Mitigating Malnutrition Through Farm-Women Empowerment

हिमाचल की 53 फीसद महिलाओं में खून कम

पहाड़ी प्रदेश की 53 फीसद महिलाओं को खून की कमी है। इनमें जनजातीय जिला किन्नौर व लाहुल-स्पीति की ज्यादा महिलाएं हैं। यह खुलासा भारत सरकार के स्वास्थ्य एवं परिवार कल्याण मंत्रालय द्वारा करवाए गए नेशनल फैमली हेल्थ सर्वे-चार में हुआ है। सर्वे के मुताबिक प्रदेश में अल्प कारण करीब 21 प्रतिशत ...म के बच्चों का ...फीसद

सुझाव

- बच्चों का वजन बढ़ाने के लिए उन्हें छह माह तक मां का दूध पिलाना जरूरी है। छह माह बाद प्रोटीनयुक्त आहार जैसे सोयाबीन आधारित व्यंजन, मूंगफली, तिल, चना, मूंग दाल, अंकुरित अनाजों के आटे का पाउडर भोजन में सम्मिलित करना चाहिए।
- अनीमिया से प्रभावित बच्चों को हरी पत्तेदार सब्जियां जैसे पालक, मेथी, चौलाई, फल, मूंगफली, तिल, गुड और ...क्त दालें देनी चाहिए।

दूध व दूध से बने उत्पाद, अंडा, मांस, मछली आदि का सेवन करना चाहिए साथ ही प्रतिदिन एक मौसमी फल अवश्य खाना चाहिए।

- भोजन के साथ आयरन और फोलिक एसिड की गोलियां 100 दिन तक प्रतिदिन खाएं।

- स्वास्थ्य एवं परिवार कल्याण मंत्रालय के नेशनल फैमिली हेल्थ सर्वे-चार में हुआ खुलासा
- किन्नौर व लाहुल-स्पीति में अनीमिया ग्रसित महिलाएं व बच्चे सबसे ज्यादा
- 21 फीसद बच्चों का वजन कम, सोलन जिले में ज्यादा संख्या

कम वजन अनीमिया ग्रसित बच्चों और महिल

जिला	5 वर्ष से कम आयु तक के कम वजन के बच्चे	6 से 59 माह वाले अनिमिया ग्रसित बच्चे
मंडी	16.2	37.8
कुल्लू	11.0	54.9
कांगड़ा	23.3	47.3
हमीरपुर	19.4	41.2
बिलासपुर	23.4	28.3
चंबा	22.5	66.3
शिमला	24.8	70.0
सोलन	29.4	71.8
सिरमौर	25.3	65.1
किन्नौर	15.9	83.1
ऊना	14.6	56.6
लाहुल-स्पीति	16.1	94.7

...क्ते स्वास्थ्य व स्वस्थ जीवन ...अभियान की ... तक स्कूली बच्चों, किशोरियों, महिलाओं खासतौर पर गर्भवती व स्तनपान कराने वाली महिलाओं को पोषण संबंधी जानकारी

Mitigating Malnutrition through Farm-Women Empowerment

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एफ एन ए, ए फ एन ए एस सी, एफ एन ए ए एस
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Foreword

National Family Health Survey for the year 2015-16, carried out by the Ministry of Health and Family Welfare, Government of India, presented a gloomy picture of nutrition standards in India where children of under five years of age and adults of 15 to 49 years of age were found severely malnourished. The proportion of stunted Indian children was estimated at 38.4 per cent while this proportion of wasted, underweight and anaemic children was 21.0, 35.7 and 58.4 per cent, respectively. The picture in case of adults was also not bright as more than one fifth of Indian adult population was underweight and more than half of the women population was suffering from anaemia. This is happening at a time when higher disposable income of the individuals is being spent on junk food. Traditional nutritional wisdom, reflected in the olden food habits and practices, has been compromised due to reduction in food diversity and increasing number of nuclear families due to rapid urbanisation and tendencies to follow western culture.

Honourable Prime Minister of India stressed upon making special efforts for training prospecting mothers on food habits and other aspects of lifestyle for addressing the problem of malnutrition in the country during a meeting on issues related to Science and Technology on 18 July 2017. It is heartening to see that ICAR-ATARI Zone-1 has brought out this comprehensive volume "Mitigating Malnutrition through Farm-women Empowerment" in such a short period of time. This book covers the experiences of ICAR-ATARI Zone-1 and their KVKs in employing innovative extension strategies to tackle malnutrition especially through the celebration of National Nutrition Week during 1-7 September 2017. The book takes account of all major components of human nutrition along with possible solutions and strategies towards the goal of achieving an ideally nourished nation. I extend my heartfelt congratulations to the institute for bringing out this quality publication in the interest of general masses.

(T. Mohapatra)

Dated the 13th October, 2017

New Delhi

Preface

The past two decades have witnessed a sizeable expansion in agricultural production and food supply. The fast developing Indian economy during this period has enabled higher disposable income in the hands of people. In spite of all this, the incidence of malnutrition in India is still widespread and much higher than the reasonable levels. Child under-nutrition rates in India are among the highest in the world, with nearly half of all children under three years of age are either underweight or stunted. The ongoing problem of under-nutrition in India now coexists with the occurrence of obesity and its associated non-communicable diseases for another segment of the population. The health of women and children forms the foundation of public health and future of the nation which needs an upliftment in terms of adequate health care and pertinent nutrition interventions.

This book intents to provide its readers with an outline of all major constituencies of current nutrition in India along with details of factors responsible for malnutrition, efforts of ICAR-ATARI Zone-1 to combat malnutrition in its jurisdiction and strategies to fight malnutrition in the near and distant future in the country through its eleven chapters. Data from multiple surveys, databases and official reports available in the public domain have been collectively used to create a meaningful and compact compilation that will help to identify key areas for addressing the pinpointed problems of malnutrition in India.

The book begins with an overview of global and Indian food and nutritional security situation along with its challenges and actions already taken, followed by the detailed factors affecting malnutrition in India. In subsequent section interventions and programmes employed to combat malnutrition have been described. The book then presents current scenario of nutritional indicators in India followed by the extent of prevalence of obesity in different groups of states in India. Afterwards, this book has focussed on significance of traditional nutritious foods, need to harness the treasure of traditional knowledge available with grandmothers and importance of slow food in curbing the fast rising menace of obesity. Subsequently, the significance of glycaemic index, dietary fat and nutritional anaemia were elaborated. In successive chapters nutritional status of people in ATARI Zone-1 states *viz*. Punjab, Haryana, Jammu and Kashmir, Himachal Pradesh and Uttrakhand has been discussed. This discussion has

been followed by the description of various innovative extension strategies employed by ICAR-ATARI Zone-1 in celebrating National Nutrition Week during 1-7 September 2017 though the network of its KVKs. Last chapter of the book presents abstract strategies to address various problems associated with health and nutrition of Indian population in the near and distant future.

The KVKs under ATARI Zone-1 showed exemplary sincerity and enthusiasm in celebrating National Nutrition Week. The experiences of all the KVKs on this week celebration have served as a foundation for significant contribution towards this book. The valuable inputs of all our KVKs in terms of print media coverage clippings and photographic evidence of undertaking a large number of activities to celebrate National Nutrition Week are duly acknowledged. As authors I have a deep sense of gratitude towards the Secretary DARE and Director General ICAR, Dr. T. Mahopatra for his constant encouragement and motivation to bring out this book on one of the most critical challenges our country is facing.

(Rajbir Singh)

Dated the 13th October, 2017

Ludhiana

Contents

Chapter No.	Title	Page No.
	Foreword	3
	Preface	5
1.	Global and Indian food and nutritional security -challenges and actions	9
2.	Determinants of malnutrition in India	14
3.	Interventions and programmes to combat malnutrition in India	19
4.	Current scenario of nutrition indicators in India	26
5.	Assessment of malnutrition in different groups of states	33
6.	Prevalence of obesity in different groups of states	44
7.	Traditional Indian foods	51
8.	Involving grandmothers to promote nutrition	56
9.	Moving towards slow food to curb over nutrition	59
10.	Glycaemic index of food items as precursor of hyperglycaemia and obesity	64
11.	Dietary fat-significance in human health and it's management	73
12.	Nutritional Anaemia-causes and management	84
13.	Nutrition indicators for ATARI Zone-1 states and strategies for further improvement	93
14.	Delivering nutrition awareness in ATARI Zone-1 states through National Nutrition Week celebration	100
15.	A pursuit to make India healthy	118
	About Authors	126

Chapter-1

Global and Indian food and nutritional security -challenges and actions

Food and nutritional security has become one of the most elusive global phenomenon as coexistence of food abundance and hunger along with malnourishment is widespread. This chapter provides an important overview of the global and Indian food security issues and actions employed to tackle the problem.

Impending global food insecurity challenge

Global population, especially in the developing countries, is expanding at an alarming rate subsequently the food availability both in terms of quantity as well as quality has become a serious problem. At present, the world population has crossed 7.5 billion and to feed such a big number of mouths has become a daunting task for policy makers. In the present era, wherein, the natural resources are diminishing at very fast rate on one side and climate change posing serious threat on the other side, and ensuring sustainable food security is one of the biggest challenges before mankind. The growers and producers have shouldered the responsibility for producing food so as to fulfil the food requirements of the whole world. With ever increasing population, sustained increase in crop production is needed to uphold the food availability.

