement.

Nutritional parameters in India have shown proportionally little improvement in spite of rising economic indicators over the years and the execution of several government policies, programs, and schemes such as the National Right to Food Security Act, 2013 (GoI 2013) addressing chronic hunger particularly among the most disadvantaged; the Integrated Child Development Services program aimed at improving nutritional outcomes for children in the age group 0–3 years as well as adolescent girls and pregnant women; the Mid-Day Meal Scheme (MDMS) aiming at improving the nutritional and health status of children in schools; the Targeted Public Distribution System, the Total Sanitation Campaign, and other investments like the National Rural Employment Guarantee Scheme for providing livelihood security to people in rural areas. India ranks 68th out of 109 countries on the Global Food Security Index (The Economist Intelligence Unit 2015), was not successful in meeting the Millennium Development Goal (MDG) for nutrition, and has shown poor progress on nutritional indicators between the last three rounds of the National Family Health Survey (NFHS 1998–1999; 2005–2006; 2015–2016).

Malnutrition in India is a major public health challenge, and investing in early nutrition—from infancy through adolescence—is thus an overwhelmingly sound move yielding staggering returns. This book stems from a 3-year long research project in rural areas of Southern India to study this crucial issue and address the detrimental effects of malnutrition on children's health and learning. The book opens by presenting one of the gravest health-related issues that confronts children across the globe, particularly in India: *Malnutrition*. It presents the harsh reality of childhood malnutrition in India, and explores its effects on children's lives, their education, growth, and development. The focus is particularly on malnutrition among primary school children; and its relationship to their age, gender, and other socioeconomic characteristics.

Most available data pertain to children under 3 or under 5 years of age. Some data is available on BMI and anemia in adolescent girls. There is a big slice of the childhood pie that falls under the radar. What is the nutritional status of school-age children? What happens after they turn 5 years old? This question is even more important in remote and marginalized populations, where much less is known. We know that these children are the economic powerhouse of tomorrow, since the link between nutritional status and education, as well as a country's economic future, is well established.

The book sheds light on the mismatch between various measures both at policy and program levels and their impact on the status and prevalence of malnutrition; and focuses beyond the "how" and "why" of policy to the "how" and "why" of malnutrition. Setting this context, the introductory chapter of the book highlights the importance of working on this serious topic as researchers and practitioners; and the framework within which the authors of the book have structured the available evidence on nutrition of primary school children.

1.2 An Overview of Nutritional Status of Children in India

Much has been said about the situation regarding childhood malnutrition in India, largely referring to data about children in the age group 0–5 years. Suffice it to say that despite the progress over the last few decades, children still fall short on all measures—stunting, underweight, wasting, anemia. The available data for nutritional outcomes of children under 5 years of age show that India's performance is among the worst in the world. Given our large population, in sheer numbers the statistics are staggering:

- The prevalence of child undernutrition in India is among the highest in the world, nearly double that of Sub-Saharan Africa (Gragnolati et al. 2005).
- In the HDI rankings, India is 130th out of 187 countries (UNDP, Human Development Report 2015).
- For stunting, India was ranked 11th highest out of 136 countries (UNICEF 2008, State of the World's Children 2009).
- The HungaMa (Hunger and Malnutrition) report put out by the Naandi Foundation in December 2011, which surveyed 112 rural districts (including 100 focus districts from the lower end of the index developed for UNICEF, and 20% of children under age 5 in India) determined that 42% of children were underweight, with 59% moderately to severely stunted. There were districts where 60–70% of children were stunted.
- 70% of adolescent girls in India are anemic and half of adolescents are below the normal body mass index (UNICEF, http://unicef.in/Whatwedo/10/Stunting).

- In spite of improvement in economic indicators, there has been slow improvement in nutritional indicators. According to Herklotz (2013)—"there are two prominent trends in India—impressive economic growth and wealth creation, and stagnation in key social indicators, particularly among disadvantaged populations."
- Similarly, the Economist has highlighted the conundrum in India of little improvement in nutritional parameters in spite of improving economic indicators over the years (The Economist).

Table 1.1 shows the nutritional crisis faced by young children in selected states. DLHS four data (2012–2013) shows that even in Kerala, a state celebrated for its social sector outcomes, including in health and education, almost one in four children is stunted or wasted, and one in five is underweight. In West Bengal, more than a third of the children are stunted and underweight and about a third are wasted. Even the southern states, which are generally considered to be better performing in terms of social indicators as compared to the Extended Action Group (EAG) of states (Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand, and Uttar Pradesh), show alarming rates of malnutrition. The figures for rural children are worse than for urban children in most states, although not by much.

There has been a change in the decadal rates of underweight between 2002–2004 and 2012–2013; however, the rate of decline is slow. An annual decline of 1.7% is seen in Andhra Pradesh, Karnataka, and Kerala; however, states such as West Bengal, Maharashtra, and Tamil Nadu have declined at 1% and less.

1.3 Nutrition of School-Age Children in India

Little is known about the status of nutrition among primary school children in India. Even less is published on this subject in poor and marginalized populations. When our study in 2013–2015 in the remote areas of Karnataka led us into this relatively uncharted territory, we were sufficiently surprised by our results to merit an in-depth review leading to the publication of this book.

Most studies have been conducted on infants and children up to the age of three (the first 1000 days), some up to age 5. As an initial approach to the alarming problem of childhood malnutrition, it makes unarguable sense to try and optimize the growth and development of the mind and body in the early formative period. Consequently, almost all of the interventions are aimed at pregnant mothers, infants, children under age 3, and up to age 5. This focus has been justified in that these are the most vulnerable times to intervene to prevent low birth weight, prematurity, and morbidity/mortality from malnutrition-related causes. On a global scale, such programs have yielded excellent results although in India we have succeeded only partially and more needs to be done to catch up with the success

Table 1.1 Change in nutritional status of children 2002–2012

States	DLHS 2 (2002–2004)	DLHS 4 (2012–2013)						% Change DLHS 2 to DLHS 4	Annual % change DLHS 2 to DLHS 4
Nutritional status	Underweight	Stunted		Wasted		Underweight		Underweight	
	Total	Total	Rural	Total	Rural	Total	Rural	Total	
West Bengal	44.9	37.4	39.7	28.2	29.9	37.4	41.7	−7.5	−0.8
Maharashtra	47.7	30	30	34.1	34.7	38.7	39.9	−9.0	−1.0
Andhra Pradesh	42.3	27.7	28.7	23.7	23.4	27.3	28.2	−15.0	−1.7
Karnataka	44.8	29.9	29.1	26.4	27	29.7	29.6	−15.1	−1.7
Kerala	35.8	22.7	24.1	24.1	22.3	20.9	22.6	−14.9	−1.7
Tamil Nadu	38.3	27.3	30.1	28.3	29	32.5	35.1	−5.8	−0.6
Telangana	–	23.7	20.8	29.5	32	29.5	31.7	–	–
India	49.2	–	–	–	–	–	–	–	–

DLHS 2 figures are for children aged 0–71 months and DLHS 4 under 5 years (DLHS 2 based on International Reference Population Median and DLHS 4 based on WHO standards)

– Data not available

Ref: DLHS (2002–2003) and DLHS (2012–2013)

seen elsewhere. India did not deliver on the original Millennium Development Goals (MDGs) for malnutrition measures, and needs to do a lot more to meet the Sustainable Development Goals by 2030 (Patwari 2013).

1.3.1 Prevalence of Malnutrition Among Primary School Children

In India, the subject of nutrition in school-age children has been explored by a few researchers (Chap. 2 provides an exhaustive list of the most recent literature on the issues). Overall, the data on the nutritional status of primary school children reveals a disappointing picture. Singh (2014) studied primary school children living in the slums of Hyderabad, and found about 30% of children 6–11 years old were underweight and about 20% were stunted. Father's literacy was found to be significantly correlated with the child's malnutrition. Another study in Uttar Pradesh (Singh et al. 2014) found high levels of underweight among boys and girls 5–18 years old at 45 and 37% respectively. About 26% of the boys and 21% of the girls were also found to be stunted. The same study found high levels of morbidity among the same cohort of children, in terms of upper respiratory tract infections, repeated episodes of diarrhea and scabies. Srivastava et al. (2012) studied children 5–13 years of age in the urban slums of Bareilly and found high levels of both stunting and underweight among children 11–13; and high levels of wasting among children 5–7 years old. The impact of malnutrition at this age on cognitive learning is quite severe (Tarleton et al. 2006).

The importance of adequate nutrition among school-going children cannot be emphasized enough. Low weight-for-age has been found to raise the relative risk of dying due to several disease conditions, and a significant proportion of deaths among young children can be attributed to malnutrition (Caulfield et al. 2004; Black et al. 2003). A World Health Organization (WHO) report by Bryce et al. (2005) found undernutrition to be the underlying cause of 53% of all deaths worldwide of children under 5 years of age. The long-term physiological impacts of childhood malnutrition are well known: they range from changes in the autonomic nervous system to higher risk of hypertension and insulin-resistance in adulthood. There is also evidence that it can adversely impact brain development, cognitive ability, and school achievement (Martins et al. 2011). Murphy et al. (1998) established that school hunger and food insufficiency among children <12 years of age in inner-city schools in the US resulted in poor behavioral and academic functioning. Szalavitz (2013) similarly reported that a study in Barbados found that adults who had experienced childhood hunger tended to be more anxious, less sociable, less interested in new experiences, and more hostile than those who were well-nourished throughout childhood.

Sridhar (2008) points to short- and long-term pathways by which ill-health can impact cognitive development and school participation. There is evidence that in

the short-term, poor health can lead to poor participation, irregular attendance, and high rates of school dropout. Poor health and nutrition impacts school children in several important ways: first, evidence shows that parasitic infections and repeated bouts of illness are major reasons for school absenteeism. Miguel and Kramer (2004) found that deworming of children in Kenya improved school attendance; second, poor nutrition in childhood can have a severe impact on the child's physical growth, leading to stunting, low-energy levels, and low immunity which leaves children vulnerable to frequent bouts of illness. For example, iodine deficiency is the largest contributor to brain damage and mental retardation in the early years, and Vitamin A deficiency contributes to measles morbidity and mortality as well as frequent diarrheal disease and even blindness (Sommer and West 1996); and finally, poor nutrition in childhood has a severe impact on the ability to learn. Iron deficiency, for example, leads to cognitive impairment (Grantham-McGregor and Ani 2001). In addition, there is an inter-twining of biological and cultural forces: so, for example, participation of girls in education is often affected by the taboos associated with menstruation; menstruation could exacerbate iron deficiency anemia which impacts learning outcomes, and may even signal early marriage which spells the end of schooling for most girls.

In the long-term, promoting good health among children can significantly impact their future welfare. Poor health and nutrition can be the result of poverty and poor socioeconomic status: evidence from China, for example, shows how the nutritional environment in the home is associated with household socioeconomic status, which predicts children's school performance (Kim et al. 2004). It is a significant mediator of poverty effects on schooling for children in early primary grades. The reverse is also true: Schultz (2002) found that each centimeter gained in height due to improved nutrition for children in Ghana and Brazil lead to a wage differential as adults of 8–10%. The impact of repeated bouts of malaria as a child can have an even more dramatic effect: a multi-country study in USA, Mexico, Colombia, and Brazil found that the wage differential as adults for children protected from malaria is as high as 50% (Bleakley 2007). This finding has been confirmed in a study conducted in India as well (Cutler et al. 2010). The impact of childhood anemia on future productivity has been estimated in terms of income foregone at between 2% in Honduras and almost 8% in Bangladesh (Horton and Ross 2003). Thus, there are significant short- and long-term gains of ensuring good health of school-going children: it enhances the chances of their staying in school, it improves their chances of learning and retaining what they have learned, and it improves their life chances through externalities such as increased height.

1.4 The Need for Action

2016–2025 has been named the United Nations Decade of Action on Nutrition, and the latest Global Nutrition report (IFPRI 2016) says we need to do a lot more to address the issue of childhood malnutrition. What is required is a call for action, and

a change in the "business as usual" approach. There is a need for a fresh framework within which to contextualize childhood malnutrition, particularly among children in primary schools. There is enough evidence to show that malnutrition in early childhood extending into the school years leads to poor school performance and ability to learn. The growth and development of the school-age child is of critical importance. Primary school is a time when there is great potential for both physical and mental growth; and poor nutrition at this age can lead to low school enrolment, high absenteeism, early dropout, and unsatisfactory classroom performance.

The big question we pose is: what happens to children when they turn 5? They are still growing, still developing, and most importantly, they are learning. What happens between the age of 5 and adolescence lays the foundation for the adults that will form the socioeconomic backbone of our country. Yet, the available body of knowledge is scattered and provides a patchy picture of the current status of the health and nutrition of the school-going child.

Some common themes begin to emerge from our analysis of the available data and recent literature on school-age children in India:

- The first issue is that of the sheer numbers and percentages of underweight and stunting in school-age children. No matter what methodology is used to measure malnutrition, the number of children of all age groups at risk is unacceptably high.
- The second point we will be making is that as children progress through primary/elementary school, their nutritional status deteriorates. Older children do consistently worse than younger children, and there is an urgent need to understand why.
- Third, this trend seems to magnify further in adolescence, when the dietary deficits and growth concerns become more exaggerated. This is particularly of concern, since breaking the vicious cycle of inter-generational malnutrition requires that adolescent girls, particularly, are healthy and well nourished.
- The last point that surprised us, but has been corroborated by other studies, is that boys in the higher classes in fact are worse than the girls. We will be exploring possible causes for this and the other points above through the course of this book.

1.5 The Book: What It Covers and How It Is Organized

The book analyses the problem of nutritional deficiencies among school-going children with research based evidence, policies and theoretical constructs and makes recommendations at various levels—family, school, community, and policy to address the serious issue. The following chapters bring together an exhaustive review of all the available literature on primary school-going children: their nutritional status as measured by commonly used nutritional indices; the adequacy

and appropriateness of methods being used to measure their nutritional parameters; their access to food and factors that affect their dietary choice; the risks posed by the dislocation of traditional food systems and its impact on vulnerable and marginalized communities; the role of the school and school teachers in shaping nutritional outcomes for school-going children; and policies and programs aimed at supporting childhood nutrition, their successes and limitations. The book ends by offering an alternative framework for addressing the nutritional risks faced by school-going children and makes recommendations for the way forward.

The book could serve as a textbook for those who are looking for a comprehensive introduction to the issues surrounding school-age nutrition. It uses data from our study in the state of Karnataka to illustrate many of the issues that have been troubling those who have been involved in addressing this topic. Importantly, the book hopes to guide and provide new directions for policy, and new insights that will contribute to solving a problem that has persisted despite the best efforts of current policy and programming. With over 300 million children of school-going age in the country, this vexed issue requires an urgent response; both as a human rights issue as well as an investment in the future.

The rest of the book is organized in the following chapters:

Chapter 2: Measuring Child Malnutrition: A Methodological Review of Assessments of Nutritional Status of School-Going Children in India

The second chapter takes a critical look at the different approaches to measuring and studying malnutrition. The issue of measurement takes on a particular salience given the multiple ways that such measures have been used and interpreted in the literature. There have been several recent debates on whether indeed the extent of malnutrition in India is as severe as has been presented by research studies and survey data. Much of this debate revolves around whether the standards being applied are appropriate to the Indian context. This chapter presents an exhaustive review of the most recent literature on measures of malnutrition among school children in India, and critically evaluates the findings based on these measures. It walks the reader through key concepts and commonly used indicators of malnutrition; and traces the history of different globally used nutritional measurement standards, many of which are still in use in both research and practice. By comparing the results of several growth standards using our own dataset, we demonstrate that: (i) malnutrition among school-going children is unacceptably high regardless of which measurement standard is used; (ii) accurate measurement of malnutrition among young children is critical for the creation of high-impact policies and programs; and (iii) it is essential to rationalize the growth reference/standard that is most appropriate in the Indian context and use a uniform measure for estimating child malnutrition, so as to avoid confusion and misunderstanding of the extent of this problem among Indian children.

Chapter 3: Malnutrition among Students in Primary School: A Profile of Government School Students

Some evidence on nutritional status of children in the age group 0–5 is available through large-scale surveys such as the NFHS, albeit not frequently enough. The

recently released NFHS-4 data indicates that there has been a slow decline in the proportion of children (0–3 years) who are underweight and stunted; and a more substantial decline in the proportion of wasting in the same age group. However, the tracking of nutritional status through the childhood years is not systematically undertaken, and evidence on the nutritional status of older children in primary school is thin. This chapter presents the analysis of a large, multidistrict dataset that provides insights into the socioeconomic profile and nutritional status of children who attend government schools in three districts of Karnataka. We first examine the broader district-level context within which the schools are operating, and then look at household characteristics that contribute to nutritional risk and vulnerability of government primary school-going children. This chapter focuses on two central questions: (i) based on this wide recognition of the linkage between poverty, social development, and malnutrition, *does overall development of a region/district predict the level of malnutrition to be found among government school-going children in that region/district?* and (ii) recognizing that district-level indices may not be reflected in the nutritional outcomes of individual children, *does the household profile of children who attend government schools predict the level of malnutrition found among those children?* The chapter then suggests alternative approaches to enhancing the nutritional status of school-going children.

Chapter 4: Vulnerability and Childhood Malnutrition: Narratives from Tribal Households

There is little information on the nutritional outcomes of a particularly neglected group: tribal children in primary schools, in the age group 5–12 years. Tribal children in this age group are highly vulnerable to nutritional deficit, and its impact on their physical and mental growth can be critical to their leading a full and productive life. The chapter examines the food choices made by tribal communities in Karnataka and factors that contribute to these choices. Our data show that there has also been a substantial decrease in the range of different categories of food being consumed by tribal communities. Using the personal accounts of mothers and grandmothers of their changing dietary choices, we paint a picture of what they ate when they were young and what they are eating now; what has sustained and what has been destroyed. The chapter presents a wide range of factors that influence this choice such as changes in agricultural patterns, availability of food through public distribution system, increase in cost of food items, declining range of homemade food, changes in consumption pattern, nature of employment and the eco-system. The chapter argues that a multipronged approach is required to restore traditional food systems: interventions are needed at the policy, program, and household level to establish a comprehensive framework for nutritional support to those most at risk, provide an adequately diversified diet to fulfill nutritional needs, and enable households to access a wholesome diet that respects their dietary traditions.

Chapter 5: How Much Food Is Enough? Food Consumption of School-Going Children

Evidence shows that the food intake of school-going children has changed over time. Linking the trend observed in national level data and other surveys that indicate that despite economic growth and improved incomes, we observe that there has actually been a decline in the overall consumption of food in terms of calories, as well as a decline in the consumption of specific types of foods that are considered essential for the healthy growth and development of the child. How does this vary between different groups of children? Using Food Frequency data collected from the respondents of our study, the chapter compares the actual food intake of different categories of students and measures this against the appropriate Recommended Daily Allowance prescribed by the National Institute of Nutrition. The results are presented in a detailed set of graphs that clearly demonstrate the level of under-consumption of key food groups, disaggregated by age and sex. This chapter: (i) throws light on the particular vulnerability of specific groups of children, given their marginalization in other spheres; and provides evidence for the need to intervene urgently to address the causes of such vulnerabilities; (ii) provides important insights into the methodological complexities of collecting and utilizing food frequency data, and adds to the literature on the challenges of estimating food intake; and (iii) discusses the implications of such analysis for food and nutrition policy, particularly in schools.

Chapter 6: What Do Children Eat in Schools? *Teachers' Account*

Moving beyond households and grandmothers, the next chapter shares accounts of interactions with several teachers of government schools. It explores their perceptions regarding the implementation, benefits, and challenges of the school meal program and other health-related measures being implemented by the government. It presents a detailed analysis of the teachers' understanding of the health and nutrition status of children in their schools and the changes in their food consumption patterns. It also shows the extent to which the teachers show awareness and appreciation of health-related measures in school by relating it with various positive changes in social life such as reduction in child labor. The chapter shows how an integrated curriculum of education, health, and nutrition could be taken up as a route to improve the health and nutritional profile of students and subsequently their academic performance. The school can provide an important locus for providing critical nutritional inputs for the children through improved quality of food provided through the MDM; through proper monitoring of quality and composition of the food, training of cooks in preparing tasty and healthy meals, re-introducing traditional/locally preferred foods such as ragi and jowar, and engaging with the community on promoting healthy eating practices both in school and at home.

Chapter 7: The Government Response

Drawing linkages between multiple dimensions of poverty, socioeconomic status of students attending government schools, and evidence on nutritional outcomes of children, the chapter critically analyzes government interventions in terms of nutritional policies and programs. Examining the evolution, scope, implications,

and impact of programs such as ICDS, MDMS, and PDS, the chapter draws linkages between the accessibility and adequacy of such programs and the implications for the children, their households, and varied stakeholders. Since health and nutrition policies can have far-reaching impacts on the achievement of other social sector goals—for example, Education for All—it is important that the Government rethinks the current approach. Supporting health and nutrition policies and programs for children in the school age can promote equity by helping to level the playing field between the poorest children and their better off counterparts, and in some cases even remediate early deprivation so that children can reach their full potential. In order to succeed, there needs to be genuine convergence between all policies and programs aimed at enhancing health and nutrition outcomes for children; and no matter what the mechanism, a common understanding and mission needs to be evolved that keeps the interests of the child at front and center.

Chapter 8: A Health and Nutrition Framework for Primary Schools: Policy Recommendations

The book concludes by introducing a multidimensional support system, "***a Health and Nutrition Framework***", to enable children especially the poor and the marginalized to grow and develop to their full potential. Going beyond looking at the systemic response, we suggest a framework that puts the child in the middle, and conceptualizes what it would take for a concerted "child-centric" response. While current thinking proposes using the school as the locus of action to redress nutritional deficits among school children, we propose an eco-system approach, bringing together the family, school, the community, policy, and programs at local and national levels.

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Chapter 2
Measuring Child Malnutrition: A Review of Assessment Methods of the Nutritional Status of School-Going Children in India

Abstract This chapter takes a critical look at different approaches to measuring and studying malnutrition. The issue of measurement takes on a particular salience given the multiple ways that such measures have been used and interpreted in the literature. There have been several recent debates on whether indeed the extent of malnutrition in India is as severe as has been presented by research studies and survey data. Much of this debate revolves around whether the standards being applied are appropriate to the Indian context. This chapter presents an exhaustive review of the most recent literature that presents measures of malnutrition among school children in India, and critically evaluates the findings based on these measures. It walks the reader through key concepts and commonly used indicators in the measurement of malnutrition; and traces the history of different globally used nutritional measurement standards, many of which are still in use in both research and practice. By comparing the results of several growth references using our own dataset, we demonstrate that: (i) malnutrition among school-going children is unacceptably high regardless of which measurement standard is used; (ii) accurate measurement of malnutrition by using appropriate nutritional indicators is critical for the creation of high-impact policies and programs; and (iii) it is essential to rationalize the growth reference that is most appropriate in the Indian context and use a uniform measure for estimating child malnutrition, so as to avoid confusion and misunderstanding of the extent of this problem among Indian children.

This chapter has been co-authored based on substantive contributions by Nilanjan Bhor, Research Coordinator, Health, Development and Society Initiative, Azim Premji University and Shreelata Rao Seshadri.

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2.1 Measuring Child Malnutrition: Some Important Concepts

The National Policy for Children 2013 recognized "a child as any person below the age of 18 years." In India, children are categorized into two groups in the context of measuring malnutrition: under 5 years and children aged 5–18 years. National level surveys measure malnutrition among children <5 years of age. Despite acknowledging that there is likely a high prevalence of malnutrition among school-aged children, national level surveys like the National Family Health Survey (NFHS), District Level Household and Facility Survey (DLHS), and the Rapid Survey on Children (RSoC) have failed to capture data on nutritional status of children aged 5–18 years. Currently, there is a growing consensus on the urgency of tackling malnutrition among school-aged children in India and research studies on "nutritional status of school-going children" have been growing in the literature in the past decade (see Annex 2.7).

While there are methodological challenges to constructing growth charts, including having to periodically revise and update them with nationally and internationally representative data, the existing country-specific and international growth charts are valuable tools to assess the nutritional status of children; and to make important policy choices based on the prevalence of malnutrition in the surveyed population. Currently, such growth charts are available for tracking age and sex specific anthropometry for children ranging from 0 to 18 years of age. The following section unpacks and clarifies some key concepts relating to anthropometric measures of children's growth, including (i) the difference between "growth standard" and "growth reference"; (ii) commonly measured nutritional indicators; and (iii) determination of cut-off points in terms of percentile and standard deviation (SD) (also expressed as *z*-score).

2.1.1 Growth Standard Versus Growth Reference: What Is the Difference?

There are two types of growth charts: growth standards and growth references. Growth standards are *prescriptive*; they chart how a population of children should grow to ensure optimal nutrition and optimal health. Growth references, on the other hand, are *descriptive* and are constructed based on measurements taken from a population which is thought to be growing in the best possible state of nutrition and health. They represent how children are actually growing rather than how they should be growing (Khadilkar and Khadilkar 2011).

World Health Organization (WHO) 2006 growth charts for children under 5 years are an example of growth standards. They define how children of the world under the age of 5 years should grow if most of the controllable variables functioned optimally. As opposed to this, Agarwal et al. (2001) data and Indian Growth

Charts by Khadilkar et al. (2009) for affluent children are examples of growth references which describe how children in India were growing at the given time. So while a growth standard maps the growth potential of children of a particular age group if they were to grow optimally, a growth reference maps the actual distribution of growth in the population of interest, which could be used as a comparison to a growth standard (WHO MGRSG 2006).

Growth standards allow for objective comparison. For example, a growth standard such as WHO 2006 allows for comparison between children of all countries, races, and ethnicity. However, for the same reason, such standards could over diagnose underweight and stunting in a large number of apparently normal children (Khadilkar et al. 2010) especially in developing countries such as India.

Growth references are a true representation of the existing growth pattern of children belonging to a particular population; and therefore allow for the study of secular trends in terms of height, weight, and obesity. However, such reference curves need to be regularly updated to stay current with changing growth rates among the reference population; they also run the risk of classifying obesity as normal, given the rising incidence of obesity (Khadilkar and Khadilkar 2011). Growth references could facilitate comparisons between different populations, or describe changes within the same population at different points in time. However, references do not necessarily reflect optimal growth, although they are derived from apparently healthy children (Waterlow 1997).

2.1.2 Nutritional Indicators for School-Aged Children

The four building blocks of anthropometric indices are age, sex, height, and weight. Each variable provides one piece of information about a child; when two or more of these building blocks are used together, they generate an "index" (Cogill 2003). The three specific indicators that are used to measure nutritional imbalance in children are underweight (weight-for-age), stunting (height-for-age), and body mass index (BMI)-for-age (Table 2.1).

Table 2.1 Commonly used nutritional indicators

Index	Outcomes	Indication of growth/nutrition problems
Weight-for-age	Underweight (inadequate weight related to age)	Both chronic and acute malnutrition
Height-for-age	Stunted (inadequate height related to age)	Chronic malnutrition
BMI-for-age	Low-BMI for age or risk of overweight and obese	Low-BMI for age Overweight and obesity

BMI-for-age is widely used to measure malnutrition among school-aged children both in India and internationally, and calculated using the standard formula: weight (kg)/height (m^2). Almost all country-specific and international growth references provides sex and age-specific cut-offs for BMI (Dinsdale et al. 2011). Since both height and weight of children are easy to measure in a field setting, the BMI is perhaps the most appropriate measure for assessing under/overweight in children and adolescents (Malina and Katzmarzyk 1999).

2.1.3 Percentiles and z-Score (or SD Score) in Anthropometry

Anthropometric measures are often expressed in smoothed percentile curves and *z*-scores. According to Wang and Chen (2012), "a percentile is the value of a variable below which a certain percentage of observations (or population) falls, i.e., the percentile refers to the position of an individual on a given reference distribution" (pp. 33). Commonly used percentiles include the 3rd, 5th, 50th (median), 85th, 95th, 97th, and 99th. Individuals below the 3rd and above the 97th percentile are considered to be out of the normal range. The 85th and 95th percentiles indicate overweight and obesity cut-offs (Table 2.2).

Many institutions are now recommending the use of *z*-scores. There are several advantages to this: (i) *z*-scores are calculated on the basis of and reflect the distribution of the reference population (both the mean and the standard deviation); (ii) since they are a standardized measure, *z*-scores can be used to make comparisons across age, sex and anthropometric measure; (iii) *z*-scores can be used as a continuous variable and generate summary statistics such as the mean and SD. *Z*-score values can classify the growth status of children who would fall outside the percentile ranges (WHO 1995). Table 2.3 shows the classification of nutritional status according to SD variation from the normal range.

In this chapter, we examine the implications of using the various growth measurement "standards" or "references" or "classifications" that are available nationally and globally; and their appropriateness to measure the growth of school-aged children. In order to illustrate this, we use the database of height and weight of surveyed children (N = 5340) from the study—'Do we know what they eat and why? A Study on School-level Dietary Adequacy and Impact of Cultural Beliefs on Dietary Choice' collected from government school-going rural children in three districts of Karnataka; Mysuru, Yadgir, and Mandya. Based on our review and analysis of the different methodologies, we end with policy implications for the measurement of malnutrition among school-aged children in India.

Table 2.2 Comparison of percentiles and *Z*-scores

	Percentiles	*Z*-scores
Definition	The percentage of observations (or population) that falls below the value of a variable	The number of standard deviations (SD) away from the mean, when the distribution is normal
Scale	Rank scale	Continuous scale
Strengths	(a) Intuitively more understandable (b) Indicating the expected prevalence	(a) Allowing comparisons across age and sex (b) Able to quantify the extreme values (c) Good for assessing longitudinal changes in growth status
Limitations	(a) Not comparable across different anthropometries (b) Extreme values are lumped to the highest/lowest percentile (c) Not suitable for assessing longitudinal growth status	Difficult to interpret, as compared to percentiles
Under normal distribution, a percentile must correspond to a fixed *Z*-score Following is a list of usually used percentile—*Z*-score conversion values		
	0.2nd (or 0.1st or 1st) 2.3rd (or 3rd) 2.5th 5th 15th 16th (or 15th or 15.9th) 50th (median) 84th (or 85th or 84.1st) 85th 95th 97.5th 97.7th (or 97th) 99.8th (or 99.9th or 99th)	−3 −2 −1.96 −1.64 −1.04 −1 0 +1 +1.04 +1.64 +1.96 +2 +3

Source Wang and Chen (2012)

Table 2.3 SD classification by nutritional indicator

SD classification	Weight-for-age	Height-for-age	BMI-for-age
>+2SD	Overweight		Obese
>+1SD	Normal	Normal	Overweight
−2SD to +1SD	Normal	Normal	Normal
−2 to −3 SD	Moderately underweight	Moderately stunted	Moderately Thin
<−3 SD	Severely underweight	Severely stunting	Severely Thin

2.2 An Overview of Available Measures of Childhood Malnutrition

A review of over 45 papers looking at under and overnutrition among school-going children in India (see Annex 2.1) reveals that there is no standardized methodology for measuring their growth. As there are no country-specific or international "growth standards" for school-aged children, "growth references" are widely used as a standard by comparing the survey population with the reference population. This review picked up 10 such methods that were used to identify nutritional status of children. In the international context, these include National Center for Health Statistics (NCHS) 1977 reference, Centers for Disease Control (CDC) 2000 reference, World Health Organization (WHO) 2007 reference, International Obesity Task Force (IOTF) 2012 BMI cut-offs, Gomez classification, and Waterlow's classification. In the Indian context, they include Agarwal standards, Indian Council of Medical Research (ICMR) reference values, Indian Academic Pediatrics (IAP) reference values, and BMI cut-offs for overweight and obesity of Indian children. A new growth reference by Marwaha et al. (2011) for BMI was also reviewed. The review not only documents the methods but also the geographical location, total number of children surveyed (boys and girls) with their age group, type of school (government or private) and reports the results in terms of prevalence of undernutrition and overnutrition.

The literature review shows many inconsistencies in the selection and use of various growth standards or references. Many studies have conducted comparative analysis using mixed methods, and several have adapted their methodology based on the type of research data in hand. Many of the studies reviewed reported results using versions of growth references that were 2–3 decades old even when there is a current/revised version of these references available. Most importantly, there was no mention of the "year launched," which created confusion over whether an old or revised version of the growth reference was being used. The majority of the literature reported results in percentiles except those that used the WHO reference. Few studies did not use any references but compared the height and weight data of the sample population with a comparable reference sample drawn from a national or international population or both.

2.2.1 Definitions of Growth References Applicable to Indian School-Aged Children

The following table (Table 2.4) is based on the findings of the extensive methodological review, and documents all the information extracted from the

Table 2.4 National and International growth references applicable to school-aged children and their data source, geographical representation and types of growth charts

Growth references	Year launch	Data source/ethnicity/location covered	Revision/simplification/normalization	Geographical representation	Growth charts available
Harvard Growth Curves	1960 National	White children near Iowa City, Iowa, and in Boston, Massachusetts, United States (1930–1945)	Simplified version of combined sexes curve by WHO	International (1966)	
NCHS	1977 National	National surveys: NHES—II and III NHANES—I and Fels data as supplementary, United States (1963–1974)	Normalized by CDC/WHO	International (1978)	Percentile curves specific to sex and age of 2–18 years: Weight-for-age Stature-for-age and Weight-for-stature
British (U.K.)	1990	Nationally representative data from 11 distinct surveys, United Kingdom (1978–1990)	A revised version of Tanner–Whitehouse reference curves, 1960	National (for UK children)	Percentile curves specific to sex and age of 0–23 years: BMI-for-age
Agarwal et al.	1992	Affluent urban children from eight states (12 cities) covering all major zones	Adopted by IAP in 2007	National (for Indian children)	BMI criteria Birth—18 years
CDC	2000	National surveys: NHES—II, III NHANES—I, II, III, United States (1963–1994)	A revised version of NCHS growth reference, 1977/1978	National (for US children)	Percentile curves specific to sex and age of 2–20 years: BMI-for-age Weight-for-age Stature-for-age and Weight-for-stature
WHO	2007	NCHS original statistics data from US population (1963–1974) and smoothed data with WHO growth standard 2006	A revised version of NCHS 1977/1978	International	Percentile and *z*-score curves specific to sex and age of 5–19 years: BMI-for-age Height-for-age Weight-for-age
Marwaha et al.	2011	Raw data collected from 19 cities from four different zones based on children 3–18 years belonging to both upper and lower socioeconomic strata Jan 2006–Dec 2009	Not applicable	National (for Indian children)	Sex-specific normative charts of 5–18 years: Height Weight BMI percentile
Extended IOTF cut-offs	2012	Nationally representative surveys from Brazil, Great Britain, Hong Kong, Netherlands, Singapore (1978–1993) and US national surveys (1963–1980)	Not applicable	International	Specific to sex and age of 2–18 years: BMI cut-offs for Thinness grades (severe, moderate and mild) and Overweight, Obesity with adult linked BMI
Khadilkar et al.	2012	Urban affluent children from 11 affluent schools from 11 cities of India (June 2007–January 2008)	Not applicable	National (for Indian children)	Specific to sex and age of 5–18 years: cut-offs points for overweight, obesity with adult linked BMI
IAP	2015	Collated data from nine published studies over 10 years from 14 cities in India (2005–2014)	A revised version of IAP 2007 growth references	National (for Indian children)	Percentile curves specific to sex and age of 5–18 years: BMI charts Height and weight charts WHO 2006 and IAP 2015 combined height and weight charts for 0–18 years

literature with regard to growth references/standards, including the year launched, data source, location covered, availability of current/revised version, geographical representation, and various sex and age-specific growth charts available, and their cut-off values to identify problematic growth among school-aged children. The section then provides a brief on the various growth references/standards that have been used over time to assess nutritional status of school-aged children.