Report published on food and health issues by Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), United Nations Children's Fund (UNICEF), World Food Programme (WFP) and World Health Organization (WHO) has depicted an alarming situation of the world hunger and risk involved in food security. An approximate number of undernourished people have swiftly increased from 777 million in 2015 to 815 million in 2016. Although, food security has deteriorated as global economy slowed down which has challenged the access to food for the poor, yet, chronic child malnutrition (stunting) has continued to decline, but at a much slower pace in several regions of the world. Despite the decline, in 2016 stunting still affected one out of four children under the age of five years which accounts for 155 million children across the world. In some regions, even one-third of children under five years of age have been recorded as stunted. Wasting continues to

threaten the lives of almost 52 million children (8 per cent). Besides, almost one-third (33 per cent) of women of reproductive age worldwide are also suffering from anaemia which puts their offspring at high risk of malnutrition (FAO 2017).

Inversely, childhood obesity is also escalating at a troublesome rate both in low and middle income countries. Multiple forms of malnutrition are affecting countries with simultaneous high rates of child malnutrition and adult obesity. To combat these frightening circumstances, sustainable development appeals to all countries and stakeholders to come together at a common platform to eradicate starvation and subsequently prevent all forms of malnutrition by 2030. This ambition can only be fulfilled if agriculture and food systems become sustainable, so that food supplies are stable and all people have access to adequate nutrition and health.

Indian dilemma

Asia and India constitute the largest food growing centres on the world map. At the same time, world's most populous countries (China and India) are also located in this region which make this part of the world the largest consumer of food as well and a huge section of world's poor and hungry is also dwelling in this region. Consequently, the food scarcity has turned into food insecurity in Asia as well as India. India today, is the world's third largest economy in terms of its Gross National Income based on Purchasing Power Parity and has the potential to rapidly grow more equitably in order to be counted as one of the developed nations of the world. But, the country presents a big contradiction—a food bowl that is full to the brim but cannot feed those who need food in order just to survive. Today's India possesses sufficient number of refined interventions and technologies required for providing desired health care to her people. Yet the gaps in health outcomes continue to widen. Not only food security, but India is also facing the biggest challenge of nutrition security.

Health and nutrition are the inevitable aspects for human growth and development in the country. Nutrition deals with the food accessibility and nutrient utilization and both of these are concurrently indispensable to augment and extend a hale and hearty wellbeing. Thus, nutrition helps to establish foundation for human development by mitigating chances of infections, illnesses and hence also the mortality risk. It is necessary for intellectual as well as proper physical performance. A variety of factors such as dietary, lifestyle, social, economic, and environmental *etc.*, pave way a health status of any individual but the most crucial for an individual's health is the foundation built for nutrition in their childhood.

Food productions versus malnutrition

Indian government has improved their production situation at national as well as international level. As per the second advance estimates released by the agriculture ministry, Food grains production in India has estimated to increase by 8.7 per cent in 2016-17 to reach a record level of 273 million tonnes. This production has surpassed the previous record of 265 million tonnes in 2013-14. The production of key crops like rice, wheat and pulses is estimated at new record levels during the year. Total wheat production is estimated to rise by 4.7 per cent to 96.6 million tonnes in 2016-17 (compared to 92.3 million tonnes in 2015-16) and the production of rice is estimated to increase by over 2 million tonnes, from 104.4 million tonnes last year to 106.7 million tonnes in 2016-17. The production of pulses is also expected to rise by 35 per cent from 16.4 million tonnes last year to 22.1 million tonnes in 2016-17 (PIB 2017).

Although, India has shown an all-time record food production in 2016-17, yet a huge proportion of food grains produced in the country go waste due to lack of storage facilities and poor handling. In the country like India wherein 46 per cent of children are malnourished, any wastage of food grains is a serious matter. The data compiled by the Food and Agricultural Organization (FAO) show that India has the highest number of hungry people in the world *i.e.*, 194.6 million which accounts for 15 per cent of India's total population during 2014-16. According to the Global Hunger Index Report, 2016 published by the International Food Policy Research Institute, India ranks 97th among 117 countries at the front of managing hunger (IFPRI 2017). These figures are frightening and world hunger & food insecurity issues are to be addressed seriously to accomplish Millennium Development Goals of the WHO. Both, hunger and undernourishment jeopardize individual survival by virtue of which national progress towards development goals is also likely to slow down. Unfortunately, the growing burden of infectious and non-communicable diseases is also blooming which has entailed to a high incidence of maternal and child mortality in India. Not only malnutrition, India is also witnessing negative outcomes of over nutrition. India is on the pathway of other developing countries that are gradually becoming more obese.

Way forward

To address various issues pertaining to food and nutrition security, national and international organisations joined hands to attain a sustainable food security in Asia and India. Undoubtedly, food security is attainable. There are basically three pillars to uphold food security. The first is food availability that can be achieved through more

crop production. The country has abundant supply of food grains to feed our population. Concerted efforts to augment production of pulses and oilseeds have started showing results. For further management of vitamins and minerals the fruit and vegetables production in India is responding very well to the rapidly growing demand for horticultural products. The second is food accessibility which is directly related to the purchasing power of the individuals. Various socio-economic development programmes initiated by the government of India with the partnership of state governments are showing intended benefits in order to ensure adequate purchasing power with the common masses targeted to fight hunger and malnutrition in the country. And, the third is food utilization which is meant by the proper absorption of the nutrients in an individual's body. Not only, have we needed to enlarge the food basket through food production but strengthening of the public distribution system (PDS) is also required to augment the food availability to a large section of population. Nutria-millets such as jowar, ragi, bajra should also be included in the PDS. Moreover, women must be declared head of households for entitlement under the PDS and should be considered in-charge of food security in the family which is imperative because women can ensure nutrition from newborns to the eldest in the family.

For a country like India, it is legitimate to give attention to infant and child health, reason being it is as important as economic growth and the people and government should understand that. Many national and international programmes have been implemented in this direction so as to uplift nutritional status of the individuals. For a triumphant execution of any nutrition programme, community participation is an obligatory element which comprises involvement, participation, ownership and empowerment. To achieve community participation, enforcement of 3-A process in nutrition relevant actions is the foremost building block. 3-A refers to the Assessment, Analysis and Action. The principle of the 3-A approach is involvement of people of all communities so as to address the problems.

The current era of electronic communication from unknown and unreliable sources has strengthened the capabilities of individuals and agencies involved in misguiding people to purchase various food products which are otherwise unhealthy. Nutritional awareness becomes imperative in order to deliver the right and comprehensive information to the common people in order to empower them to manage their own and family's nutrition more efficiently.

This book has outlined the current nutrition situation of India with regard to key issues of nutritional status, specific interventions and programmes to curtail

nutritional problems. Besides, this compilation has also touched upon various aspects of contemporary nutrition strategy such as slow food movement, traditional foods and role of grandmothers to promote nutrition. Enabling environment for ensuring efficient management of nutrition has also been targeted through the coverage of topics *viz.* significance of fatty acids in human diet, low glycaemic foods and their role in tackling diabetes and obesity, adequate awareness on role of key vitamins and minerals and their implication, and critical recommendations for mitigating overall malnutrition in the country.

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Chapter-2

Determinants of malnutrition in India

Malnutrition including both the under-nutrition and the over-nutrition has grave consequences. As India have individuals both of less as well as more than normal weight the situation of malnutrition is really complex. The complexity of determinants of malnutrition under Indian conditions being very important to be understood, this section puts special emphasis to describe web of complex factors affecting malnutrition.

Multi-dimensionality of malnutrition in India

Malnutrition potentially affects survival, development, health and productivity of individuals which ultimately affect the overall economic growth and productivity of a nation. India has the dubious distinction of harbouring every third under-nourished young child in the world (Mason *et al.* 2006). This is the irony that one quarter of newborn babies are having low birth weight in India and 41 of every 1,000 live births do not celebrate their first birthday. Vitamin and mineral deficiencies are quite common throughout the country. More than half of the children in the age group of six months to five years are iron deficient or anaemic which is a major cause of concern. It is evident that childhood growth spurts requires more iron at early stage but a high incidence of anaemia indicates low intake of iron rich foods which makes children more susceptible to illness and infection, thus elevating the count of mortality (Özdemir 2015). Needless to mention about the vitamin A and zinc deficiencies, iodine deficiency disorder, and suboptimum breastfeeding (especially nonexclusive breastfeeding in the first 6 months of life) which depicts serious dimensions of prevailing malnutrition in the country. These deficiencies need to be addressed in a holistic manner.

The gloomy picture of malnutrition prevailing among children in the country may be attributed directly to the mother's literacy and nutritional awareness. Several investigations have revealed a significant relation between low maternal nutrition education and poor nutrition status of young children (Kunwar and Pillai 2002; Abuya *et al.* 2012; Saaka 2014). Most of the developing countries have considered low status of the women a prime determinant of under-nutrition. In India, women are confronting

with social inequity on a daily basis which is reflected by the low nutritional status of women and adolescent girls due to sustained discrimination in feeding practices (Raykar *et al.* 2015).

Complexity of determinants of malnutrition

Nutritional status of a society is determined by a complex interaction of multiple factors including child care and feeding practices of children, purchasing power at the household level, and macro level food and agricultural policies.

- Economics plays a key function in proper healthcare and living conditions. All families require money in order to look after their daily needs such as a healthy diet, safe water, and hygienic dwelling conditions. But there are many challenges for sustainable income generation in rural as well as urban sector which influences the purchasing power of the individuals which have a detrimental effect on desirable living conditions.
- Access to sufficient and nutritious food for each individual is equally essential. On this front our situation has been assessed dismally poor by the International Food Policy Research Institute (IFPRI) as the access to sufficient nutritious food for all citizens is generally compromised in India.
- Sufficient health and nutrition awareness regarding balanced diet, adequate child feeding practices *etc.*, is also lacking among masses. Therefore, it is necessary to conduct an effective nutrition awareness campaign in schools and other areas of common gathering using print and social media by involving all the stakeholders in participatory mode. This would help children and communities, regardless of their income and educational levels in understanding how they should respond to their nutritional needs in the present scenario.
- Social and cultural challenges also influence nutritional status of the female counterparts which may lead to failure of a nutrition programme. It is worth mentioning that child marriage is still prevailing in many parts of the country and its derogatory that as per National Family Health Survey (2015-16-NFHS-4) data for 2015-16 more than one fourth (27 per cent) girl marriages took place before the legal age of marriage. Infants born to child brides (married before the age of 18) have a higher risk of malnutrition (NFHS 2016). Young ones who are born to undernourished mothers are most vulnerable to get trapped in the vicious cycle of under-nourishment (Anita *et al.* 2010).