2.2.1.1 International Growth References

The Stuart/Meredith Growth Charts 1946 were one of the first growth references in the world, and were derived from stature and weight measurements taken from white children living near Iowa City, Iowa, and in Boston, Massachusetts, from 1930 to 1945. The data was drawn from a small sample largely from higher socioeconomic groups (Meredith 1949). Subsequently, in the 1960 and 1970s, two data sets were frequently used as growth references: the Harvard growth curves from the US and the Tanner growth curves from the UK (Tanner et al. 1966). In 1966, the WHO generated a simplified version of the Harvard growth curves and established this as international growth reference (Jelliffe 1966). This reference, derived from data from Caucasian children in Boston from 1930 to 1956, offered the advantages of having been compiled longitudinally (Stuart and Stevenson 1950). The Harvard growth curves made a significant contribution toward clinical nutritional assessment, with two well-known clinical methods—the Garrow classification and Gomez classification—using the Harvard growth curves 50th percentile as their reference value (Dibley et al. 1987).

Due to certain limitations of the Harvard growth curves, the NCHS came up with the 1977 growth reference by combining three primary national survey datasets (the National Health Examination Survey (NHES) II (1963–1965) for ages 6–11 years, NHES III (1966–1970) for ages 12–17 years, and the first National Health, Nutrition Examination Survey (NHANES) I (1971–1974) for ages 1–17 years), and Fels data (1929–1975) collected from white middle-class infants from birth to 1 year by the Fels Research Institute in Yellow Springs, Ohio. Of 14 sex specific-growth charts that were developed, three charts, i.e., weight-for-age (2–18 years), stature-for-age (2–18 years), and weight-for-stature were applicable for school-aged children (Hamill et al. 1977; Kuczmarski et al. 2002). In 1978, CDC produced a normalized version of the 1977 NCHS curves (Dibley et al. 1987) and recommended this for international application (WHO 1978); these came to be widely known as the NCHS/WHO, CDC/WHO growth charts/reference. Major

percentiles were added to facilitate plotting of growth data of children. There were some shortcomings identified with these references, including their inability to assess size and growth at the extremes beyond the 5th and 95th percentiles, as well as growth at ages 18 and over (Roche 1994). Due to these limitations, and to benefit from the availability of more recent and comprehensive national survey data as well as improved statistical smoothing procedures, CDC revised the NCHS growth reference in 2000 for all children in the US, generally known as CDC 2000 growth reference. The CDC 2000 reference generated 15 growth charts, 4 of which allow for assessment of nutritional attainment of school-aged children in terms of undernutrition and overweight.

Meanwhile, efforts to develop country-specific growth references were also being undertaken across the Atlantic. BMI reference curves for the UK were developed in 1990 for British children covering the age range birth to 23 years to replace the 30-year-old Tanner-Whitehouse reference curves. These reference curves were constructed based on nationally representative data obtained from 11 different surveys conducted between 1978 and 1990 (Freeman et al. 1990).

The WHO, given its global mandate, took up the task of developing a single internationally applicable growth reference. In order to do this, it reconstructed the NCHS growth reference for school-age children from 5 to 19 years of age for both clinical and public health applications. The WHO 2007 growth reference for 5–19 years was constructed by pooling the three original NCHS datasets (Hamill et al. 1977): NHES II (6–11 years) and III (12–17 years) and NHANES I (birth to 17 years), after which the data were smoothed by using the WHO growth standard (2006) for 0–5-year-olds (Turck 2013). The WHO (2006) standard was constructed based on the data of 8440 healthy breastfed infants and young children from Brazil, Ghana, India, Norway, Oman, and the United States, in an effort to ensure international applicability. The final sample used for fitting the growth curves included 30,907 observations (15,537 boys, 15,370 girls) for the height-for-age curves, 30,100 observations (15,136 boys, 14,964 girls) for the weight-for-age curves, and 30,018 observations (15,103 boys, 14,915 girls) for the BMI-for-age curves (de Onis et al. 2007). Therefore, three gender-specific nutritional indicators, i.e., weight-for-age (underweight status), height-for-age (stunted status), and BMI-for-age (low BMI-for-age status) can be measured by using the WHO 2007 growth reference for 5–19 years.

The WHO recommended cut-off points for overweight and obesity based on BMI-for-age *z*-scores. WHO cut-offs for different BMI *z*-scores are shown in Table 2.5 (WHO MGRSG 2006).

Table 2.5 WHO classification based on anthropometry and cut-offs

Classification	Condition	Age 61 months to 19 years Indicator and cut-offs	z-score and percentile equivalence
Based on Body Mass Index (BMI)	Overweight	BMI-for-age > 1SD (equivalent to BMI 25 kg/m^2 at 19 years)	−3 = 0.1 −2 = 2.3 −1 = 15.9 +1 = 84.1 +2 = 97.7 +3 = 99.9
	Obese	BMI-for-age > 2SD (equivalent to BMI 30 kg/m^2 at 19 years)	
	Thin	BMI-for-age < −2 to −3SD	
	Severely thin	BMI-for-age < −3SD	
Based on height and weight	Stunted	Height-for-age < −2 to −3SD	
	Severely stunted	Height-for-age < −3SD	
	Underweight	Weight-for-age (up to 10 years) < −2SD to −3SD	
	Severely underweight	Weight-for-age (up to 10 years) < −3SD	

Source Mercedes de Onis. ECOG Obesity e-book

2.2.1.2 National Growth References

There has been a longstanding effort to construct a growth chart for Indian children. The ICMR initiated this through a nationwide cross-sectional study during 1956 and 1965. However, the anthropometric measurements were made exclusively on children of the lower socioeconomic classes and hence cannot be used as a reference standard (Khadilkar et al. 2007). Later on, Agarwal et al. (1992) collected data between 1989 and 1991 on affluent urban children (12,899 boys and 9951 girls) from all major zones of India. This was published in 1992 and 1994 and provides information on growth from birth to 18 years. These charts were then adopted by the IAP for growth monitoring in 2007.

In 2015, IAP revised its growth chart for height, weight, and BMI to replace the 2007 IAP charts for the assessment of growth of 5–18-year-old Indian children (Khadilkar et al. 2015). These charts were constructed based on data collated from 14 Indian cities and from 9 studies published in the previous 10 years. Based on this, age- and sex-specific IAP growth charts on height, weight, and BMI are now available. BMI charts follow the same method as the IOTF. They provide cut-offs based on percentiles (3, 5, 10, 25, 50, 75, 85 and 95), and SD (or *z*-score) values are also available. The 3rd percentile was used to define thinness, and a BMI of 23 adult equivalent as overweight and 27 adult equivalent as obesity cut-offs.

Other efforts to assess the growth of Indian children have also been underway. Growth references for Indian children and adolescents were constructed by Marwaha et al. (2011) from a nationally representative cross-sectional evaluation of anthropometric data (height, weight, and BMI). The data was collected in 2009

from boys and girls attending both government and private schools in the age group 3–18 years, from 19 cities located in across the country. The children belonged to both upper and lower socioeconomic strata. Height, weight, and BMI percentile charts were constructed, with sex and age specific curves expressed in nine percentiles: 3rd, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 97th. Some issues with these charts included the lack of longitudinal data and absence of year-wise grouping.

Subsequently, Khadilkar et al. (2012) conducted a study to construct age and sex specific adult equivalent BMI cut-offs for Indian children, based on a reference population of urban affluent children measured from June 2007 to January 2008. Data was collected from 18,666 children (10,496 boys and 8170 girls) from 11 affluent schools from 10 cities (Delhi, Chandigarh, Chennai, Bangalore, Kolkata, Mumbai, Pune, Baroda, Hyderabad, and Raipur). Children were measured for height and weight, after which BMI was calculated using the standard formula. The study suggested lower BMI cut-offs of 23 and 28 kg/m^2 for overweight and obesity in Asian populations as compared to cut-off point of 25 and 30 kg/m^2 that are recognized internationally as a definition of overweight and obesity in adults. Growth reference curves were constructed providing cut-off points based on five percentiles (3, 25, 50, 85, and 95), with two additional percentiles corresponding to a BMI of 23 and 28 kg/m^2 at 18 years. They did not provide SD scores but it is possible for the curves to be converted into exact SD scores using a standard formula.

The above section provides information on growth references that have been used both nationally and internationally to estimate levels of malnutrition among school-age children. The data sources on which many of the international references/standards are constructed make them less likely to be appropriate for use with Indian children. On the other hand, the WHO reference can be used to assess Indian children because the data has been smoothed with WHO growth standard 2006. WHO growth standard 2006 included data from Indian children and was accepted by IAP and Government of India to assess nutritional status of under-5 children. One of the drawbacks of the Indian growth reference developed by IAP is that it is also not truly representative as the data was collected from a sample that was limited in its coverage of geographic/regional/socioeconomic diversity. As noted by Pangariya (2012), even the NCHS standards were questioned and revised because the sample on which they were based represented a limited "geographic, cultural, socioeconomic, and genetic variability." For a growth reference to be genuinely country specific for India, it must consider rural–urban disparities, regional representation including from the northeast and children from different socioeconomic strata.

2.3 Comparison of Nutritional Status by Multiple Growth References

The height, weight, and BMI of the children (N = 5340) surveyed for the study referenced above was analyzed using the different growth references discussed above to better understand their implications for policy. How much of a difference does it make to the results, in terms of levels and types of malnutrition detected among the study sample, if we use the IAP reference versus the WHO 2007 reference, for example? To answer this question, we use BMI-for-age and BMI cut-offs for the comparison, since these are common to all growth references.

The comparative analysis of BMI-for-age included four growth references: British (1990), CDC (2000), IAP (2015), and WHO (2007). *Z*-scores were obtained from LMS macro (by using ImsGrowth program version 2.12 compiled on December 12, 2005 by Tim Cole and Huiqi Pan)[1] (Fig. 2.1). The findings reveal that the estimation of overall prevalence of undernutrition (low BMI-for-age) is higher among International references as compared to Indian references.

Children considered to be of "normal" body weight are in the range of 88.4% according to the IAP (2015) reference, as compared to 61.1% according to the CDC (2000) reference. Overall, undernutrition is estimated at about 10% by the IAP (2015) reference, with only 3.7% of children in the "severe" underweight category.

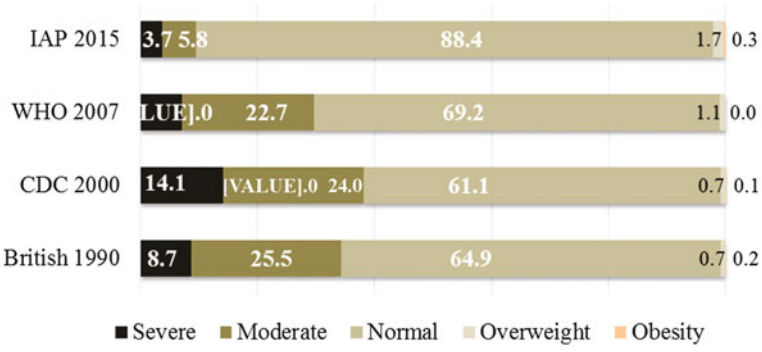

Fig. 2.1 Comparison of nutritional status (%) of children by International and Indian References

[1]LMS refers to the Lambda–Mu–Sigma method for smoothing *z*-scores. The method models the distribution of *z*-scores taking into account skewness (*L*), central tendency (*M*) and dispersion (*S*). All three parameters are first estimated by the model, and then smoothed using a variety of methods. Percentile and *z*-scores of interest can then be calculated using the smoothed *L*, *M*, and *S* parameters. For a full account of smoothing techniques, including the LMS method, see Flegal (1999).

By comparison, a much larger proportion of children—14.1 and 8.7%—fall into the severely underweight category by the CDC (2000) and British (1990) references, respectively. The WHO (2007) reference estimates place severe underweight at 7% and total underweight at 22.7%, both figures falling between the IAP and CDC/British reference estimates. Overweight and obesity are uniformly low, although here too there is a slight difference with IAP (2015) generating the highest levels of overweight and obesity at 1.7 and 0.3%, respectively. It is important to note these differences, since many studies conducted among Indian children do use CDC/NCHS/British standards which, as the previous section has established, were constructed based on data taken from US or British populations and hence could lead to substantial overestimation of underweight in the study sample.

We next used the different growth references to compare the prevalence of undernutrition by gender and age group of the children (Table 2.6). Several interesting observations emerge:

(i) In the <5 years age group, there is a remarkable convergence between the British (1990) and CDC (2000) references, both for boys and girls. In both references, all the children fall into just two categories—normal and moderate underweight, with the majority of the children within the moderately underweight range. The WHO (2007) provides a substantially different outcome, with all children falling within the normal range. There is no IAP reference for this age group.

(ii) In the next age group (5–7 years), the differences between the references become more obvious. The IAP (2015) provides the most favorable picture, with almost 90% of the children within the normal range; the WHO (2007) shows fewer boys (66.4%) than girls (76.8%) within the normal range. The CDC (2000) and British (1990) references are lower still, with the CDC being consistently lower for both boys and girls than the British reference.

(iii) For the age group 8–11 years, the four references demonstrate the same pattern, with the IAP (2015) showing the highest proportion of both boys and girls within the normal range (87.1 and 89.2%, respectively), followed by the WHO (2007), British (1990) and CDC (2000) references. Interestingly, both the IAP (2015) and WHO (2007) show a small drop in the proportion of children in the normal range between the 5–7 and 8–11 age group: the IAP (2015) shows a fall from 88.5 to 87.1% for boys, although for girls it remains the same at 89.2 for both age groups; the CDC (2000) shows a fall from 66.4 to 60% for boys and 76.8 to 70% for girls. However, both the CDC (2000) and British (1990) references show the opposite trend, with children in the normal range increasing from 53.8 to 56.9% among boys and 64.4 to 67.6% among girls according to the CDC (2000) reference, and from 59.8 to 61.9% for boys according to the British (1990) reference.

Table 2.6 Comparison of BMI of children by gender and age: International and Indian References

	Condition	Male				Female			
		<5 years	5–7 years	8–11 years	>11 years	<5 years	5–7 years	8–11 years	>11 years
British (1990)	Severe		13.9	9.7	33.3		5.8	6.1	
	Moderate	75.0	25.5	27.3	11.1	20.0	23.8	25.3	9.1
	Normal	25.0	59.8	61.9	55.6	80.0	69.8	67.5	90.9
	Overweight		0.5	0.9			0.6	0.7	
	Obesity		0.3	0.2			0.1	0.3	
CDC (2000)	Severe		21.1	15.4	33.3		13.2	8.3	
	Moderate	75.0	24.4	27.1	11.1	20.0	21.4	23.2	9.1
	Normal	25.0	53.8	56.9	55.6	80.0	64.4	67.6	90.9
	Overweight		0.6	0.5			0.8	0.8	
	Obesity		0.2	0.1			0.1	0.1	
WHO (2007)	Severe		8.8	10.2	33.3		4.1	5.2	
	Moderate		24.0	28.6	11.1		18.0	20.6	9.1
	Normal	100.0	66.4	60.0	55.6	100.0	76.8	73.0	90.9
	Overweight		0.9	1.1			1.2	1.2	
IAP (2015)	Severe		3.4	4.6	11.1		3.1	3.5	
	Moderate		6.7	6.9	22.2		4.5	5.3	
	Normal		88.5	87.1	66.7		89.2	89.2	100.0
	Overweight		0.9	1.1			3.0	1.7	
	Obese		0.5	0.2			0.2	0.3	

Blank spaces represent 0.0%

(iv) For the >11 years age group, the British (1990), CDC (2000), and WHO (2007) show a remarkable convergence, with identical estimates for both boys and girls; the IAP (2015) shows greater variation, as well as a significant difference between boys and girls.

(v) While the proportional distribution of children of all age groups and genders between the different categories of underweight (normal, moderate and severe underweight, and overweight and obesity) are significantly different between the different references, the trends are remarkably similar. In all references used in this comparison, girls fare better than boys at all ages. The IAP (2015) shows the smallest difference in this regard. Also, in all references, the proportion of children at the extremes of the distribution is small compared to those within the normal range.

The results of the comparative analysis show that there can be substantial variation in estimation of under/over-nutrition based on the growth reference/standard used for the analysis. Obtaining identical results from the different references is impossible; however, it may be possible to generate similar trends by age and gender. The CDC (2000) reference appears to generate the highest estimates of underweight as compared to the other references used; and the IAP (2015) generates the lowest. Which of these is painting the most accurate picture?

2.4 What Do the Data Tell Us?

The argument has been made that country-specific references based on national data are essential to generate accurate information with regard to levels of undernutrition, given that there could be multiple reasons that underlie differences in nutritional levels between populations (Pangariya 2012). For example, it has been suggested that the reason why India performs worse than sub-Saharan Africa on measures of malnutrition could have more to do with genetic factors than with poor access to nutrition. Deaton and Dreze (2008) have disputed this argument, stating that while genetic potential for growth could play a role in determining nutritional outcomes, there is ample evidence to show that improved access to nutrition can in fact eliminate growth differentials. However, no matter how we quibble over the numbers, the undeniable fact is that there is an unacceptably large number of malnourished children, and there is a need for an urgent response. Clearly, the important issue is to be able to generate the evidence that will identify the largest number of children who are most at risk of malnutrition, and provide appropriate guidance to policy and programming. Can we improve the methods by which we measure and assess the extent of malnutrition? Certainly, efforts to further refine the

references and standards should continue; but in the meantime, we need to use the methods available to us to shape a credible response.

Looking at some of the details of currently available Indian standards, we note that the revised IAP growth references are used as a regionally representative reference for Indian children, but have not taken into account rural-urban, socio-economic and other disparities. Second, who are the affluent healthy children on which the references are based? The definition is not clear and concise, and is an on-going challenge for anthropometric assessment. There is a need for a nationally representative sample which meets the methodological concerns over data sources by addressing issues regarding zonal representation, rural-urban disparities, and socio-economic variation to construct a country-specific growth reference for school aged Indian children.

Another issue is the poor tracking of data on children's nutritional status. Particularly in the case of school-age children, there is no national system of data collection such as is available for children 0–5 years old. The data available from studies of small samples cannot be used to construct references or standards. The issues already being faced in developing internationally acceptable references/standards for infants and children <5 years of age preclude the possibility of using an international standard for this purpose. It is therefore essential to update the available growth charts with recent and age-appropriate data periodically. Nationally representative surveys like NFHS, RSoC, etc. should also include data on children 6–18 years old, since our analysis demonstrates that children in this age group continue to be at high risk for malnutrition, and this can have seriously detrimental impacts on their physical, cognitive, and social development. A robust system for on-going data collection and analysis needs to be established for this purpose. *When alarm bells rang with regard to the HIV/AIDS epidemic in India in the late 1990s, one of the first things that the National AIDS Control Organization (NACO) did with the help of donor funding was to establish a network of sentinel surveillance sites which generated real time information on HIV incidence. As a result, NACO can produce reliable annual estimates of HIV/AIDS incidence and prevalence. Surely the epidemic of malnutrition that India now faces demands the same level of rigorous monitoring?* (Seshadri 2014)

In the next chapter, we apply the WHO (2007) reference to the dataset collected from three districts of Karnataka, India. The choice of this reference is supported by the fact that it has been adopted by the Government of India for the measurement of undernutrition in the various series of national level surveys, including the NFHS and DLHS. The analysis provides further evidence of serious undernutrition among school-going children when assessed on the basis of globally standardized measures.

Annex 2.1 Methodological review of literature on "Nutritional Status of School-going Children in India"

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
Bandikolla (2016)	Kakani, Guntur District, Andhra Pradesh	12 years	Government School	ICMR WHO	100 boys	Body mass index of the boys was 17.7 ± 9.7 kg.
Selvaraj et al. (2016)	Semi urban Southern India	9–17 years	6 schools	WHO criteria based on *z*-score	2100 (boys: 46.1% and girls: 53.9%)	Obesity: 6% Overweight: 10.9% Thinness: 13% Severe thinness: 5% Stunting: 19.8%
Sasikala (2016)	Rompicherla Mandal, Andhra Pradesh	5–15 years	Government school		613	Grade-I malnutrition: 24.14% Grade-II malnutrition: 16.48% Grade-III malnutrition: 9.95%
Kumaravel et al. (2016)	South Indian district	5–18 years	25 government and 25 private (includes primary, middle, high schools and higher secondary schools)	IAP International (IOTF) Body Mass Index cut-offs	18,001 (55.1% boys) (55.1% from government schools and 44.9% from private schools)	Thinness: 12.2% Overweight: 9.5% Obesity: 3%
Pal et al. (2016)	20 districts of West Bengal	6–13 years	Primary and upper-primary school	IAP	24,108	Overall undernutrition: 22.8% Over weight and obesity: 3% Exclusive underweight: 5.5% Exclusive stunting: 6.3%
Shashank and Chethan (2016)	Rural Ukkali, Bijapur, Karnataka	6–12 years	Not mentioned	NCHS ICMR	284 (62.6% boys and 37.3% girls)	Underweight: 34.15% (31.4% boys and 38.6% girls) Stunting: 25% (24.2% boys and 26.4% girls)
Kumar et al. (2016)	Urban slum Bengaluru, Karnataka	5–14 years	Primary school	WHO 2007 reference growth charts	404 (56% boys and 44% girls)	Underweight among boys and girls was almost the same (<3rd percentile) as also stunting

(continued)

Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
Yadav et al. (2016)	Urban Pune, Maharashtra	5–11 years (stand. I–V)	Primary school	WHO/NCHS	760 (59.3% boys and 40.7% female)	Stunting: 4.47% (severe—0.4%) Wasting: 6.32% (severe—0.3%) Underweight: 5% (severe—0.1%)
Abraham et al. (2015)	Coastal area Puducherry	5–17 years	Higher secondary school	WHO criteria	714 (51.4% boys and 48.6% girls)	Underweight (5–9 years): 30.7%, moderate—29.6% and severe—1.1% Stunting: 10.4%, moderate—10.2% and severe—0.1% Thinness (low BMI-for-age): 30.7%, moderate—26.9% and severe—3.8%
Bhattacharya et al. (2015)	Burdwan district, West Bengal	10–19 years	Government schools	NCHS	424 (61.79% boys and 38.21% girls)	Underweight: 53.31% Stunting: 47.41% Boys were more malnourished than girls Early adolescents were more stunted than late adolescents
Thakur and Gautam (2015)	Sagar town of Sagar district, Madhya Pradesh	5–18 years	8 government schools	NCHS	312 girls	Stunting: 5.4% Underweight: 5.7% Undernourished: 4.1%
Cynthia Subhaprada (2015)	Urban slum Kurnool, Andhra Pradesh	6–10 years	Government primary school	IAP	101 (48 boys and 53 girls)	Grade-I malnutrition: 35.64% Grade-II malnutrition: 15.84% Grade-III malnutrition: 10.89%
Chandramohan et al. (2015)	Udupi district, Karnataka	9–11 years (5th Standard students)	1 primary school	CDC BMI-for-age growth charts for girls and boys	76 (55% boys and 45% girls)	Underweight: 51% Overweight: 1%
Kamath et al. (2015)	Bellary district, Karnataka	class 3rd to class 7th	169 schools	WHO Multicenter Growth Reference Study growth charts	27,544 (49.1% boys and 50.9% girls)	Undernourished: 16.1% 16.9% boys undernourished and 12.3% girls obese

(continued)

Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
Singh and Sekhon (2015)	Sri Muktsar Sahib, Punjab	6–15 years	DAV Public School	NCHS (in collaborations with the National Center for Chronic Disease Prevention and health promotion 2000)	863 (495 boys and 368 girls)	In boys from 6 to 15 years, mean weight, height, and BMI ranged between 20.9–53.9 kg, 116.9–164.8 cm and 15.2–19.7 kg/m^2, respectively In girls from 6 to 15 years, mean weight, height, and BMI ranged between 19.1–49.1 kg, 115.8–157.7 cm and 14.1–19.6 kg/m^2, respectively Prevalence of malnutrition is greater than overweight and obesity in both girls and boys
Ashok et al. (2014)	Mysore city	6–12 years	1 government and 1 private (primary school)	CDC	1566 (50.9% boys and 49% girls in government and 47.9% boys and 52% girls in private school)	Underweight: 24.5% Overweight: 8.4% Obesity: 4.1% Underweight was more in government than private schools. Overweight was more in private than government schools.
Sangwan et al. (2014)	Fatehabad district, Haryana	6–12 years	Government primary school	IAP Waterlow classification	350 (155 boys and 195 girls)	Grade-I malnutrition: 44.47% Grade-II malnutrition: 28.28% Grade-III malnutrition: 2.0% Wasting: 61.43%; severely wasted: 0.58% and boys affected more than girls Stunting: 36.86% and girls affected more than boys Overall children 10 years and above affected the most

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Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
Kumar et al. (2014)	Rural Fatehabad district, Haryana	6–10 years	Primary school	IAP Waterlow classification	397 (193 boys and 204 girls)	Grade-I malnutrition: 38.29% Grade-II malnutrition: 20.90% Grade-II malnutrition: 4.79% Wasting: 63.48%; severe wasting: 0.5% Mild stunting: 48.60%; moderate stunting: 4.30% Girls were affected more than boys 6-year olds and 9-year olds were at highest risk of wasting and stunting, respectively
Thakur and Gautam (2014)	Sagar town of Sagar district, Madhya Pradesh	5–18 years	10 schools	NCHS WHO	300 boys	Stunted: 6.3% Underweight: 4.3% Undernourished: 3%
Shivaprakash and Joseph (2014)	Rural BG Nagara, Nagamangala Taluk, Mandya district, Karnataka	6–12 years	BGS Model Public School	ICMR NCHS	484 (52.5% boys and 47.5% girls)	Underweight: 30.3% (boys: 32.3% and girls: 28.3%) Stunting: 27.9% (boys: 29.1% and girls: 26.5%)
Malpani et al. (2014)	Rural Raichur district, North Karnataka region, Karnataka	5–14 years	Not mentioned	WHO 2007 Reference Growth Charts	270	The level of underweight among boys and girls was almost the same (<3rd percentile) as also stunting
Singh et al. (2014)	Dhaura Tanda, Bareilly district, Uttar Pradesh	5–18 years	A hospital based study with school children as a subject	WHO	561 (50.80%) boys and 49.20% girls)	Underweight: 41% (44.56% boys and 37.32% girls) Stunting: 23.88% (26.32% boys and 21.38% girls) Thin as per BMI: 36.18% (38.25% boys and 34.07% girls)

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Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
						Boys were more malnourished than girls
Sridhar et al. (2014)	Rural Andhra Pradesh	6–12 years	Government primary and high schools	Not mentioned	1050 (503 boys and 547 girls)	926 children were below average weight-for-age showing under nourishment, out of which 451 (42.95%) were boys and 475 (45.24%) were girls (48.86%) children were in the normal range
Hasan et al. (2013)	Azad Nagar and surrounding areas, Bangalore, Karnataka	5–14 years	Government Urdu higher primary schools	NCHS	500 (59.8% boys and 40.2% girls)	Underweight: 58.2% (boys: 65.5% and girls: 47.2%)
Suba et al. (2013)	Rural Kalapet, Puducherry	6–17 years	school	reference values of National Health and Statistics Report, CDC (according to National Health and Nutritional Survey 2003–2006)	548 (261 boys and 285 girls)	BMI: lower for all age groups in comparison to the reference value The difference in the mean BMI of boys and girls was observed to increase as age advanced
Dhanasekaran et al. (2013)	Pulianthope zone of Chennai	6–10 years	3 Government primary school	NCHS CDC	320 (52% boys and 48% girls)	Underweight: 54.3% Overweight: 6.1% Underweight was higher among girls than boys Underweight significantly increased with age
Deb and Dhara (2013)	Rural Belonia district, Tripura	6–10 years	Primary school	ICMR WHO Gomez classification Waterlow classification	152	Underweight: 94.73% boys and 92.11% girls Stunting: 50.00% boys and 44.73% girls Chronic Energy Deficiency-III: 98.68% boys and 100% girls

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Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
Das et al. (2012)	Rural Kharagpur, Paschim Medinipur district, West Bengal	6–12 years	5 Primary schools	new internationally accepted body mass index (BMI) cut-off values	500 (250 boys and 250 girls)	Thinness: 77.6% boys and 76.4% girls Girls more undernourished than boys of the same age Boys more undernourished at age 7, 10 and 11 years than the girls of the same age Grade-I thinness most prevalent among boys in all ages except age 11 and 12 years followed by Grade-II and -III Grade-III thinness most prevalent among girls in all ages except age 7, 9, and 11 years followed by Grade II and I
Sati and Dahiya (2012)	Rural Mangali and Kaimri villages of Hisar district, Haryana	7–9 years	Government primary school	NCHS ICMR Gomez Classification	200 (50% boys and 50% girls)	Stunting: 54.11% Underweight: 55.5%
Nigudgi et al. (2012)	Gulbarga city, Karnataka	10–13 years and above	Higher primary schools	Not mentioned	935 (51.23% boys and 48.77% girls)	50.05% children were below normal weight-for-age
Fazili et al. (2012)	Rural Hajin block, Kashmir	5–14 years	Primary and middle level educational facilities	WHO *z*-score system	940	Overall undernutrition: 19.2% Underweight: 11.1% Stunting: 9.25% Wasting: 12.3% Thinness: 29% In all the age groups more boys were underweight than girls. In 7 out of 9 age groups, the proportion of stunted children was higher among boys. The same trend was

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Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
						observed for wasting also. For the indicator thinness the prevalence was higher in girls in lower age group
Hasan et al. (2011)	Azad Nagar and surrounding areas, Bangalore, Karnataka	5–14 years	Government Urdu higher primary schools	WHO	700	Malnourished: 52% (boys: 53.85% and girls: 49.25%) Stunting: boys—41.47% and girls—38.81%
Manna et al. (2011)	Two districts of North Bengal, West Bengal	5–12 years	Not mentioned	ICMR Gomez classification Waterlow's classification	4457	Average height and weight of the children was lower than the national standard of ICME specifications Weight-for-age: 80.01% boys and 77.86% girls had different degrees of malnutrition. Height-for-age: more boys with mild and moderately impaired nutritional status than girls; more at higher ages than lower ages
Palanisamy et al. (2011)	Pernambut block, Vellore district, Tamil Nadu	11–18 years	6 government and government aided schools	WHO	806	Underweight BMI: 83% Normal BMI: 16% Overweight and obese: 0.45%
Banerjee et al. (2011)	Rural northern belt, Goa	10–19 years	5 secondary schools	Not mentioned	1015 adolescents (565 boys and 450 girls)	Underweight BMI: 37.8% boys and 27.5% girls Overweight: 2.8% boys and 4% girls More boys were underweight than girls and undernutrition was

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Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
						uniform across all the years of schooling
Iyer et al. (2011)	Both rural and urban Vadodara, Gujarat	Not mentioned	Not mentioned	The 5th percentile values of BMI of Must et al, Agarwal standards and CDC standards	376 (256 were from rural setup and 120 from urban)	Prevalence of undernutrition was found in both urban and rural areas. The prevalence of underweight and stunting was high in both rural and urban adolescent children, with magnitude and severity being higher in rural children The overall prevalence of obesity ranged from 0.4 to 0.8% in rural and 0.8–3.3% in urban
Dambhare et al. (2010)	Peri-urban Wardha	10–19 years	High school	WHO NCHS	116 (80 boys and 36 girls)	Underweight: 51.7% Stunting: 34.5% Early adolescents age group were at highest risk
Saluja et al. (2010)	Urban Meerut	5–11 years	5 Government primary school	IAP Waterlow classification	800	Grade-I malnutrition: 35.5% Grade-II malnutrition: 11.4% Grade-III malnutrition: 2.6% Wasting: 44.6%; severely wasted: 1.2% Stunting: 43.8%
Chakraborty and Bose (2009)	Nandigram, Purba Medinipur district, West Bengal	5–10 years	School	New international BMI bases classification cut-off points	596 (323 boys and 288 girls)	Thinness: 62.9% in boys and 61.6% in girls
Vashist et al. (2009)	Rural and Urban Rohtak, Haryana	13–16 years	Government and Private	NCHS	500	Thinness: 24.5–31.5% among boys and 14/6–15.8% among girls in rural areas; 21.9–34.1% among

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Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
						boys and 11.5–19.8% among girls in urban areas Stunting: 6.5–15.2% among boys and 7–14% among girls in urban areas
Suvarna and Itagi (2009)	Rural four villages from Dharwad district, Karnataka	7–10 years	Government Kannada medium school	NCHS Waterlow classification	102	Wasting: 35.29% (less than 8 years age group: 15.38%, 8–9 years age group: 47.27%, older age group: 28.57%) Stunting: 36.27% (less than 8 years age group: 50%, 8–9 years age group: 34.54%, older age group: 23.80%)
Ruchika et al. (2008)	Allahabad district, Uttar Pradesh.	7–10 years	not mentioned	NCHS standards	150	Wasting: 3% Stunting: 17.3% Underweight: 25%
Bose et al. (2007)	Rural Onda, Bankura district, West Bengal	6–14 years	Seven primary and secondary schools	NCHS WHO	454 (201 boys and 253 girls)	Underweight: 16.9% Stunting: 17.2% Thinness: 23.1% Underweight and thinness in boys was very high Thinness was very high in girls.
Semwal et al. (2006)	Rural Doiwala block, Dehradun district	6–14 years	Six government secondary schools	ICMR Waterlow classification	930 (377 boys and 553 girls)	Wasting: 52.6% Stunting: 26.3% 10–14 years old affected most

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Annex 2.1 (continued)

References	Location	Age group	Type of school	Methods used	*N*	Prevalence
Chandra et al. (2006)	Rural Dharwad and Haliyal taluks, Karnataka	4–14 years		WHO/Govt. of India Road to Health card CDC 2000 Standard for BMI for the given age and sex	557 (260 boys and 297 girls)	Nutrition related disorders rate: 59.4% Underweight/low BMI: 44.4% of children
Bharati et al. (2005)	Both rural and urban Raichur taluk, Karnataka	5–13 years	Primary school	NCHS Waterlow classification	560 (50% rural and 50% urban)	Children from both locations were shorter than the NCHS standard Similar trend was observed with regard to weight Higher percentage of rural children (32%) were grouped as normal and very low per cent of them (3%) were wasted as well as stunted, irrespective of age and sex

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Chapter 3
Malnutrition Among Students in Primary School: A Profile of Government School Students

Abstract Some evidence on nutritional status of children in the age group 0–5 is available through large scale surveys such as the National Family Health Survey (NFHS), albeit not frequently enough. The recently released NFHS-4 data indicates that there has been a slow decline in the proportion of children (0–3 years) who are underweight and stunted; and a more substantial decline in the proportion of wasting in the same age group. However, the tracking of nutritional status through the childhood years is not systematically undertaken, and evidence on the nutritional status of older children in primary school is thin. This chapter presents the analysis of a large, multidistrict dataset that provides insights into the socioeconomic profile and nutritional status of children who attend government schools in three districts of Karnataka. We first examine the broader district-level context within which the schools are operating, and then look at household characteristics that contribute to nutritional risk and vulnerability of government primary school-going children. This chapter focuses on two central questions: (1) based on wide recognition of the linkage between poverty, social development, and malnutrition, does overall development of a region/district predict the level of malnutrition to be found among government school-going children in that region/district? And (2) recognizing that district-level indices may not be reflected in the nutritional outcomes of individual children, does the household profile of children who attend government schools predict the level of malnutrition found among those children? The chapter then suggests alternative approaches to enhancing the nutritional status of school-going children.