Factors causing under-nutrition at different life stages

During early years

- Delayed initiation of breastfeeding
- Low birth weight
- Delayed introduction of weaning foods
- Poor child care services
- Susceptibility of children to frequent infections

During adolescence

- Low dietary intake
- Gender inequity
- Consequential occurrence of anaemia

Young women and pregnant women

- Early marriage and child birth
- Low intake of protein and iron rich foods
- Micronutrient deficiencies
- Inadequate birth spacing

Old age

- Decreased purchasing power
- Poor absorption of nutrients
- Vulnerability to frequent infections and illness
- Negligence

- Lack of proper hygiene and sanitation is also an important determinant of malnutrition. In India, open defecation remains a severe problem as a significant proportion of the population. This situation is observed mainly in the rural areas as well as among slum dwellers. Most of the people from these areas do not give adequate importance to the use of clean toilets; either they do not construct toilets, or they are not in a position to build within their living spaces due to income or space issues. Data from the National Sample Survey conducted in May-June 2015 revealed that 52 per cent rural population defecate in the open, while this prevalence among the urban population is only 7.5 per cent (IDFC 2013). Poor sanitary conditions caused by open-defecation lead to the incidence of diarrhoeal and other communicable gastro-intestinal diseases (Mara *et al.* 2010, UNICEF

2013). The Government of India has initiated a mission to make India open-defecation-free by 2019. The programme is being implemented to ensure construction of household, community and public toilets under the Swachh Bharat Mission (NSSO 2017). The mega programme on toilets construction is a constructive step for ensuring proper hygiene and sanitation. However, the success of this mission will depend on the after construction maintenance of the toilets and educating masses to keep toilets neat and clean with provision of adequate supply of water on sustained basis.

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Chapter-3

Interventions and programmes to combat malnutrition in India

A large number of documents emphasising upon policy inputs to address various issues pertaining to worsening situation of under-nutrition have been published which depict nutrition as a core public health issue in India. Having said that India seeks for an explicit policy attention to nutrition so as to uphold its progress in every sphere of development. Policy must break the association between under-nourishment, illness, and child mortality. An exclusive priority for nutrition must take place in the government's integrated health and development agenda. Policy must also prevail over the manifested inequality in nutritional status across gender, community groups, and geographical regions. Moreover, policy must possess right-based health and nutrition services as a key element and should target the linkages between under - nutrition and multiple deprivations related to poverty, exclusion, and gender discrimination. The existing policy framework to combat malnutrition includes legislative policy, plan, and programme under different ministries at the central and state government level.

Government programmes addressing nutrition issues

The most significant and conspicuous government nutrition programmes include the Integrated Child Development Services (ICDS) programme led by the Ministry of Women and Child Development (MWCD), and the National Rural Health Mission (NHRM) led by the Ministry of Health and Family Welfare (MHFW). Both Centrally Sponsored Schemes (CSSs) prioritise the role of community-level organisations – Anganwadi Centres (AWCs) and Anganwadi Workers (AWWs) under the ICDS, and Accredited Social Health Activists (ASHAs) under the NRHM – for the delivery of nutrition interventions to the target groups of pregnant women, lactating mothers, and infants. These programmes are complemented by the Public Distribution System (PDS), which is used to provide subsidised food grains to large sections of the country's poor. The reasonable rate of improvement over the last two decades has led to a long-overdue reorientation from addressing under-nutrition post-birth towards

interventions that target preventive, early action – prenatally, in the neonatal period, in early infancy, and over the first two years of life. The importance of the first 1,000 days of a child's life cannot be ignored as early stage attention are fundamental for reducing a child's vulnerability to infections, and creating a strong foundation for a child's cognitive and physical development. The most crucial interventions for the first 1,000 days of a child's life have been summarized below for the vulnerable group (pregnant and lactating women; children 0-3 years) (Table 3.1).

Table 3.1: Interventions for the first 1,000 days of a child's age

Intervention	Key elements
Integrated Child Development Services (ICDS)	Supplementary nutrition, counselling on diet, rest and breastfeeding, health and nutrition education for pregnant and lactating mothers, growth monitoring, promotion of infant and young child feeding, home based counselling for early childhood stimulation, referral and follow-up of undernourished and sick children
National Rural Health Mission (NRHM) Reproductive Child Health (RCH-II) Janani Suraksha Yojana (JSY)	Antenatal care, counselling, iron supplementation, deworming, immunisation, transportation for institutional delivery, institutional delivery, cash benefit, postnatal care, counselling for breastfeeding and spacing of children, health check-up, management of childhood illness and severe under-nutrition, referral and cashless treatment for first month of life, care of sick newborns, facility-based management of severe acute malnutrition and follow-up
Rajiv Gandhi National Crèche Scheme	Support for the care of children of working mothers
Indira Gandhi Matritva Sahyog Yojana (IGMSY)	Conditional maternity benefit

There is a critical window of opportunity to prevent under -nutrition by taking care of the nutrition of children in the first two years of life, girls during adolescence, and mothers during pregnancy and lactation – when proven nutrition interventions offer children the best chance to survive and reach optimal growth and development.

Key considerations to eradicate under-nutrition among children (<2 years of age)

- Exclusive breastfeeding during the first 6 months of life .
- Timely introduction of complementary feeding with adequate quality and accurate quantity.
- Hygienic complementary feeding practices along with safe handling of weaning foods .
- Full immunization.
- Reducing vitamin A deficiency.
- Reducing the burden of intestinal parasites.
- Prevention and treatment of diarrhoea .
- Therapeutic feeding and care for all children with severe acute malnutrition.
- Balanced food intake by adolescent girls specifically to prevent anaemia.
- Better nutrition for adult women with special reference to during pregnancy and lactation.

National Nutrition Policy (NNP)

Implementation of NNP in the year 1993 was the foremost step took forward by India to build a nation devoid of nutritional deficiencies (MHRD 1993). Owing to the results of a systematic study of nutritional requirements, the Government of India Planning Commission recommended a national norm of 2,400 and 2,100 kilocalories per day for rural and urban areas, respectively. The NNP observed under-nutrition "as a part of a larger set of processes that produces and consumes agricultural commodities on farms, transforms them into food in the marketing sector, and sells the food to customers to satisfy nutritional, aesthetic, and social needs". The NNP strategy stated that "nutrition is a multi-sectoral issue and needs to be tackled at various levels." Following the data documented on variables like dietary intake, food production, and poverty, the policy viewed critical aspects of malnutrition problems such as low birth weight, protein energy malnutrition, over nutrition, micronutrient deficiencies, impact of natural calamities on nutritional status, market disinformation and its association with under-nutrition, increasing urbanization and special nutritional problems of hilly

areas, industrial workers, migrants, and others. In this context, the NNP referred to direct and indirect policy measures (*CHP 2016*).

Direct measures under NNP

- The safety net through ICDS to cover all vulnerable groups (children, adolescent girls, mothers, expectant women)
- Fortification of essential foods with appropriate nutrients (*e.g.*, salt with iodine and/ or iron)
- Popularisation of low cost nutritious food
- Controlling measures of micro-nutrient deficiencies amongst vulnerable groups

Indirect measures under NNP

- Assuring food security through increased production of food grains
- Improvement in dietary pattern by promoting production and increasing per capita availability of nutritionally rich food
- Improvement in purchasing power of landless, rural and urban poor; expansion and strengthening public distribution system.
- Execution of land reforms to reduce vulnerability of poor
- Increasing health and immunisation facilities
- Community participation in nutrition education
- Prevention of food adulteration
- Monitoring nutrition programmes and strengthening nutrition surveillance

Various programmes under NNP

A number of nutrition programmes have been commenced under NNP to mitigate nutritional problems such as Mid-day Meal Programme (1962-63), National Iodine Deficiency Disorders Control Programme (1962), Special Nutrition Programme (1970-71), Balwadi Nutrition Programme (1970-71), Nutritional Anaemia Prophylaxis Programme (1970), National Prophylaxis Programme against Vitamin A Deficiency (1970), Integrated Child Development Services (ICDS) (1975), National Diarrhoeal Diseases Control Programme (1981), Wheat-based Supplementary Nutrition Programme (1986), National Plan of Action on Nutrition (1995), Public Distribution System (1997), National Nutrition Mission (2003), National Health Mission (2013), Promotion of Infant & Young Child Feeding Practices Guidelines (2013) and Weekly Iron & Folic Acid Supplementation (2015).

Impact of NNP

These programmes are serving to address the various aspects of nutrition. This is evident in the following patterns of decline in some of the country's key health variables: (i) proportion of under-nourished persons in the total population from 24 per cent in 1990-92 to 15 per cent in 2014-16; (ii) maternal mortality ratio from 398 in 1997-98 to 167 per 100,000 live births in 2011-13; (iii) infant mortality rate from 80 in 1991 to 41 per 1,000 live births in 2015-16; (iv) under-five mortality rate from 115 in 1991 to 50 per 1,000 live births in 2015-16; (v) percentage of children underweight, stunted, and anaemic.

National Food Security Act

Further, an endeavour to address the hunger (and nutrition) challenge is the enactment of the National Food Security Act (2013). This law aims to ensure greater access to adequate quantity of quality food at affordable prices (NFSA 2013). Up to 75 per cent of eligible rural and 50 per cent of eligible urban population as identified by States/UTs are entitled to receive food grains (five kg per person per month of rice, wheat, coarse grains at subsidised prices of INR 3/2/1 per kg, respectively) under the Targeted Public Distribution System (PDS) launched in June 1997. To bring about an improvement in the nutritional content in food products, steps are being taken towards universal food fortification. A course of action has been designed for adding essential vitamins and minerals such as iron, folic acid, vitamin, iodine to food items consumed on routine basis like rice, wheat flour, salt, edible oil, milk (MWCD 2016). The Food Safety and Standards Authority of India (FSSAI) has set nutritional benchmarks to ensure that manufacturers responsible for fortifying food add desirable levels of micronutrients to the food items.

Valuable lessons in this regard have been learnt from practices followed in the Gajapati district of Odisha where training was given to school staff engaged in preparing mid-day meals for schoolchildren so that they are able to fortify the rice with iron for increasing its nutritional value. About 1,449 schools in the district have been covered under the programme, and the Central government is interested in extending this initiative to other parts of the country as well. According to the Department of Biotechnology (DBT), clinical studies have substantiated that regular feeding for one year increases iron store and decreases anaemia in school going children. Care is however needed in ensuring that people do not consume iron beyond the required amounts, as some studies suggest a direct link between iron and diabetes (Aijaz 2017).

National Nutrition Mission

Government of India (GOI), recently approved a mega programme 'National Nutrition Mission' (NNM) under the Women and Child Development Ministry, for controlling malnourishment of masses and stunted growth among children. Under NNM the GOI is contemplating reduction of stunting, under-nutrition and low birth-weight among targeted people by 2 per cent. The programme has special emphasis of reducing anaemia among young children, women and adolescent girls by 3 per cent every year. The NNM will progress phase wise covering 315 districts in 2017-18, 235 districts in 2018-19 and remaining districts in 2019-20. The programme will integrate different components and agencies involved in nutrition management in India.

State level initiatives

Not only nation, but it is the responsibility of the states also to raise the level of nutrition and the standard of living and to improve public health. Some states have adopted this provision by launching nutrition missions. For instance, Maharashtra's nutrition mission aims to reduce malnutrition in all its forms (Vandana 2016). The mission strategy includes the following aspects: deliver evidence-based interventions; focus on adolescent girls' nutrition, education and empowerment; combine facility, outreach and community-based interventions to bring services and support closer to the people; and monitor pregnancy weight gain at every ante-natal care visit. Today, the mission is seen as a model because it has contributed to encouraging improvements in the people's nutritional status. Similar initiatives have also been undertaken in Madhya Pradesh (2010), Karnataka (2010), Gujarat (2012), and Uttar Pradesh (2014). Likewise, a mission has been launched in Jharkhand with technical support from UNICEF in the year 2015 which is intended to make the State malnutrition-free within 10 years; modernise Anganwadis through the use of corporate social responsibility funds create a database of pregnant mothers, improve nutrition awareness in communities, and foster linkages for nutrition action among departments.

Activism on food security issues

Besides the above-mentioned government interventions, judicial and civil society activism is making inroads in bringing down India's malnutrition rates. For example, the Right to Food Campaign (launched in March 2014), which is an informal network of organizations and individuals across local and national levels which targets the state for entitlement to food. Using the interim orders of the Supreme Court in

2001, the campaign converted welfare initiatives for children into legal entitlements for access to nutritious food by holding state officials accountable at the local level; it also worked towards the enactment of the National Food Security Act of 2013. The campaign is not seeking efficient public food distribution alone; it also makes demands for children's nutrition, employment guarantees, and land rights.

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Chapter-4

Current scenario of nutrition indicators in India

Nutrition related data is a preliminary requirement for assessing and framing policies to address the serious issues involved in the overall health and welfare of masses. In India, major sources of data on nutrition monitoring are periodic surveys carried out by National Nutrition Monitoring Bureau (NNMB), National Sample Survey Organization (NSSO), National Family Health Survey (NFHS) of the Ministry of Health and Family Welfare, and District Level Household Survey (DLHS) under Reproductive and Child Health Phase. These data on nutritional indicators collected by these agencies provide assistance for decision making on program planning, management, monitoring and evaluation

Dubious distinctions

The 2016 Global Nutrition Report has revealed that India ranks 114th out of 132 countries in relation to stunting among children aged less than five years. Further, the percentage of stunting in less than five years of age is 38.7 per cent, placing India at the 34th position among 39 Asian countries whereas pertaining to wasting under five years of age, India has been placed at 35th rank amongst 38 countries in Asia. Even the underdeveloped countries like Nepal and Bangladesh have performed better than India on the front of managing nutritional security of their people. Anaemia among women is also a cause of concern as India ranks 170th among 185 countries on this parameter. According to the Global Hunger Index Report 2016 published by the International Food Policy Research Institute (IFPRI), indicated that India ranked 97th in Global Hunger Index (GHI) among 117 identified countries in respect to its performance on managing hunger. While comparing GHI, it is evident that the index in India was more *i.e.*, 28.5 as compared to neighbouring countries except Pakistan wherein the corresponding figure is 33.4 (IFPRI 2017).

Silver lining

Everything in India is not on the path of deterioration and there is small consolation that the current figure of Indian Global Hunger Index (GHI) rank during 2016 has been slightly lower than the GHI rank of previous years including the 2015.

National Family Health Survey-4 (2015-16-NFHS-4) for 2015-16 has shown positive trends in key health indicators, including a decline in Infant Mortality Rate (IMR) and improvement in sex ratio at birth during 2015-16. IMR has declined from 57 to 41 per 1,000 live births between 2005-06-NFHS-3 and 2015-16-NFHS-4. IMR has declined substantially in almost all the states during the last decade. It has dropped by more than 20 per cent in Tripura, Jharkhand, West Bengal, Arunachal Pradesh, Rajasthan and Odisha. Under-5 mortality rate (U5MR) has also shown a decline from 74 to 50 in over this period of time (NFHS 2016). These data indicate that we are progressively improving but we have still to go long way in order to place our self in the category of developed countries.

Alarming bell from NFHS findings

The situation of malnutrition in India is really worrisome and disgraceful. Children and youth in this condition suffer from numerous nutritional deficiencies which adversely impact their health. In India, the new National Family Health Survey-4 (2015-16-NFHS-4) data for 2015-16 unveiled that 38 per cent of children below five years of age are stunted, 21 per cent are wasted and 36 per cent are underweight. The nutritional status of children under five years of age is critical in Bihar, Jharkhand, Uttar Pradesh, and Dadra and Nagar Haveli whereas situation is better in Kerala and Mizoram. Body Mass Index (BMI) below normal is the most evident in Bihar, Jharkhand, Madhya Pradesh, and Uttar Pradesh while the condition is better in Sikkim.

The 2015-16-NHHS-4 report has also highlighted a substantial decline in anaemia. However, it still remains widespread as more than half of the women in eleven states/Union Territories (UTs) are anaemic. A considerable decline of anaemia from 69 per cent in NFHS-3 to 58 per cent has been observed among children aged 6-59 months. The maximum decrease has been reported in Assam followed by Chhattisgarh, Mizoram and Odisha. Further, anaemia is prevalent in women (53 per cent) and men (23 per cent) in the 15-49 age groups. The incidence of anaemia among non pregnant and pregnant women aged between 15-49 years has been reported as 53 and 50 per cent, respectively. Anaemia has high prevalence in Chandigarh, Dadra & Nagar Haveli, Bihar and Meghalaya whereas the prevalence of anaemia is low in Manipur and Mizoram.