3.1 Introduction

The Sarva Shisksha Abhiyaan (SSA 2001) was meant to promote Universal Elementary Education across the country and ensure that all children aged 6–13 were enrolled in school. As a result, enrolment rates have been steadily rising, and data show an encouraging decline in the proportion of children out-of-school (NSS 2014). While this is good news, a matter of some concern is the quality of education

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being imparted; as well as wide disparities between different social groups and genders in their access to education. As with other sectors, most notably the health sector, private players have been gradually expanding their presence in the education system, even at the primary level (Desai et al. 2008).

Private options are perceived to be of better quality, although this comes at a high cost. Therefore, children who have access to private schools must necessarily come from relatively better off households. Research in India and elsewhere confirms the hypothesis that socioeconomic status and parental education are strong predictors of school choice: better-educated and more affluent parents choose to send their children to private school, both due to the perception of better quality and because they can afford to do so (Desai et al. 2008). Why do parents prefer private schools? There is evidence to show that per pupil expenditure in private schools is less than half of what it is in public schools (Kingdon 2008); but teacher absenteeism and poor accountability are more characteristic of government schools as compared to private schools (Muralidharan and Kremer 2008). Large-scale national surveys have also found that learning outcomes are better for students at private schools as compared to their government school-going peers (Pratham 2005). Hence, those who have the option move their children to private schools.

The probability that children in government schools largely belong to poorer households raises an important concern: how ready are the children to benefit from their schooling? The coexistence of poverty and undernutrition is widely recognized, as well as the resultant negative impact on childhood growth (Varadharajan et al. 2013). There is strong evidence that nutrition and other environmental factors have an important impact on cognitive development and learning outcomes (Deshpande et al. 2014); and that malnutrition can adversely impact brain development, cognitive ability, and school achievement (Martins et al. 2011). The impact of malnutrition on physical and mental growth is also well documented (Aubery 2012; Jukes 2005; Luzi 2012).

Some evidence on nutritional status of children in the age group 0–5 is available through large scale surveys such as the NFHS. The NFHS 4, conducted after a gap of ten years, indicates that there has been a slow decline in the proportion of children (0–3 years) who are underweight and stunted; and a more substantial decline in the proportion of wasting in the same age group. Yet, even now, one in three children is stunted and one in five is underweight: clearly, malnutrition among young children continues to be a "public health disaster" (Baru et al. 2008). Despite this, the tracking of nutritional status through the childhood years is not systematically undertaken, and the availability of evidence on the nutritional status of older children in primary school is extremely poor. This chapter adds to the evidence and presents the analysis of a large, multidistrict dataset that provides insights into the socioeconomic profile and nutritional status of children who attend government schools in three districts of Karnataka. We first examine the broader district-level context within which the schools are operating, and then look at household characteristics that contribute to nutritional risk and vulnerability of government primary school-going children.

This chapter focuses on two central questions:

(i) Based on the wide recognition of the linkage between poverty, social development and malnutrition, we ask the question: *Does overall development of a region/district predict the level of malnutrition to be found among government school-going children in that region/district?*
(ii) Recognizing that district-level indices may not be reflected in the nutritional outcomes of individual children, we then take the question down to the level of the household and ask: *Does the household profile of children who attend government schools predict the level of malnutrition found among those children?*

The chapter then suggests alternative approaches to enhancing the nutritional status of school-going children.

3.2 Nutritional Outcomes of Government School-Going Children

To look at the impact of "development" as measured by commonly used indices, we examined the relative performance of children with BMI- and height-for-age, with the prediction that there would be wide disparities in the nutritional outcomes of the children based on human development indicators in the three districts selected for the study: Mandya, Mysuru and Yadgir. Further, the study focused on one selected block (taluk) in each district: North block in Mandya; Hegadadevana Kote (HD Kote) in Mysuru; and Shorapur in Yadgir.

3.2.1 Profiles of the Study Districts and Blocks

Mysuru is the largest district and scores highest in the state HDI ranking, followed by Mandya and Yadgir. Comparison between the three districts on basic social sector indicators (Table 3.1) shows the following:

(i) Yadgir is an outlier on a few important social development parameters: (a) the TFR at 3.1 far exceeds that of Mandya at 1.2 and Mysuru at 1.3, and falls well short of the goal of replacement level TFR of 2.1. Lingaraju and James (2012) have documented the persistence of relatively high fertility in the northern districts of Karnataka despite concerted state efforts to bring it down; (b) the district has the largest proportion of SC and ST population at 23.3 and 12.5%, respectively—both Mysuru and Mandya have a substantially smaller SC population, and Mandya has only a small fraction (1.2%) of STs; (c) the most stark difference is in the literacy rate, which lags almost 20 percentage points behind both the other districts. Both male and female

Table 3.1 Selected district and block-level indicators (Census 2011)

	Mysuru district	HD Kote taluk	Yadgir district	Shorapur taluk	Mandya district	North Block taluk
Total population	3,001,127	237,968	1,174,271	360,893	1,805,769	277,795
Total fertility rate (TFR)	1.3	NA	3.1	NA	1.2	NA
Sex ratio	985	984	989	979	995	985
0–6 sex ratio	961	995	951	945	939	942
Life expectancy at birth (LEB)[a]	66.3	NA	63.9	NA	63.9	NA
% Scheduled caste (SC)	17.9	28	23.3	21.7	14.7	14.1
% Scheduled tribe (ST)	11.1	24.3	12.5	20.6	1.2	0.6
% Total literacy	72.8	66	51.8	55	70.4	70
Male %	78.5	72	62.3	65	78.3	NA
Female %	67.1	60	41.4	46	62.5	NA
% Main workforce agricultural laborers	23.7	40.4	42.8	44.1	24.8	29.7
Of which male %	53.5	55.8	37.1	43.1	46.8	54.4
Of which female %	46.5	44.2	62.9	56.9	53.1	45.6
Per capita income[b]	65,759	31,199	38,097	40,675	46,049	26,205
District HDI rank	8	NA	29	NA	15	NA

District-level data is taken from raitamitra.kar.nic.in unless otherwise specified. Block-level data is taken from censusindia.gov.in. Both are based on Census of India 2011

Annual Report of Registration of Births and Deaths; 2011

[a]Census of India 2011

[b]District data from http://www.investkarnataka.co.in/district-profiles

literacy fare poorly, with male literacy lagging about 15 percentage points behind the other two districts, and female literacy at only about 41% compared to about 67% in Mysuru and 63% in Mandya; and (c) at almost 43%, the district has the largest proportion of agricultural laborers in the workforce as compared to about 25 and 24% in Mandya and Mysuru, respectively. In addition, two-thirds of the agricultural laborers in Yadgir are female.

(ii) Some factors are common to all districts: (a) LEB, an important indicator of health status, is almost the same in all districts; (b) the sex ratio is fairly uniform across the districts at 985, 989 and 995 in Mysuru, Yadgir, and Mandya, respectively. The sharp drop in the 0–6 sex ratio is common to all districts and worst in Mandya at 939.

(iii) Per capita income in Yadgir is substantially lower than the other two districts; and there is a large differential between Mandya and Mysuru as well.

We now look at the blocks selected for the present study. Comparison is possible between the block and the parent district, and between the selected study blocks.

(i) In terms of how the study blocks perform vis-à-vis their parent districts, the main differences appear to be (a) with regard to proportion of SC/ST population, which in both HD Kote and Shorapur are greater than in their respective districts. In Mandya North, however, the proportion of both groups is lower than in the district as a whole; (b) the proportion of the workforce engaged in agricultural labor is higher in the study blocks as compared to their parent district, particularly so in HD Kote. This points to greater economic vulnerability of the study population, as is reflected in the block's per capita income, which is less than half of the district average (Rs. 31,199 as compared to Rs. 65,759). Shorapur, like Yadgir, has a larger number of female workers engaged in agricultural labor; (c) the difference in per capita income between the study block and the district average is large in both Mysuru and Mandya, while in Yadgir the figure is slightly higher for the study block.

(ii) The comparison between the study blocks highlights differences in literacy, women working in agricultural labor and per capita income. In terms of literacy, both male and female, Shorapur lags behind the other two blocks by between 7 and 15 percentage points. In terms of women in agricultural labor, the ratio to women to men is about 55:45 in Shorapur, the reverse of the other two blocks. Rather counter-intuitively, the per capita income in Shorapur is higher than in the other two blocks.

(iii) The relatively poor performance of Yadgir with regard to important social development indicators such as TFR and literacy, echoed as well in Shorapur in terms of poor literacy and high female participation in agricultural labor, would lead to the prediction that children in Yadgir would present the poorest nutrition profile of the three study sites. Next, while Mysuru district performs relatively well on social development indicators, HD Kote presents a picture of greater vulnerability, with a greater proportion of SC/ST

population and greater proportion of agricultural labor in the workforce, both of which would be reflected in the children's nutritional profile. Finally, the prediction is that Mandya would be the best performer in terms of nutritional profile, given that the district and block performance on several of the key indicators.

3.2.2 Performance on BMI- and Height-for-Age by District

Table 3.2 presents data on the performance of the children included in the study on basic indicators of nutritional adequacy. The study shows that the proportion of children with normal BMI is very similar between the districts, irrespective of their HDI ranking or other social indicators.

(i) 31% of the children in Mysuru, 29% in Yadgir and about 30% in Mandya are underweight and fall into the thin and severely thin categories. Mandya district shows a small proportion (2%) of the children as overweight.
(ii) There is a significant difference between girls and boys: overall, girls tend to be less underweight than boys, at around 25, 19 and 23% in Mysuru, Yadgir and Mandya, respectively, as compared to around 38, 34 and 35% for boys in the same districts.
(iii) Older children (8–11 years) are significantly more underweight than younger children (5–7 years) at approximately 36, 30 and 31% in Mysuru, Yadgir, and Mandya, respectively, as compared to 25, 26 and 28% for younger children in the same districts.
(iv) Children belonging to Scheduled Tribes (ST) are significantly more likely to be underweight than non-ST children: there is about a 10 percentage point difference between ST and non-ST children in Mysuru; and a 9 percentage point difference in Yadgir. In Mandya, all children were non-ST.

The data show even greater variance when we consider stunting:

(i) Children are least likely to be stunted in Mandya, followed by Mysuru and then Yadgir. About 16% of children are stunted in Mandya district, as compared to almost 34% in Yadgir: more than double. Severe stunting is high in Yadgir at about 8%, as compared to 2% in Mandya.
(ii) Severe stunting is highest among ST children in Yadgir at 9.2%.
(iii) Although Mysuru has the highest HDI ranking among the three districts, it fares worse than Mandya on this indicator.
(iv) Within each district, the differences in height between boys and girls, older and younger children, and social groups are less significant than the differences in weight.

Table 3.2 BMI-for-age and height-for-age status by gender, caste, and age group

WHO 2007 growth reference										
Indicator (*n*)		BMI for age %					Height-for-age %			Chi square test
		Severely thin	Thin	Overweight	Normal	Chi square test	Severe stunting	Stunting	Normal	
Mysuru										
Gender	Male (719)	11.1	27.5	0.6	60.8	χ^2 = (3, *N* = 1644) 38.8, 0.000	4.2	19.9	75.9	χ^2 = (2, *N* = 1644) 1.0, 0.59
	Female (925)	5.1	20.3	0.4	74.2		4.5	21.7	73.7	
Caste	ST (730)	9.7	27.4	0.3	62.6	χ^2 = (3, *N* = 1644) 22.9, 0.000	4.1	22.3	73.6	χ^2 = (2, *N* = 1644) 1.7, 0.43
	NST (914)	6.1	20.4	0.7	72.9		4.6	19.8	75.6	
Age	5–7 years (788)	4.7	21.4	0.8	73.1	χ^2 = (3, *N* = 1644) 29.2, 0.000	3.6	19	77.4	χ^2 = (2, *N* = 1644) 7.0, 0.030
	8–11 years (847)	10.5	25.5	0.2	63.8		5	22.9	72.1	
Total	Total (1644)	7.7	23.5	0.5	68.3	–	4.4	20.9	74.7	–
Yadgir										
Gender	Male (1075)	9.4	25.4	0.7	64.6	χ^2 = (3, *N* = 2158) 49.5, 0.000	7.8	24.9	67.3	χ^2 = (2, *N* = 2158) 1.5, 0.46
	Female (1083)	3.8	18.5	0.7	77		8.5	26.8	64.7	
Caste[a]	ST (414)	8.2	27.5	0.7	63.5	χ^2 = (3, *N* = 2150) 7.8, 0.004	9.2	27.1	63.8	χ^2 = (2, *N* = 2150) 1.3, 0.52
	NST (1736)	6	20.7	0.7	72.6		7.9	25.6	66.5	
Age	5–7 years (878)	6.7	19.6	0.3	73.3	χ^2 = (3, *N* = 2158) 49.5, 0.05	8.4	25.9	65.7	χ^2 = (2, *N* = 2158) 0.14, 0.93
	8–11 years (1265)	6.5	23.7	0.9	68.9		7.7	25.8	66.5	
Total	Total (2158)	6.6	21.9	0.7	70.8	–	8.2	25.9	66	–

(continued)

Table 3.2 (continued)

WHO 2007 growth reference										
Indicator (*n*)		BMI for age %					Height-for-age %			Chi square test
		Severely thin	Thin	Overweight	Normal	Chi square test	Severe stunting	Stunting	Normal	
Mandya										
Gender	Male (749)	8.5	26.7	1.9	62.9	χ^2 = (3, *N* = 1538) 21.6, 0.000	2.3	12.1	85.6	χ^2 = (2, *N* = 1538) 3.6, 0.16
	Female (789)	5.3	19.3	2.7	72.8		2	15.5	82.5	
Caste	OBC (1113)	6.4	22.3	2.4	68.9	χ^2 = (3, *N* = 1538) 3.2, 0.36	1.8	12.9	85.3	χ^2 = (3, *N* = 1538) 6.7, 0.035
	NOBC (405)	8.4	24.4	2.0	65.2		3.2	16.5	80.2	
Age	5–7 years (807)	7.4	21.6	2	69	χ^2 = (3, *N* = 1538) 3.2, 0.36	1.6	12.9	85.5	χ^2 = (2, *N* = 1538) 3.8, 0.15
	8–11 years (726)	6.2	24.5	2.6	66.7		2.6	14.9	82.5	
Total	Total (1538)	6.9	22.9	2.3	67.9	–	2.1	13.8	84	–

Out of 5344 only 5340 students are included in the analysis because either age, weight, or height is missing of four students

[a]*n* = 2150 because caste data was missing for eight students

3.3 Household Characteristics of Government School-Going Children

3.3.1 Socioeconomic Characteristics of Sample Households

From the larger sample of 5340 students, 1080 were selected for more in-depth study, including an examination of household factors that could impact nutritional outcomes. Table 3.3 presents the data from the household survey of those 1080 households. The data indicate:

Table 3.3 Socio-economic characteristics of sample households (figures in %)

		Mysuru (HD Kote)	Yadgir (Shorapur)	Mandya (North Block)
Family own land	Yes	56.9	74.3	60.2
	No	43.1	25.7	39.8
Family income	Regular income	3.3	32.1	8.3
	Irregular income	96.4	67	91.7
Mother education	Mother literate	89.7	21.8	76.2
	Mother illiterate	9.4	77.4	23.8
No. of years of schooling	Can sign only	17.5	–	1.9
	5 years schooling	26.1	13.4	14.6
	8 years schooling	25.3	5.3	21
	$\geq$ 10 years schooling	20.8	3.1	37.6
Father education	Father literate	80.3	41.1	60.5
	Father illiterate	18.3	56.4	35.4
No. of years of schooling	Can sign only	19.7	–	0.3
	5 years schooling	22.5	17	14.6
	8 years schooling	11.1	10.1	11.3
	$\geq$ 10 years schooling	27	14	34.3
House type	Kaccha	11.4	29.3	4.7
	Semi-pucca	86.9	57.3	91.2
	Pucca	1.7	13.4	4.1
Fuel used for cooking	Wood/straw	86.1	99.4	87.6
	Dung cake	0.8	–	–
	LPG	34.2	1.7	29.6
	Kerosene	6.4	5.6	73.2
Toilet facility	Open defecation	61.4	96.4	72.9
	Common community toilet	1.7	2.5	–
	Toilet in house	36.9	1.1	27.1
Primary source of drinking water	Well	0.3	26	1.4
	Common tap in neighborhood	31.1	23.7	57.7
	Tap in house	58.6	13.4	34
	Common hand pump	9.2	33	6.9
	Common local water body	–	3.6	–

(i) More than a third of the children attending government schools in Mandya and Mysuru come from landless households, the highest being in Mysuru at 43%; in Yadgir, about three-fourths of all families have some amount of agricultural land.
(ii) The majority of the children in Mandya and Mysuru belong to families who do not have a regular source of income: greater than 90%. In Yadgir the figure was much lower, perhaps due to greater access to land, even a small holding (see above): about a third of households in Yadgir reported having a regular income.
(iii) Literacy of the parents is relatively high in Mysore and Mandya, but as low as 41% for fathers and 21% for mothers in Yadgir. In addition, very few of the mothers and fathers have had more than 5 years of schooling in Yadgir; while in Mandya more than a third of both fathers and mothers have had >10 years of schooling.
(iv) Almost 90% of the families in Mysuru and Mandya live in semi-pucca houses; and in Yadgir about half of the children live in semi-pucca houses, while almost one third of them live in kaccha houses.
(v) In Mysuru and Mandya about one in three homes reported using a toilet within the home; in Yadgir, open defecation is almost universal.
(vi) Most homes in all districts have access to water, either with a tap in the home, or a common hand pump.
(vii) The most common cooking fuel used is wood, and in Yadgir it is almost the exclusive source of fuel. In Mysuru, this is followed by LPG. In Mandya, both kerosene and LPG are used.

3.3.2 Degree of Variation in Nutritional Status of Children by Different Characteristics

Table 3.4 shows the characteristics which were found across all three study sites to significantly impact underweight among the children studied. As mentioned earlier, boys were significantly more underweight than girls; ST children were significantly more underweight than non-ST children; and older children (8–11) were significantly more underweight than younger children (5–7). In addition, several household characteristics were associated significantly with BMI-for-age: (1) children whose mothers have two or less children were less underweight. Perhaps having fewer children allowed the mother to provide more focused attention to each child; (2) children living in pucca houses were less underweight; (3) children practicing open defecation were more underweight; and (4) children who had attended an anganwadi before joining primary school were less underweight. Family size, maternal attention, and type of dwelling clearly play an important role in determining nutritional outcomes.

Table 3.4 BMI for age *Z*-score mean difference with household characteristics

Variable	Total $N = 1080$	n	BMI for age Z scores			
			Mean	SD	t test value	p value
Gender	Boys	540	−1.7	1	−5.5	<0.001
	Girls	540	−1.4	1		
Caste	ST	358	−1.7	0.9	−2.6	<0.001
	NST	722	−1.5	1		
Age group	5–7 years	539	−1.5	1	3	<0.001
	8–11 years	541	−1.7	1		
No. of children to mother	Above 2	469	−1.6	1	−2	<0.05
	2 or less	611	−1.5	1		
Type of house	Kaccha	163	−1.8	0.9	−3.7	<0.001
	Semi-pucca/pucca	917	−1.5	1		
Toilet facility	Open defecation	830	−1.6	1	−2.4	<0.05
	Toilet available	250	−1.4	1		
Child attended anganwadi	No/irregular	225	−1.7	0.9	−2.1	<0.05
	Yes/regularly	855	−1.5	1		

Table 3.5 looks at the relationship between height and a range of household indicators across all study sites. We find that ST children are significantly more stunted than non-ST children, and older children are more stunted than younger children. Apart from this, the following household characteristics are significantly associated with stunting: (1) children whose mothers had fewer children and who lived with fewer family members were less stunted; (2) children living in a pucca house, with a toilet, separate kitchen, and piped drinking water were less stunted; (3) children whose mothers were literate and members of a SHG were less stunted. Again, family size and type of dwelling, and in addition a literate mother, have a significant impact on stunting.

3.4 Concluding Reflections

This chapter looks at children who continue to attend government school; those whose parents due to lack of funds and/or lack of awareness have not shifted their children to a private school. We started with two questions:

(i) *Does overall development of a region/district predict the level of malnutrition to be found among government school-going children in that region/district?* The analysis shows that there is no clear pattern that emerges with regard to underweight status of government school-going children and the social development status of the district/block in which they live. There are significant differences between different categories being studied: gender, caste, and

age. But these differences are equally significant across all districts, irrespective of their performance on social development indicators. In terms of stunting, some relationship is observed between stunting and social development status as shown by the substantial difference between Yadgir and Mandya on stunting and severe stunting. Intra-district variations according to gender, caste, and age are relatively small. Therefore, our prediction that the diversity of the districts in terms of their socioeconomic indicators would be reflected in a similar diversity in the nutritional status of children enrolled in the public education system is not borne out as far as underweight is concerned; but is reflected in terms of height.

(ii) *Does the household profile of children who attend government schools predict the level of malnutrition found among those children?* The study clearly finds that children attending government schools in the study districts experience multiple dimensions of poverty; and that there is a consistent pattern of serious nutritional deficit among the children. Household survey data show that households in all three districts studied experienced a range of different types of poverty, in terms of their social class, living conditions, and family circumstances. Social determinants such as gender and mother's educational levels, and economic factors such as ownership of land, assets, and type of dwelling also significantly impacted children's nutritional levels. A large proportion of the respondents belonged to families where one or both parents were agricultural laborers, or small or marginal farmers. The majority of families did not have a regular source of income.

Malnutrition is both caused by and results in underdevelopment (Kaliamoorthi 2013). While improved incomes do lead to a reduction in malnutrition, economic development alone cannot eliminate malnutrition (Radhakrishna et al. 2004). The association of malnutrition with issues associated with poverty, such as household, social, and demographic characteristics, is well recognized (Shyma 2013). This finding is echoed in a study linking malnutrition with cognitive development and school participation, which found that malnourished children experienced a range of environmental challenges associated with poverty, including poor housing, poor health care, and weak family and community support systems (Sood 2010). Childhood stunting has been found to be associated with multiple factors, including socioeconomic, environmental, community, and household factors (Stewart et al. 2013). Other reasons for stunting include poor feeding practices, poor maternal nutrition, and poor sanitation (Spears 2013). Studies across different regions have found similar results: a study of children in Laos found that those from the southern region and from ethnic minority groups were more likely to be malnourished. Parent's education, assets of the household, sanitation, and water supply were all found to be significant factors determining childhood nutritional outcomes (Kamiya 2011); in Bangladesh, under 5 malnutrition was found to be significantly associated with parents' education, size at birth and mother's BMI (Rayhan and Khan 2006); in Kenya, Ayaya et al. (2004) found that poverty, social conditions under which the child was living, sex of the child and incomplete immunization (often a good

Table 3.5 Height-for-age *Z*-score mean difference with household characteristics

Variable	Total $N = 1080$	n	Height-for-age *Z*-scores			
			Mean	SD	t test value	p value
Caste	ST	358	−1.4	1	−2.1	<0.05
	NST	722	−1.3	1		
Age group	5–7 years	539	−1.2	1	3.6	<0.001
	8–11 years	541	−1.4	1		
No. of children to mother	Above 2	469	−1.5	1	−4.7	<0.001
	2 or less	611	−1.2	1		
Toilet facility	Open defecation	830	−1.4	1	−2.5	<0.05
	Toilet available	250	−1.2	1		
Family members	Above 4	705	−1.4	1	−2.6	<0.05
	Less than 5	375	−1.2	1		
Mothers education	Illiterate	403	−1.5	1	−3.7	<0.001
	Literate	677	−1.2	1		
Type of house	Kaccha	163	−1.5	1	−2.4	<0.05
	Semi-pucca/pucca	917	−1.3	1		
Kitchen separate	No	206	−1.5	0.9	−2.1	<0.05
	Yes	874	−1.3	1		
Source of drinking water	Others	116	−1.5	1	−2.2	<0.05
	Tap	964	−1.3	1		
Mother SHG member	No	617	−1.4	1	−2.2	<0.05
	Yes	463	−1.2	1		

indicator of the effectiveness of the health system) were good predictors of childhood malnutrition. Similarly, in a study comparing nutritional status of primary school children in private versus government schools, researchers in Lahore, Pakistan, found that poverty, low literacy, large family size, food insecurity, and women's education were important determinants of the differences in nutritional outcomes (Babar et al. 2010).

By establishing the link between poor nutritional outcomes and the socio-economic status of government school-going children, the data concludes that the needs of children going to government schools go beyond the four walls of the school. Interventions to compensate for the shortcomings of government schools have largely focused on the following aspects (Kumar and Sarangapani 2010): (1) specific subjects of the school curriculum, with the intention of making the teaching of these subjects more effective; (2) developing specific unconventional areas of the school curriculum, such as environmental education or health and hygiene; (3) whole school approaches, which also sought to engage the community in school activities; (4) language teaching, with a particular concern for first-generation learners; and (5) demands for school accountability and better quality, including through community mobilization.

Evidence indicates that such approaches may not be sufficient to achieving the desired improvements in learning outcomes. The finding of high levels of malnutrition among government school-going children linked to household economic constraints points to the need to look at issues that go beyond curricular and pedagogical practices within the classroom. The recognition of the link between poverty, poor social development indicators, and malnutrition led the government of South Africa, for example, to include nutritional supplementation as an integral part of their social support program (Vorster 2010). Similarly, in India as well, the government has implemented several health and nutrition programs in schools such as the Mid-Day Meal Scheme (MDMS) and the School Health Program (SHP); these could well be critical not only to the children's health and well-being, but also to the school's curricular goals.

The first 1000 days of a child's life have been emphasized as being the basic building block, when adequate nutrition and care ensures that the child develops and flourishes, and grows into a productive and successful young child and then an adult (Chilton et al. 2007). Failing to do so would relegate the child to a lifetime of playing "catch up" and compensating for early deprivation. This is the argument which has been made to support investments in maternal and newborn care, early childhood nutrition and education, and care of the adolescent girl (the mother-to-be).

But our data shows that the story cannot end there. The school-going child continues to require support to be able to grow and flourish. Ensuring that health and nutrition services of consistent and high quality are made available to children in government schools should be a priority for the public school system. There is evidence to show that health and nutritional support during this phase positively impacts contextual factors such as school attendance and retention; evidence also shows that it impacts nutritional levels, particularly for children most vulnerable to malnutrition. In the next chapter, we examine the nutritional outcomes of one of the most vulnerable and marginalized groups: tribal children. This group of children is impacted not only by social marginalization; they also bear witness to the far-reaching impact of changing economic policy, loss of habitat and dwindling access to natural resources. The evidence clearly indicates that the need to establish a framework of support for the health and nutrition of tribal children and their communities is even more urgent.

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Chapter 4
Vulnerability and Childhood Malnutrition: Narratives from Tribal Households

Abstract This chapter provides evidence on the nutritional outcomes of a particularly neglected group: tribal children in primary schools in the age group 5–12 years. Tribal children in this age group are highly vulnerable to nutritional deficit, and its impact on their physical and mental growth can be critical to their leading a full and productive life. We examine the food choices made by tribal communities in Karnataka and factors that contribute to these choices. Our data show that there has been a substantial decrease in the range of different categories of food being consumed, particularly by tribal communities. Using the personal accounts of mothers and grandmothers of their changing dietary choices, we paint a picture of what they ate when they were young and what they are eating now; what has sustained and what has been destroyed. It presents a wide range of factors that influence food choice such as changes in agricultural patterns, availability of food through public distribution systems, increase in cost of food, declining range of homemade foods, changes in consumption pattern, nature of employment, and the eco-system. The chapter argues that a multipronged approach is required to restore traditional food systems: interventions are needed at the policy, program, and household level to establish a comprehensive framework for nutritional support to those most at risk, provide an adequately diversified diet to fulfill nutritional needs and enable households to access a wholesome diet that respects their dietary traditions.

4.1 Introduction

According to the Census 2011, 8.6% of India's population belongs to the Scheduled Tribes (ST), amounting to more than a 100 million people. Ninety percent of the tribal population in India lives in rural areas (GoI, Primary census abstract data for Scheduled Tribes 2011a), often in remote rural areas with limited access to public services. The Census 2011 reports that only 14% of the tribal population in rural

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areas have a source of drinking water within their homes; almost 75% practice open defecation; only about 17% of households have a bathing facility within their households; and less than half (46%) have household electricity supply [GoI, Scheduled Tribe (ST) Data Tables—(India and States/UTs) 2011b].

Health outcomes of tribal groups continue to be a public health challenge. The maternal mortality ratio (MMR) for tribals was estimated at 212 per 100,000 live births in 2011 as compared to 178 per 100,000 for the general population (GoI, Special Bulletin on MMR 2011). At 95.7 per 1000 live births, under 5 years mortality for STs was significantly higher than the rates for Scheduled Caste (88.1), Other Backward Class (72.8), and other categories (59.2) (MoHFW, NFHS-3 2005–06). The data show that tribals make up 8–9% of the population, but account for 14% of all under-5 deaths and 23% of deaths in the 1–4 years age group (Das et al. 2010). Both adult and child malnutrition are widely prevalent amongst tribal groups: only about 52% of women and 57% of men had a Body Mass Index (BMI) within the normal range; almost 70% of women were anemic; and almost 40% of men were also anemic (MoHFW, NFHS-3 2005–2006). A review of seven studies conducted between 2006 and 2012 indicates that the prevalence of stunting among tribal children under 5 years of age, in rural areas, ranges between 50 and 60%. The UNICEF (2014) report on the nutritional status of ST children in 11 Indian states shows severe stunting was 9% points higher among ST children as compared to nontribal children (29 vs. 20%). It was also reported that stunting was high across gender, birth order and in all age group compared to nontribal children. Infant deaths attributable to malnourishment are also rampant: a study in Attapady tribal block, Kerala, showed that the Infant Mortality Rate (IMR) among tribal children was 66 per 1000 live births as compared to 14.1 in the rest of the state (Manikanda 2014). Maternal stunting, pregnancy interval, maternal illiteracy, and household poverty were also found to be important determinants of stunting among tribal children. For example, the gap in literacy rate between the tribal and general population has declined between 1991 and 2011, but continues to be high at 14%.

Another critical gap is lack of information: National surveys such as NFHS, District Level Household Survey (DLHS), Rapid Survey on Children (RSoC) have failed to capture data on the prevalence of malnutrition among children above 5 years of age. This chapter provides evidence on the nutritional outcomes of a particularly neglected group: tribal children in primary schools, in the age group 5–12 years. Already susceptible, tribal children in this age group continue to be highly vulnerable to nutritional deficit, and its impact on their physical and mental growth can be critical to their leading a full and productive life.

Here we examine the food choices made by tribal communities in Karnataka and factors that have contributed to change in these choices, as an illustration of the dietary transformation that is taking place among tribal communities across the country. National Sample Survey Organization (NSSO) data highlight a paradox that is peculiar to India: despite sustained economic growth since the 1990s, there

has been a reduction in caloric intake; this is contrary to global trends which associate economic growth with enhanced food consumption. Our data show that there has also been a substantial decrease in the range of different categories of food being consumed, particularly by tribal communities. We find that the shrinkage in dietary choice is partly due to structural reasons relating to development policy frameworks and program interventions, and partly also due to shifting tastes and preferences as communities move away from traditional lifestyles.

The chapter argues that a multipronged approach is required to address this public health emergency. Interventions are needed at the policy, program, and household level to establish a comprehensive framework for nutritional support to those most at risk, provide an adequately diversified diet to fulfill nutritional needs, and enable households to access a wholesome diet that respects their dietary traditions.

4.2 Methodology

Our analysis of the dietary choice of tribal communities relies on both quantitative and qualitative data. The quantitative data presented here was collected from 3770 tribal and nontribal children from 59 government schools in Mysuru and Yadgir districts in grades 1–5. Anthropometric measurement including height and weight of the children, plus their gender, caste, and age were recorded. Nutritional status was assessed using WHO references for 5–19 years: BMI-for-age (underweight) and height-for-age (stunting).

The qualitative data was collected using the purposive sampling method from two sources: (1) 116 tribal and nontribal grandmothers were interviewed in nine Focus Group Discussions (FGDs) and five In-Depth Interviews (IDIs) between January and August, 2015. The participants were all grandmothers who had at least one grandchild included in the study. The primary purpose was (a) to understand how food availability and accessibility have changed over the years; and (b) to understand from senior community members how these changes have affected the community's health and nutrition, especially of children and women; (2) 358 mothers were selected based on gender and age of the children included in the study to collect information on the food intake of the children; and (3) In-depth Interviews were conducted with five tribal and nontribal mothers between August 2014 and February 2016 to understand the transition of dietary pattern and different food choices over time. The participants were selected from Kasaba, Antherasanthe, and Saraguru hoblis of HD Kote Taluk, Mysuru district.[1]

[1]Names of mothers mentioned in the analysis have been changed due to ethical considerations and to maintain confidentiality.

4.3 Nutritional Status of Tribal Children: All-India and Karnataka

In Karnataka, ST groups comprise 7% of the state's population. Roy et al. (2015) estimate that about 50 different tribal groups live in Karnataka, including primitive groups. The distribution of tribal populations across the state is shown in Fig. 4.1. The gender ratio among tribals of Karnataka is 900 females to 1000 males (higher than the all-India average for STs). Although gradually increasing, literacy rates for STs continue to be low at 53.9% in 2011, as compared to 75% for the state average (Roy et al. 2015).

National level data clearly show the nutritional vulnerability of tribal children. The RSoC 2013–14 shows the relative performance of tribals as compared to rural children: both all-India and Karnataka figures indicate that tribal children fare much worse. Low-birth weight is almost double among tribals in Karnataka as compared to the rural population, and 4% points higher at the national level; and both wasting and underweight are relatively much higher among tribal as compared to the rural population in Karnataka as well as all-India. Looking at the data on the nutritional status of tribal children specifically, as compared to national averages, Karnataka performs as follows: more than a third of tribal children are born low birth weight in Karnataka as compared to about one-fifth nationwide; almost one in four tribal children are wasted in Karnataka, compared to less than one in five nationwide; and 37.6% of tribal children are underweight, very similar to the national average of 36.7%. Karnataka does better only on stunting: about 37.2% as compared to 42.3% (Table 4.1).

4.3.1 Prevalence of Malnutrition Among Tribal School Children of Mysuru and Yadgir Districts

The nutritional status of tribal children of HD Kote taluk has been estimated from the anthropometric data of 3770 children in Classes 1–5 taken from the HD Kote taluk of Mysuru district and the Shorapur taluk of Yadgir district (Table 4.2). About 30% of the children in the sample belonged to ST households.

The data indicate that:

- Except for male children aged 5–7 years, in all other categories, tribal children were significantly underweight as compared to their nontribal counterparts. Overall, only 63% of tribal children were within the normal range for weight, as compared to 72.5% of nontribal children.
- The proportion of underweight among tribal children increased with age: while 71.2% of tribal girls aged 5–7 were recorded to have normal weight, this fell significantly to 67.6% for tribal girls aged 8–11 years of age. Similarly, while 65.7% of tribal boys aged 5–6 years of age were within the normal range for

Fig. 4.1 Tribal population as percentage of total population—Karnataka. *Source* Census (2011)

Table 4.1 Prevalence of malnutrition among tribal children (<5 years) all-India and Karnataka

	RSoC (2013–14)					
	Karnataka			India		
	Tribal	Rural	Total	Tribal	Rural	Total
Low-birth weight	33.8	17.2	17.2	21.6	18.7	18.6
Stunted	37.2	34.2	34.2	42.3	41.6	38.7
Severely stunted	14.3	14.8	15.1	19.5	19.1	17.3
Wasted	23.9	17.8	17.0	18.7	15.1	15.1
Severely wasted	9.7	7.2	6.3	5.3	4.5	4.6
Underweight	37.6	30.2	28.9	36.7	31.6	29.4
Severely underweight	17.2	11.1	9.8	13.0	10.6	9.4

Source Rapid Survey on Children (2013–14)

weight, only 48.7% of tribal boys 8–11 years of age had normal weight. While nontribal children also registered a drop in the proportion of children registering normal weight as they grew older, in neither age group was the drop as substantial.

Table 4.2 Underweight and stunting rates by age, sex, and social category in study districts: Mysuru and Yadgir

$N = 3770$ (n)	BAZ (underweight)					HAZ (stunting)			
	Severely thin	Thin	Over weight	Normal	Chi square value	Severely stunted	Stunted	Normal	Chi square value
ST (1137)	9.1	27.4	0.4	63	$X^2 = (3, N = 3770)$ 37.8, 0.000	5.9	24.2	69.9	$X^2 = (2, N = 3770)$ 0.68, 0.712
NST (2633)	6.1	20.7	0.7	72.5		6.6	23.6	69.8	
FST 5–7 years (257)	3.9	24.1	0.8	71.2	$X^2 = (3, N = 885)$ 10.8, 0.013	5.4	19.5	75.1	$X^2 = (2, N = 885)$ 0.83, 0.661
FNST 5–7 years (628)	3.2	15.3	0.5	81.1		5.9	22	72.1	
FST 8–11 years (321)	8.4	23.4	0.6	67.6	$X^2 = (3, N = 1107)$ 12.3, 0.006	5.9	33.3	60.7	$X^2 = (2, N = 1107)$ 9.0, 0.011
FNST 8–11 years (786)	3.9	19.6	0.6	75.8		7.8	24.7	67.6	
MST 5–7 years (268)	8.6	25.4	0.4	65.7	$X^2 = (3, N = 777)$ 1.04, 0.791	4.9	23.1	72	$X^2 = (2, N = 777)$ 2.3, 0.320
MNST 5–7 years (509)	8.1	22.6	0.6	68.8		7.3	25	67.8	
MST 8–11 years (291)	15.1	36.8	0	48.1	$X^2 = (3, N = 1001)$ 26.8, 0.000	7.2	19.2	73.5	$X^2 = (2, N = 1001)$ 2.62, 0.270
MNST 8–11 years (710)	9.6	25.4	1	64.1		5.4	23	71.7	

ST scheduled tribe, *NST* nonscheduled tribe, *M* male, *F* female

- Stunting data showed less significant variation between tribal and nontribal children. The only exception is tribal girls in the age group 8–11 who are significantly more stunted than nontribal girls of the same age.
- The data show a clear linkage between gender, age, and caste and both underweight and stunting.

4.4 Dietary Adequacy and Diversity of Tribal Households

What could be the reason for the nutritional deficit being faced by tribal children and their families? The literature offers several explanations, which include nutritional risk factors for tribal newborns and infants as well as children of school-going age. In general, malnutrition is associated with low literacy of the mother, poverty, higher birth order, lower birth intervals, and faulty feeding habits (Mathad and Shivaprasad 2013). With respect to tribal malnutrition, Manikandan (2014) has identified land alienation of tribals; loss of traditional foods such as ragi, tubers, and other items; lack of political will to address the nutritional needs of tribals; and failure of various social safety net programs such as the Public Distribution System (PDS) and Mahatma Gandhi Rural Employment Guarantee Scheme (MNREGS) to reach tribal hamlets. Others have interpreted malnutrition to be one symptom of the socioeconomic disruption of tribal societies. Loss of access to forests and forest produce and increased population pressure have been identified as key issues influencing nutritional outcomes for tribals (Sonowal 2010; Raju et al. 2015). This finding has been echoed by Tagade (2012) looking at tribals in Maharashtra, who concludes that lack of access to forest resources—a traditional source of food for tribals—plays an important role in determining their nutritional status. Their geographical isolation, uncertainty in food supply, lack of adequate healthcare facilities, as well as traditional beliefs have also been identified in a study of the Chenchu of Telengana (Rao et al. 2015). Repeated bouts of illness, including waterborne diseases and malaria, also contribute significantly to malnutrition (Chakrabarty and Bharti 2010; Tubid 2015). Another issue is child-rearing practices: a study among tribal people in Northeast India found that children who received colostrum and were vaccinated against measles were less likely to be wasted (Singh et al. 2015). Nutritional deprivation of mothers during pregnancy as well as poverty, lack of awareness, poor water and sanitation facilities leading to frequent bouts of communicable disease and poor access to social safety net programs have been identified by others as important determinants of tribal malnutrition (Gangadharan and Kumar 2014). Lack of awareness of nutritional disorders and poor utilization of available health and nutrition services have been identified elsewhere as well (Das et al. 2010; Ghosh-Jerath et al. 2013).

Our analysis explored some possible contributors from the study areas that could explain persistent malnutrition among tribal children. The section below uses the quantitative data collected from the Food Frequency Questionnaire (FFQ) and the

recommended daily calories/nutrients provided under the Mid-Day Meal Scheme (MDMS) to estimate the quantity of different types of food consumed by the children; and examines the qualitative responses elicited from the in-depth interviews to construct a picture of the determinants of dietary adequacy, diversity, and choice.

First, we examine the quantity of different types of food consumed by tribal children as estimated from FFQ and MDMS data (Fig. 4.2).

It is clear from the above figures that the diets of tribal children are far from adequate; and there are important gaps in nutritional intake that will have far-reaching consequences on their nutritional status. Some of the key observations include the following:

- All children below 7 years consume cereals at or above the RDA. About 30% of children in the 7–9 age group fall short of RDA and about 60% children who are 10 and above are not eating as per RDA.
- Less than 50% of children below 7 years consume pulses/nonvegetarian food as per RDA; and only 10 children aged 7 years and above do so.
- Consumption of fruit as per RDA declines with age, from about 50% of children below 7–10 years of age to less than 30% of children 10 years and above.
- Vegetable consumption of all age groups is below the respective RDA.
- Only one child consumes milk and milk products as per RDA; in fact, 99% have less than half of the RDA.
- Overall, across all age groups, food consumption (including food provided in the MDMS) as per RDA declines with age, and is lower than the recommended amounts for most food groups.

Interviews with the grandmothers and mothers revealed that food availability and accessibility depend critically on family income, type of work, time taken to cook specific food types, ownership of agricultural land and milch cattle, as well as critical cultural factors. As a result of these factors, apart from dietary diversity, quantity of food consumed also varies significantly.

The discussions with the grandmothers also provided some insights into the ways in which dietary diversity had changed for tribal communities. They were able to pinpoint the many ways in which dietary preferences and choice had been transformed for a variety of reasons:

- *Cereal*: Among cereals, nutritious millets such as barley and pearl millet no longer form a part of their diet. Apart from ragi (finger millet) and wheat, the main staple now is different forms of rice. Pulses such as black sesame, horse gram, and black gram no longer figure in the diet, although they are all cheap and rich sources of protein.
- *Vegetables*: The variety of vegetables consumed has come down significantly—10 types of green vegetables now as compared to 20 before, for example; and there has been a shift in the types of vegetables being consumed. Earlier, the choice was largely traditional, locally grown produce, such as gourds, roots and tubers, and a variety of green leafy vegetables. But now, the preference is for

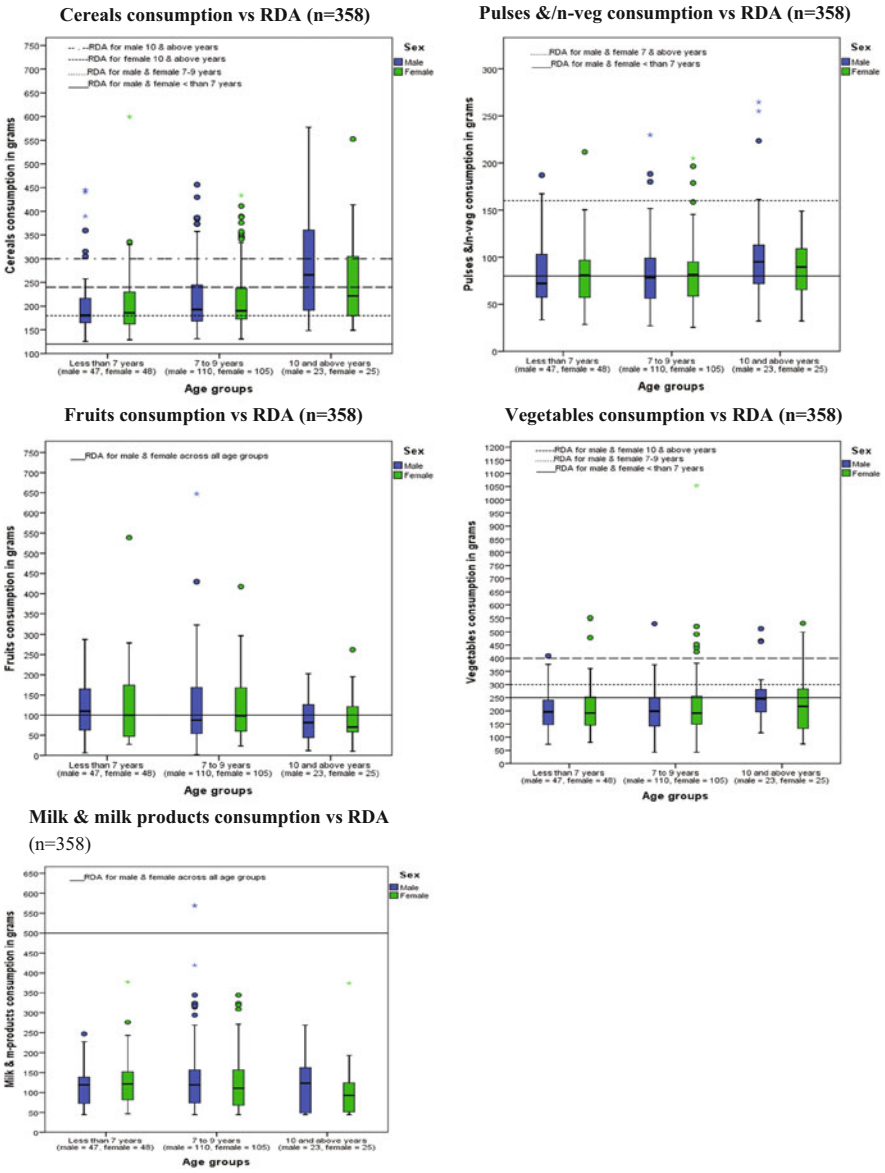

Fig. 4.2 Types of food consumed by tribal children

what are termed "English vegetables" such as cauliflower, cabbage, and tomatoes. These are more expensive and not part of the traditional diet. The choice of fruit has been severely curtailed, with various types of berries and wild fruit being discontinued, and the preference mainly for fruit that find their way to the market like apples and bananas (Table 4.3).

Table 4.3 What we ate then and what we eat now: grandmother's recollections

Food group	What we ate in the past…	What we eat now…
Cereal	Beaten rice, bamboo rice, corn (small and big), brown rice, white rice, jowar, barley, pearl millet, ragi, wheat	White rice, bread, beaten rice, jowar, ragi, wheat
Pulses	Bengal gram, black gram, black sesame, channa, channa dal, chickpea, cowpea, green gram, groundnut, horse gram, kidney beans, pigeon peas, moong dal, red gram, peas, urad dal	Peas, cowpea, green gram, groundnut, kidney beans, red gram, pigeon peas, urad dal
Vegetables	20 different types of green leaves, green banana, bamboo shoots, beans, beetroot, bitter gourd, bottle gourd, brinjal, carrot, core of the banana, drumsticks, cluster beans, green chillis, ivy gourd, lotus root, onion, potato, pumpkin, ridge gourd, roots/tubers, snake gourd, thorny potato	10 different types of green leaves, cucumber, onion, beans, beetroot, bitter gourd, brinjal, cabbage, carrot, cauliflower, drumsticks, green chili, okra, lemon, potato, pumpkin, radish, ridge gourd, tomatoes, yam
Fruit	Gooseberry, apple, banana, blueberry, cactus fruit, cashew apple, custard apple, dates, two types of banana, elephant apple, figs, grapes, guppatta, helepi, jackfruit, jambu, jauviri, jujube, kajjari, karae hannu, kavali, majjige hannu, mango, musambi, nagarahannu (traditional fruits), oranges, papaya, pomegranate, wild apple, wild berry	Apple, banana, guava, papaya, banana, wild berry
Milk products	Butter, buttermilk, cow's milk, curds, ghee, buffalo milk	Butter, buttermilk, cow's milk, curds, ghee, buffalo milk
Meat	Antelope, bison, cat, chicken, chikuli, crabs, deer, different types of fish, duck, egg, forest rat, goat, jungle fowl, mutton, peacock, pork, prawns, rabbit, sheep, tortoise, water snake	Crabs, egg, farm bred chicken, goat, pomfret, mutton, pork, rabbit, sheep, water snake
Other	Chili bonda, chutney, porridge	Biscuits, bonda/bajji, cake, chips, chutney, coffee, gobimanchuri, Horlicks, kadubu, Kurkure, Maggi noodles, masala puri, pani puri, puffs, vada, chocolates, mithai

- *Meat*: This has changed dramatically: wild animals found in the forest are no longer part of the diet. Antelope, deer, tortoise, duck—this wide range of choice that was available to the grandmothers when they were young has now shrunk to a handful of choices, with only rabbit and water snake being the two items which perhaps are not available in the shop, but are still consumed.

- *Other dietary choices*: The category "other" is very telling: it reveals a long list of packaged junk food of dubious nutritional value but high cost: Maggi noodles, Kurkure, chips, as well as deep fried and sugar laden goods of various types.

4.5 Determinants of Dietary Choice

The key determinants of dietary availability and choice are very diverse as expressed by the grandmothers and mothers who were interviewed. We classify them as follows:

4.5.1 Structural

(a) ***Family income***

The economic situation of the family significantly impacts availability of food. Family income varies with the nature and duration of work. In all cases, adult members of the family were engaged in daily wage work available in surrounding villages. *"All of us get paid daily—if they don't have money then they pay us weekly" says Saraswathi, "Therefore sometimes we have money and sometimes we don't."* Secondly, monetization of food has impacted consumption patterns. Local cereals, pulses, vegetables, tubers, and fruits which were freely accessible earlier either by growing them or exchanging with their neighbors/friends are now available only in the market; but the prices of these items has increased so much that they cannot afford to buy them, which has resulted in low consumption. Thirdly, going through a critical life event such as accident and injury of the main earning member of the family or head of household puts the whole family at risk…. "*Due to a bike accident, my husband has not been able to work for the last one year; and even though he has recovered, he cannot work much. Therefore the situation between before and now has changed a lot" says Gowramma.*

(b) ***Land Ownership***

Land ownership can be an advantage to the household since a few crops are cultivated mainly for household consumption and not for sale. These become part of the daily menu for the family. *"We own a half acre of land where we work and grow cotton and ragi. The ragi was not for sale because production is not sufficient. We supplement this with rice we get from the society. If that's not enough then we buy more from the shop" says Gowramma.* But the uncertainties of rain-fed agriculture contribute to the food insecurity of the household. *"Four years back there*

was loss of crop because rains failed but that has not happened recently. If there is rain then we have work; else we stay at home" says Saraswathi. The uncertainty of rainfall forces families also to engage in daily wage labor to bring in some income. Due to rain-fed agriculture, many crops are not being cultivated currently. "*Only when the rain comes—tomatoes, methi (watercress) and chillis are also grown. If a pump set is available, then we can cultivate other crops…otherwise we have no water*."

However, this too is changing, due to a change in economic incentives. There is a rising trend toward growing cash crops such as cotton, resulting in reduction in the availability of food for household consumption. *Saraswathi said that "ragi cultivation has reduced. Now there is a change; people grow ginger, marigold, etc. Ragi and pulses are grown only for household consumption*." Similarly, tribal families would earlier rear cattle and consume the milk and milk products; but now even if they rear cattle, the milk is sold to the dairy instead of being used at home. Some respondents expressed their concern about this: *"We had cows and used the milk at home but now everything is sent to the dairy. In earlier times, curds, butter, buttermilk were used at home and given to the children too" says a grandmother from Mandya.*

(c) ***Shift in agricultural practices as a cause for changing dietary choices***

An important reason behind the shift of dietary choices over time is agricultural practices. "*Earlier people were growing ragi, now it is rice, jola (maize or jowar), cotton…other crops. Tobacco, cotton and jola have good price in the market. Growing ragi involves a lot of work. Growing jola is easier—once you do the inter-cultivation and some fertilizer is given, that is it. With ragi, inter-cultivation has to be done twice, fertilizer has to be given many times, and then after harvesting it has to be tied in bundles—it involves a lot of work. Jola doesn't require that much work" says Sanjivee*.

An additional concern expressed was over the quality of the food being grown. The general perception among the respondents was that today's food contains too many chemicals. The grandmothers constantly commented that food today is impacting the health of everyone due to a variety of reasons, such as the use of pesticides, fertilizers, and chemicals that are used to ripen fruits, as well as modern irrigation practices: "*Farmers spray large amounts of medicines while growing cereals which causes more diseases*." They were also of the opinion that they could not produce anything in their fields without using chemicals now because the soil has lost its fertility after constant use of fertilizers over the years. "*Earlier jowar, sesame were grown; but now there is no rain, and we need a lot of chemicals and machines to grow those crops. Earlier oilseed cakes were used as fertilizer but now we have to get fertilizers from the co-operative, otherwise seeds don't sprout and grow*" (Mandya). "*We used homemade fertilizers, fertilizers made of cow's waste and we grew good crops; now it has become impossible to grow crops without adding foreign fertilizers*" (Yadgir).

The introduction of hybrids was perceived as another problem. The local varieties of cereals and pulses have disappeared which they think had very high nutritive value when compared to hybrids. "*Not only pulses, but native varieties of all food grains have disappeared. Wherever you look, hybrids have taken over*" (HD Kote).

(d) ***Impact of policy change***

The grandmothers reported that in previous generations they would hunt and eat different types of animals from the forest; but now the restrictions laid down by the Forest Department preventing hunting/entry into designated forests have deprived them of this option. The range of nonvegetarian food that they used to eat has therefore come down drastically, and they depend largely on market-bought foods (see Box 4.1).

Box 4.1: Changing food habits of Jenu Kuruba tribe at H D Kote (Mysuru)

Jenu kurubas are a primitive tribal community living in Heggadadevana kote (H D Kote), Mysuru district, Karnataka. Traditionally forest-dwelling tribes, they have now been relocated by the Forest Department out of the designated reserve forests, and live on the fringes of the forest. They have been provided small one-room huts, without any sanitation facilities or electrification.

Family size ranges from three to nine members including children. Many of the children have dropped out of school. The families are landless and the men frequently migrate seasonally to Kodagu and elsewhere to work on the plantations.

The Forest Rights Act 2006 has restricted their access to forest resources, thus preventing them from accessing roots, tubers, nuts, honey, fruits and other forest produce on which they were dependent for their food. The government instead distributes additional food rations, consisting of a monthly allotment of 15 kg of ragi, 2 kg jaggery, 1 kg oil, 30 eggs, and a kg each of red gram, green gram, and horse gram.

The family food diary:

Most of the family members get up between 6 and 7 am; if they have money, they buy milk to prepare tea or else just boil water and add tea powder/leaves and jaggery. Those who can afford it, eat some bread or biscuits or rusks with their morning tea; sometimes it is only given to the children. If they are at home, they eat breakfast between 9 and 10.30 am. Sometimes they can make *ragi* balls with pulses curry, *uppusaru (salt water boiled with spices),* or tomato curry at breakfast time; otherwise it is *uppittu (cream of wheat), chitranna (lemon rice), dosa*, *chapatti (unleavened whole wheat bread),* or *puliyogare (tamarind rice)*. Lunch time is between one and 2.30 pm but the majority of them do not have lunch. Those who eat lunch consume what was made in the morning—ragi balls or rice and curry or

else boiled rice *ganji* (gruel) with chutney. Dinner is between 8 and 9 pm. They prepare *ragi* balls, rice, and curry and eat it hot. They use the pulses and rice bought in the PDS and procure some greens from the fringes of the forest.

Nonvegetarian foods consumed by the family are fish, mutton, and chicken. But this is only rarely since they have to buy these in the market now. Earlier when they lived inside the forest, they used to get rabbit, forest hen, and other small animals which were a welcome supplement to their daily diet. Now, on a rare occasion, their dog might catch a stray rabbit; but on special occasions when guests are invited, they need to purchase meat.

Latha (name changed), one of the tribal women, shared that they used to gather 100–150 varieties of greens from the forest during the rainy season; and 10–15 types of tubers, honey and various fruits and berries. But now that they can no longer go into the forest, they have to buy whatever vegetables are available in the shops—tomatoes, beans, turnip, beetroot, brinjal; and fruits—banana, apple, orange, grapes, *musambi* (sweet lime). They also buy masala powders, coffee and tea, betel leaves and nuts, and chewing tobacco.

In HD Kote, on average, about 30% of the children are underweight and about 26% are stunted. In villages where the population is predominantly tribal, the proportion is much higher. Moving tribal communities away from their traditional habitats has had a devastating impact on access to their traditional diet and dietary diversity.

Case study compiled as part of a study conducted by the Health, Development and Society Group, Azim Premji University: Do we know what they eat and why? A Study on School-level Dietary Adequacy and Impact of Cultural Beliefs on Dietary Choice in Rural Karnataka, India.

4.5.2 Programmatic

(a) ***Impact of subsidized supply***

The foods that continue to be cheap are those that are available through the Government's PDS: for Rs. 48, each household can procure about 30 kg of rice, 2 kg of wheat, and 1 kg of sugar, apart from some cooking oil. Partly because of this, they now get a stomach full of food. The government food subsidies are seen as a way to even out food availability even when they are not able to get regular work. "*Due to the irregular nature of the work and family income, it is sometimes very difficult to buy food. But life is better now as compared to 5 years back. Now we get food supplementation from the government; oil, pulses, jaggery and eggs, and rice from the society" says Sanjivee*.

4.5.3 Household/Individual

(a) ***Change in preferences***

Mothers mentioned a shift in dietary choice over time. According to them, the foods eaten during their childhood are slowly disappearing, and these days children do not even like such foods. "*I ate ragi balls at every meal in my childhood and in those days mothers used to try to give their children fruits and roots (as vegetables)*" *says Sanjivee*. Even now she prefers those foods, but her children like *bhath* (mixed rice) and *chitranna*. "*Only if we eat ragi balls will we have strength to work in the fields; so we eat it every day. But the children don't like it—we force them to eat it but they eat very little. Actually it is so healthy*" *says Saraswathi*. Therefore, ragi balls were considered good for adults, while children most often eat vegetables and rice even though the mother's preference was for them to eat ragi. Gowramma still gives ragi to her grandchild and she likes it. However, overall the mothers felt that the children were better off than before. *Saraswathi said that "earlier buying fruits was difficult. The minimum wage that was earned was not sufficient even for basic food. Now because of regular work and food subsidy from the government, at least we are able to take care of children and give them better food.*"

In the past, in Mysuru district the staple cereal was ragi and in Yadgir it was jowar. In recent years, ragi consumption has gone down mainly because the present generation does not like ragi based items. The case is the same with jowar. There is a big shift according to them from ragi/jowar to rice. "*Nowadays we eat more rice. There is no strength in it, elders in the house need ragi balls. Women of today quarrel when asked to make ragi balls*" (Mandya). This is partly due to the type of cooking fuel used. In all the households, firewood is the main source of cooking fuel. This is in keeping with the Census 2011 finding that about 88% of tribal households across the country use firewood, crop residue, or cow dung for fuel (GoI, Census 2011). The type of cooking fuel determines the ease of cooking various types of food. "*As everyone leaves by 8 am, I need to finish cooking as soon as possible; I feel bad if anyone goes to work or school hungry. Vegetables, lemon rice or rice bhath can be prepared quickly. Ragi balls are also easy to prepare but gravy takes time. Therefore I cook only rice and sambar (lentil stew) in the morning; and make ragi balls only at night"says Sanjivee*. Idli, dosa, and uppittu are also frequently prepared for breakfast as also chitranna and puliyogare, since all of these can be cooked quickly.

There is also a change in other tastes as well. With regard to meat, the younger generation demands broiler chicken in preference to traditional meats. One participant in Yadgir commented: "*We used to eat sweet dishes like obbattu (sweet bread) and payasa (sweetened milk) but today's kids eat chocolate, biscuit, Kurkure, mithais from sweet shops and suffer from stomach upset.*"

(b) ***Changing traditions/practice***

Grandmothers reported that they ate different varieties of vegetables and fruits from the forest which they are not getting now because the present generation is not willing or allowed to go into the forest and collect them. Rearing cattle has become difficult because children are not interested in helping to look after them; cattle are not allowed in the forest for grazing by the Forest Department; and there is a scarcity of grass.

(c) ***Gender and eating habits among children***

Gender equity is relatively better among tribal groups as compared to the general population as reflected in the sex ratio: although the tribal sex ratio has declined from 985 females per 1000 males in 1991 to 957 in 2011, it is higher than the sex ratio for the general population at 910 females per 1000 males. This is echoed at the household level by the attitude toward feeding of girls and boys. Mothers see no differences in the eating habits between a boy and girl child. Food is distributed equally to both boys and girls at home. They do acknowledge some differences due to differences in their activities: "*Boys will be roaming outside and might not eat in the afternoon; whereas girls are at home and they eat in time. There is no difference in serving food to both", observed Saraswathi*. Yet mother's perception of their children eating habits and especially health is very different. *Sanjivee said, "Boys are healthier. Girls have a lot of work at home, whereas boys eat well and play. Girls have work from morning until they go bed. It is only when we see a child not eating or looking tired that we know that s/he is weak and has to be taken care of*."

Gowramma perceived her children as thin for their age but at the same time she did not want them to be fat. She did not compare the health of her children with the children of her neighbors. She said, "*Their children are like them, mine are like us. They are also thin like my children, but both are healthy*." Children are perceived to be healthy except when they fall ill or have fever. According to her "*All children are the same, some children are thin and some are fat.*"

4.6 Addressing the Nutritional Vulnerability of Tribal Children

Tribal children in India continue to be nutritionally vulnerable. Diets have changed considerably in tribal households, due to several factors: household income, access to agricultural land, changes in agricultural practices; as well as household level factors that constrain dietary availability and diversity. Dietary choices made by children have changed: preferences have moved away from traditional healthful choices such as ragi to largely rice-based options. The monthly food ration distributed to tribal families as well as the midday meal provided to children in schools are important and valued contributors to the food security of tribal families; and their reliance on them is evident.

Given what we know about the nutritional status of tribal children, their food intake, and household factors that determine dietary adequacy, availability and diversity, a few critical recommendations emerge as a guide for future action:

(i) At the policy level, (a) The monthly food ration needs to not only continue, but perhaps also be expanded to ensure food security. Given the economic constraints faced by these families, the seasonal nature of their employment, as well as low land ownership, tribal families find it exceedingly difficult to supplement the government rations from their own resources. Promoting traditional food systems through policy and programmatic interventions is critical to support tribal families to maintain their dietary diversity and variation in food choices. Due to easy availability of certain foods, ease of preparation and shifting food preferences of the children, tribal families are moving away from traditional foods and adopting food choices that may be less healthy and nutritious than their traditional diets would have been. Ensuring easier access to traditional foods such as ragi as well as familiar root vegetables and meat products through the food distribution system would significantly enhance their ability to preserve traditional diets; (b) intersectoral action is critical: agriculture and forest policies should support families to supply their own food needs, and make it financially and otherwise viable for them to do so.

(ii) At the program level, (a) various in-school and out-of-school programs have been put in place to ensure provision of nutritious food to those who need it. However, the nutritional composition of the food being provided either through school meals or through the ICDS program needs to be examined. Currently, these diets are also carbohydrate heavy; and the prescribed protein, dairy, and vegetable elements are often left by the wayside due to considerations of cost or availability. The risk of noncommunicable disease at a later age is significantly elevated, however, due to a switch from traditional cereals such as ragi and jowar to rice. The establishment of vegetable gardens in schools—as envisaged as part of the MDMS and demonstrated effectively in the Bangladesh Nutrition Project—should be encouraged. Other efforts to block the marketing of junk food to school children—documented in the Center for Science and Environment Report (CSE 2014)—need to be taken up so as to prevent the marketing and sales of such products within and near educational institutions. Apart from this, healthy food choices and the importance of having a nutritious and balanced diet should be introduced into the curriculum to raise awareness of children of these important issues; (b) regular growth monitoring of children needs to be instituted at both anganwadis and schools to ensure that the nutritional status of children is being tracked and at-risk children are identified in a timely manner for appropriate intervention. This could be accompanied by regular counseling for mothers on the nutritional needs of children as well as appropriate feeding practices, since the evidence indicates that mothers' awareness on nutritional issues appears to be low.

(iii) At the household level, there is a need to do a lot more to address the issue of healthy food choice: (a) increasing awareness and education at the community and household levels to motivate farmers to cultivate cereals like ragi over rice; (b) encouraging people to make the effort to cook and eat such healthy alternatives; (c) awareness about organic farming and its health benefits; and (d) introducing innovative ideas such as creating seed banks of local cereals and pulses with high nutritive value, re-discovering forgotten foods and recipes and creating a knowledgebase, etc.

Urgent action needs to be taken to improve the nutritional outcomes of tribal children. As the next chapter will show, the diets of nontribal children are also deficient in many of the critical ingredients necessary for wholesome nutrition. It will require steps to be taken at the policy, program, school, and household level aimed at restoring traditional food systems, enhancing knowledge and awareness of healthier dietary options, and increasing availability of healthier foods through better structured food subsidies and supplementation programs. Awareness needs to be raised about locally available foods, their nutritive value, and importance in reducing malnutrition. With the limited resources that are available, people can make more affordable and sustainable choices that could prove to be the long-term solution to the persistent tragedy of childhood malnutrition.

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Chapter 5
How Much Food Is Enough? Food Consumption Among School-Going Children

Abstract Discussing the alternative methodologies for measuring food intake, this chapter describes the food intake of school-going children and how this has changed over time. It links the trend observed in national level data and other surveys that indicates that despite economic growth and improved incomes, there has actually been a decline in the overall consumption of food in terms of calories, as well as a decline in the consumption of specific types of foods that are considered essential for the healthy growth and development of the child. How does this vary between different groups of children? Using Food Frequency data collected from the respondents of our study, the chapter compares the actual food intake of different categories of students and measures this against the appropriate Recommended Daily Allowance prescribed by the National Institute of Nutrition (2010). The results are presented in a detailed set of graphs that clearly demonstrate the level of underconsumption of key food groups, disaggregated by age and sex. This chapter: (1) throws light on the particular vulnerability of specific groups of children, given their marginalization in other spheres; and provides evidence for the need to intervene urgently to address the causes of such vulnerabilities; (2) provides important insights into the methodological complexities of collecting and utilizing food frequency data, and adds to the literature on the challenges of estimating food intake; and (3) discusses the implications of such analysis for food and nutrition policy, particularly in schools.

5.1 The Construction of an Adequate Diet: Preconditions and Impacts

India is in the middle of an epidemiological transition: while there is still a considerable burden of communicable disease in the country, there is a rising burden of non-communicable diseases such as cardiovascular disease, stroke, and cancer.

This chapter has received substantial contributions from Suraj Parab, Research Coordinator, Health Development and Society Initiative, Azim Premji University.

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Many of these are also termed "lifestyle" diseases and are closely related to changing dietary patterns (Shetty 2002). Contributing to this is the "nutritional transition," defined as the shift in dietary consumption and energy expenditure that coincides with economic, demographic, and epidemiological changes (Popkin 2002). Vaz et al. (2005) have looked at the issue of nutrition transition, and identify the following major dietary shifts that impact the transition: (1) an increase in the consumption of legumes, vegetables and milk as well as animal foods where applicable; (2) substitution of coarse grains such as ragi and jowar with highly polished grains such as white rice, as well as a reduction of cereals as a proportion of the total diet; (3) increases in the consumption of edible fat; (4) increases in the consumption of sugar and sweets. Understanding the factors that determine an appropriate diet and the complex ways in which these determinants affect nutritional outcomes both in the short- and long-term has important implications for food and nutrition policy as we go forward.

The literature points to a variety of factors that contribute to the final desired outcome: that children eat an adequate and diverse diet that provides them the necessary nutrition to grow and flourish. Dietary diversity is an important component of nutritional adequacy. Hooshmand et al. (2013) compared the dietary diversity of urban school children in India and Iran and found that dietary diversity was significantly associated with the children's weight and height. Total food group scores increased with improving height, while severely and moderately stunted children had lower mean scores. Height for age z scores were associated with consumption of pulses, dairy products, beverages, and fats. Similarly, higher Body Mass Index (BMI) was associated with higher consumption of cereals, fruits, vegetables, dairy products, beverages, sweets, and fats. However, a comparative review of studies documenting the dietary diversity and adequacy of school children in 42 countries found that the diets of school children and adolescents in developing countries are deficient in animal foods, fruits, and vegetables. As a result, they suffer from micronutrient deficiencies (Ochola et al. 2014). Protein intake of underweight school children has been found to be significantly lower than the recommended daily allowance (Banerjee et al. 2011). On the other hand, there is an increasing intake of high-calorie foods, particularly in urban areas; and this is contributing to the emerging public health concern of overweight and obesity among children. Few studies have looked at the determinants of greater dietary diversity among children; but the best evidence points to age, gender, socioeconomic status, parental preferences, and availability/accessibility of the foods in the home. Girls and younger children tend to be more likely to consume fruits and vegetables, for example, than boys and older children (Rasmussen et al. 2006).

One obvious determinant of dietary adequacy and diversity is the socioeconomic status (SES) of the household. A study in Karachi, Pakistan found that 70% of the obese children in their sample belonged to higher SES households, while 63% of the underweight children belonged to low SES households. An additional finding was that obese children were twice as likely to eat meat every day as compared to children with normal weight. In India, higher SES has been found to be associated

with a higher likelihood of obesity, probably because of greater consumption of junk food (Ramachandran et al. 2002; Bharati et al. 2008; Goyal et al. 2010).

Factors such as urbanisation have played an obvious part in this transition: Ramachandran et al. (2002) found urban adolescents to have higher rates of obesity; this has been confirmed by various other studies as well (Bharati et al. 2008). A review of the literature on nutritional status of Indians (Kalra et al. 2012) reported the results of studies in urban centers in Punjab, Maharashtra and Tamil Nadu. Overall, the studies found obesity among urban adolescents to be higher as compared to their rural counterparts, ranging from 11.6% in Ludhiana, Punjab to about 20% in Pune, Maharashtra, and about 17% in Chennai, Tamil Nadu. The review attributed the growing levels of overweight and obesity among urban children to low levels of physical activity, greater television viewing and consumption of junk food. Urbanization has also been found to be associated with greater consumption of sweets and carbohydrates (Hakeem et al. 2002). Gupta et al. (2014) studied adolescents in urban New Delhi and found 17.4% of the males in the study sample to be overweight and 7.6% obese; the rates were slightly lower for females at 12.4 and 6.7%, respectively. Their study attributed these high rates to relatively more frequent (more than once a week) consumption of fast foods, fried foods, and sweets. Frequent consumption of high-energy snacks (or junk food) was also identified as a contributor to obesity among school children in Davangere City, Karnataka (Kumar et al. 2009). Others found the consumption of fried foods more than 6 times a week raised the odds of being overweight as compared to fried food consumption less than 2.5 times a week (Kuriyan et al. 2007).