Infant mortality rates at different stages

High Infant Mortality Rate (IMR) and its different constituents have been an

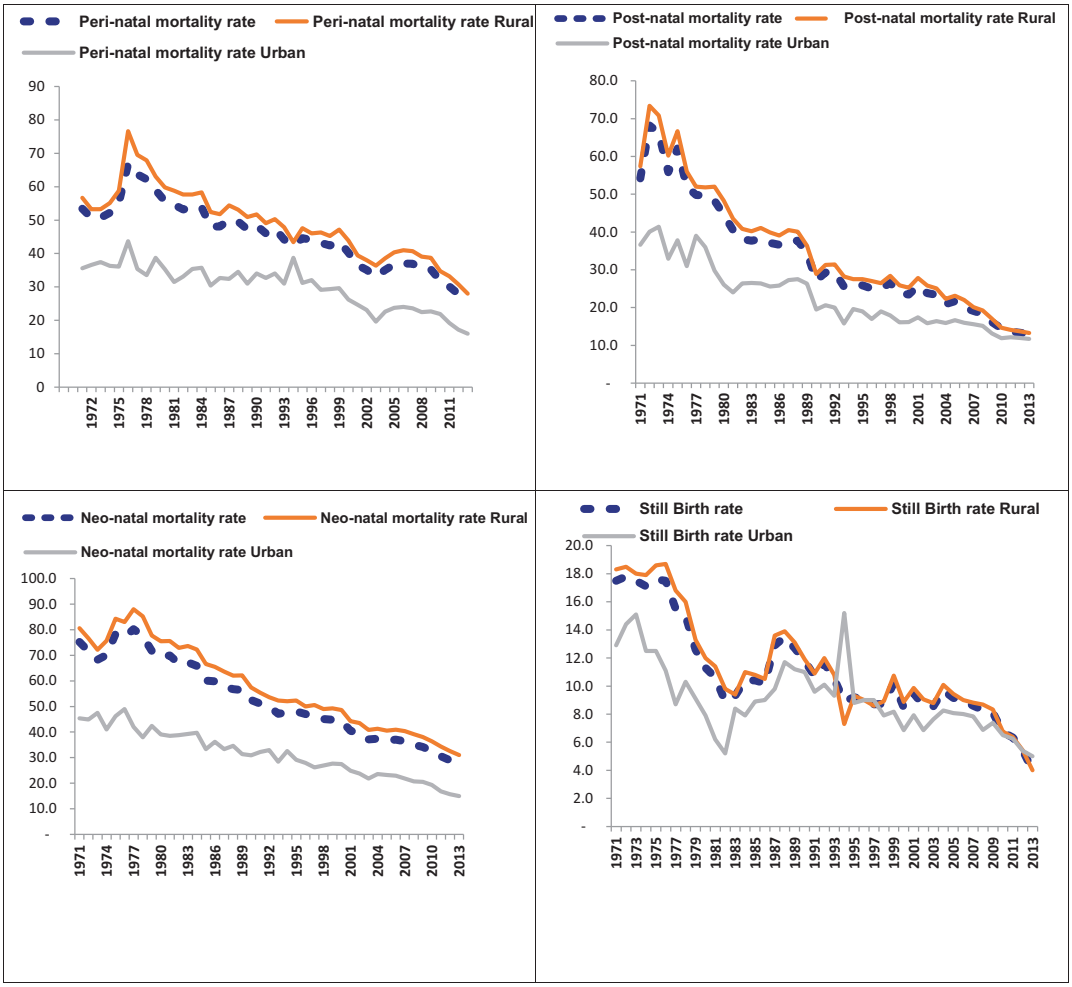
indicator of poor nutrition and health standards in India. However, India has been able to reduce its rate of infant mortality over more than previous four decades. The country is marching slowly towards achieving Millennium Development Goals. Over the last couple of years, the State Governments with several other international organizations have focused extensively on improving health care facilities such as neo-natal hospitals/ institutes and labour rooms for pregnant mother across all the states in India. However, nutrition and health being the primary factors responsible for IMR, detailed analysis of IMR and its constituents has been carried out in this section based on the 1971 to 2013 data (RGI 2013).

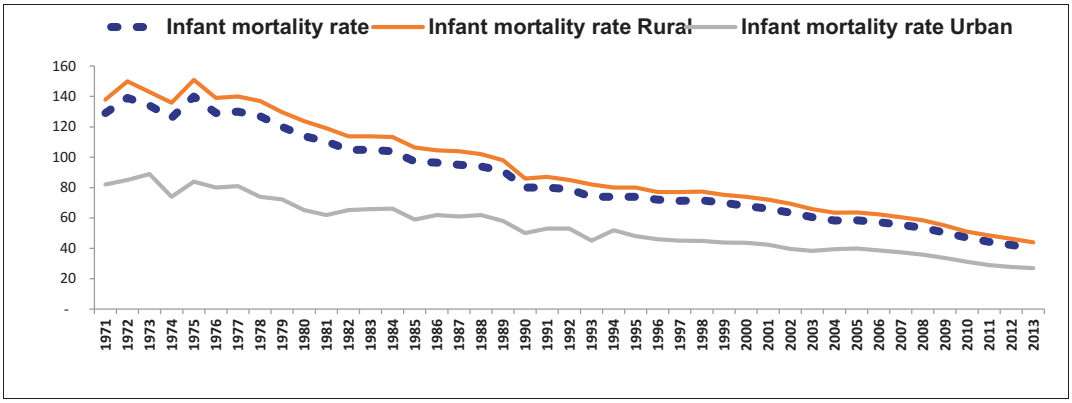
Pre-natal Mortality Rate: Pre-natal stage is the process by which a baby develops inside the mother's womb and is also known as antenatal care. Pre-natal development takes about 38 weeks to complete in the womb of the mother. During this time, a single cell becomes a full-term baby. In 1976, rate of prenatal mortalities was 66.8 per 1000 births. The rate of this mortality has gradually decreased both in rural as well as in urban areas. In 2013 the rate of prenatal mortality decreased to 26 per 1000 births as per the records of Registrar General of India (Fig. 4.1).

Post-natal Mortality Rate: Post natal mortality is generally related to Sudden Infant Death Syndrome (SIDS), congenital malformations, and unintentional injuries. In 1972, the highest rate of 68.2 per 1000 live births was reported; however, the percentage decreased to 12.9 per 1000 live births in 2013 (RGI 2013). More number of deaths was reported from rural areas than in urban areas due to lack of medical facilities, low literacy rate of mothers in rural areas and unavailability of adequate and recommended diet for pregnant mothers hampering growth of child in mother's womb.

Neo-natal Mortality Rate: The first 28 days of life of the neonatal is the most vulnerable time for a child's survival. It is evident from the Figure that in 1977 the rate of neonatal mortality was *i.e.* 80.2 per 1000 live births, whereas in 1971 neonatal mortality was 75.2 per 1000 live birth. In India neonatal mortality rate fell from 75.2 to 28 death per 1,000 live births between 1971 and 2013 due to advancement in medical facilities in urban and rural areas. The education of mother also played an important part in the survival of the child. Leading causes of neonatal death have generally been low birth weight, premature delivery, diseases of respiratory system and certain undesirable practices like feeding of honey and water at the birth time resulting in many health complications in infants.

Figure 4.1: Different stages of mortality rates in infants in India from 1971-2013





Data source: Registrar General of India; Note: IMR is per 1,000 live births.

Still Birth Rate: The pregnancy that ends before the twentieth week is called a miscarriage rather than a stillbirth, even though the death of the foetus is a common cause of miscarriage. After the twentieth week, the unintended end of pregnancy is called a stillbirth if the infant is dead at birth. There are many causes of still birth mortality *e.g.* diabetes in mother, abnormalities in the foetus, high blood pressure, fluid retention and protein in the urine. The rate of stillbirths decreased to four per 1000 births in 2013 from 17.5 in 1971. The problem of still birth is high in urban areas as compared to rural areas due to sedentary life style of pregnant mothers. The common reasons for still birth are early age pregnancy, late age pregnancy and anaemia in pregnant mothers. Moreover in India women workload is higher and low intake of nutritious food also leads to still birth in pregnant women.

Infant Mortality Rate: Infant Mortality Rates (IMR) refers to the death of an infant between 1 day and 1 year of age (deaths before age 28 days can also be classified as neonatal mortality). There are many different causes of infant mortality, right from infection to birth defects or accidents. In 1975, the highest infant mortality (140 million infant mortalities) was recorded. In 2013, the infant mortality got reduced to 40 million in India as per records of Registrar General of India during 2013. Infant mortality occurs more in rural families where skilled delivery attendant are less as compared to urban areas.

Institutional deliveries with good health care service at Primary Healthcare Centres (PHCs) have lead to decline in the infant mortality rate. Government should provide adequate medical care facilities and adequate number of ambulances to cater the emergencies should be ensured in order to reduce the Infant Mortality Rate in India.

Child feeding practices

In India, the rate of early initiation of breastfeeding has been increased from 23 per cent in 2005-06 to 42 per cent in 2015-16 (20015-16-NFHS-3; 2015-16-NFHS-4). A little more than half (55%) of infants below six months were exclusively breastfed. Only 43 per cent Indian infants aged six to eight months received some kind of complementary foods in addition to mother's milk. In India, only nine per cent breastfed children aged between 6-23 months received an adequate diet whereas the corresponding proportion among non-breastfed children of same age is only 14 per cent (NFHS 2016).

Over-nutrition: a wake-up call

India faces the double burden of malnutrition with the coexistence of under nutrition on one hand and obesity or over-nutrition on the other. In past one decade, the number of obese people has doubled in the country. As per the survey conducted by Ministry of Health and Family Welfare (MoHFW), people having Body Mass Index (BMI) more than 25 Kg/m^2 have been considered as obese. Most of the states have witnessed swift increase in the number of obese people during past one decade or so. Andhra Pradesh, Andaman and Nicobar, Puducherry and Sikkim have more than 30 per cent of their populations falling under the obese category. More than 10 per cent population in Bihar, Madhya Pradesh, Meghalaya, Tripura and West Bengal is obese.

Obesity is the major reason for developing different types of diabetes mellitus. Several researchers have highlighted that obesity accounts for 80-85 per cent of the risk of developing type-2 diabetes. The survey highlights that urban population is more prone to obesity as compared to their rural counterparts. In Andhra Pradesh, 44.4 per cent urban men suffered from obesity, while the percentage in rural area was 28 per cent. Similarly, 45.6 per cent of the urban women in the state were obese against the 27.6 per cent women in rural Andhra Pradesh. In Bihar, around 20 per cent urban and 11 per cent rural men were obese. Additionally, three in ten women are overweight in Andaman and Nicobar Islands, Andhra Pradesh, Goa, Puducherry, and Tamil Nadu.

In all ATARI Zone-1 states *i.e.* Punjab, Haryana (before the restructuring in 2017), Jammu & Kashmir, Himachal Pradesh and Uttrakhand (after the restructuring of 2017), proportion of obese individuals in urban (both men and women) was higher than the rural individuals. Similarly in all these states the proportion of female obese individuals (both in rural and urban areas) was higher than the male individuals. Higher prevalence of obesity was found in Punjab in all categories (both male and female among rural as well as urban areas), compared to their respective national averages. Haryana had lower proportion of obese persons in urban area than national average both for males as well as females; however, the proportion of obese persons as compared to national averages was higher in rural areas of Haryana. Himachal Pradesh and Jammu & Kashmir generally possessed higher obesity than the national averages except urban men in Himachal Pradesh and rural men in Jammu and Kashmir. The proportion of obesity in Uttrakhand was lower than national average in all categories.