There are multiple lifestyle-associated risks of poor nutritional outcomes: inappropriate diet (excess fast food, low fruit and vegetables) is an important one (Vohra et al. 2011). Among adolescents, experimenting with alcohol and smoking is another (Singh et al. 2006). Duration of sleep and television viewing have been positively correlated with overweight: children who slept less than 8.5 h a day had significantly higher odds of being overweight as compared to children who slept greater than 9.5 h a day. Children who viewed greater than 1.5 h of television a day had greater odds of being overweight as compared to those who viewed television for less than 45 min a day (Kuriyan et al. 2007). This was confirmed by Aggarwal et al. (2008) who found that overweight adolescents spent 1–4 h per day at the computer or watching television; they also tended to eat out and replace snacks with meals. Choosing to be sedentary by watching television prevents children from engaging in outdoor activities and play, which also negatively impacts their health. Vohra et al. (2011) found that, apart from SES as indicated by father's education and occupation, children playing outdoor games for more than 30 min significantly impacted their nutritional status. Skipping breakfast due to oversleeping was found to significantly impact the energy and protein intake of children 10–15 years old; with children not skipping breakfast meeting one-quarter to one-third of their energy and protein requirements through their morning meal (Chitra et al. 2007).

Childhood malnutrition could also be contributing to the epidemic of diabetes and heart disease facing Indians. Already the increasing incidence of overweight and obesity among school children is impacting measures of heart health such as hypertension: a study in Ludhiana, Punjab found that there is a significant increase in the prevalence of hypertension in both rural and urban areas with increasing BMI (Mohan et al. 2004). Such findings have been confirmed by other studies as well (Singh et al. 2006). There is evidence to show that poor early childhood nutrition, which is common in India where a large proportion of children are born underweight, leads to certain metabolic and hormonal changes that allow the body to adapt to nutrient-poor environments. If in later years these same children access calorie-packed foods, their adaptive mechanisms may reduce their ability to metabolize them, leading to obesity, diabetes, and other nutrition-related problems (Bankman 2013). Worldwide, this is becoming a serious public health concern, and threatening the viability of basic public health services as well as contributing to the growing costs of medical care (Raj et al. 2010).

There is a growing body of evidence of the nutritional choices of children being influenced by media and advertising. A systematic review of the impact of food promotion on children's food knowledge, preference and behavior (Hastings et al. 2006) showed that in both developing and developed countries: (1) children are the targets of a significant amount of food advertising, particularly on television; (2) largely this is for energy dense or junk foods, with attractive branding; and (3) children typically appreciate such advertising and retain the messages. In fact, television viewing has been associated with an increase in calorie consumption, specifically of those foods that are commonly advertised on television (Wiecha et al. 2006). A systematic review of the evidence on the global extent and nature of food promotion to children and its impact on their food knowledge, preferences, behavior and diet-related health outcomes (Cairns et al. 2009) found that food promotion has now expanded beyond television to other channels such as websites and mobile telephony. The review confirmed that the food being promoted to children is highly nutritionally undesirable, being energy dense and high in fat, salt, and sugar.

It is clear that dietary adequacy and diversity are determined by a complex set of factors, and that there are significant differences in how diets have been transformed over time depending on the geographic region, socioeconomic class, gender and other factors. This chapter will look at whether certain trends observed in the literature that point to a nutrition transition, with a growing tendency toward choosing diets that result in greater chances of overweight and obesity, are largely an urban phenomenon or a phenomenon of the upper socioeconomic classes; or are such trends observed also in the government school-based subjects of the study of nutritional status in rural Karnataka.

5.2 Changing Household Food Intake in India

How has food intake changed over time for the average Indian household? Data from nationwide surveys provide interesting insights into changing trends in the quantity and types of food choices being made across the country. Evidence shows that dietary intake rose steadily from the mid-1970s to the mid-1990s, with National Nutrition Monitoring Board (NNMB) reports (NNMB 1979–2005) showing an increase in total energy, protein and fat intake during that period (Ramachandran 2011). However, since then, despite sustained economic growth, there has been a reduction in energy intake; this is contrary to the general pattern where increased income is associated with increased energy intake. Ramachandran (2011) also reports further complexities that emerge from the data: (1) NNMB data indicate that in the past three decades, the proportion of households where adult dietary intake is adequate has risen twofold, but the intake of preschool children is inadequate, reflecting poor intra-household distribution of food; (2) while stunting, wasting and underweight were associated with mothers who were underweight (BMI <18.5), even with mothers who were overweight (BMI >25), about a third of preschool children were stunted and a fifth were underweight, suggesting that poverty and household food insecurity are not the only determinants of malnutrition; and (3) school-age is a critical time when dietary habits are set and the nutritional status of the adult is determined.

5.2.1 NSSO Data

National Sample Survey Organization (NSSO) data from 1983 to 2011–2012 provide interesting insights into trends in household nutritional intake during this period. Total caloric intake per family has remained fairly flat across the years, with a definite dip in the all-India average as well as state-specific averages for 2004–2005 in rural households; subsequent to this, there has been some recovery, and the 2011–2012 levels are very similar to what was seen in 1983. Per capita calorie intake in urban and rural households is very similar with about a 5% variation in the all-India average as well as in most states (Table 5.1).

The overall calorie intake has shown little variation over the years, and the situation with per capita protein consumption is very similar. In most states, as well as the all-India average, the pattern is flat from the mid-1990s to 2011–2012; and this is true of both rural and urban areas (Fig. 5.1).

The pattern with per capita intake of fat provides some evidence of a significant change in dietary choice. In both rural and urban settings, there is a clear upward trend in consumption of fat in all states and at the all-India level as well. Average consumption of fat has risen from about 30 and 40 g per capita per day in rural and urban areas, respectively in 1993, to 40 and 50 g, respectively in 2011–2012 (Fig. 5.2).

Table 5.1 Trends in household nutritional intake 1983–2012

Estimated per capita calorie intake (kcal) per day in different years										
States	Rural					Urban				
	1983	1993–1994	2004–2005	2011–2012 Sc1	2011–2012 Sc2	1983	1993–1994	2004–05	2011–2012 Sc1	2011–2012 Sc2
Karnataka	2260	2073	1845	2003	2164	2124	2026	2046	2007	2245
Maharashtra	2144	1939	1933	2103	2260	2028	1989	2039	2039	2227
Andhra Pradesh	2204	2052	1995	2186	2365	2009	1992	2052	2150	2281
Gujarat	2113	1994	1923	1915	2024	2000	2027	2058	2070	2154
West Bengal	2027	2211	2070	2092	2199	2048	2131	2134	2026	2130
Rajasthan	2433	2470	2180	2263	2408	2255	2184	2335	2151	2320
Uttar Pradesh	2399	2307	2200	2436	2548	2043	2114	2131	2379	2363
Bihar	2189	2115	2049	2057	2242	2131	2188	2171	2080	2170
India	2221	2153	2047	2099	2233	2089	2071	2156	2058	2206

Source NSSO various years

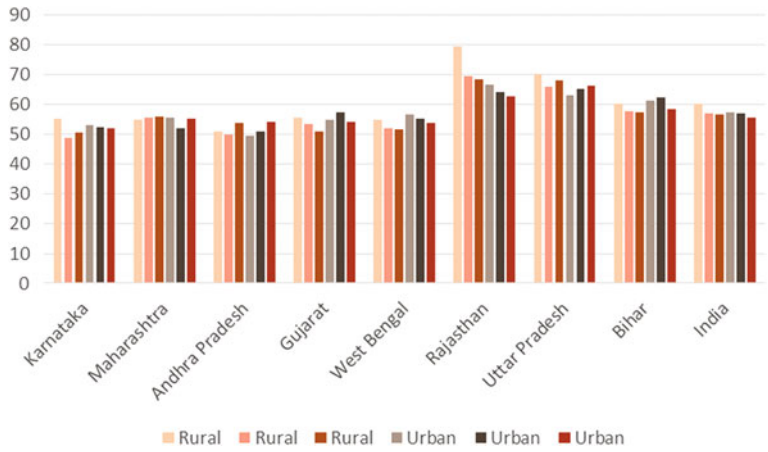


Fig. 5.1 Per capita protein intake (grams) per day. *Source* NSSO various years

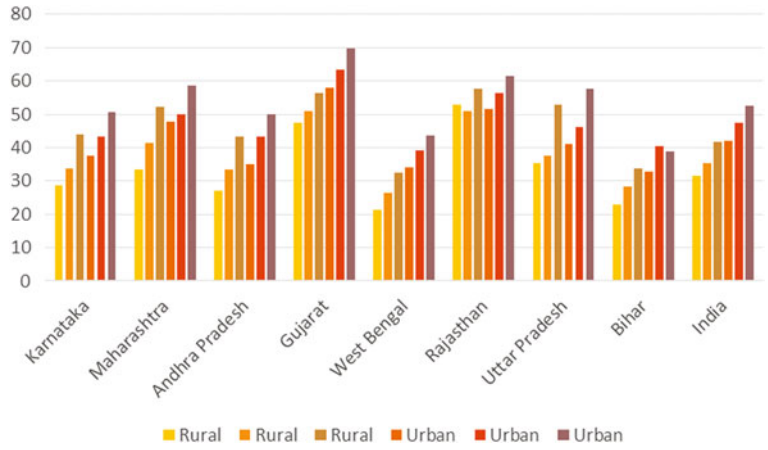
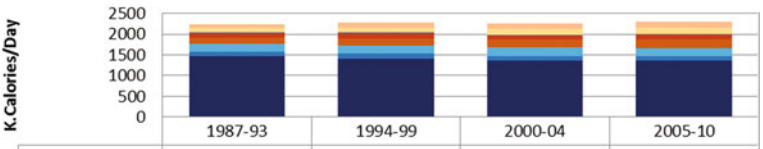


Fig. 5.2 Per capita fat intake (grams) per day. *Source* NSSO various years

Finally, if we look at the actual composition of the diet and how it has changed over the years, we find some interesting trends. Cereals provide the bulk of calorific intake across all years, although there has been a gradual reduction in their share in the total diet. Items that have increased significantly are vegetable oils, vegetables and fruits and "other": each of these categories has increased by between 30 and 50%. There has been a gradual increase in the consumption of meat/eggs/fish, while there has been a marginal decline in the consumption of pulses (Fig. 5.3).

While this analysis provides interesting insights into the changing composition of the Indian diet in terms of various food groups, it leaves open the question of



	1987-93	1994-99	2000-04	2005-10
Other	100	124	134	148
Vegtables&fuits	109	123	131	156
Meat/Egg/Fish	28	30	31	35
Milk	99	106	96	105
Vegetable Oils	147	179	184	204
Sugar	183	198	207	200
Pulses	120	115	106	112
Cereals	1459	1407	1367	1351

Fig. 5.3 Trends in composition of per capita calorie intake by type of food. *Source* NCAER (2014)

why such changes are taking place, and how they are reflected in the food choices being made at the household level.

5.3 What Do Measures of Food Frequency Tell Us?

Estimating food intake is an important prerequisite to analyzing the adequacy and diversity of dietary choices. There are several methods available to assess this (Table 5.2), although there are challenges associated with all the methods due to the subjective nature of the reporting methods. More objective methods such as biomarkers to measure the intake of particular nutrients have been used successfully. Such methods avoid the biases that could creep into subjective dietary recall (such as the social desirability of certain foods, subject's inability to fully recall or describe foods eaten or attempting to report what is appropriate); however, biomarkers have their own challenges and are affected by the individual's absorptive capacity, their metabolism, and the presence of disease (Shim et al. 2014). This section reports on dietary intake data collected through a Food Frequency Questionnaire (FFQ), which is essentially a checklist that takes dietary history and asks respondents how often and how much of a particular food they ate over a specified time period. The advantage of this method is that it allows for estimation of long-term food intake in a relatively simple and cost-effective manner. The FFQ needs to be adapted to the specific context, since the checklist contains items that are appropriate to the diet of the cultural/social group being studied. (Details of how the FFQ was structured and administered are in Annex 1 to this chapter).

A review of the history of use of different dietary assessment methods reveals that the prevalence of particular methods has changed over time. In the initial days of quantifying food intakes during the 1930s and 1940s, the preference was for taking dietary histories and constructing lengthy food records. Later, in the 1950s, attempts

Table 5.2 Dietary assessment methods in epidemiological studies

	Duplicate diet approach	Food consumption record	24-h dietary recall	Dietary record	Dietary history	Food frequency questionnaire
Methods	Collection of duplicate diet sample and direct analysis	Objective observation by trained staff at the household level	Subjective measure using open-ended questionnaires administered by a trained interviewer	Subjective measure using open-ended, self-administered questionnaires	Subjective measures using open- and closed-ended questionnaires administered by a trained interviewer	Subjective measure using a predefined, self- or interviewer-administered format
Collected date	Actual intake information throughout a specific period	Actual intake information throughout a specific period	Actual intake information over the previous 24 h	Actual intake information throughout a specific period	Usual intake estimates over a relatively long period	Usual intake estimates over a relatively long period (e.g., 6 months or 1 year)
Strengths	Measurement of dietary exposures possible (e.g., envi ronmental contaminants)	Ease of application among those with low literacy or those who prepare most meals at home	Provides detailed intake data; relatively small respondent burden (literacy not required)	Provides detailed intake data; no interviewer required; no recall bias	Assesses usual dietary intake	Assesses usual dietary intake simply; cost-effective and time-saving; suitable for epidemiological studies
Limitations	Not suitable for large-scale studies	Individual dietary consumption not accurate; Not suitable	Possible recall bias; trained interviewer required; possible interviewer bias; expensive and	Relatively large respondent burden (literacy and high motivation required, possible	High cost and time-consuming; not suitable for epidemiological studies	Specific to study groups and research aims; uses a closed-ended questionnaire; low accuracy (recall bias);

(continued)

Table 5.2 (continued)

	Duplicate diet approach	Food consumption record	24-h dietary recall	Dietary record	Dietary history	Food frequency questionnaire
		among those frequently eat outside the home	time-consuming; multiple days required to assess usual intake; possible changes to diet if repeated measures	under-reporting); expensive and time-consuming; multiple days required to assess usual intake; possible changes to diet if repeated measures		requires accurate evaluation of developed questionnaires

Source Shim et al. (2014)

were made to compare the results of different methodologies, which by now included shorter term food records and 24-h dietary recall. With the launching of large-scale epidemiological studies, FFQs were increasingly used as well as 24-h dietary recall. Analytical and computational tools and techniques improved substantially in the decades that followed and allowed for more sophisticated statistical analysis of data as well as greater refinement in data collection methodologies (Medlin and Skinner 1988). Studies have demonstrated that semi-quantitative FFQs are reproducible and provide a fairly reliable estimate of food intake, even in a diverse cohort (Katsouyanni et al. 1997; Hernandez-Avila et al. 1998; Mayer-Davis et al. 1999). Due to its ease of administration and ability to capture usual dietary intake, the FFQ is often used in large-scale epidemiological studies (Subar et al. 2001).

5.4 Food Intake of School Children in Rural Karnataka

An examination of the FFQ data of school children in Mandya, Mysuru, and Yadgir districts of Karnataka as compared to National Institute of Nutrition standards of recommended daily allowance (RDA) of various food groups shows some interesting patterns. The methodology used in collecting FFQ data is described in Annex 1. We used the data to first look at disparities between boys and girls of different ages across the entire group of students included in the study. Figure 5.4 shows that:

- All the children below 7 years of age are eating cereals as per RDA. Among 7–9 year olds, around 25% of boys and girls are falling short. Among boys 10 years old and above, one-third are falling short of RDA; whereas half of the girls in this age group are not consuming cereals as per RDA.
- About half of the children between the ages of 5–7 years are eating pulses as per RDA. However, among children 7 years and above, around 95% fall short of RDA.
- Consumption of fruits falls short by about 40–60% across all age groups.
- Around 40% of boys and girls below 7 years of age eat vegetables as per RDA. This reduces to about 25% of children between 7 and 9 years of age; while only around 5% of the boys and 10% of the girls in the age group 10 years and above eat vegetables according to RDA.
- Only 11 children out of 1080 across all age groups have milk and milk products as per RDA.

The evidence shows that at lower age groups—5–7 years—both boys and girls are more likely to be eating all categories of foods in accordance with RDA. With increasing age, both boys and girls fall short of RDA in almost all food categories; with the most severe shortfalls consistently occurring among children in the age group 10 and above. There is a slight disadvantage evident for older girls as compared to boys, particularly in the case of cereals and vegetables.

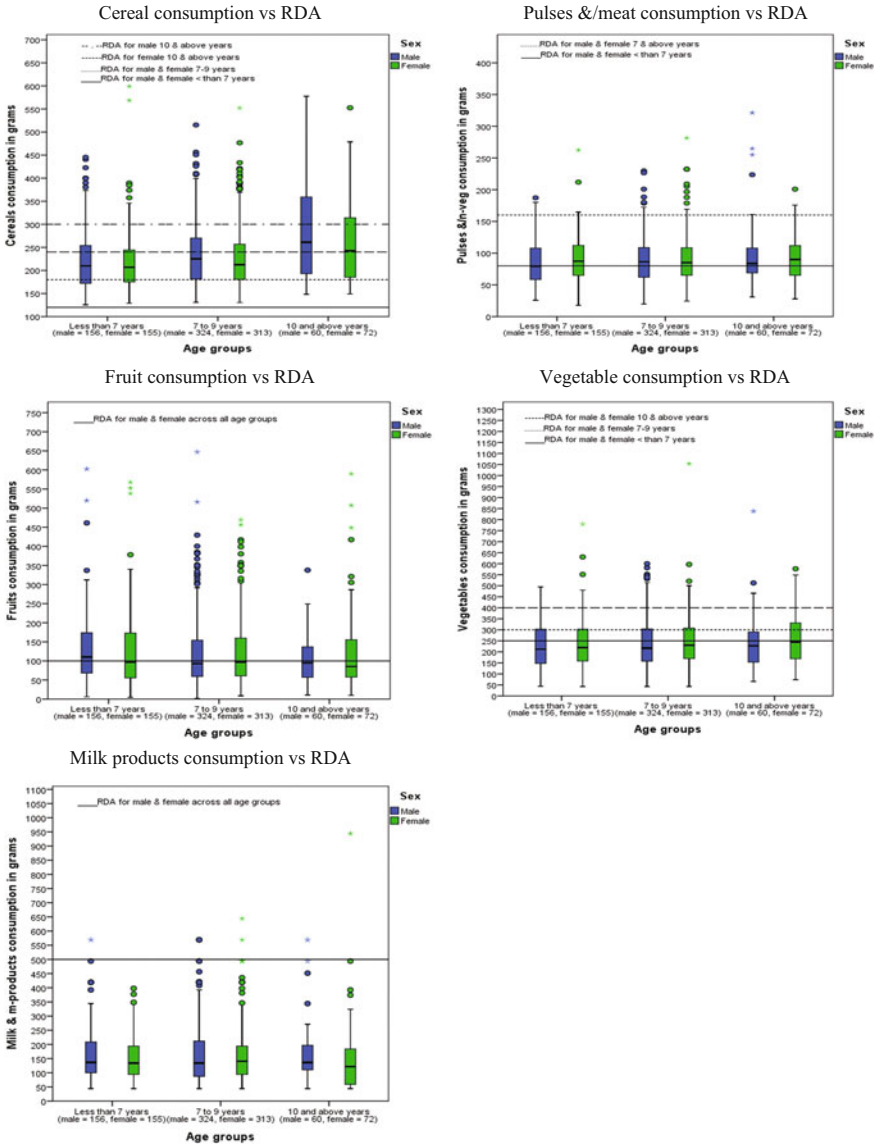


Fig. 5.4 Nutritional status, age and gender wise comparison of food consumed daily versus recommended daily allowance (N = 1080)

To get a better sense of disparities in food intake between different geographies within the state, we next look at disparities between the three districts selected for the study. The districts had been chosen purposively since they represent a diversity of socioeconomic indicators, as seen in Table 5.3.

Table 5.3 Social sector indicators—selected districts

	Sex ratio[a] (females per 1000 males)		Literacy rate[a]				Income index[b]	Education index[b]	Health index[b]	Human Development index[b]	State HDI rank
			Male		Female						
	2001	2011	2001	2011	2001	2011	2011/2012	2011/2012	2011/2012	2011/12	2011/2012
Kalaburgi[c]	958	962	66.2	75.1	42.1	55.9	0.17	0.53	0.33	0.31	24
Mandya	986	989	70.5	78.1	51.5	62.1	0.18	0.65	0.86	0.46	15
Mysuru	964	982	70.9	78.4	55.8	66.6	0.35	0.69	0.76	0.56	8

Source [a]Census 2001 and 11; [b]Economic Survey of Karnataka (2011–12); [c]Kalaburgi represents Yadgir, carved out as a separate district in 2000

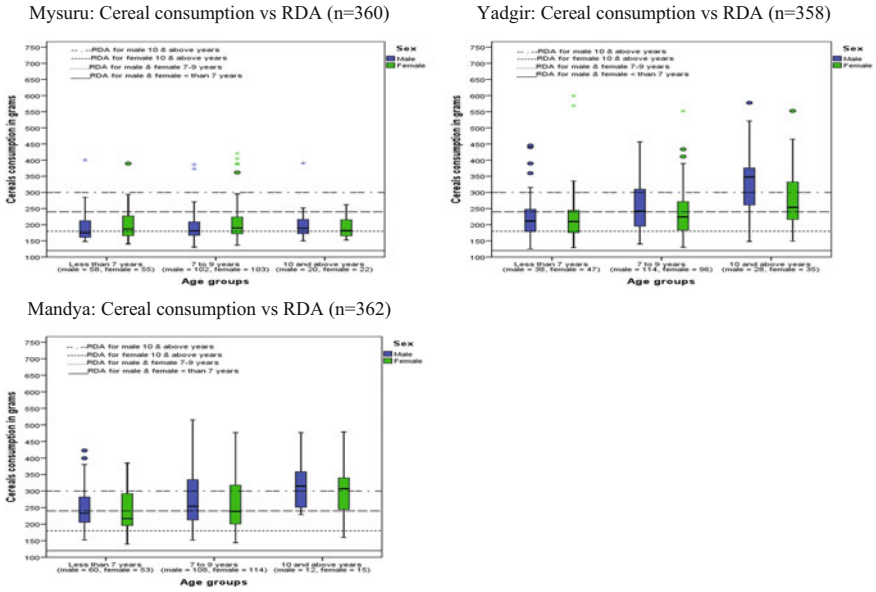


Fig. 5.5 District-wise comparison of cereal intake compared to RDA

Looking at the relative performance of the selected districts on the Human Development Index (HDI), we see that Mysuru district has been consistently the best performer amongst the three, ranking 8th in the state for the HDI (out of a total of 30 districts); the ranking has improved between 2001 and 2011. Kalaburgi has consistently been the worst performer, slipping from 25th to 26th and 24th rank on HDI in 1991, 2001, and 2011, respectively. Scores on other indices demonstrate a similar pattern, with Mysuru performing the best on male and female literacy, the Income Index and the Education Index; and Mandya performing better on the sex ratio and Health Index. From each of the three districts, one block was purposively selected to represent a broad range of disparity: HD Kote taluk in Mysuru district is a largely tribal block; Shorapur in Yadgir district is one of the poorest blocks in the state; and Mandya North is an average block in Mandya district. The intention was to examine whether the overall socioeconomic performance of the district has any impact on the nutritional outcomes of school children in that district.

Looking at each of the food groups separately, we compare food intake district-wise. With regard to cereal consumption (Fig. 5.5), we see that:

- In all three districts, children below 7 years of age eat cereals according to RDA.
- Among 7–9 year olds, around 50% of the boys and 30% of the girls fall short of RDA in Mysuru; 20% of the boys and 25% of the girls in Yadgir; and 12% of the boys and 15% of the girls in Mandya.

- All boys in the age group 10 and above in Mysuru eats far less than RDA. In Yadgir around 35% of the boys fall short of the RDA and in Mandya this figure is around 40%. Around 10% of girls from Mysuru in this age group, 60% in Yadgir and 25% in Mandya eat according to RDA.
- Overall, children in Mandya district of all age groups are the best in terms of eating cereals above or close to RDA as compared to children in Mysuru and Yadgir. However, in all three districts, students who are 7 years of age and above do not consume cereals at the recommended level.

In terms of pulses and meat, the FFQ data show that (Fig. 5.6):

- In the consumption of pulses and meat, among children below 7 years of age, around 75% of the boys and 50% of the girls in Mysuru, 60% of the boys and 50% of the girls in Yadgir and 25% of the boys and girls in Mandya fall short of RDA.
- In the 7–9 age group, only 1 boy and 1 girl in Mysuru, around 2% of the boys and 0.5% of the girls in Yadgir and around 5% of the boys and girls in Mandya eat according to recommendation.
- Not even a single child in Mysuru who is 10 years old and above is eating pulses and meat per RDA. In Yadgir only around 5 boys are eating per RDA. In Mandya, not even a single boy is eating per RDA, although around 20% of the girls are managing to do so.

A similar comparison of the consumption of fruits and vegetables shows the following:

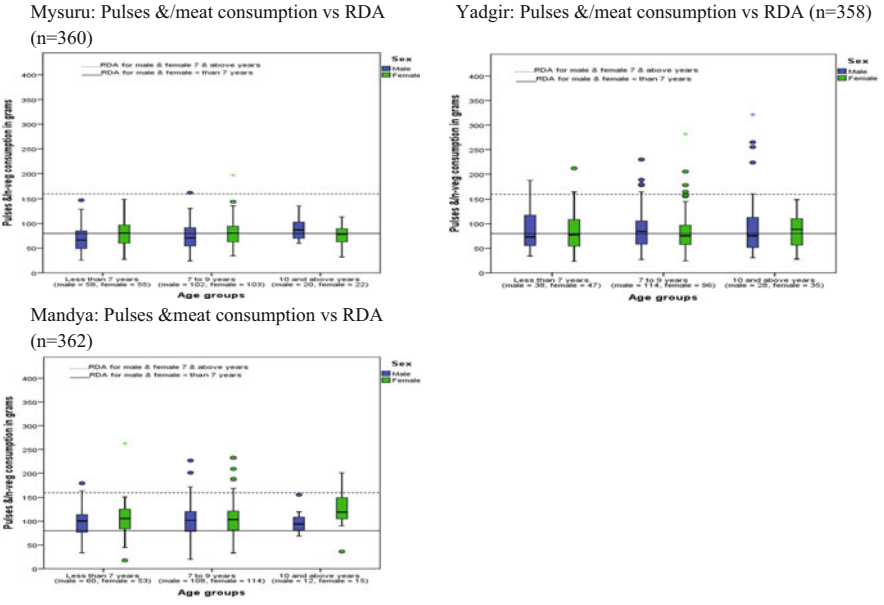
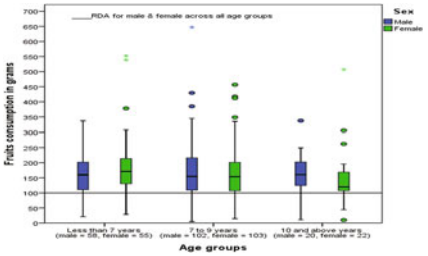
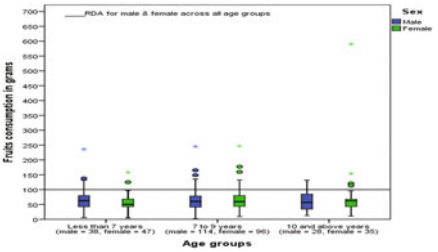


Fig. 5.6 District-wise comparison of pulses/meat, fruit and vegetable intake compared to RDA

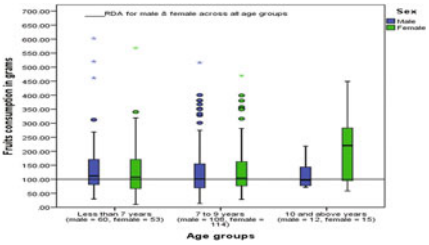
Mysuru: Fruit consumption vs RDA (n=360)



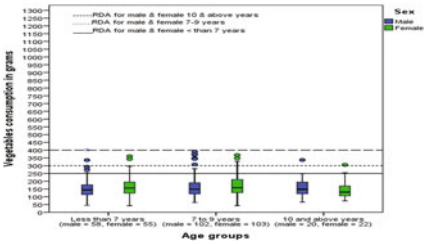
Yadgir: Fruit consumption vs RDA (n=358)



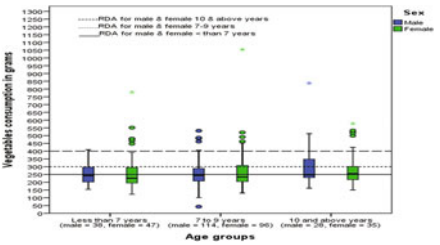
Mandya: Fruit consumption vs RDA (n=362)



Mysuru: Vegetable consumption vs RDA (n=360)



Yadgir: Vegetable consumption vs RDA (n=358)



Mandya: Vegetable consumption vs RDA (n=362)

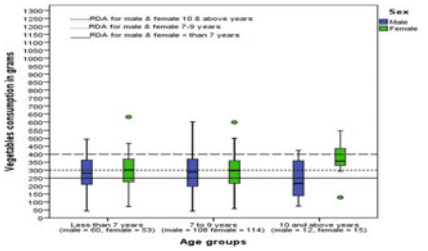


Fig. 5.6 (continued)

- Fruits consumption in Mysuru across all age group is far better than Yadgir and Mandya, with less than 25% of the children consuming less than the RDA. However, in the case of vegetables, the picture is very different: among those less than 7 years of age, less than 1% of the boys and only about 10% of the girls eat according to the RDA. In the 7–9 years age group, only about 5 boys and 8% of the girls eat vegetables according to RDA; and in the 10 years and above age group, this figure comes down to zero for both boys and girls.
- In Yadgir more than 75% across all age groups fall short of RDA in the consumption of fruits. However, among those less than 7 years of age, about 50% of the boys and 40% of the girls eat vegetables according to RDA. In the 7–9 year age group, this reduces to 25% of boys and girls, while in the 10 years and above age group only 15% of boys and 5% of girls eat vegetables according to RDA.
- In Mandya around 40–50% children are falling short of RDA in the consumption of fruits except girls 10 years and above, who are doing better with only about 25% falling short of RDA. Among children below 7 years of age, Mandya fares quite well in the consumption of vegetables, with 60% of the boys and 70% of the girls eating vegetables according to RDA. Among children 7–9 years of age, about 50% of both boys and girls eat vegetables according to RDA; and among children 10 years and above, the figure is 5% for boys and 30% for girls.

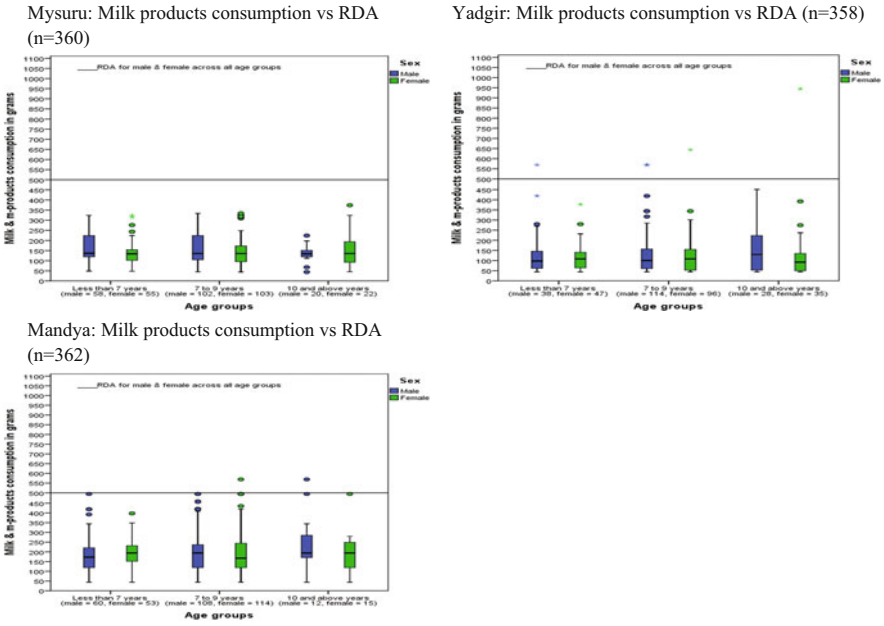


Fig. 5.7 District-wise comparison of milk products intake compared to RDA

Table 5.4 Relative ranking of districts on consumption of food groups according to RDA

Food group	Mandya						Mysuru						Yadgir					
	Boys			Girls			Boys			Girls			Boys			Girls		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Cereals	1	1	2	1	2	2	1	2	1	1	1	3	1	2	3	1	3	1
Proteins/meats	1	1	3	1	1	1	3	3	3	2	3	3	2	2	3	2	2	3
Fruit	2	2	2	2	2	1	1	1	1	1	1	1	3	3	3	3	3	3
Vegetables	1	1	1	1	1	1	3	3	3	3	3	3	2	2	2	2	2	2
Milk products	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Totals	8	8	11	8	9	8	11	12	11	10	11	13	11	12	14	11	13	12

A $\leq$ 7 year old; *B* = 7–9 year old; *C* $\geq$ 10 year old; in cases where no child met the RDA, a rank of 3 was scored

Finally, in terms of milk and milk products, consumption in all three districts is well below RDA. Overall, only 11 children in the entire sample were found to be consuming milk and milk products according to RDA (Fig. 5.7).

To understand the implications of this inter-district comparison, we summarize the relative ranking of each district on each of the food groups according to the extent to which they are achieving RDA standards, separately for boys and girls (Table 5.4).

By aggregating the scores across all food groups by sex and age group, we find that overall Mandya scores the highest in all categories. Mysuru comes second, with Yadgir scoring the least across all categories; although Mysuru and Yadgir do come very close in many cases. If we recall the HDI and other rankings of the districts, Mysuru in fact consistently had the highest ranking across many of the indices measured, followed by Mandya. However, the sample drawn in Mysuru was from the largely tribal block of HD Kote, and the FFQ ranking reflects the relative disadvantage suffered by tribal communities in accessing adequate food and nutrition (see Chap. 4). The relative positions of Mandya and Yadgir in terms of children having access to various food groups compared to RDA is not surprising, given the relatively greater affluence of Mandya district as a whole as compared to Yadgir. What is surprising is the large proportion of children who fail to achieve an adequate diet even in Mandya; but this could be explained by the fact that the sample has been drawn from government schools and the socioeconomic profile of children attending government schools tends to reflect the fact that they are the last resort of poor households, with wealthier households preferring to send their children to private schools (see Chap. 3).