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Chapter-5

Assessment of malnutrition in different groups of states

Adverse state of human nutrition in India has been widely discussed by various authors (Ramachandran 2011; Raykar *et al*. 2015; RGI 2015; Zakaria and Donato 2016; Aijaz 2017; IFPRI 2017). Our performance on mitigating even the hunger in India vis-a-vis our neighbouring countries is also not encouraging. India compares poorly with their neighbours like Nepal, Bangladesh and Sri Lanka on the front of managing hunger as per various reports of the International Food Policy Research Institute (IFPRI) on Global Hunger Index (Table 5.1). The report has depicted extra-ordinary results in managing hunger by China who showed gradual and impressive improvement from the levels of 1992. Indian performance has largely been patchy and the only consolation for India is that we have performed better than the Pakistan (IFPRI 2017).

Table 5.1: India vis-a-vis our neighbouring countries in Global Hunger Index

Countries	1992	2000	2008	2016
India	46.4	38.2	36.0	28.5
China	26.4	15.9	11.5	7.7
Nepal	43.1	36.8	29.2	21.9
Pakistan	43.4	37.8	35.1	33.4
Bangladesh	52.4	38.5	32.4	27.1
Sri Lanka	31.8	27.0	24.4	25.5

Source: IFPRI (2017), Global Hunger Report-2016

Indicators of child and adult health such as stunting, wasting, Infant Mortality Rate (at various states of infancy) and extent of anaemia have been explained in previous chapter (Chapter-4) at the overall country level. However, in this chapter an

attempt has been made to analytically describe malnutrition in different groups of states in India based on the data of National Family Health Survey-4, 2015-16 (NFHS 2016).

Extent of malnutrition in predominantly non-vegetarian states

Punjab and West Bengal states were considered representatives of non-vegetarian states in India. It will help comparing the malnutrition status between the non-vegetarian states having different levels of purchasing power. The proportion of stunted, wasted, underweight and anaemic children of less than five years of age was lower than the national average in these two states. Except anaemia, the children of Punjab (under five years of age) has much lower incidence of stunting, wasting and underweight compared to the state of West Bengal. Slightly higher incidence of anaemia among the children of Punjab (6-59 months of age) in comparison to the state of West Bengal was primarily due to consumption of a lot of junk food (Table 5.2).

Table 5.2: Extent of malnutrition in predominantly non-vegetarian states of India

States	Children (under 5 years)				Adults (15 –49 years)			
	Stunted	Wasted	Underweight	Anaemic (6-59 months)	Low BMI@		Anaemic	
					Women	Men	Women	Men
Punjab	25.7	15.6	21.6	56.6	11.7	10.9	53.5	25.9
West Bengal	32.5	20.3	31.5	54.2	21.3	19.9	62.5	30.3
India	38.4	21.0	35.7	58.4	22.9	20.2	53.0	22.7

Note: BMI=Body Mass Index; @=underweight; Source : National Family Health Survey–4, 2015-16

In spite of being predominantly non-vegetarian states, both Punjab and West Bengal states are worse than the national averages at the front of fighting anaemia among adults (15-49 years of age). This is in fact an unexpected finding and there might be under-reporting of anaemia in many other states of India. West Bengal has considerably higher incidence of anaemia among adults, both in men as well as in women, as compared to Punjab. However, both these states had lower proportion of underweight individuals among both the men and the women compared to the national averages. The incidence of low BMI (underweight or thinness) was much lower among the adults of Punjab (among both men and women) as compared to the West Bengal. Comparison of Punjab and West Bengal states clearly indicates that the difference in

purchasing power plays most significant role in human nutrition than other determinants of nutrition.

Extent of malnutrition in predominantly vegetarian states

Gujarat, Haryana and Rajasthan states have been considered representatives for vegetarian population in India. Unfortunately, Gujarat has been by and large worse than the national averages on all counts of human nutrition except anaemic population among men. Anaemia has been found wide spread among children (6 to 59 months of age) in all the three vegetarian states. Except the slightly better situation of stunted and underweight children in Haryana as compared to the national average the nutritional indicators, in general, were poorer than the national average. In Rajasthan the incidence of anaemia was considerably lower than Gujarat and Haryana along with the national average both among men as well as among the women population (Table 5.3). A comparison of malnutrition in West Bengal (having lower average purchasing power than Gujarat and Haryana) with the predominantly vegetarian states indicated that non-vegetarian food affects better nutrition among humans.

Table 5.3: Extent of malnutrition in predominantly vegetarian states of India

States	Children (under 5 years)				Adults (15 – 49 years)			
	Stunted	Wasted	Underweight	Anaemic (6-59 months)	Low BMI@		Anaemic	
					Women	Men	Women	Men
Gujarat	38.5	26.4	39.3	62.6	27.2	24.7	54.9	21.7
Haryana	34.0	21.2	29.4	71.7	15.8	11.3	62.7	20.9
Rajasthan	39.1	23.0	36.7	60.3	27.0	22.7	46.8	17.2
India	38.4	21.0	35.7	58.4	22.9	20.2	53.0	22.7

Note: BMI=Body Mass Index; @=underweight; Source**:** National Family Health Survey–4, 2015-16

Comparison of non-vegetarian and vegetarian states

Malnutrition among children (less than five years of age) was, by and large, higher among vegetarian states as compared to the non-vegetarian states. Even the incidence of malnutrition among adult men and women was lower in non-vegetarian states. However, proportion of anaemic men was invariably lower in all the vegetarian states as compared to the non-vegetarian states along with the national averages. Overall, non-vegetarian states had better nutrition standards among children (less than

five years of age) along with optimum Body Mass Index among adult (15 – 49 years of age) men and women.

Extent of malnutrition in North-Western Hill states

Himachal Pradesh, Jammu & Kashmir and Uttarakhand constitute the group of North-Western Hill States and malnutrition in these states is by and large lower than the national average. Except for incidence of anaemia among women in Himachal Pradesh and children (6-59 months of age) in Uttarakhand the North-Western Hill states performed better than the national level respective averages on all counts. However, proportion of underweight children in Jammu & Kashmir and Himachal Pradesh along with stunting and wasting of children in these two states was considerably lower than the national average. Similarly, incidence of underweight among adults was much lower in Jammu & Kashmir compared to the national average both for men and women. Proportion of anaemic population in the states of Jammu & Kashmir and Uttarakhand was much lower than the national average for men as well as women (Table 5.4).

Table 5.4: Extent of malnutrition in North-Western Hill states of India

States	Children (under 5 years)				Adults (15 – 49 years)			
	Stunted	Wasted	Underweight	Anaemic (6-59 months)	Low BMI@		Anaemic	
					Women	Men	Women	Men
H.P.	26.3	13.7	21.2	53.7	16.2	18.0	53.4	20.1
J&K	27.4	12.1	16.6	43.3	12.1	11.5	40.3	15.1
Uttarakhand	33.5	19.5	26.6	59.8	18.4	16.1	45.2	15
India	38.4	21.0	35.7	58.4	22.9	20.2	53.0	22.7

Note: BMI=Body Mass Index; @=underweight; Source: National Family Health Survey–4, 2015-16

Review of literature revealed that in selected parts of Himachal Pradesh and Uttarakhand states, deficiency of highly crucial iodine element and its disorders was much common among school children and expecting (pregnant) mothers (Chander *et al*. 2013; Kapil 2015). Overall the nutrition standards in North Western Hill states were the best in Jammu and Kashmir followed by Himachal Pradesh and Uttarakhand.

Extent of malnutrition in North-Eastern states including Sikkim

The incidence of malnutrition in North Eastern states of India including Sikkim was lower than the national level on various counts. Arunachal Pradesh, Mizoram, Nagaland and Sikkim states had better than national level nutritional standards on all parameters of children and adults (both men and women of 15 to 49 years of age). Assam had higher problem of thinness (underweight) among men and women than the national level while Meghalaya and Tripura had higher proportion of adult men and women having the problem of anaemia. Meghalaya also had much higher proportion of stunted children than the national average. Similarly Assam had one fourth of their men population as anaemic which is higher than the national average (Table 5.5).

Table 5.5: Extent of malnutrition in North-Eastern states of India

States	Children (under 5 years)				Adults (15 – 49 years)			
	Stunted	Wasted	Underweight	Anaemic (6-59 months)	Low BMI@		Anaemic	
					Women	Men	Women	Men
A.P.	29.4	17.3	19.5	50.7	08.5	08.3	40.3	16.9
Assam	36.4	17.0	29.8	35.7	25.7	20.7	46.0	25.4
Manipur	28.9	608	13.8	23.9	08.8	11.1	26.4	09.6
Meghalaya	43.8	15.3	29.0	48.0	12.1	11.6	56.2	32.4
Mizoram	28.0	601	11.9	17.7	08.3	07.2	22.5	09.6
Nagaland	28.6	11.2	16.8	21.6	12.2	11.5	23.9	10.1
Sikkim	29.6	14.2	14.2	55.1	06.4	02.4	34.9	15.7
Tripura	24.3	16.8	24.1	48.3	18.9	15.7	54.5	24.7
India	38.4	21.0	35.7	58.4	22.9	20.2	53.0	22.7

Note: BMI=Body Mass Index; @=underweight; Source**:** National Family Health Survey–4, 2015-16

In seven out of eight states under this group the proportion of stunted children was lower than the national average but Tripura had the least and much lower incidence of child stunting than other states. All North-Western Hill states including Sikkim had lower incidence of wasting, underweight and anaemia in children. However, Manipur, Mizoram and Nagaland had remarkably lower incidence of wasting among children. Similarly Arunachal Pradesh, Manipur, Mizoram, Nagaland and Sikkim had much lower proportion of underweight children while Assam, Manipur, Mizoram and Nagaland had much lower incidence of anaemia among children of 6 to 59 months of

age compared to the national average. Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim had remarkably lower proportion of underweight adult men and women while Manipur, Mizoram and Nagaland had much lower incidence of anaemia among adult men and women as compared to the national level respective incidences.