5.5 Implications of Food Frequency Analysis

The FFQ data has provided useful insights into the dietary intake of the government primary school-going child. As with the NSSO data reviewed earlier, the diet of the school children is heavily skewed toward cereals: it was the only food group which

was being consumed at close to the RDA by the largest proportion of children across all food groups. The consumption of pulses and other sources of protein are at levels that are a cause for serious concern, as also the consumption of other food groups, particularly milk and milk products.

There seems to be little gender differential in the underconsumption of various food groups. The most obvious pattern that emerges is the increasing severity of underconsumption with increasing age. Older children are less and less likely to be consuming any of the food groups in accordance with RDA.

The overall development of the region does have a positive impact on the likelihood that children will be consuming more food, possibly due to better livelihood opportunities for parents, or a greater likelihood that parents are educated or exposed to information that has a direct bearing on child-rearing practices. However, further study is required going forward.

The information emerging out of the FFQ data has important implications for school policy and programming:

(i) School feeding programs such as the MDMS need to take into account the poor intake of protein-rich foods in the diets of school-going children. Currently, the school meal menus are heavily cereal based, consisting largely of rice-based items on a daily basis. The addition of a glass of milk in Karnataka or an egg in Tamil Nadu and Odisha has enhanced the availability of protein somewhat, but there needs to be a serious push toward enhancing the protein content of the meal;

(ii) The same applies to ensuring that school meals include more fruits and vegetables, where the shortfall in consumption by all age groups is quite significant. The cost of fruits and vegetables is often prohibitive and is a barrier to their inclusion given the meagre budget that most schools have at their disposal. However, other creative avenues could be explored for filling the gap, including having kitchen gardens both at the school and in the home, encouraging students to grow their own vegetables as part of their environmental science studies and so on;

(iii) Parents should be made aware that children's food intake needs to increase with age, and that school-age children require a substantial amount of food in order to grow, be healthy and well-nourished. They also need to be educated on providing healthier and more varied food options for their children. Often parents are unaware of the full scope of nutritional inputs required by young children, and provide either too little or the wrong kinds of foods at family meals;

(iv) Food subsidy/support programs should take into account the nutritional risk of poor families, particularly children, and ensure that more emphasis is laid on providing subsidized access to proteins and not just cereals as is currently the case. Local foods such as millets, which are not only part of traditional diets but are also richer in nutrients, could be substituted for the polished rice being currently supplied;

(v) Finally, nutrition-sensitive programs such as improved drinking water and sanitation facilities need to be ensured for children of all ages, so that whatever nutrition they do take in is absorbed efficiently and optimally and not lost due to illness or infection.

Annex 1: Methodology for Collecting Food Frequency Data

Food frequency data was collected in all the three surveyed districts. Table 5.5 shows the number of children selected using stratified random sampling from all the three districts, their age, gender, and caste.

A total of 1080 children were selected from the three districts in the age group 5–11 years of age. The interviewers were selected from social science background and trained by the research team to collect the food frequency data. FFQ questionnaire was translated in Kannada and piloted in Mysuru district and necessary changes were made accordingly.

Information on the child's diet was collected from the mother of the index child on how often a child eats a particular type of food in cooked form. In case there were two or more siblings from the same household, a separate food frequency questionnaire was filled up for each child. A comprehensive assessment of dietary intake was attempted, with an exhaustive list of various familiar cereals, pulses, fruits, vegetables, meats and dairy products. Average consumption frequency was assessed using open-ended questions, with responses varying from "never" to "three times a day." For foods that were consumed only seasonally, respondents were asked how frequently they were consumed and for what duration.

Estimating portion sizes has been a contested issue (Willett 2012). To measure the quantity of the food items consumed by each child, measuring cups were used for cereals, pulses, vegetables, and milk and milk products. In the "cereals" category, ragi consumption was measured in balls (size of tennis ball was shown to the mother to estimate the size of the average ragi ball consumed by the child, estimated to weight 150 g); cereals consumed in the form of chapattis or rotis were estimated

Table 5.5 Sample selected from 3 districts for collecting food frequency data

District (N = 1080)	Age group (years)	Male		Female	
		ST	Non ST	ST	Non ST
Mysore (n = 360)	5–7	45	45	45	45
	8–11	45	45	45	45
Yadgir (n = 358)	5–7	47	46	45	42
	8–11	43	44	43	48
	Age group (years)	OBC	Non OBC	OBC	Non OBC
Mandya (n = 362)	5–7	45	44	46	44
	8–11	46	45	44	48

Table 5.6 Measurements and conversion factors used from cooked to raw form

Measurements		
Ragi ball	1 ball	150 g
All other cereals, pulses and vegetables (except sweet potato) and milk and milk products	1 small bowl	75 g
	1 medium bowl	150 g
	1 big bowl	300 g
Mango	1 medium size	120 g
Banana	1 medium size	95 g
Grapes	1 bunch, 12–14 pieces	83 g
Watermelon	1 slice	168 g
Muskmelon	1 slice	168 g
Orange	1 medium size	74 g
Pomegranate	1 medium size	160 g
Custard apple	1 medium size	40 g
Apple	1 medium size	113 g
Guava	1 medium size	52 g
Jackfruit	1 piece	40 g
Papaya	1 slice	100 g
Sweet potato	1 medium size	55 g
Egg/fish/meat	Egg = full, fish and meat = 1 piece	40 g
Conversion factors used to convert from cooked to raw form		
Rice, rice flakes, puffed rice	–	0.36
Ragi, corn, jowar	–	0.29
Wheat	–	0.27
Bengal dhal, black gram dal, moong dal, tuver/red gram, Horse gram, chickpeas/chhole, black gram, field bean	–	0.45
Cowpea	–	0.28

Source Table adapted from methodology presented in Bowman et al. (2011)

in number of pieces consumed, with each piece estimated to weigh 27 g. Consumption of fruits, meat, and eggs was measured in the form of either pieces or bowls. The measurements and conversion factors used to convert from cooked to raw form for data analysis purposes are presented in Table 5.6.

After multiplying the frequency of consumption using the scores from Table 5.7, the conversion factor was used for converting each food from cooked to raw form to get an estimate of the daily consumption of each food item in its raw form.

All the foods were then clubbed into six main categories; cereals, pulses, vegetables, fruits, meat, and milk and milk products. Food items provided in school as part of the Midday Meal program (MDM) were also added to the child's estimated food consumption at home. The MDM input was calculated based on the amount

Table 5.7 Frequency of consumption score

Sr. No.	Number times consumed	Scores assigned
1	Daily or 5–6 times a week	7
2	3–4 times a week	3.5
3	1–2 times a week	1.5
4	Fort nightly	0.50
5	Monthly	0.25
6	Rarely	0.10
7	Never	0

Table 5.8 Recommended daily consumption for different age group and sex: NIN Standards

Recommended daily consumption by NIN in grams						
Age groups	Sex	Cereals	Pulses and/n-veg	Vegetables	Fruits	Milk and milk product
Less than 7 years	Male and female	120	80	250	100	500
7–9 years	Male and female	180	160	300	100	500
10 and above	Male	300	160	400	100	500
	Female	240	160	400	100	500

Note Table is made using NIN recommended balance diet chart: Link—http://ninindia.org/DietaryguidelinesforIndians-Finaldraft.pdf

provided per child as per the child's age under the program (see http://mdm.nic.in/Files/Schoolpercent20Healthpercent20Programme/Nutrition_Support/Nutrition_support_Introduction.pdf). Government of Karnataka also provides 150 ml milk for each child twice a week; this was converted into grams [300 ml = 309 g (conversion factor 1.03)] and added to each child's daily consumption (44.14).

According to National Institute of Nutrition (NIN) guidelines, children should eat according to age-appropriate RDA; as age increases, the consumption of most of the foods should be increased. NIN food recommendations in grams (in raw form) for the particular age group of children included in the study are in Table 5.8.

Box 5.1 Example of How We Calculated Daily Consumption of a Child Food Items and How We Related it to RDA

The following example illustrates the case of a 9 year old male child eating 2.5 small bowls of rice and 0.25 portion of ragi ball daily; and 2 pieces of chappatis and 1 small bowl of puffed rice 1–2 times a week. Calculations made for child's cereals consumption can be seen below:

Cereals	Quantity consumed	Frequency (see Table 5.4 for scores)	Formulas used of calculating daily consumption	Conversion factors to compute into raw form
Rice	2.5 small bowls	Daily or 5–6 times a week	=2.5 × 75 = 187.50	187.50 × 0.36 = 67.5
Ragi	0.25 ball	Daily or 5–6 times a week	=0.25 × 150 = 37.50	37.50 × 0.29 = 10.88
Wheat	2 pieces (1 piece = 40 g)	1–2 times a week	=80 × 1.5 = 120/7 = 17.14	17.14 × 0.27 = 4.6
Puffed rice	1 small bowl	1–2 times a week	=1 × 75 × 1.50 = 112.5/7 = 16.07	16.07 × 0.36 = 5.7
Cereals consumption per day at home				88.68
Cereals consumption per day at school (MDM)				85.71
Total Cereals consumption at home and school				174.1

If a child is eating certain foods daily, then it is calculated directly by multiplying the quantity by 7 or by using the assigned frequency score (Table 5.7) divided by 7 to get the daily estimate. Once the daily quantity was calculated, the conversion factor (Table 5.6) was used based on the type of cereal consumed. Subsequently, all the cereals consumed were added to get the total consumption of cereals per day. In this example, the total daily consumption of cereals is 174.1 g which is less than RDA (180 g, as seen in Table 5.8) for his age. Similar calculations were made for pulses, fruits, vegetables, milk and milk products and meats for each child.

Annex 2: Review of Literature on Risk Factors for Over-/Undernutrition

Year	Reference	Location	Age group	*N*	Purpose of study	Results
Risk factors for malnutrition						
2014	Gupta et al. (2014)	Delhi, India	10–19 years	811 from 851 households, *M* = 52.2%, *F* = 47.8%	To determine the magnitude of underweight, overweight and obesity in adolescents of an urban area in Delhi and to assess relationship of malnutrition with sociodemographic factors, nutritional intake and physical activity in the study subjects	Lower consumption of green leafy vegetables/fruits and more than once/week consumption of fast food, fried food or sweets was associated with being overweight and obese
2013	Hooshmand et al. (2013)	Awaz in Iran and Mumbai in India	6–9 years	4570, Iranian = 2234 (Boys = 1016 and Girls = 1218), Indian = 2336 (Boys = 1240 and Girls = 1096)	The aim of this study was to assess the effect of dietary scores and nutritional status of urban Iranian and Indian school children	Total dietary diversity scores were significantly higher for Indian children who had normal weight or who were overweight ($F = 32.197$, $p = 0.000$) and lowest for underweight children. Similar trends were observed for the children from Iran ($F = 9.345$, $p = 0.000$). Total food group scores increased with better height status of the children. In both countries, severely and moderately stunted children had lower total mean scores than those who had normal and above average height.

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						Analysis of data for individual food groups showed that increasing weight was associated with higher scores for almost all food groups in India. Heights for age
2012	Kalra et al. (2012)	India		Systematic review		Nutritional status of the Indian population varies significantly across the regions. Certain regions are associated with extremely high rates of childhood undernutrition (ranging from 20 to 80%), whereas others have a high prevalence of adult undernutrition (>50%), and some have both
2011	Vohra et al. (2011)	Lucknow, India	5–12 grade	407	j	Overweight and obesity was found to be 4.17 and 0.73%, respectively; they together constitute 4.91% for overweight/obesity. The study revealed that the important correlates of overweight/obesity were father's education, father's occupation, class, children playing outdoor games for less

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						than 30 min, and those consuming fast foods
2010	Goyal et al. (2010)	Ahmedabad, India	12–18 years	5664	To investigate the prevalence of obesity and overweight and their association with socioeconomic status (SES) and risk factors like diet, physical activity, sleeping in afternoon, eating junk food, eating out, family history of diabetes and obesity	Age adjusted overweight = 14.3% among boys and 9.2% among girls, obesity = 2.9% in boys and 1.5% in girls. Prevalence of overweight among children was higher in middle SES as compared to high SES group and obesity was higher in high SES group as compared to middle SES group. Eating habits like junk food, chocolate, eating outside at weekend and physical activity like exercise, sports, sleeping habit in afternoon had significant effect on prevalence on overweight and obesity among middle to high SES group. Family history of diabetes and obesity were also found to be positively associated
2009	Warraich et al. (2009)	Karachi, Pakistan	6–8 grade	284	To determine prevalence of obesity and malnutrition in school-going children, from grades 6th to 8th of different	Underweight = 52%, Normal = 34%, Overweight = 8% and Obese = 6%. Of all obese

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
					schools of Karachi and assess associations that affect the weight of the children	children, 70% belonged to the higher socioeconomic status (SES) group, while of the underweight children, 63.3% were in the lower SES. Amongst obese children, 65% ate meat every day, compared to 33% of normal kids
2008	Aggarwal et al. (2008)	Ludhiana, India		1000 (equal no of boys and girls)	To study the prevalence of obesity among adolescents in public schools of Ludhiana, catering to the affluent segment of population	Overall incidence of obesity in the study group was 3.4%, with no significant difference between boys and girls. A significantly greater number of boys (15%) as compared to girls (10.2%) were overweight. 57.2% of boys and 52.8% of girls, spent 1–4 h/day viewing TV or sitting at the computer. Out of the total obese children, significant percentages (82.3%) were non-vegetarian. A normal body mass index was most characteristic of vegetarians. The incidence of obesity/overweight was significantly higher in those who ate meals outside home. The mean scores of replacing snacks for meals were

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						significantly higher in obese and overweight adolescents as compared to adolescents with a normal BMI
2008	Bharati et al. (2008)	Wardha, Central India	5–7 and 8–10 grade	31 middle schools and high schools	To study the magnitude of overweight/obesity and its correlates among school going children	Overweight = 3.1% and Obesity = 1.2%. Multivariate logistic regression showed that important correlates of overweight/obesity were urban residence, father and/or mother involved in service/business, English medium school and child playing outdoor games less than 30 min
2007	Kuriyan et al. (2007)	BangaloreIndia	6–16 years	598, male = 324		The duration of sleep and TV viewing were significantly associated with overweight. Children who slept less than 8.5 h/day had significantly higher odds (6.7, $p = 0.013$) of being overweight when compared to children who slept more than 9.5 h/day, after adjustments for age, gender, location of stay and socioeconomic status. The adjusted odds of being overweight for children who viewed television for greater

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						than or equal to 1.5 h/day was 19.6 ($p = 0.001$), when compared to children who viewed television for less than or equal to 45 min/day. Among eating behaviors, the consumption of fried food items, more than 6 times/week, was associated with significantly higher odds of being overweight (3.1, $p = 0.014$) when compared to fried food consumption less than 2.5 times/week. None of the other eating behaviors were found to be significantly associated with being overweight
2007	Chitra et al. (2007)	Secunderabad, Andhra Pradesh, India	10–15 years	802	To ascertain the breakfast habits of 10–15-year old schoolchildren and to assess the quality of this meal as well as its relationship to the food consumption pattern for the full day	Only 42.8% of the children ate breakfast regularly. Over half of the children skipped breakfast, ranging from daily to once in two weeks. The energy and protein composition of breakfasts eaten by the children indicated that those who did not skip breakfast met one-quarter to one-third of their total daily

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						energy and protein requirements. Over half of the schoolchildren studied skipped breakfast frequently, the main reason being getting up late. Children who consumed breakfast had higher daily intakes of energy and protein than children who skipped breakfast
2006	Rasmussen et al. (2006)	Global data	Children and adolescents	98 papers were identified from Medline and PsycINFO	To find out the determinants of fruit and vegetable consumption among children and adolescents	The determinants best supported by evidence are: age, gender, socioeconomic position, preferences, parental intake, and home availability/accessibility. Girls and younger children tend to have a higher or more frequent intake than boys and older children. Socioeconomic position, preferences, parental intake, and home availability/accessibility are all consistently positively associated with intake
2006	Wiecha et al (2006)	Boston	11–12 years	*N* = 548 students 48.4% female	To test whether increased television viewing is associated with increased total energy intake and with	After adjusting for baseline covariates, each hour increase in television viewing was associated with an additional

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
					increased consumption of foods commonly advertised on television, and whether increased consumption of these foods mediates the relationship between television viewing and total energy intake	167 kcal/day (95% confidence interval, 136–198 kcal/day; $p < 0.001$) and with increases in the consumption of foods commonly advertised on television. Including changes in intakes of these foods in regression models provided evidence of their mediating role
2004	Mohan et al. (2004)	Ludhiana, India		3326, Urban = 2467 Rural = 859	To evaluate the prevalence of sustained hypertension and obesity in apparently healthy school children in rural and urban areas of Ludhiana using standard criteria	Prevalence of sustained hypertension was 6.69% ($n = 165$) and in rural area it was 2.56% ($n = 24$). Males outnumbered females in both rural and urban areas. There was significant increase in prevalence of hypertension in both rural and urban population with increased body mass index in urban students; those with normal body mass index had prevalence of hypertension of 4.52% ($n = 96$), in overweight it was 15.33% ($n = 44$) and in obese it was 43.10% ($n = 25$). In rural areas, prevalence of sustained hypertension among

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						overweight students was 6.82% (n = 3) and in obese group it was 61.76% (n = 21). None of the students with normal BMI in rural area was found to be hypertensive. The mean BMI of hypertensive population in both rural and urban areas was significantly higher than respective normotensive population
2002	Hakeem et al. (2002)	UK and Pakistan	10–12 years	3 groups in Pakistan and 3 in UK	To examine the food habits and nutrient density of diets of six groups of rural and urban school children aged 10–12 years	With urbanization, the intake of sugar increased steadily. The intake of vitamin C, vitamin BI2, and folates was higher among the UK groups
2002	Ramachandran et al. (2002)	India	13–18 years	4700, M = 2382, F = 2318	To quantify the prevalence of overweight and its risk factors in adolescent children in urban India	Overweight was 17.8% for boys and 15.8% for girls. It increased with age, higher in lower tertiles of physical activity and in higher socioeconomic group. Birth weight and current BMI were positively associated. High prevalence of overweight in adolescent children in urban India. Life style factors influenced BMI in adolescent age

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
Policy issues						
2014	Ochola et al. (2014)	42 countries		Literature Review (50 studies and 42 countries)	To characterize the dietary patterns and assess the adequacy of nutrient intake to identify the effects on public health and nutrition. The analysis was based on 50 studies performed in 42 countries, published from 2000 to 2014	Diets of schoolchildren and adolescents in developing countries are limited in diversity, with very little consumption of animal foods and fruits and vegetables. Consequently, many children are deficient in micronutrients. Consumption of high-calorie foods is increasingly becoming popular among schoolchildren and adolescents in urban areas
2010	Maliye et al. (2010)	Wardha, Central India	10–18 year	430 adolescent girls	To assess the nutrient intake of rural adolescent girls	Overall, 57% of the adolescents were thin (BMI for age <5th percentile for Center for Disease Control (CDC) 2000 reference) and 43% of the adolescents were normal (BMI for age between 5th and 85th percentile for CDC 2000 reference). The average energy intake, which was 1239.6 ± 176.4 kcal/day, was deficient of recommend daily allowance (RDA) by 39%. The average protein intake was 39.5 ± 7 g/day. It was deficient by 36% and the

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						average iron intake, which was 13.2 ± 2.5 mg/day, was deficient by 48% Conclusion: The findings reiterate the dietary deficiency among adolescent girls which adversely affects the nutritional status
2010	Raj et al. (2010)	Global data		Systematic review		Worldwide (2.6 million deaths yearly), obesity trends are causing serious public health concern and in many countries threatening the viability of basic health care delivery. It is an independent risk factor for cardiovascular diseases and significantly increases the risk of morbidity and mortality. The last two decades have witnessed an increase in health care costs due to obesity and related issues among children and adolescents
2009	Kumar et al. (2009)	Davangere, KarnatakaIndia	10–15 years	1,496,975 boys, 521 girls	To study the prevalence of obesity in two groups of affluent school children in Davangere city, in classes 5–10; and identify factors influencing childhood obesity	Obese; boys = 4.10, girls = 8.82. The difference observed in prevalence of obesity between boy's habit of snacking of high-energy foods and lack of physical activity

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						were the important influencing factors of childhood obesity
2009	Cairns et al. (2009)	Previous systematic reviews and academic database		Systematic review	To review evidence on the global extent and nature of food promotion to children, and its effects on their food knowledge, preferences, behavior and diet-related health outcomes	The review confirms that in both developed and developing countries food promotion to children is common. Television advertising is the most dominant promotional channel but a range of promotion and marketing techniques and strategies are used. The emergence of new mass media channels such as website and mobile telephone SMS services offer less visible but highly direct targeted marketing opportunities. The evidence base for the effect and reach of these newer promotional channels is quite small, but to date, suggests it is gaining share rapidly and effectively
2007	Hawkes et al. (2007)	Global data		Systematic search which was done based on 2004 report	To examine the changes in the global regulatory environment around food marketing to children since 2004 (At the Fifty-seventh World Health	From a global perspective, there has been more talk about regulation than action to implement regulations. Important changes have

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
					Assembly in May 2004, the Member States of World Health Organization (WHO) adopted resolution WHA57.17, endorsing the Global Strategy for Diet, Physical Activity and Health (DPAS) (1). The Strategy provides a series of options which Member States can follow to help prevent obesity and diet-related chronic diseases)	occurred in the global regulatory environment around food marketing to children. These changes are still ongoing, in some cases at a fast pace. This heightened level of discussion and action has been directly and indirectly stimulated by DPAS. Subsequently, there are now an increasing number of ideas and proposals on how food marketing to children can be regulated.
2006	Singh et al. (2006)	Delhi, India	10–18 years	510	To evaluate the prevalence of lifestyle-associated risk factors for non-communicable diseases in apparently healthy school children in an urban school in Delhi using standard criteria	The study documents the inappropriate dietary practices (fast food consumption, low fruit consumption), low physical activity, higher level of experimentation with alcohol and to a lesser extent smoking, high prevalence of obesity and hypertension in the school children. The study also showed an association between BMI, systolic and diastolic blood pressures amongst children and other lifestyle factors

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
2006	Hastings et al. (2006)	Two previous systematic reviews and academic database		Systematic review	To review of the extent and nature of food promotion to children and its effects on their food knowledge, preferences and	This review confirms that in both developed and developing countries: (1) there is a great deal of food promotion to children, particularly in the form of television advertising; (2) this is typically for highly-processed, energy dense, unhealthy products with evocative branding; and (3) that children recall, enjoy and engage with this advertising. More complex research from developed countries shows that it is having an effect, especially on their food preferences, purchase behavior and consumption. Although none Although none of these more complex studies was undertaken in the developing world, other research shows that children everywhere respond to food promotion in similar ways. There is, therefore, reason to believe that children in the developing

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Year	Reference	Location	Age group	*N*	Purpose of study	Results
						world will be just as vulnerable to food promotion
1995	Chaturvedi et al. (1995)	Rajasthan, India	10–18 years	941 adolescent girls	To assess the nutrient intake of adolescent girls belonging to low socioeconomic group of rural Rajasthan	The diets were deficient in calories by 26–36%, and in proteins by 23–32%. Nutritional status as assessed by body mass index revealed that 8.1% of adolescent girls suffered from chronic energy deficiency (CED) grade I, 6.6% grade II CED, and 78.8% grade III CED. About 73.7% of subjects suffered from anemia and 43.6% had signs of vitamin B complex deficiency

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Chapter 6
What Do the Children Eat in Schools? *Teachers' Account*

Abstract Moving beyond households and families, the next chapter shares accounts of interactions with teachers of government schools. It explores their perceptions regarding the implementation, the benefits and challenges of the school meal program and other health-related measures being implemented by the government. It presents a detailed analysis of the teachers' understanding of the health and nutrition status of children in their schools and the changes in their food consumption patterns. It also shows the extent to which teachers show awareness and appreciation of health-related measures in school by connecting it with various positive changes in the social context such as reduction in child labor. The chapter illustrates how an integrated curriculum of education, health, and nutrition could be built as a route to improve the health and nutritional profile of students and subsequently their academic performance. The school can provide an important locus for providing critical nutritional inputs for children through improved quality of food provided through the MDM; through proper monitoring of quality and composition of the food, training of cooks in preparing tasty and healthy meals, reintroducing traditional/locally preferred foods such as ragi and jowar, and engaging with the community on promoting healthy eating practices both in school and at home.

6.1 The Role of the Teacher in School Health and Nutrition Programs

Globally, the school is now recognized as an important locus of intervention to promote the health and nutrition of children. Evidence shows that schools have resources and infrastructure available that is not available through any other service network, including the health system. This makes schools the most cost-effective vehicle for delivering health and nutrition services to school-going children (Bundy et al. 2006). The role of the school teacher, however, has not been so clearcut and has been contested. There is evidence that teachers have a key role to play in ensuring availability and quality of services being provided within their institution

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for the benefit of the children, whether education or health and nutrition, and as role models in terms of the choices they make generally but also importantly in terms of the food they eat (Eliasson 2011). Regardless of the food choices children have at home, teachers can influence food preference and choice in the school, which can lay the foundation for lifelong eating behavior. Research indicates that it is possible for teachers to be aware of the importance of nutrition education in promoting healthy nutrition behaviors among young children, and more educated and experienced teachers see this connection more clearly (Al-Amari 2012). However, this is not universally true: a study in Brazil on "teaching managers" perceptions of the relationship between school feeding programs and the promotion of healthy eating habits among the students found that their engagement with this issue was not very strong; and the importance of providing food to children was not seen as a central part of their pedagogic responsibilities (Cervato-Mancuso et al. 2013). In cases where the teachers or school managers do demonstrate knowledge and concern regarding the nutritional value of the school meal, issues regarding availability of budget are prominent, along with the lack of time to devote within the classroom to nutrition education due to competing pedagogic demands (United States General Accounting Office, School Lunch Program 2003). Supervision of the midday meal by teachers is seen as a legitimate part of a teachers' contracted duties, although it is seen as a "non-teaching" duty (The National Union of Teachers guidelines, United Kingdom 2002), and teachers cannot be directed to undertake this task. Many teachers objected to being assigned to lunchroom duty, arguing that this time was required for reviewing student submissions and planning for class; as a result (for example) the right of the Principal to assign teachers to this duty was revoked in New York City in 1996 (Rothstein 2002). However, many did see this time spent informally with students as a time for getting to know students better and, hence add to their pedagogic strategies—the time could be a teaching resource.

In India, the issue of the teacher's role in the management and provision of the midday meal in schools has been a contentious one. The Midday Meal Guidelines (National Programme for Nutrition Support to Primary Education 2006) specifically state that the responsibility of preparing the meal should be assigned to either: (1) a women's Self-Help Group; (2) a local youth group; (3) an eligible voluntary organization; or (4) a cook/helper employed by the Panchayat/relevant authorities for the purpose. However, there were recurrent complaints that the management and provision of the meal were taking up too much of the teachers' time, and impeding the teaching–learning process. Teachers' protests against this responsibility for what they termed "non-academic work" turned increasingly vociferous, with disastrous consequences such as the state-wide strike of school teachers in Bihar in 2013 following the tragic death of 23 children after consuming a deadly midday meal in school. Subsequently, a series of legal decisions were taken (*inter alia* Allahabad High Court, July 2013; Mumbai High Court, March 2014), limiting the role of the teacher in the MDM (Press Trust of India, July 26, 2013; March 1, 2014). This prompted the government to again clarify the role of the teacher, and a circular on the scheme (Press Information Bureau, Government of India December 4, 2014) reiterated the limited responsibility of the teacher toward the MDM: "The

Mid-Day Meal Guidelines envisage that teachers should not be assigned responsibilities that will impede or interfere with teaching–learning. Teachers should, however, be involved in ensuring that (1) good quality, wholesome food is served to children and (2) the actual serving and eating is undertaken in a spirit of togetherness, under hygienic conditions, and in an orderly manner so that the entire process is completed in 30–40 min. It should, however, be ensured that the food prepared is tasted by two to three adults including at least one teacher before it is served to children. Thus, the teacher is to supervise that the midday meal is served in an orderly manner within specified time (recess period) and to taste the meal on a rotational basis before it is served" (GoI, Revamping of Mid Day Meal Scheme). However, not all teachers are averse to taking up limited responsibility toward ensuring that their students benefit from what is acknowledged to be a valuable intervention toward increasing enrollment, retention, and attendance (Khera 2006). In a moving plea for restoring the midday meal in Jharkhand, a teacher wrote in the aftermath of the Bihar tragedy that, far from being an unwelcome chore, the task of overseeing the MDM had given her the opportunity to actively ensure that children remained in school. She saw the MDM as a tool for giving students a chance to attend school, especially those from the most vulnerable households who were being sent to school primarily so that they would get a free meal. And therefore monitoring the scheme to ensure that the meal was as nutritious and varied as possible was an essential role that could be played by the teacher, thereby safeguarding the future of students who would otherwise never make it to school (Sharma 2013).

In addition, there have been a few published reports of teachers' views on the quality and efficacy of the MDM. Teachers in Karnataka suggested that the MDM could be improved by a periodic change in the weekly menu and supply of better quality of food (Avinash and Manjunath 2013). In West Bengal, 67 teachers were interviewed of whom 53% reported that quality of food supplied in the MDM was not good, 50.7% thought it had no impact on learning outcomes, and 70% felt it had no impact on health outcomes (Sarkar and Bhattacharyya 2015). Overall, however, the review of available literature highlights the fact that little is known about the knowledge and attitude of school teachers toward the health and nutrition of their students; and despite the critical role that could potentially be played by the teacher, not much scholarly attention has been paid to this issue. In order to address this gap and get a better idea of teachers' perceptions of their students' health and nutritional status, we interacted with several teachers in government schools in Karnataka. The objective was to explore their perceptions regarding the implementation of the school meal program, and its benefits and challenges.

In order to do this, 9 Focus Group Discussions (FGDs) were conducted across the 3 study districts. Participants were selected from those schools where the baseline survey was carried out, from different hobli/blocks according to convenience and interest shown by the school teachers. Participants in each FGD ranged from 6 to 8. Mean work experience of teachers was 9.5 years in Mysuru, 9.9 years in Yadgir and 17.7 years in Mandya. Table 6.1 gives the details of numbers of FGDs and profile of participants.

Table 6.1 Sample for teachers FGDs

Participants	Districts	Total No. of FGDs	Participants for FGD	Average participants/FGD	Mean age	Years of experience
Teachers	Mysuru	3	25	8.3	–	9.5
	Yadgir	3	23	7.7	35.7	9.9
	Mandya	3	19	6.3	43.5	17.7
	Total	9	67	7.4	39.2	12

The purpose of the FGDs was:

- To understand the perceptions of teachers regarding the general health and nutrition status of their students, and the implementation, benefits, and challenges of school meal program on school children;
- To invite suggestions from them regarding measures which could improve the health, nutrition and school performance of students.

6.2 Teacher's Evaluation of the Midday Meal Scheme

All the teachers in all three districts were aware of the objectives and benefits of the MDMS. When asked about the objectives and benefits of the Scheme, they provided the following responses (Table 6.2).

Table 6.2 Teachers' Perception of objectives and benefits of MDM

MDM	Mysuru	Yadgir	Mandya
Objectives	Improve health Improve nutritional status Improve attendance Improve concentration Improve enrollment Improve learning outcome Reduce dropouts	Improve health Improve attendance Improve concentration Improve enrollment Improve learning outcome Reduce dropouts Stop caste discrimination	Improve nutritional status Improve attendance Improve enrollment Improve learning outcome Stop caste discrimination
Benefits	Promote child growth Increase energy level Improved attendance Improved concentration Improved memory Reduce dropouts	Promote health Promote child growth and overall development Improve attendance Improve concentration Improve memory Improve participation	Promote health Promote child growth Improve attendance Improve concentration Improve memory Improve participation Reduce dropouts

6.2.1 Teachers' Role in MDM

Teachers were of the opinion that they play a very vital role in the implementation of MDM in all the study districts. They monitor MDM and also taste it before serving to children. They encourage children to eat appropriately, guide them to sit properly and not waste food. They explain the importance of nutrition and its impact on the body in the classroom since it is included in the curriculum in subjects like science.

6.2.2 Positive Impact Due to MDM

(1) **Improved enrollment and attendance and reduction in dropouts**: MDM has helped in improving the attendance in all three districts, both for boys as well as girls. Attendance of boys in Yadgir has increased for class 2, 5, and 7. "*Enrollment of girls has increased due to this program in the last 3–4 years*" (Yadgir). "*After this scheme has come it has had a good effect on attendance. Previously parents used to take girls for labor work for the sake of food. Now that has stopped*" (Mysuru). Teachers also mentioned that dropout of girls has reduced in recent years: "*The number of dropouts was more among girls. Now that has reduced*" (Mysuru, and teachers in Mandya made similar statements); (2) **Better health**: Teachers reported that children's health is stabilizing after the introduction of the MDM (all districts). Their weight and height have increased (Yadgir, Mandya). They are energetic till the end of the school day; they do not fall asleep; they take part in all the activities (all districts). "*The way the child's face looks in the morning, it looks the same even post lunch, and they are still fresh at 4 pm. Because they are not hungry, they take part in playing/sports activities as well as concentrate in studies*" (Mandya); (3) **Better participation in school**: As children are not hungry, they are able to concentrate on their studies and participate in all extracurricular activities. Teachers in all three districts also feel that their memory has improved; (4) **Children are eating a variety of foods**: Many children have had milk for the first time in school. They have also started eating a variety of vegetables due to the MDM. Teachers reported that if food is tasty the children eat well; (5) **Reduced child labor**: In the FGDs among teachers in Mysuru, they mentioned that child labor among girls has reduced because of MDM. Parents are sending their daughters to school now and not taking them for labor work.

6.2.3 MDM Menu

All the schools are provided with the daily menu by the government (see Tables 6.3 and 6.4). Most schools follow this menu as far as possible.

Table 6.3 MDM menu recommended by GOK

Days	Food list	Vegetable used for sambar	Remarks
Monday	Rice sambar	Spinach, drumstick leaves and other greens, potato, brinjal, onion, tomato, etc., vegetables	Dal/grain compulsory
Tuesday	Rice sambar	White pumpkin, carrot, beans, cabbage, beetroot, tomato, etc., vegetables	Locally available vegetables are used to prepare the food
Wednesday	Rice sambar	Drumstick, potato, onion, tomato, etc.	Locally available vegetables and sambar ingredients are used to prepare the food
Thursday	Rice sambar	Pumpkin, bottle guard, cucumber, lady's finger, radish, ridge guard, etc.	AG mark or certified sambar powder only or good quality sambar ingredients
Friday	Bisibelebath	Beans, turnip, carrot, capsicum, onion, tomato, cereals	Locally available vegetables are used to prepare the food
Saturday	Food product from wheat	Carrot, beans, cabbages, onion, dill greens and other cereals	

Ref: http://www.schooleducation.kar.nic.in

Table 6.4 Supplements provided in Karnataka schools

Tablets	Quantity	Supplying department
Iron and folic acid 1–5th std 6–10th std	Once in a week 45 mg 100 mg	Health department
Vitamin "A" (2 lakh IU) 1–7th std	2 tablets per year per child. Once in 6 months	Education department
Albendozole	400 mg 2 tablets per year	Health department

Ref: http://www.schooleducation.kar.nic.in

6.2.4 Likes and Dislikes of Food Items in MDM

Teachers reported that students have definite likes and dislikes as far as the MDM menu is concerned. For example, on Saturdays when lemon rice or upma is served, students eat less; or when ingredients are not available and the cook has to prepare the food with whatever is available. Apart from such circumstances, teachers in all three districts reported that students eat properly: "*If it is made well, they will eat everything. When the headmaster doesn't get the proper ingredients and the cooks have to do with whatever is available, then children don't like that*" (Mandya, and teachers in Mysuru had the same view).