Extent of malnutrition in Central States/ UTs + Odisha of India

Chhattisgarh, Daman & Diu UT, Dadra & Nagar Haveli UT, Jharkhand, Madhya Pradesh, Maharashtra and Odisha constitute this group of Indian states/ UTs and unfortunately, the incidence of child and adult malnutrition is quite high in the states/ UTs of this group. Jharkhand, Madhya Pradesh and Dadra & Nagar Haveli had much grimmer situation of malnutrition compared to other states in the group as well as to the national average. Proportion of stunted children of less than 5 years of age was much lower than the national average in the Union Territory of Daman & Diu while Jharkhand followed by Madhya Pradesh and Dadra & Nagar Haveli had much higher incidence of child stunting compared to other states/ UTs in the group and the national average. Except Odisha, all other states/ UTs in this group had higher proportion of wasted children while the situation in Jharkhand and Dadra & Nagar Haveli was the worst (Table 5.6).

Proportion of underweight children was much lower than national average in Daman & Diu union territory while Jharkhand and Madhya Pradesh possessed much

Table 5.6: Extent of malnutrition in Central States/ UTs + Odisha of India

States/UTs	Children (under 5 years)				Adults (15 – 49 years)			
	Stunted	Wasted	Underweight	Anaemic (6-59 months)	Low BMI@		Anaemic	
					Women	Men	Women	Men
Chhattisgarh	37.6	23.1	37.7	41.6	26.7	24.1	47.0	22.2
Daman & Diu-UT	23.4	24.1	26.7	73.8	12.9	12.0	58.9	23.6
D & N Haveli-UT	41.7	27.6	38.9	84.6	28.5	19.7	79.5	30.7
Jharkhand	45.3	29.0	47.8	69.9	31.5	23.8	65.2	29.9
Madhya Pradesh	42.0	25.8	42.8	68.9	28.3	28.4	52.5	25.5
Maharashtra	34.4	25.6	36.0	53.8	23.5	19.1	48.0	17.6
Odisha	34.1	20.4	34.4	44.6	26.4	19.5	51.0	28.4
India	38.4	21.0	35.7	58.4	22.9	20.2	53.0	22.7

Note: BMI=Body Mass Index; @=underweight; Source : National Family Health Survey–4, 2015-16

higher proportion of underweight children as compared to other states/ UTs in the group and the national level average. Anaemia has been a rampant problem among Indian children of 6 to 59 months of age (58.4 per cent), however, this incidence was remarkably lower in Chhattisgarh (41.6 per cent) followed by Odisha (44.6 per cent). The incidence of anaemia among children was as high as 84.6 per cent in Dadra & Nagar Haveli union territory followed by Daman & Diu union territory (73.8 per cent), Jharkhand (69.9 per cent) and Madhya Pradesh (68.9 per cent).

The situation of adult malnutrition (among both men and women of 15 to 49 years of age) was also not better than the national level situation on many counts when we make comparison of Central States/ UTs + Odisha group at national level. Jharkhand, Madhya Pradesh and Chhattisgarh had much higher proportion of underweight individuals (both men and women) while Dadra & Nagar Haveli had much higher proportion of underweight men. However, Daman and Diu UT had remarkably lower incidence of thinness among their men and women compared to other states/ UTs in this group and the national average. Anaemia has been much common among Indian women (53 per cent) compared to the men (22.7 per cent), however, 79.5 per cent anaemic women in Dadra & Nagar Haveli and 65.2 per cent in Jharkhand were considerably higher than the national average while 47 per cent anaemic women in Chhattisgarh and 48 per cent in Maharashtra was on the lower side. The incidence of anaemia among men population was much higher than the national average in Dadra & Nagar Haveli (30.7 per cent), Jharkhand (29.9 per cent) and Odisha (28.4 per cent) while Maharashtra (17.6 per cent) was on the lower side.

Extent of malnutrition in South Indian and Island States/ UTs of India

Andaman and Nicobar Islands UT, Andhra Pradesh, Goa, Karnataka, Kerala, Lakshadweep UT, Puducherry UT, Tamil Nadu and Telangana comprised this group of states/ UTs in India. By and large the nutrition standards in the states/ UTs of this group were much better than the national level averages on various parameters of child and adult nutrition. All the states/ UTs under this group had lower incidence of child stunting than the national averages while Kerala had much lower proportion of underweight children as compared to other states/ UTs in the group as well as the national average. At the front of child wasting, Karnataka performed poorly with a considerably higher proportion of wasted children as compared to other states/ UTs in the group along with the national average. However, Lakshadweep UT and Kerala showed much lower incidence of child wasting when compared to other states of the group as well as the national average. Situation of child anaemia was by and large

better in the states/ UTs of this group while Kerala had exceptionally lower incidence of child anaemia when compared to other states/ UTs of the group and at national level (Table 5.7).

Table 5.7: Extent of malnutrition in South Indian & Island States/ UTs of India

States/ UTs	Children (under 5 years)				Adults (15 – 49 years)			
	Stunted	Wasted	Underweight	Anaemic (6-59 months)	Low BMI@		Anaemic	
					Women	Men	Women	Men
A & N Islands-UT	23.3	18.9	21.6	49.0	13.1	08.7	65.7	30.8
Andhra Pradesh	31.4	17.2	31.9	58.6	17.6	14.8	60.0	26.9
Goa	20.1	21.9	23.8	48.3	14.7	10.8	31.3	11.0
Karnataka	36.2	26.1	35.2	60.9	20.7	16.5	44.8	18.2
Kerala	19.7	15.7	16.1	35.6	09.7	08.5	34.2	11.3
Lakshadweep-UT	27.0	13.8	23.4	51.9	12.5	07.4	45.7	10.7
Puducherry-UT	23.7	23.6	22.0	44.9	11.3	10.2	52.4	15.9
Tamil Nadu	27.1	19.7	23.8	50.7	14.6	12.4	55.1	20.4
Telangana	28.1	18.0	28.5	60.7	23.1	21.4	56.7	15.4
India	38.4	21.0	35.7	58.4	22.9	20.2	53.0	22.7

Note : BMI=Body Mass Index; @=underweight; Source: National Family Health Survey –4, 2015-16

Nutrition standards of South Indian and Island states/ UTs were also better than the national level in adults of 15-49 year of age. Except Telangana where proportion of underweight men and women was slightly higher than the national average, all other states had lower incidence of thinness (underweight individuals). Kerala, Lakshadweep UT and Puducherry UT had remarkably lower proportion of underweight men and women at group as well as national level. Men population in Andaman and Nicobar Islands UT also had exceptionally lower proportion of underweight individuals. Although situation of adult anaemia in this group was better than national level, yet Andaman and Nicobar Islands UT and Andhra Pradesh had considerably higher proportion of anaemic adults (men and women) as compared to other states/ UTs of the group and national average. Women in Tamil Nadu and Telangana also had slightly higher proportion of anaemia than at national level. Both men and women in Goa and Kerala and men population in Lakshadweep had considerably lower proportion of anaemic individuals as compared to other states/ UTs of the group and the national level averages.

Extent of malnutrition in Urban Representative State/ UT of India

Chandigarh being proxy of affluent urban population and Delhi being the reflector of mixed urban population were taken as representatives of urban population in India. Chandigarh had much better standards of child nutrition compared to national averages as well as Delhi, however, at the front of child anaemia the situation was very bad in Chandigarh where more or less three fourth of children in the age group of 6 to 59 months were anaemic. In Delhi even the proportion of anaemic children is slightly higher than the national average (Table 5.8).

Table 5.8: Extent of malnutrition in Urban Representative UT/ State of India

States/ UTs	Children (under 5 years)				Adults (15 – 49 years)			
	Stunted	Wasted	Underweight	Anaemic (6-59 months)	Low BMI@		Anaemic	
					Women	Men	Women	Men
Chandigarh-UT	28.7	10.9	24.5	73.1	13.3	21.7	75.9	19.3
Delhi NCT-UT	32.3	17.1	27.0	62.6	12.8	17.7	52.5	21.6
India	38.4	21.0	35.7	58.4	22.9	20.2	53.0	22.7

Note: BMI=Body Mass Index; @=underweight; Source : National Family Health Survey–4, 2015-16

The nutritional standards for adults (men and women of 15-49 years of age) were by and large better in Chandigarh and Delhi compared to the national average. However, situation of women anaemia in Chandigarh was very bad compared to Delhi as well as the national average. The data provided by National Family Health Survey-4, 2015-16 showed that all components of human nutrition except anaemia improved with urbanization and better purchasing power while incidence of anaemia in children and women had been increasing due to urbanization and improvement in purchasing power. Higher intake of fast food (junk food) is one of the foremost reasons for this development.

Extent of malnutrition in Northern Plain States of India

Bihar and Uttar Pradesh are the highly populous states of India and are also the part of agriculturally highly productive Gangetic North Indian Plains. Besides their major contribution to Indian population these two states account for large proportion of geographical territory of India. These two states have mixed food habits in terms of vegetarian versus non-vegetarian sources of food. By and large, the level of malnutrition in Bihar and Uttar Pradesh was higher than national level. Further, state of Uttar Pradesh had overall lower incidence of malnutrition than Bihar.

Among children of less than 5 years of age, the problem of stunting was much higher than the national level in these two states. Similarly both these states had higher proportion of underweight children as well as anaemic children as compared to national average. However, the proportion of wasted children in Uttar Pradesh was considerably lower than the national average and Bihar.