6.2.5 Challenges Faced in Implementing MDM

Teachers talked about the challenges they face in implementing MDM in all three districts. The major hurdles for running the MDM are: (1) **Teacher's time management**: Teachers in all locations felt that they had to spend a lot of their time in handling MDM activities; due to this, it becomes very difficult for them to give adequate time for educational activities: "*Teachers role is to teach, and this keeps us very busy as it is. This program has burdened the teachers. This is making us concentrate more on MDM program than on studies*" (Mandya). "*Maintaining records is becoming a problem. Teachers are responsible for everything. Handling bank transactions, procuring cooking gas, provisions, vegetables—it has become a problem*" (Yadgir); (2) **Insufficient and late supply of materials**: Teachers complained that vegetables, cereals and grains, gas cylinders—all the requirements of the MDM—are provided late and in insufficient quantity: "*The problem lies when things are not received in time. Some days you see the gas is finished and cooking has to be done on firewood. Cooks are not interested in preparing the food on firewood, whereas the government says that you cannot stop meals even on a single day. So the burden falls on the teachers/head teacher to see that meals are ready everyday which has an impact on the teaching time and there are chances of children's performance going down*" (Mandya); (3) **Low salary for cook**: Maintaining a cook is a big problem in all three districts mainly because of low salary. Cooks are often untrained and unaware of practices to ensure cleanliness.

6.3 Students' Health and Nutrition: The Teacher's Point-of-View

6.3.1 *Health and Nutritional Status of Children in Schools: Teachers' Perception*

When asked about their perception of school children's health and nutritional status, the teachers in all the study districts had mixed perceptions, based on their long experience with working with school children. According to them, on the one hand, there has been a significant improvement in children's health and nutritional status over the years in all three districts. There are fewer episodes of children falling sick and they are more energetic than before. This has been demonstrated clearly in the student's capacity to engage in physical activities: in the words of the teachers—"*It was earlier very difficult while trying to get the children to do physical training, now that problem is not there*" (Mysuru); "*Compared to previous days, children do not fall sick so frequently*" (Yadgir); and "*Earlier when we took them for sports competitions, we used to find our children small in front of others. But for the last few years we are able to see their growth, might be due to tablets (Iron and Vitamin A supplements provided by the School Health Program) or more nourishing food in the MDM*" (Mandya).

Box 6.1 Health and Nutrition in Schools: Some Programs Initiated in Karnataka

MDM is Government of India's flagship program for the achievement of Universalization of Elementary Education (UEE) and is being implemented in partnership with state governments to cover the entire country. The history of Midday Meal (MDM) in Karnataka dates back to 1946 in Bangalore city, providing cooked rice and yogurt. There was provision of giving 3 kg of rice/wheat per month/per child who had 80% or more attendance in 1995. Cooked meal was started in 7 north eastern districts during 2002–2003 (James 2013). After 2002–2003, it was extended to the entire state following the Supreme Court order of 2001 (Sapkota 2015).

In Karnataka apart from MDM there are two major health programs targeting school-going children;

(i) **Suvarna Arogya Chaitanya (SAC)** in which students studying in 1–10th grade in Government and Government aided, unaided and residential schools are medically examined and treated. Since 2006–2007 children needing major operation/treatment are identified and treated at major hospitals under the Yashaswini scheme. Implant cost, investigations and travel expenses are also covered under this scheme (GoK, SAC).

(ii) **Rashtriya Bal Swasthya Karyakram (RBSK)** is aimed at screening children from 0 to 18 years for 4 Ds—Defects at birth, Diseases, Deficiencies and Development Delays including Disabilities. Children diagnosed with illnesses receive follow-up including surgeries at tertiary level, free of cost under NRHM. Government of Karnataka piloted

the RBSK in two taluks in two districts: Mundaragi Taluk in Gadag District and Challakere Taluk in Chitradurga District; based on the experience it is expected to be scaled-up (GoI, RBSK).

However, they feel health and nutritional problems have not been completely wiped out and continue to be a matter of concern.

6.3.2 Major Health Problems Among Students

When asked about what are the major health issues faced by children in their schools, the teachers provided a long list of ailments (see Table 6.5) and concerns.

According to them, more than one-third of the children are sick at any given time in all three districts (in a few schools in Mandya teachers said it is about 10%). The list of illnesses was higher in Yadgir as compared to Mysuru and Mandya. In all the three districts, teachers mentioned the burden of malnutrition, which is supported by our quantitative findings (Refer Chap. 3, Table 3.2). One of the teachers mentioned that: "*The problem is malnutrition in the children; due to that, there are several diseases like Tuberculosis and stomach problems* etc." (Mysuru). In Mandya, teachers mentioned obesity as one of the issues of concern, even though the quantitative data shows only 2% of the children being overweight. Some teachers were concerned about the dental problems in some children, saying that: "*There is no proper growth in their teeth; and even when they grow, they just get broken. I have seen it many of the children. This problem has been brought to the notice of the local nurse. We don't understand the reason for this problem and have to look into it.*" The teachers did not mention Fluorosis, but the symptoms mentioned above are consistent with excessive fluoride in the water. In summary, the majority of illnesses listed were related to malnutrition, poor quality of water and sanitation, and lack of hygiene.

Table 6.5 Major illnesses faced by teachers in school

Mysuru	Yadgir	Mandya
Malnutrition, cold, diarrhea, tuberculosis and gastritis	Malnutrition, stomach ache, dizziness, fever, vomiting, diarrhea, cough, cold, mosquito related diseases, jaundice, fainting, visual problems and anemia	Malnutrition, fainting, dental problems, obesity, anemia, headache, cold and cough

6.3.3 Reasons for Poor Health and Nutrition

6.3.3.1 Structural

Poverty and Hunger: The students who come to school hungry are either poor (Yadgir) or both their parents are working (Mandya). Some children do eat left overs of the night, but this consists only of rice and is not nutritious. Teachers found that the children of working parents often come to school without breakfast, and even without brushing their teeth or washing their face which adds further to their health problems. Most of the parents are uneducated, with little knowledge of health and nutrition. Very few children are fortunate that their grandmothers stay with them, which means that they do get to eat some food in the morning (Mandya).

Poor living conditions: Teachers were of the opinion that many of the health problems faced by the students are because they live in impoverished localities, where they are exposed to diseases caused by air pollution, poor sanitation, and stagnant water. Mosquitos breed in the stagnant water, causing a variety of vector-borne diseases. The quality of water is poor as it has excess lime that affects their bones (Mandya). In addition to that poor awareness and practices of sanitation and hygiene are a matter of concern for teachers in all three districts.

Gender equality: some change, but still a long way to go: As compared to earlier times, teachers felt that there is a little less gender discrimination in the home. Girls and boys are treated equally, fed equally, and parents take better care of them as they have fewer children. They now want girls to be educated and stand on their own feet. Within the school, teachers felt that there is no discrimination and both boys and girls are treated equally. However, gender inequality in certain matters still persists in the home environment. According to the teachers, boys are given more importance than girls as far as nutrition, health, and education are concerned. According to some of the teachers: "*Parents serve freshly prepared food to boys and leftover food to girls*" (Yadgir). "*Parents take a lot of care of the boys and feed them well; while what is left over is given to girls. This difference is still prevalent in our villages. So the health of boys is a little better than girls*" (Mandya). While this was the subjective opinion of the teachers, the data collected by our study did not bear this out. Girls were nutritionally better off than the boys at all ages. "*There is no discrimination in the school but there is discrimination at home*" (Mysuru). There is discrimination even in the educational opportunities made available to the children: for example, teachers in Mandya reported that in some villages, boys are sent to convent schools while girls go to government schools.

6.3.3.2 Programmatic

Low nutrients in home food as well as in the Midday Meals: Teachers were of the opinion that neither in the home nor in school do children have access to nutritious

food. They felt that the MDM provided in the schools was not adequately nutritious (Yadgir) and this was leading to poor health and nutrition among the children.

Improved Health Care facilities over the years: Teachers observed a dramatic change in healthcare facilities in the villages where the children lived. Earlier they used to depend largely on home remedies and on faith-based healers, but now the situation has changed and they have greater access to a doctor. Earlier government clinics and private practitioners were far away but now they have come much closer to home. Grassroot health workers such as the ASHA, ANM, and Anganwadi workers do regular home visits and if there are any health-related issues they refer those children to the government hospitals. They felt that the government was doing a much better job of providing basic health services in the villages of their districts, which had contributed to some improvement in the health status of the children.

Government interventions in schools through School Health Program: Several new programs have been introduced by the government that the teachers felt had made a significant difference to the children's access to health services. Under "Suvarna Arogya Chaitanya" Program, all the students are provided a health checkup by the doctors of the local Primary Health Centers twice in an academic year. The treatment is free of cost and for any major illness children are referred to the larger government hospitals Apart from this, a health card for each child is maintained in schools. Students are given Tetanus Toxoid injections, iron tablets, vitamin A tablets, and deworming tablets under this program. Eye checkup camps are organized and schools are provided with a First Aid box. For adolescent girls, there is a Kishori program from class V–VIII. This has created awareness on health, hygiene, cleanliness, school attainment, social environment, puberty, reproductive and sexual health, and life skills. There are also district-specific programs such as the Vanavasi Kalyana Yojane in Mysuru, which has benefited the people's health. They reported that NGOs like MYRADA work extensively and provide facilities such as First Aid boxes for schools.

Counseling by teachers and awareness generation: Teachers in all districts counsel the students to eat MDM, especially vegetables which they generally keep aside. They also explain to them the benefits of a healthy diet: "*We take classes on nutrition, tell children about nutrients and how to follow a healthy diet. We also set an example during the school lunch by eating vegetables that children do not like so that children can follow us. Earlier they never touched brinjal, but now they understand it has iron content that helps in growth*" (Mandya). Teachers make a note of children who are weak and contact their parents and ask them to improve their diet. They also spread awareness about different kinds of food and their nutritive value, particularly during their meetings with student's mothers. "*We have 'Mothers Association' (thayindra samiti) and we do discuss nutrition issues and what kind food should be given to the children at home*" (Mandya). They also have discussions during these meetings on safe drinking water, use of toilets and personal hygiene.

Role of Media in improving health and nutritional status: The teachers felt that TV has an important role in communicating messages on healthy behaviors. Most

children and their parents watch TV and this perhaps is influencing parents in understanding the importance of a healthy diet to some extent: "*Parents understand the importance of sprouts, raw vegetables* etc." (Mandya) Since family size has also reduced substantially, with parents now having only one or two children, they are better able to take care of their needs. Television programs such as "Bal Kishoris" has been helpful in bringing change.

6.3.3.3 Household/Individual

Low preference for healthy food and false beliefs: Children refuse to eat certain food items like vegetables and greens simply because they do not like them or because of beliefs that they will harm their health. For example, tomato, pumpkin, brinjal, and curry leaves are rejected for this reason (Yadgir). In Mandya, a few teachers mentioned that students are getting affected because of increased consumption of junk food. In addition, there are strong belief systems involved in determining food preferences: for example, parents sometimes restrict teachers from providing milk, wheat-based items and food cooked on a gas stove in school (Mandya, Mysore). "*Some children get a cough after drinking milk and cannot understand why? Of the 39 students in my class, 10 do not drink milk; their parents come and tell us not to give milk as it causes phlegm and the children start coughing*" (Mandya, similar statements were made in Mysuru also). Such false belief was seen even among the teachers: for example, in Mysuru, they restrict the girl child from drinking hot water and eating "allergic food" (food believed to increase body heat in traditional/ayurvedic food systems, such as onion and garlic) when they reach puberty. One teacher shared that: "*There is no such thing as dietary food practice in the school. But when girls 'mature', a special dietary practice is observed. We avoid hot water and allergic food*" (Mysuru).

Traditional Practices: Some teachers in Mysuru mentioned that a few children do not eat in school during the month of Shravana (Hindu calendar) since they fast during that month. In terms of seeking health care, teachers felt that many people prefer to go to faith-based healers as their first choice; and only approach the government hospital as a last resort (Yadgir, Mandya). "*When a child doesn't sleep they go and get a talisman tied around the child's wrist. We have advised the parents that many illnesses are due to change in the weather and to take the child to the doctor, but the parents say—'madam you don't know' and take them to the temple or priest. But they are now changing. If the children have not recovered in a few days, then they go to the doctor*" (Mandya).

Change in food habits: Teachers in Yadgir and Mandya observed increased consumption of rice based foods. Teachers in Mandya feel that people who eat old traditional food (ragi balls) are healthy even today. However, parents have started understanding the importance of a healthy diet, and have started giving their children milk regularly along with the vegetables grown in their fields: "*They have cows, but the milk is supplied to the dairy and not given to the children. Now there is an improvement, and in some houses they have started giving the milk to their*

children" *(Mandya).* Parents have also started giving fruits for their children: "*Previously, children did not get fruits to eat at home and they would go blank if questioned about fruits that they eat. But now they tell us what fruits their parents buy and they get to eat. Therefore, there is a change to some extent*" (Yadgir). Teachers also observed that MDM is positively impacting the children's health and nutritional status to a large extent. "*There has been some change in the food habits. Earlier children used to eat only in the morning, if at all, and then go hungry until the evening. They did not have any lunch. But now due to the midday meal there has been a change, we are giving vegetables and milk. There has been a change for the better*" (Mandya).

6.4 Suggestions to Improve Health and Nutrition in Schools

In the teachers' perception, the overall health of their students has improved in all three districts. However, they felt there was still room for improvement. Some of the suggestions given by the teachers to improve health and nutritional status in schools are:

6.4.1 Create More Responsive Systems

The Health Department should put in place a mechanism for regular monitoring of the School Health Program. They should ensure that the children's health checkup is done thoroughly and more frequently (Mysuru, Mandya). The teachers suggested that the Health Cards should be designed in a way that would enhance their utility. "*Some children get hospitalized but neither do doctors ask for health card nor do parents take it. We also never use the health card! We simply ask children whether they are feeling sick, and then write it on a piece of paper and send them home*" (Mandya). Doctors also do not conduct the routine checkups regularly: "*Ideally they should come once a week or fortnightly but they come only once a year and even then they do not do a thorough check up*"; "*So far, no doctor has identified any illness or referred any child for further checkups. They come and do their work in a hurry*" (Mandya). Teachers were dissatisfied with the availability of medicines in government facilities: "*In the olden days they used to give only one particular tablet, now it is not like that. Many medicines are available in the market, but not in the government hospital. Moreover, house visits are made by health workers but they do not carry sufficient medical supplies. The government should supply sufficient medical supplies as the population also has increased*" (Mandya).

6.4.2 Increase Awareness Programs

The teachers felt that there is a need to generate awareness among parents on nutritional requirements for children's physical and mental growth. There is also a need to increase awareness about superstitions and false beliefs. The parents should be made aware of the importance of taking the child to a doctor first rather than faith-based healers. The media could play an important role in such awareness campaigns as well.

6.4.3 Place Restrictions on Junk Food

According to one teacher, Government should ban junk food: "*The main reason for falling ill is that children go to the shop and buy and eat those snacks that are sold for 1 rupee. They are very unhealthy. Those are cheap food products and it reduces the children's strength. Government should ban these snacks. Earlier it was only chocolate but now so many other things which are not good for health are sold. They should sell nutritious food for low price instead of all these, so that children can afford to buy something that is healthy*" (Mandya).

6.4.4 Improve the Quality of the MDM

Teachers in all three districts reported the need for improvement in MDM. They suggested the introduction of ragi balls, more variety of vegetables, pulses and sprouts (Mysuru), banana, eggs, green gram and beans (Yadgir). They suggested that the government should allocate more money to the MDM to improve the taste of the food (Mysuru). They indicated that allocation of separate rooms for storage of groceries and cooking is required. Cooks need to be trained in better hygiene practices, and their salaries need to be increased (Mandya).

6.4.5 Outsource MDM

Teachers in all locations felt that the MDM is a burden on them and is affecting their main duties. Teachers feel that MDM should be outsourced to external bodies like ISKCON, NGOs, SDMCs, or SHGs where food is cooked in a centralized kitchen. Keeping records of materials is overburdening the teachers (Mysuru). Some teachers also recommended the outsourcing of the food preparation because parents restrict their children from eating food cooked by a lower caste cook: "*Earlier, food was supplied by the Resource Centre. If that system continues, we*

can pay more attention towards children. Doing so will eliminate the problem of caste system because some parents tell their children not eat the food prepared by a lower caste cook at school. One after the other, all the children learn from each other and stop eating the food" (Yadgir).

6.5 Teachers' Reflections for the Future

Overall, the teachers in all three districts felt that the health and nutritional status of children has improved over time due to school health programs and MDM. They ascribed this to their own role in creating greater awareness in schools on health and nutrition issues, the increased interventions of the health department, improved medical facilities at village level and the role played by media in creating awareness. But there is a long way to go and teachers are not fully satisfied with the improvement thus far.

In their opinion, much more needs to be done in terms of spreading awareness among both students and their parents of better health and hygiene and the importance of a healthy diet; as well as issues such as gender equality, and dispelling false beliefs and superstitious practices. Programmatic issues such as poor quality of food provided, lack of incentives for cooking staff, overburdening of teachers due to MDM, shortage of cooking materials, and training of cooking staff need to be urgently addressed by the government; and greater emphasis needs to be placed on regular monitoring and evaluation of the MDMS.

There are several implications of the conversations with the teachers for future action:

(i) Improvement in the quality of food provided for MDM as well as the introduction of an additional meal (for example, breakfast or a snack before children are sent home) would fulfill the recommended daily allowance of various nutrients for the children, and would have the added advantage of reducing malnutrition among children attending government schools. Persistent malnutrition was not only noticed by teachers in all three districts, but has been confirmed by the data collected on anthropometry and FFQ presented in Chaps. 3 and 5, respectively.

(ii) Proper monitoring of the implementation of MDM and a quarterly evaluation mechanism which involves students and parents should be put in place by the Government.

(iii) Training cooks in cooking tasty and hygienic food should be conducted every year along with increased salaries and timely supply of cooking material and equipment.

(iv) Cooking local foods like ragi balls in Mysuru and Mandya and jowar roti in Yadgir instead of following a universal menu will enhance the acceptability of food.

(v) Where possible, the MDM could be outsourced to external bodies like "Akshaya Patra" or SHGs in order to reduce the extra burden on teachers of managing MDM-related activities.

(vi) There should be a greater focus on increasing knowledge and awareness on healthy diets. Training teachers on healthy eating practices and health-related issues will help teachers to generate awareness among students and parents. Creating avenues for spreading health awareness through media can be an added advantage.

(vii) Greater efforts are required to restrict access to junk food and its advertisement and/or creating awareness about its negative impact on health.

(viii) Government-sponsored health checkups could be organized more frequently, and the interface between the education and health systems should be made seamless. For example, the Health Cards provided to children in the school could be used also as their registration card for health services. This would better enable tracking and follow-up of children's health status.

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Chapter 7
Food and Nutrition Policy: The Government Response

Abstract Drawing linkages between multiple dimensions of poverty, socioeconomic status of students attending government schools and evidence on nutritional outcomes of children, the chapter critically analyzes government interventions in terms of nutritional policies and programs. Examining the evolution, scope, implications, and impact of programs such as ICDS, MDMS, and PDS, the chapter draws linkages between the accessibility and adequacy of such programs and the implications for children, their households and varied stakeholders. Since health and nutrition policies can have far-reaching impacts on the achievement of other social sector goals—for example, Education for All—it is important that the Government rethinks the current approach. Supporting health and nutrition policies and programs for children in the school age can promote equity by helping to level the playing field between the poorest children and their better off counterparts, and in some cases even remediate early deprivation so that children can reach their full potential. In order to succeed, there needs to be genuine convergence between all policies and programs aimed at enhancing health and nutrition outcomes for children; and no matter what the mechanism, a common understanding and mission needs to be evolved that keeps the interests of the child at front and center.

7.1 Introduction

Drawing upon the linkages presented in previous chapters between multiple dimensions of poverty, nutritional status, the socioeconomic background of the children attending government primary schools and their nutrient intake, this chapter critically analyzes nutrition-related policies and programs, their performance and impact. The chapter traces the evolution of nutritional policies and programs over time; and examines the challenges that have been faced in their implementation, which have limited their potential impact. The chapter ends by highlighting some key issues that need to be addressed in order to enhance health and nutrition outcomes for school age children.

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7.2 Government Policy: The National Nutrition Policy and Food Security Act

The National Nutrition Policy (1993) The Policy recognized that undernutrition was part of the "vicious cycle of poverty," where inadequate intake of food lead to poor physical growth and ill-health; this in turn reduced the capacity for physical activity and work; such reduced capacity translated into reduced earning capacity, greater morbidity and mortality, leading to further poverty and the repetition of the vicious cycle. In order to break this, the Policy undertook to strengthen the linkage between agriculture, food and nutrition; and to address the following specific gaps in nutritional profile: (i) low protein intake, resulting in Protein Energy Malnutrition (PEM), and the prevalence of other types of micronutrient deficiencies such as iron, iodine, and Vitamin A; (ii) low birth weight among newborns; (iii) seasonal dimensions of malnutrition, including the high proportion of rain-fed subsistence farming which increased the vulnerabilities of farmers in the event of poor rainfall; (iv) other natural calamities such as famine, flood, and drought that could lead to loss of employment or crops or both; (v) market distortion and disinformation, whereby prices of food could be manipulated and become unaffordable; (vi) urbanization and migration, as reflected in the extremely poor nutritional status of children of slum-dwellers and other urban poor; and (vii) regional variations in vulnerability, as with people living in the hills and other remote areas.

Recognizing the multidimensional nature of nutrition, the Policy aimed to address malnutrition both through direct interventions as well as broader strategies of overall economic development. Direct interventions included: (i) expanding the nutritional interventions under the Integrated Child Development Services (ICDS), by extending coverage and by strengthening growth monitoring; (ii) better coverage of women and adolescent girls to ensure a safer pregnancy and healthier babies; (iii) food fortification, particularly again for pregnant and nursing mothers and adolescent girls; and (iv) popularization of cost-effective healthy diet alternatives based on locally available raw materials. Policy level interventions include: (i) ensuring food security through agricultural policies aimed at increasing overall food production; (ii) enhancing income security through employment guarantee schemes; (iii) strengthening the Public Distribution System of food grains to poor households; (iv) a range of health-related interventions to reduce morbidity and improve knowledge of positive health and nutrition practices; and (v) most importantly, nutrition surveillance and research, to track the incidence and prevalence of malnutrition and to understand the dynamics of its occurrence and possible ways to halt and reverse it.

The Policy also outlined the administrative arrangements at the central and state levels to operationalize the provisions of the Policy; as well as the different programmatic interventions (such as the ICDS, MDMS, and others) that would need to be extended and strengthened to achieve the goals of the Policy (National Nutrition Policy 1993).

The provisions of the National Nutrition Policy have been implemented with varying degrees of success. Previous to this, in 1992, India was a signatory to the World Declaration on Nutrition made at the International Conference on Nutrition in Rome, which highlighted priority areas, with specific objectives, to be covered within a given timeframe. The National Plan of Action on Nutrition (NPAN) was drawn up in 1995 with the following goals: (i) reduction in moderate and severe undernutrition in children by half; (ii) reduction in chronic undernutrition and stunting in children; (iii) reduction in low birthweight deliveries to less than 10%; (iv) elimination of blindness due to Vitamin A deficiency; (v) reduction of iron deficiency anemia among pregnant women to 25%; (vi) universal iodization of salt to reduce iodine deficiency disorders to 10%; (vii) production of 250 million tons of food grains; (viii) improvement of household food security through poverty alleviation programs; and (ix) promoting appropriate diets and healthy lifestyles (NPAN, 1995). The NPAN included several "sectoral plans of action" including in agriculture, civil supplies and public distribution, education, forestry, maternal and child health, food processing, information and broadcasting, labor, rural and urban development and women and child development. The idea was to apply a multi-sectoral implementation strategy, coordinated and overseen by the National Nutrition Council—a high-powered body, chaired by the Prime Minister and tasked with drawing up guidelines and monitoring progress toward achievement of goals. A Taskforce on Nutrition Surveillance was set up within the Department of Women and Child Development to track nutritional levels nation-wide; as also to develop District Level Nutrition Profiles to provide data disaggregated by gender, urban/rural, etc., to aid in better planning of nutrition interventions.

Despite these efforts, malnutrition rates in the country continued to be high, and prompted the creation of the National Nutrition Mission in 2003, specifically aimed at increasing effective coordination between nutrition-related interventions of different ministries. The Mission created national level leadership for addressing malnutrtion and included Chief Ministers of states, federal ministers, as well as academics, NGOs and technical experts. The Mission launched a pilot project in 51 districts identified as "nutritionally deficient" to distribute food grains free of charge through the Targeted Public Distribution System (TPDS) to adolescent girls and pregnant/lactating women in the Below Poverty Line (BPL) category. This was followed in 2008 by the establishment of the National Council on India's Nutrition Challenges; this focused on reforming the ICDS, and recommended institutional and programmatic convergence at the state, district, block and village level for dealing with 200 "high burden malnutrition districts" (NAC 2011). Finally, the National Advisory Council (2004) was extended in 2010 to include special working groups on Food Security and ICDS reforms (Mohmand 2012).

Apart from such government-led efforts, civil society activism has also played an important role in influencing the development of food and nutrition policy in India. A public interest litigation by the People's Union for Civil Liberties in 2001, for

example, led to the universalization of ICDS as well as the provision of a midday meal in schools. This was the genesis of the Right to Food Campaign (Khera. India's right to food campaign), which contributed significantly to the promulgation of the National Food Security Act 2013.

Right to Food With regard to India's record in assuring its citizens the Right to Food, the Special Rapporteur to the Human Rights Council has commented as follows (Ziegler 2008):

> "India provides one of the best examples in the world in terms of the justiciability of the right to food. The Constitution of India prohibits discrimination and recognizes all human rights. The right to life is recognized as a directly justiciable fundamental right (art. 21), while the right to food is defined as a directive principle of State policy (art. 47). As it has interpreted these provisions, the Supreme Court of India has found that the Government has a constitutional obligation to take steps to fight hunger and extreme poverty and to ensure a life with dignity for all individuals."

In pursuance of these commitments, the country adopted the National Food Security Act (2013) which promises "….to provide for food and nutritional security in human life cycle approach, by ensuring access to adequate quantity of quality food at affordable prices to people to live a life with dignity and for matters connected therewith or incidental thereto" (National Food Security Act 2013). The provisions of the Act are as follows:

- Beneficiaries will be provided rice at Rs 3 per kg, wheat at Rs 2 per kg and coarse cereals at Rs 1 per kg. Up to 75% of the rural population and 50% of the urban population will get 5 kg of food grain every month. The poorest who fall under the Antyodaya Anna Yojana will continue with their present monthly entitlement of 35 kg of food grains.
- Around 80 million of India's 1.2 billion population will be entitled to subsidized food grain under the TPDS. The responsibility of identifying the beneficiaries lies with the state governments. Additional benefits are envisaged for pregnant and lactating women, and for children 6 months to 14 years old. The Bill also empowers women, by designating the oldest woman in the house as the "head of the household."

Given the previous experience with the TPDS, the success of the program depends critically on the fair, equitable, and transparent implementation of its provisions. The cost has been criticized for being quite steep: at the level of coverage that has been proposed, the total estimated annual food grains provided will be 612.3 lakh tons and the corresponding estimated cost for implementation of National Food Security Act, at 2013–2014 rates, is about Rs 124,747 crore. The fate of the translation of the provisions into action will depend crucially on the political will of the present government to follow through on a process initiated by the previous government; so far, there is little evidence that the spirit of the Act will be honored. In fact, there have been delays in conducting the Socioeconomic and Caste Census (SECC) which is essential to identifying the beneficiaries; as well as budget cuts for nutrition-related programs.

7.3 Programmatic Response to Malnutrition

Health and nutrition programs to address the needs of children facing socioeconomic disadvantage have existed in many countries, including India, for several decades. Programs launched by Government of India can be categorized into three sets of interventions: (i) nutrition-specific; (ii) nutrition-sensitive; and (iii) enabling interventions (Table 7.1).

Table 7.1 National Nutritional Programs targeting children in India

Name of the program	Responsible Entity	Year	Target group
Midday Meal Program (different from Midday Meal Scheme below)	Ministry of Education, Government of India	1961–1962	Elementary school children, to improve school attendance
National Nutritional Anemia Prophylaxis Program	Ministry of Health and Family Welfare, Government of India	1970	Mothers and children 1–5 years given iron and folate
Vitamin A Prophylaxis Program (part of National Program for Control of Blindness)	Ministry of Health and Family Welfare, Government of India	1970	Pre-school children
Balwadi Nutrition Program	Department of Social Welfare, Government of India	1970	Children 3–6 years attending Balwadi
Special Nutrition Program	Ministry of Social Welfare, Government of India	1970–1971	Pregnant/nursing mothers and children below 6 years in certain high risk areas
Integrated Child Development Services Scheme	Department of Women and Child Development, Government of India	1975	Pregnant and lactating women Adolescent girls Children 0–6 years
National Iodine Deficiency Disorders Control Program	Ministry of Health and Family Welfare, Government of India	1992 (1962)	(Previously National Goitre Control Programme)
National Program of Nutritional Support to Primary Education (NP-NSPE, also known as Midday Meal or MDM Scheme)	Government of India (Centrally sponsored, State assisted)	1995	Dry rations for primary school children across the country
Sarva Shiksha Abhiyan	Ministry of Human Resource Development, Government of India	2000–2001	Knowledge dissemination on nutrition within the syllabus, school health check-up and Midday Meal
NP-NSPE amended to Cooked MDM per Supreme Court	Government of India (as above)	2002	Cooked meals; extended till Class VIII in 2006–2007

(continued)

Table 7.1 (continued)

Name of the program	Responsible Entity	Year	Target group
Nutrition Program for Adolescent Girls (Kishori Shakti Yojana)	Ministry of Women and Child Development, Government of India	2002–2003	Adolescent girls pregnant women and lactating mothers
National Rural Health Mission/Reproductive and Child Health II	Ministry of Health and Family Welfare, Government of India	2005	Micronutrient supplementation, deworming and management of severe malnutrition for 0–3 and 3–6 year olds; weekly Iron and Folic Acid supplementation

Nutrition-specific programs are those that directly address basic nutritional needs within the context of the government pre- and primary school system. The objectives of the programs match well with the evidence available on the appropriate health and nutritional services needed by children of different age groups, and include some combination of feeding, micronutrient supplementation, immunization, deworming, vision screening, and cognitive stimulation. In addition, each program has either created/established an institutional network or leverages an existing institutional network to bring such services to the intended beneficiaries. Many of the interventions aimed at children of school age are to be implemented through schools. This is in keeping with the global paradigmatic shift toward using schools as the point of delivery for child-related services; and, by doing so, enhances the ability to serve multiple objectives with a single intervention. Details on these programs are provided in the section below.

The Integrated Child Development Services (ICDS) was first launched in 1975 with the primary goal of improving the nutrition and health of children from 0 to 6 years old; to reduce the rates of mortality, morbidity, and malnutrition; and to augment the ability of mothers to look after the health and nutritional needs of their children. The program covers about 89.3 million children and pregnant/lactating mothers. Services are provided at designated Anganwadi Centers (AWCs), where an Anganwadi Worker (AWW) and a helper cater to the nutrition and early child development needs of children enrolled in the center. Apart from ensuring the provision of a hot cooked meal—the responsibility of the helper—the centers also provide nutrition education and supplementation, immunization services and pre-school education. There are currently close to 1.5 million AWCs across the country providing such services. The program is administered by the Department of Women and Child Development, and at the field level it is expected that the AWW and the Auxiliary Nurse Midwife (ANM)—the corresponding field worker reporting to the Health Department via the National Rural Health Mission (NRHM, now re-christened the NHM)—will work closely and coordinate their activities. There is little connection between this program and the Education

Department or Sarva Shiksha Abhiyan, although the expectation is that the children will "graduate" from the AWC into the primary school. It is often the case that the AWC is located on the campus of the government primary school. This is convenient since both can share a common kitchen; in addition, older children can supervise their younger siblings without having to miss going to school.

The Midday Meal Scheme provides a hot meal to school-going children. Precursors to the nation-wide program have existed for many decades in states such as Tamil Nadu, Kerala, and Karnataka, but it was only after a Public Interest Litigation filed by the People's Union for Civil Liberties in Rajasthan (2001) seeking the Court's intervention in enforcing the "Right to Food" for school children that the program was scaled up at the national level. Consequently, children in government and government-aided primary schools are provided freshly cooked meals on all working days and for at least 200 days in a year. Meals have a stipulated nutritional value, in terms of the number of calories they should provide, the amount of protein, and the specific composition of the meal in terms of rice, dal, vegetables, and so on. About 120 million children are covered across the country by this program every year. The program has a complex administrative structure, with both central and state government involvement. In terms of flow of funds, the money is routed from the central government to the state Department of Elementary Education from where it flows to its nodal officers at the district and block levels (District Elementary Education Officer, Block Elementary Education Officer or equivalent). However, the food grains that are to be supplied to each school are provided by the Food Corporation of India through its state units. As a separate administrative entity, the Education Department has no control over the food supply chain (Table 7.2).

The School Health Program (SHP) addresses the health needs of school-going children and adolescents in the 6–18 year age group in government and government-aided schools. It provides for health screening twice a year and early management of disease and disability. The purpose is to address the physical and mental health needs of children, provide micronutrient supplementation and promote physical activity. The program also provides counseling and immunization, weekly iron folic acid supplementation, along with biannual deworming. More than 70 million students are covered annually by this program. The SHP was launched and is administered by the MoHFW, under the umbrella of the NHM. While

Table 7.2 Food Norms per child per day under MDM

Item	Primary (class one to five)	Upper primary (class six to eight)
Calories	450	700
Protein (in g)	12	20
Foodgrains (in g)	100	150
Pulses (in g)	20	30
Vegetables (in g)	50	75
Oil and fat (in g)	5	7.5

providing for the health needs of children in schools, the SHP document makes no bones about the objectives of the program: (i) to impact the health of children, their families and generations to come; (ii) to achieve population stabilization and gender balance by introducing these ideas as early as possible; (iii) to universalize immunization, health awareness and health seeking behavior; and (iv) to hold state governments accountable for the implementation of the program. In short, while providing much-needed health services for school children, the program was also meant to achieve certain demographic and administrative goals of the MOHFW.

Since these are longstanding programs, several evaluations have been conducted of their efficacy and impact. A large-scale evaluation of the ICDS conducted by the Government of India (2011) found that (i) there are large coverage gaps, with only 62% of eligible children covered by the program at the national level; (ii) only about 38% of pregnant and lactating women and 10% of adolescent girls received benefits under the supplementary nutrition component of the ICDS; (iii) serious problems in availability of infrastructure at the AWCs have had a negative impact on service delivery and quality of services—and by extension, on the ability of ICDS to have a substantial impact; (iv) there was some evidence to show a greater likelihood of breastfeeding within the first hour of birth among beneficiary mothers, as well as greater school enrolment and retention among children who attended Anganwadis; (v) the success of the program depended on the contribution of other stakeholders as well—water and sanitation, Panchayati Raj members, as well as the community (Government of India 2011). Coverage gaps and program implementation related issues have been identified elsewhere as well, with the conclusion that such issues seriously compromise the effectiveness of the program (Chudasama et al. 2014; NIPCCD 2009).

Evaluations of the MDMS indicate several positive impacts: (i) substantial and consistent evidence to indicate that there has been increased enrolment and retention of children in schools. Dreze and Goyal (2003), based on data from Chattisgarh and Rajasthan, conclude that the dramatic jump in enrolment of girls could largely be attributed to the MDMS; (ii) reduction in classroom hunger: a Planning Commission study indicated that 43% of the beneficiaries of the MDM belonged to rural agricultural labor households, and poor households. Children from these households were more likely to be hungry during the day, and the MDMS was likely to be an important nutritional supplement (Government of India 2010); (iii) the impact on social equity is mixed: the MDMS was meant to get children from different castes and backgrounds to eat together, thereby breaking down existing social taboos. The Planning Commission study found that this was largely the case; although other studies reported that there was objection to Dalit cooks, and segregated meals of poorer quality were being served to Dalit students (Lee, 2005); (iv) National Sample Survey (NSS) 61st round data indicates that at least one member of the household of the bottom 30% of income deciles was benefiting from the MDMS, indicating that the program was reaching the targeted beneficiaries (MS Swaminathan Research Center 2011).

However, most studies report that this program too is beset with implementation issues particularly regarding management of distribution of food grains, cooking and distribution of meals, and availability of personnel. A study in Punjab found that there is often no proper kitchen, or seating arrangements for the children to eat. Cooks are unaware of the guidelines to ensure hygiene; and parents are unaware of the grievance redressal mechanism (Uma 2013). A study by Mohanty (2014) conducted in Odisha found that rice and pulses provided were not of good quality and insufficient in quantity, cooking conditions were unhygienic, salary for cooking staff was low, and funds were released irregularly. Insufficient food provided under the MDM was reported elsewhere as well: a study in Gujarat observed a deficit in ration used of 55.5 g/day/child (Nambiar and Desai 2013). Similarly, poor management of the MDM has been reported by several studies: a study conducted in Bihar found lack of proper planning, poor level of involvement of the community and students; half the schools lacked a proper kitchen, and almost no school had soap for hand washing, Headmasters were dissatisfied with the ration supplied and parents and community members were dissatisfied with the quality of food (Mishra 2014).

Finally, no systematic evaluation has been conducted of the SHP. However, observations in the field indicate that there are major challenges to the implementation of the program since it requires close coordination with the Health Department for the secondment of doctors and nurses to schools to conduct the medical check-ups. Due to poor availability of health personnel in Primary Health Centers, which are the nodal institution for the SHP, the school visits are mostly irregular.

The second set of programs is those that are sensitive to the nutritional needs of school children, and address the issues indirectly, which include:

The Targeted Public Distribution System —the largest food grain distribution program in the world—makes food more accessible for poor households by providing 35 kg of food grain per month per household at a subsidized rate (http://dfpd.nic.in/public-distribution.htm). Over and above well-documented leakages and other implementation problems, this still only provides a poor household—with no means to procure additional grain in the open market—half the needed food grain. At about 14–17 kg per capita per month, estimating about 5 persons per household, each household would require about 70 kg of grain per month (Adume et al. 2005). The National Food Security Bill also speaks of a similar quantum of food being made available at the subsidized rate. The TPDS is meant to promote food security in poor households, by providing subsidized food grains to the disadvantaged populace. It should also facilitate operationalization of the proposed National Food Security Act which will then provide statutory food security to the vulnerable. The functioning of the TPDS has come under severe criticism over the years: the system has been plagued by poor targeting and ubiquity of ghost cards; leakage and "siphoning off" of TPDS supplies is well known and is estimated to amount to about 33% of total distribution; another 20% or more is misdirected to APL households; and the cost of providing food subsidies through the TPDS has been calculated as much higher than other possible modes (Government of India 2005). If the TPDS

can ensure efficient and accountable food distribution, it has the potential to make an important contribution to household food security in India, as has been the case in other countries such as China and Brazil (Kattumuri 2011).

The Total Sanitation Campaign is aimed at reducing open defecation, now well-recognized to contribute to malnutrition; and along with many other programs indirectly addresses the well-being of children and impacts their nutrition, increases school enrolment (particularly for girls), and raises the age at marriage. There is some evidence to indicate that the program has reduced incidence of disease and medical expenses in beneficiary households; and that women feel more secure. However, there are implementation issues in terms of availability of water, quality of construction of toilets, as well as persistent issues relating to behavior change among beneficiary communities (Government of India 2013).

The third set of programs are investments in creating an enabling environment for improved nutrition, such as:

The National Rural Employment Guarantee Scheme This program is meant to enhance the livelihood security of people in rural areas, and to provide poor families with an assured income which would contribute to household food security. The Act guarantees 100 days of wage employment in a financial year to every rural household. The Act covers 615 districts and has provided employment of about 2900 million person days in 2010–2011. The Scheme potentially upgrades infrastructure and increases agricultural productivity thereby changing the geography of poverty, empowering women, and preventing unnecessary migration.

Box 7.1 Midday Meal Scheme in Karnataka: Government response
Many best practices adopted by Karnataka to improve the MDM have been documented in Best Practices in the Implementation of Midday Meal Programme in Karnataka (Srinivas 2008). They include:

- SDMC and Mother Committees actively participate and contribute to the school
- Records are properly maintained and the information is displayed on the school wall
- Teachers' participation is encouraged
- Fruit and kitchen gardens have been planted in the school compound
- One cook appointed in every center necessarily belongs to the SC/ST communities
- LPG is used in the preparation of food in the interest of protecting greenery, reducing air pollution, and also protecting the women's health and cleanliness
- SDMC and other civil amenities committees provide good quality vegetables/fruits/sweets to children on festivals and other special occasions

- Rain water harvesting has been implemented for improved ground water management
- Cooks have been trained in the preparation of hygienic and healthy food and in maintaining cleanliness
- Good convergence practices
- All children are served food by making them sit in rows irrespective of caste and creed. This helps in coordination, cooperation, equality, and moving toward casteless society
- Pucca kitchen sheds are provided to the schools out of various schemes of Zilla Panchayat and State Funds.

A performance evaluation of cooked midday meal (Government of India 2010) was conducted by the Planning Commission in May 2010 across 17 states including Karnataka, which revealed that the cooked midday meal has had an impact on reducing classroom hunger and promoting social equity. Findings from research conducted on the impact of the MDM scheme in Karnataka show the following:

(i) In a study in rural Bangalore, Karnataka, Minj et al. (2014) conducted a pre- and post-assessment of the impact of the MDM on the nutritional status of primary school children aged 6–12 years old. They found that the MDM had a positive impact on the children's nutritional status: stunting among girls had reduced, as well as grade 2 and grade 3 undernutrition among both boys and girls. Girls fared better post-MDM as compared to boys.

(ii) Kamath et al. (2015) covered 27,544 children in Bellary district, Karnataka who were attending class 3–7. The objective was to assess the impact of the Akshaya Patra MDM program. The study estimated the BMI-Z score for all the children, based on which they estimated that 13% of the children were thin and 3.1% were severely thin. Here again, girls fared better than the boys with regard to undernutrition; and more girls were obese than boys. Overall, the nutritional status of the children was better than estimates provided by other studies.

Clearly, the MDM has the potential to make a difference to the nutritional status of children if designed and implemented well. However, the MDM cannot accomplish this on its own: a study by NIN showed that the MDM could bridge only 50% of the energy gap. This finding has also been corroborated by other studies (Jain and Shah 2005; De et al. 2005; Afridi 2005). Hence the involvement of communities and households is important in ensuring that the child receives adequate nutritional support.

7.4 Policy Implications

Have policies and programs aimed at enhancing the health and nutrition of our primary school children achieved their objectives? The latest survey data on health, nutrition, and education outcomes paint a grim picture of lost opportunity and underperformance. The Millennium Development Goals, which specifically covered each of these aspects, present a mixed picture in India: while the goal of achieving universal primary education was achieved by 2015, other significant goals with regard to reducing maternal and child mortality were off track. Similarly, the goal of eradicating extreme poverty and hunger by 2015 was not achieved. Civil society has been active in trying to achieve these goals: through sustained efforts of many committed civil society individuals and organizations, the Right to Education —in line with the global goal of Education for All—has become a reality in India. This has likely been instrumental in ensuring progress toward universal primary education, a goal which now has an end in sight. Similarly, since the 1978 Alma Ata Declaration, of which India is a signatory, there has been a movement demanding a Right to Health. With the government putting in place some semblance of a Universal Health Coverage program through various health insurance programs, it appears that there is now wide-ranging recognition of this right. The Right to Food Bill was passed in 2013 and its provisions ensure that poor families have access to a minimum entitlement of food to be free from hunger, and perhaps escape the worst ravages of malnutrition.

So there is a promise of a genuine safety net being put in place. It is important that these initiatives are not only sustained but enhanced. Developing appropriate policies and programs to address the health and nutrition of school age children can have far-reaching impacts, and it is imperative therefore that the Government gets it right for several reasons.

First, Jukes et al. (2008) make a powerful moral argument for promoting health and nutrition programs for school-going children: in their view, it "levels the playing field." Two important issues related to promoting equity are cited to support their argument: (i) the issue of double jeopardy. Poor children are already disadvantaged in terms of their health and nutrition as a result of poverty and lack of access to resources as compared to their better off counterparts. This already has a detrimental impact on their ability to benefit from schooling. Double jeopardy arises when they are subjected to any further health or nutritional shocks: their financial, physical and social resources are too depleted for them to be able to cope. This is where the support provided by health and nutrition programs can make the critical difference between continued attendance in school and dropping out; (ii) Capability Theory provides the basis for the second argument, which is that children who are unable to develop their capabilities due to disability or disease caused by poverty or other structural reasons, need additional support to access the necessary resources to be able to do so. When additional resources are provided, through health and nutrition interventions, the poorest and most disadvantaged are likely to benefit the most.

Second, Bundy (2011), in his book: *Rethinking School Health—A Key Component of Education for All*, places school health and nutrition squarely at the core of achieving the Education for All goal set by the United Nations and its partners. Quoting from the 9th. Communique of the High Level Group for Achieving Education for All (2010), Bundy lays out three of the crucial conclusions that the Group arrived at after their deliberations on the role of health and nutrition in schools:

- Barriers of cost, distance, and discrimination continue to deter millions of poor and marginalized children from attending school.
- In addition, poor health, malnutrition and diseases… affecting hundreds of millions of poor children… reduce enrollment, increase absenteeism and diminish cognitive development and learning.
- More and more countries are implementing cost-effective, evidence based policies and interventions to achieve EFA… including school fee abolition, ECD programs, targeted school health and feeding programs (Ibid., pp. xvi).

Essentially Bundy points out that a child who is hungry or sick will not be able to come to school in a position to learn; this in turn will have an important negative impact on the global achievement of the goal of Education for All by 2015.

Third, there is evidence to show that, if properly implemented, policies and schemes aimed at enhancing nutritional outcomes of school age children can reverse the impact of early childhood deprivation. It is commonly understood that children who suffer from nutritional deprivation in the critical window of the first 1000 days can never recover and gain normal attain normal nutritional status. However, Boersma and Wit (1997) put forward the hypothesis that, with proper supplementary nutrition, even older children could experience "catch up" growth and completely recover from early malnutrition. A study in Andhra Pradesh (Singh 2014) was able to establish that school meals at age 5 compensated for malnourishment due to droughts that the children had experienced several years before, before the age of 2. The implications of such findings are important: while the best opportunity to prevent malnutrition is in the first thousand days of life, it may still be possible to provide remediation for children who remain malnourished beyond that window. The imperative to overcome the implementation challenges of school health and nutrition programs is therefore very high.

But to succeed, it requires genuine convergence between all programs aimed at enhancing health and nutritional outcomes for school children. In the final analysis, all these programs are aimed at the same beneficiaries. At the level of the community, the programs are delivered through the schools, the health subcenters/primary health centers, and the Anganwadi. Each of these centers has its own infrastructure and community workers. If these community level people and structures could work together and have a common mission in terms of their pool of beneficiaries, their reach and impact could be multiplied many fold. At the moment, unfortunately, each program works in its own separate silo, with little engagement with the concerns of the other. Bridging these barriers should be one of the goals for future directions in policy and programming.

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Chapter 8
A Health and Nutrition Framework for Primary Schools: Policy Recommendations

Abstract The book concludes by introducing a multi-dimensional support system, "a Health and Nutrition Framework", to enable children to grow and develop to their full potential. Going beyond looking at the systemic response, we suggest a framework that puts the child at the center, and conceptualize what it would take for a concerted "child-centric" response. While current thinking proposes using the school as the locus of action to redress nutritional deficits among school children, we propose an ecosystem approach, bringing together the family, school, the community, as well as policy and programs at local and national levels.

8.1 Health and Nutrition of Primary School Children: Why Should We Care?

The linkage between health, nutrition, and education is critical for the school-going child. The ethical imperative of compulsory primary schooling—which ensures that a child spends the bulk of the day in school—is to establish a broader mission for schools that go beyond the academic program. Over a century ago, in his book *Poverty* published in 1904, the social reformer Robert Hunter wrote, "It is utter folly, from the point of view of learning, to have a compulsory school law which compels children, in that weak physical and mental state… to sit at their desks, day in and day out for several years, learning little or nothing… because hungry stomachs and languid bodies and thin blood are not able to feed the brain" (Hunter 1904:217).

Across the globe, social safety net programs attempt to support human development by providing consistent access to high-quality health, nutrition and education programs. There is wide recognition that ensuring good health among school children requires a lifecycle approach, and attention to the health and nutrition needs of children both before they enroll in school and during the school years. This calls for a sequence of programmatic interventions, beginning in utero with programs focusing on adolescent and maternal health, and extending throughout the

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childhood years, including management of early childhood illness and care, and school-based health and nutrition programs (Bundy et al. 2006). In India, the government has attempted to adopt a lifecycle approach, starting with the "first 1000 days" through the ante-natal and post-natal interventions of the National Health Mission; continuing on to the health and nutrition interventions for children aged 0–6 years through the Integrated Child Development Services (ICDS); continuing further through the school years with the Midday Meal Scheme (MDMS), School Health program (SHP), and adolescent girl programs; to end again with the care of pregnant mother and her fetus.

In addition, it is now also well-recognized that good health and nutrition are prerequisites for learning. Links between specific physical insults and cognitive deficits have been established both through epidemiology and research into child and cognitive psychology.

Most importantly, improvements in curriculum and pedagogical methods can be effective only if a child is "present, ready and able to learn" (Bundy et al. 2006). The goal of Education for All has resulted in significant increases in school enrolment, even among the poor and marginalized (UNESCO 2015). Impoverishment and poor living conditions make such children more vulnerable to a range of illnesses, including malaria, worm infestation, diarrhea and the like. If untreated, such conditions can significantly reduce the child's ability to attend school or be ready to learn.

A model based on the idea of school-centric health and nutrition services that has been widely disseminated by the World Health Organization (WHO) is the FRESH (Focusing Resources on Effective School Health) Framework. This was initiated in the year 2000 by several United Nations partners, including the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Children's Fund (UNICEF), the WHO and the World Bank in the year 2000. The Framework brings together a set of interventions aimed at giving focus to school health policies (The Partnership for Child Development 2017). The Framework includes the following guidelines:

1. Establishing school policies that support effective school health programs;
2. Creating mechanisms within schools that ensure adequate access to clean water and sanitation facilities, provide a safe and supportive environment, as well as physical and psychosocial support as needed;
3. Providing services that have been proven to enhance health and nutrition outcomes of school children such as deworming, micronutrient supplementation, midday meals, and Human Immunodeficiency Virus (HIV) prevention as well as screening and referral services;
4. Making available ongoing skill-based health education that could have long-term impacts on the behavior and choices made by school children.

Deshpande et al. (2014) make a strong case for "re-imagining school health," by which they mean integrating various aspects of health into school health programs, including physical health and nutrition, as well as emotional and social health. They

argue that health, nutrition, and education within schools need to be seen as "intimately linked"; and that schools and teachers need to take full ownership of the delivery of this package of services. Currently, schools and teachers are the last and final link in a long chain that extends all the way back to Government of India, with little opportunity for their voice to be heard.

We argue that the response to the epidemic of malnutrition that we face among school-going children has to go well beyond the school. For too long, the success or failure of the response has been judged on the basis of the effectiveness of the programs that have been implemented and their impact. Such discussions have been largely "program-centric": how can we improve program implementation so that it is better able to deliver the desired outcome? A shift of thinking away from national programs to school-based programs will only result in a shift away from examining the performance of programs such as the MDMS and SHP to examining the performance of schools and school teachers. What we need is a paradigm shift if we want to change business as usual. We have to move away from "program centric" thinking to "child-centric" thinking. Who is the beneficiary that we have been talking about? The beneficiary of the linkage between health, nutrition, and education is the primary school-going child, between the ages of 5 and 14. When the discussion remains focused on program-level improvements, the critical issue of whether services are reaching the end-beneficiary - the child - gets lost or forgotten. Bringing the child back into central focus is essential; putting children first, empowering them and giving them voice to shape the program to suit their particular needs will be the turning point that can offer the existing programs their best chance for success.

8.2 A Framework for Addressing the Health and Nutrition of School Age Children

The evidence presented in this book makes a strong argument for a multi-pronged approach that brings together policy makers, program implementers, communities/households and schools, while all the while remaining focused on the child and his or her nutritional outcome. These key actors are the foundation on which to build the concerted response to the problem (Fig. 8.1).

So what can each of them do to make a difference?

8.2.1 The Role of Policy Makers

Policy makers have a large role to play in creating the necessary enabling environment and political will to address the issue of school age undernutrition head on. Let us look at some important policy dimensions that require focused effort:

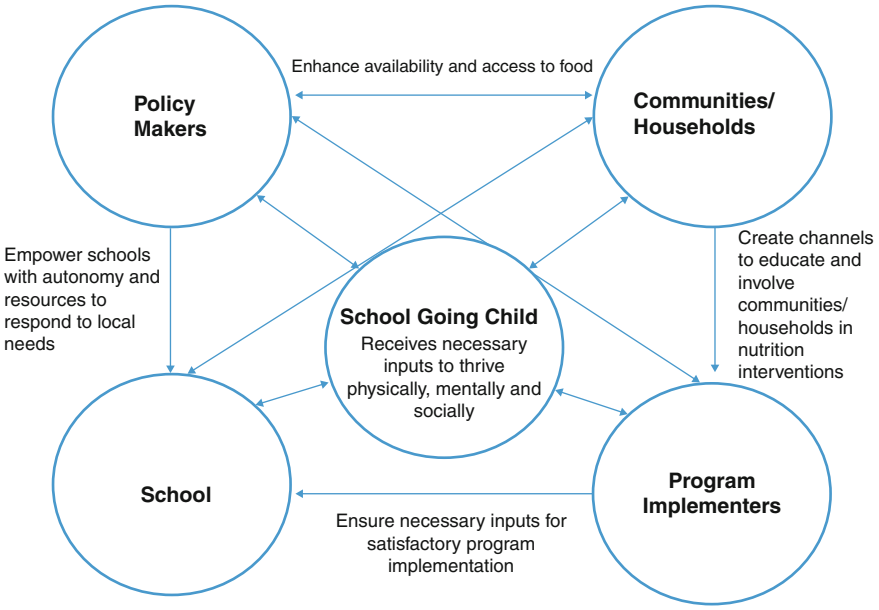

Fig. 8.1 A framework for action

8.2.1.1 Increasing Resource Allocation for Health, Nutrition, and Education

In Chap. 6, we explore from the point of view of the teachers—those who are the first point of contact with the schooling system for the children—how programs designed to address the health and nutritional needs of children in school, and help them to be ready to attend school and benefit from schooling, are not really working as effectively as they should. The programs are either underfunded or underperforming, and consequently essential services are not being delivered as expected. Health, nutrition, and education programs are our social safety net. Yet investments in these programs has been declining. A quick analysis of Budget 2016 (Singh 2016) showed that the government's priorities failed to include the concerns of children, who form more than a third of the population. Public expenditure on health continues to stagnate at about 1% of GDP; there was a marginal decline in the budget allocation to ICDS, the government's flagship project aimed at supporting early childhood development; and the allocation to the Sarva Shiksha Abhiyan, which funds the MDM, saw only a meager hike. Such neglect of critical social sector investments is bound to have a seriously negative impact on both the quality and reach of these programs. This trend needs to be reversed.

8.2.1.2 Enhancing Availability and Accessibility of Food, Particularly to Poor Households

By food availability, we mean the total amount of food grain per person that is produced in the country. As we have seen in Chap. 5, food production has been growing and yet consumption of critical food items is in decline. In 2010–2011, the country produced a record amount of food grain, reported at 241.6 million tons; yet the amount of food grain available per person actually went down. Between 2006 and 2010, available food grain per person declined from 445 to 439 g per day. A comparison of food grain production over a period of five decades (between 1950–1951 and 2002–2003) found an increase of almost 50% in availability of all cereals, including rice, wheat, and coarse grains during that time period. As a result, availability of cereals per person remained within the appropriate range; however, availability of pulses was found to have declined, falling below the required level of 68 gms per person per day in 2002–2003 (Veni and Alivelu 2005). Production of an adequate quantum of food grain is an ongoing concern of the Government of India (GoI), and this has resulted over the years in the launching of several initiatives meant to support agricultural output including the National Agriculture Development Program, the National Food Security Mission, the Micro Irrigation Mission and so on.

While food availability is concerned with the total amount of food, food accessibility has to do with the distribution of food. There are two aspects to this: the first is concerned with the ability of the individual or the household to obtain the required amount of food that they need for their sustenance; the second is concerned with the way in which the available food is apportioned among different members of that household. As discussed in Chap. 3, both these dimensions are closely associated with poverty and related to various socioeconomic factors (gender, educational levels, occupation, income, household size, etc.). According to most estimates, poverty in India has declined since the 1970s, coming down to almost half from around 55% to about 28%. Despite this, about 300 million people still live in poverty—and this might quite likely be an underestimate (GoI 2009). Almost 50% of household expenditure is earmarked for food. Currently, the poverty line is set at Rs. 32 per day in urban areas and Rs. 26 in rural areas. While these figures have been disputed, the reality is that in most poor households the proportion of household income spent on food is likely to be even higher. Given this limited envelope of resources that could potentially be dedicated to the purchase of food items, the dietary availability and choice of poor households are significantly determined by the occupation and income levels of the adults in the family.

Another important determinant of food accessibility within the household is gender. Differential access to food for women in the family has been well documented (NNMB 1979–2006). Some significantly associated issues that have been shown to impact nutritional outcomes include the level of education of the mother, and if the household is headed by a woman.

8.2.1.3 Addressing Larger Structural Issues Associated with Food Security and Nutrition

There are larger structural issues that need to be addressed in order to ensure that citizens are able to exercise their Right to Food. The Technical Support Team (TST) brief on *Food Security and Nutrition* (UNDP) underlines the urgency of taking a people-centred approach towards ending hunger, food insecurity and malnutrition:

> The broader environment that encompasses food systems, and their production and consumption components, has changed considerably in recent years. More or new forms of investment are flowing into the food and agricultural sectors, although needs far exceed investment levels. New patterns of governance of food systems are emerging. The environment for food production is increasingly challenging – particularly for smallholders – due to environmental and climate-related constraints, degradation of ecosystems, globalization, and market integration. This new landscape has profound implications across national boundaries, underlining the need for holistic, innovative, and collaborative solutions, policies, and strategies. There is need for a universal agenda, but also for country and context-specific strategies. People-centered approaches are needed, underpinned by principles of human rights, inclusion, national ownership, and accountability (TST Issues Brief, Pg 1).

8.2.1.4 Reviving Traditional Food Systems Through Necessary Policy Changes

Reviving traditional food systems will enable resilience within communities to address their nutritional needs in well-established, familiar ways. In particular, policies should not create barriers to communities accessing their traditional food sources, as is happening with tribals being unable to access forest produce. According to Shepherd (1999) the dietary choices people make are the result of much more than nutritional need; social and cultural influences play a critical role in determining these choices. Shepherd uses a theoretical framework drawn from social psychology, and suggest that people's beliefs and attitudes intervene when making dietary choices. The framework places the individual's physiological needs in terms of their nutritional requirements within a much larger context which includes such disparate determinants of attitudes toward food such as popular media/advertising, pricing and perceived value.

How much of our dietary choices are determined by such cultural factors, and—on balance—how important are they when compared to other socioeconomic determinants? Our evidence, presented in detail in Chap. 4, shows that traditional food systems have been substantially disrupted due a variety of factors, including the pull of modernization, exposure to media and advertising, as well as structural and policy factors that are pushing foods that are alien to traditional diets. Restoring traditional food systems could go a long way toward restoring food sufficiency among the vulnerable.

8.2.2 The Role of Program Implementers

Program implementation needs to be strengthened in multiple ways.

8.2.2.1 Reducing Inefficiencies and Malpractice

Reports of inefficiencies in the ICDS and MDM programs are of longstanding. Ramachandran (2005), reflecting on the implementation of the ICDS, notes that:

> The situation in Uttar Pradesh is rather grim. While the government had made allocations and the official data on supply of supplementary nutrition reported that 100% of the AWCs received supplies, the reality (as evident in the AWC records) was that there was no supply from August 2003 to March 2004. Here we are faced with a situation where procurement of nutrition supplements has been made (on paper) and funds have also been utilized, but there is nothing to show on the ground (www.india-seminar.com/2005).

She attributes the "routine" siphoning off of ICDS resources (funds, food supplies) to the lack of political will in many states, and therefore lack of concern for poor performance of these schemes. She goes on, in the same article, to allege political complicity in mis-procurement, delays in delivery of food (mostly perishable) to feeding centers, poor quality of food and other program inefficiencies. Similarly, the Odisha Human Rights Foundation noted that corruption and administrative failure in the implementation of the MDM in Odisha had largely eroded any benefit to the school child from the program. "Every day, there are reports of mismanagement, low quality of food, insects and scorpion in dalma, cockroach and lizard in rice and rotten eggs" the report states, painting a horrific picture of rampant corruption in program implementation and callous disregard for the well-being of the children (Pioneer 2015).

It is possible, however, to significantly improve the implementation record of these programs with more stringent monitoring. For example, there has been substantial progress in stemming leakages in the PDS, with states such as Chattisgarh, Odisha, and Bihar registering dramatic reductions in leakage rates (Khera 2016). States such as Tamil Nadu, Karnataka, and Odisha have been able to enhance the nutritive value of the MDM through the introduction of eggs and/or milk; and provided that governments remain vigilant and prevent the implementation problems noted above, such innovations can be replicated across the country and achieve maximal impact.

8.2.2.2 Redesigning Programs to be Locally Appropriate

Programs can be redesigned to become more responsive to local conditions, rather than having a standardized response across the board. Local conditions can be manifested in multiple ways: the criticality of the nutritional crisis varies between geographies, for example; the type of nutritional challenge varies as well—it could

be fluorosis in one region and discrimination against the girl child in another; program implementation can be a major hurdle, particularly in states/districts with poor capacity for governance; some communities might more readily accept nutritional information than others. Programs would need to be designed bearing in mind such local level variations. A slightly different situation might arise in cases where an immediate and urgent response is required. In such an event, food fortification and supplementation might be more feasible rather than trying to bring about a change in traditional food systems. There are many ways in which this can be done, and the WHO has been at the forefront in developing and supporting multiple strategies to supplement and/or fortify diets in impoverished areas (Allen et al. 2006). These include ready-to-eat prepackaged foods (RUTFs), supplementary pills, fortified powders that can be added to soymilk or milk, rice or other local grains that are fortified, as well as adding vitamins/minerals to flour. A well-known and widely accepted additive is iodine in salt; also now commonly being implemented is the 6 monthly administration of high-dose Vitamin A to children. Such interventions if carried out properly can quickly achieve "catch-up" in a population.

While the efficacy of food fortification and supplementation has been demonstrated globally, several significant challenges remain. Some issues include scalability, availability, and acceptability. In the long term, changes based on self-sufficiency will be more sustainable and have a greater chance of success. Ensuring a balanced and nourishing diet through locally produced food would not only provide a more acceptable alternative, but would also have the added advantage of stimulating the local economy. Ultimately, rather than relying on fortified foods that require a high-level of technology in manufacturing and distribution, enhancing dietary diversity through locally available fruits, vegetables, poultry and dairy products offers a more sustainable long-term solution.

8.2.2.3 Strengthening the School as the Focal Point for School Health

Global evidence shows that the school is an important locus for the promotion of health and nutrition of children. Evidence also highlights the fact that school systems are already endowed with resources and infrastructure that enable them to be an efficient and cost-effective means to deliver such services. Other service networks (health, for example) do not have the same advantage (Bundy et al. 2006). In India, the school is already being used as a centre for the delivery of several of these health and nutrition services, including school feeding, basic health care, deworming, and the like. In addition, primary school curricula include a range of age-appropriate health- and nutrition-related activities in all classes, ranging from lessons on personal cleanliness and hygiene such as combing hair and cutting fingernails; to making simple and nutritious salads as an in-class activity; to campaigns against tobacco use for older children. Finally, school management and teachers are largely appreciative of the positive impacts of school health programs on their students' readiness to learn and overall well-being, despite the additional burden that they might impose. What remains is for schools to have the necessary

autonomy and resources, manpower and capacity building to be able to reach every child with the support they need.

8.2.2.4 Coordinating Health, Nutrition and Education Programs Better

Related to the above, there needs to be better convergence between programs. Currently, they are being managed by three separate departments: the Health Department, the Department of Women and Child and the Education Department. These departments need to develop mechanisms to work together in an integrated manner if we want the programs to be delivered effectively. Nutrition in India is currently in the throes of a vicious cycle: with a high proportion of children still born with low birth weight, the risk of their growing up to be undernourished as children is high. This undernutrition continues to follow them through adolescence; and for girls this is particularly risky, since they enter their child bearing years anemic and malnourished. Inevitably, this results in their giving birth to children who are underweight and the vicious cycle is perpetuated. Breaking this intergenerational cycle of undernutrition requires focused efforts that go beyond providing supplementary nutrition, as is currently being done through programmatic efforts such as the MDMS, the SHP or the ICDS. Far more needs to be done to strike at the multiple sources of malnutrition such as repeated episodes of diarrhea, helminthic infestation, and other severe infections. This can only be done by strengthening and enhancing access to the available primary health care services, as well as clean water and sanitation. Having a fragmented response will not address the multiple sources of malnutrition among different age groups. A well-coordinated and multisectoral effort, on the other hand, would go beyond short-term solutions and hold the hope for long-term impacts.

8.2.3 The Role of the Community

Communities need to be empowered to make the most of available services and to hold programs accountable if they are not delivering the goods. This could be done by:

8.2.3.1 Ensuring that Existing Mechanisms for Expressing Community Voice are Functional

Currently, there are some mechanisms in place, such as the School Development and Monitoring Committees (SDMCs), but they do not function well. Their purpose is to bring together school administrators, community representatives (panchayat members) and parents to ensure that children's needs are being met. An important

role they should play is to make sure that intended benefits are reaching the children in a timely and satisfactory manner. Are the school health check-ups being done regularly? Is the food served in the school wholesome and nutritious? They should be able to get answers to these questions. Activating these Committees with sufficient autonomy and resources should be a priority for all these reasons.

8.2.3.2 Encouraging Community-Based Efforts to Ensure Food Security

Efforts to ensure food security could include creating community kitchen gardens, community kitchens and the like, that would support the most vulnerable households to meet their nutritional needs. As discussed above, locally available solutions offer the best answer to the issue of expanding dietary choice. For example, it has been suggested that encouraging the production of local foods and grains such as sorghum and millets by small farmers—who have been largely neglected by more recent agrarian reforms—would be preferable both from a nutritional and sustainability standpoint than rice and wheat. The Deccan Development Society, a Non-Governmental Organization (NGO) based in Medak, Andhra Pradesh, is showing the way. Using an integrated approach, they work with poor Dalit women to enhance the productivity of the land given to them by the government. Through this strategy, they provide the women an opportunity to pursue a sustainable livelihood, and at the same time grow food grains that have high nutritive value, particularly as compared to the white rice that is distributed at a subsidized rate through the PDS. Other interventions that have a proven track record are vegetable gardens, which have been implemented in several countries including Bangladesh, the Philippines and Thailand (Midmore et al. 1991). In many ways, the revival of kitchen gardens or vegetable gardens is similar to the growing trend of "Farm-to-Table" foods which is gaining popularity in Western countries, both because locally grown produce is perceived to be more fresh and healthy, and because it stimulates the local economy and promotes livelihoods. Apart from such practical and hands-on responses to the challenge of involving communities in ensuring their own food security and dietary diversity, more long-term strategies are also needed. While examining the impact of socioeconomic and cultural factors on the health and nutritional outcomes of a group of Nigerian women in their childbearing years, a study found that dietary choices were largely shaped by socioeconomic and cultural factors, and were importantly influenced by their level of education (Ene-Obong et al. 2001). These long-term strategies which involve sustained behavior change in the target population require that local communities "buy-in" to the changes; and rather than being recipients of interventions, they become active participants in the design and delivery of these initiatives. This requires a long process of community engagement, where communities are sensitized and oriented to the need to improve the nutritional status of both themselves and their children; and taught ways in which this can be done in feasible and

sustainable ways. This will go a long way to ensuring their active participation and enhancing the possibility of a positive outcome.

8.2.4 The Role of the Family

Finally, we come down to the level of the household, and the individuals who are ultimately responsible for the health and nutrition of their child. Families, particularly the mothers, of young children need to be educated on healthy food choices and appropriate feeding practices. Our research indicates that dietary patterns have changed dramatically in the last couple of generations, away from protein rich foods and more toward carbohydrates and fats. Using locally available nutrition-rich foods like groundnuts, bananas, guavas, papaya, spinach—this could make a crucial difference in the child's health status. Increasing the breastfeeding rate is another intervention that we know improves the nutrition of infants and has long-term benefits for children. Misinformation gleaned from advertising should be dispelled. Families should be supported to better equip themselves with the knowledge and skills to provide better and more nutritionally rich meals to their children.

8.3 Conclusion

Ultimately, the health of the school-going child is a joint responsibility: the government is responsible for providing critical services to support his or her mental and physical well-being; the community is responsible for holding the government accountable for quality and transparency; the school is responsible for ensuring that each and every child is reached with the services they need; and finally parents are responsible for ensuring that their children are well-fed and cared for. A lot has been done on all these fronts, but there is still a large unfinished agenda. Implementing interventions in isolation has proved inadequate. For example, childhood malnutrition persists even in places where the MDM is performing at an acceptable level; perhaps because the nutritional vulnerabilities of the child outside of school - within the household - are not being addressed alongside. For another example, significant expansion in the number of ICDS centres has not resulted in eliminating malnutrition among children 0-6 years old; perhaps because referral networks for acutely malnourished children are poorly developed. In short, tweaking one or the other element of this complex web of responsibility cannot beat the problem: what we need is a concerted response that recognizes the multiple determinants of childhood nutrition. Too complicated? Not at all. Public health issues that presented as much complexity, such as the HIV/AIDS epidemic, have been tackled with some success. It required a coordinated, multi-pronged and sustained effort. Most importantly, it required a sense of urgency at the highest levels of government, and a determination to thwart the destructive potential of the

disease. It will take a similar sustained effort, sense of urgency and political determination to tackle the epidemic of malnutrition faced by the country today. We hope that the evidence and arguments presented in this book will nudge that effort forward.

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