The overall adult (both men and women of 15 to 49 years of age) nutrition standards in these two states were lower than the national level average. Proportion of underweight individuals was much higher in Bihar as compared to national average while Uttar Pradesh also had higher incidence of underweight adults compared to national level but it was lower than Bihar. Proportion of anaemic men and women was much higher in the state of Bihar compared to national level and Uttar Pradesh (Table 5.9).

Table 5.9: Extent of malnutrition in Northern Plain States of India

State/ UT	Children (under 5 years)				Adults (15 – 49 years)			
	Stunted	Wasted	Underweight	Anaemic (6-59 months)	Low BMI@		Anaemic	
					Women	Men	Women	Men
Bihar	48.3	20.8	43.9	63.5	30.4	25.4	60.3	32.2
Uttar Pradesh	46.3	17.9	39.5	63.2	25.3	25.9	52.4	23.7
India	38.4	21.0	35.7	58.4	22.9	20.2	53.0	22.7

Note: BMI= Body Mass Index; @=underweight; Source: National Family Health Survey–4, 2015-16

Conclusion

Overall some group of states performed better than the national average and predominantly non-vegetarian states, North Western Hill states (except Uttarakhand), North Eastern Hill states including Sikkim, South Indian and Island states/ UTs of India (except Telangana) and urban representative states (except on anaemia) constituted this category of groups of states. The other category of group of states which performed by and large worse than the national average include predominantly vegetarian states (except Haryana having higher purchasing power), central states/ UTs + Odisha (except Odisha which had relatively better nutrition standards) and Northern Plains state. Analysis provided in this chapter suggests that better purchasing power had been the foremost determinant of nutrition while non-vegetarian food had also contributed towards better nutrition. However, modern lifestyle and intake of more fast/ junk food has led to higher incidence of anaemia among children as well as the adult population in India.

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Chapter-6

Prevalence of obesity in different groups of states

India is striving hard to tackle the problem of under-nutrition among its population on one hand, while the country is simultaneously facing relatively newer problem of obesity or overweight primarily due to faulty eating practices, overeating and sedentary lifestyle (Chakraborty and Bose 2014). The per cent of men and women are categorized as obese or overweight whose Body Mass index (BMI) is above 25.0 kg/m^2 (Table 6.1). In the last ten years (2005-06 to 2015-16) the number of obese people has almost doubled in India according to survey report of National Family Health Surveys 2005-06-NFHS-3 and 2015-16-NFHS-4 (NFHS 2006; 2016).

Table 6.1: Nutritional status based on the WHO and Asian criteria values

Nutritional status	WHO criteria BMI cut-off	Asian criteria BMI cut off
Underweight	<18.50	<18.50
Normal	18.5-24.9	18.5-22.9
Overweight	25.0-29.9	23.0-24.9
Pre-obese	–	25.0-29.9
Obese	≥ 30.0	≥ 30.0
Obese type 1 (obese)	30.0-40.0	30.0-40.0
Obese type 2 (morbid obese)	40.1-50.0	40.1-50.0
Obese type 3 (super obese)	>50.0	>50.0

Source: Llido and Mirasol (2012)

The 2015-16-NFHS-4 depicts that one fifth of Indian women population in the age group of 15-49 years of age were obese (20.7 per cent) which had increased from 12.6 per cent during 2005-06. The Indian women suffering from obesity has increased by more than 64 per cent during the last decade. In case of Indian men, the obesity increased from 9.3 per cent during 2005-06 to 18.6 per cent during 2015-16. As per

2015-16-NFHS-4 report women has higher proportion of obese individuals both in urban (31.36 per cent women versus 27.22 per cent men) as well as rural (18.16 per cent women against 16.82 per cent men) at national level. The figure has exactly doubled in case of men between the age group of 15-49 years during the last ten years (NFHS 2016). Obesity has lead to many non-communicable diseases like cardio vascular diseases, heart stroke, diabetes mellitus and breathing problems. Analysis of obesity in different groups of states has been discussed in the following text.

Predominantly non-vegetarian states

Among the predominantly non-vegetarian states (Punjab and West Bengal) the urban population of Punjab had higher per cent (32.1 and 32.4 per cent men and women, respectively) of obese population than West Bengal (20.7 per cent obese men and 30.6 per cent obese women). The urban population had been suffering more from obesity problems than the rural counterparts in both states of Punjab and West Bengal. The proportion of overweight people in Punjab is higher than the national average while this proportion is considerably lower than the national average in case of the state of West Bengal (Table 6.2). The gap in proportion of obese population residing in rural and urban areas was higher in West Bengal as compared to the state of Punjab. Higher incidence of poverty in West Bengal than Punjab might be the principal reason for higher over nutrition in Punjab. Moreover, Punjab people are primarily the consumers of chicken and mutton as non-vegetarian food as compared to West Bengal where fish is the preferred non-vegetarian food and fish is considered to be leaner non-vegetarian food than the chicken followed by mutton.

Table 6.2: Pattern of obesity in predominantly non-vegetarian states of India

State/UT	Urban		Rural		Overall	
	Men	Women	Men	Women	Men	Women
Punjab	32.1	32.4	25.0	30.6	27.8	31.3
West Bengal	20.7	30.6	11.2	15.0	14.2	19.9
India	27.22	31.36	16.82	18.16	18.6	20.7

Source: 2015-16-NFHS-4

Predominantly vegetarian states

Pattern of obese individuals in the three predominantly vegetarian states of India *viz.* Gujarat, Haryana and Rajasthan, which is largely below the national average, has been depicted in Table 6.3. The higher obese population of 34.5 per cent was found

Table 6.3: Pattern of obesity in predominantly vegetarian states of India

State/UT	Urban		Rural		Overall	
	Men	Women	Men	Women	Men	Women
Gujarat	25.9	34.5	14.4	15.4	19.7	23.7
Haryana	21.0	24.3	19.3	18.8	20.0	21.0
Rajasthan	19.7	23.7	10.6	10.7	13.2	14.1
India	27.22	31.36	16.82	18.16	18.6	20.7

Source: 2015-16-NFHS-4

in urban women of Gujarat while the other urban obese population of these vegetarian states was considerably less than the national average. However, in rural areas, except Haryana (both men and women) the obese population was less than the national average. Gujarat had higher proportion of obese men and women in urban areas followed by Haryana and Rajasthan. However, in rural areas Haryana had higher proportion of obese men and women followed by Gujarat and Rajasthan.

Obesity in non-vegetarian versus vegetarian states

Eating habits and food culture, in addition to food affordability as determinants of nutrition play higher role in rural areas than the urban areas. As a result, Punjab had higher proportion of rural obesity followed by Haryana, Gujarat, West Bengal and Rajasthan. However, sedentary lifestyle and food affordability are major factors for urban obesity which was more prevalent in Punjab followed by Gujarat, West Bengal, Haryana and West Bengal. The comparison is inconclusive especially in urban areas where high proportion of obese population nullifies the notion of exceptionally higher role of non-vegetarian food as source of obesity under Indian conditions.

North-Western Hill states

Among the three North- Western Hill states of India, the highest percentage of obesity was found among urban women in the state of Jammu and Kashmir (40.6) followed by HP (38.4). It might be due to large consumption of non-vegetarian food by the people in these two states, particularly in high hills. In Uttrakhand obesity found was the least both in urban and rural areas when compared with other two states as well as the national average (Table 6.4). Food habits and geography of Uttarakhand being similar to Himachal Pradesh the lower incidence of obesity in the former state might have been due to lower food affordability. The incidence of rural obesity was higher in Himachal Pradesh than other two states while women in Jammu & Kashmir had obesity higher than the national average.

Table 6.4: Pattern of obesity in North-Western Hill states of India

State/UT	Urban		Rural		Overall	
	Men	Women	Men	Women	Men	Women
Himachal Pradesh	26.9	38.4	21.0	27.6	22.0	28.6
Jammu & Kashmir	30.1	40.6	15.8	21.4	20.5	29.1
Uttarakhand	23.0	28.4	14.1	16.0	17.7	20.4
India	27.22	31.36	16.82	18.16	18.6	20.7

Source: 2015-16-NFHS-4

North-Eastern states + Sikkim

The 2015-16-NFHS-4 data reveals that in eight North Eastern states of India including Sikkim, the highest percentage of obesity was found in urban men followed by urban women of Sikkim state (41.5 and 34.1 per cent, respectively). Sikkim state had the exceptionally higher proportion of men as well as women under obese category among all eight states. The obese population of urban men (28.1 per cent) in Mizoram was higher than the national average. Meghalaya, Nagaland and Tripura states had lesser number of obese individuals in all categories compared to their respective national averages. The proportion of obese rural women (22.4 per cent) in Manipur and rural men in the same state (18.4 per cent) was higher than their respective national averages (Table 6.5).

Table 6.5: Pattern of obesity in North-Eastern states of India including Sikkim

State/UT	Urban		Rural		Overall	
	Men	Women	Men	Women	Men	Women
Arunachal Pradesh	26.0	25.7	18.4	16.3	20.6	18.8
Assam	24.8	26.1	10.5	10.9	12.9	13.2
Manipur	21.8	31.2	18.5	22.4	19.8	26.0
Meghalaya	17.1	18.4	08.1	10.2	10.1	12.2
Mizoram	28.1	26.8	09.9	12.3	21.0	21.1
Nagaland	16.6	20.7	12.3	13.2	14.0	16.2
Sikkim	41.5	34.1	29.7	23.1	34.8	26.7
Tripura	18.2	23.5	14.9	12.8	15.9	16.0
India	27.22	31.36	16.82	18.16	18.6	20.7

Source: 2015-16-NFHS-4

Obesity in North-Eastern versus North-Western states

The variation on incidence of obesity was much higher in North-Eastern states vis-a-vis North-Western states. It was primarily due to more number of states having higher variation in food culture and food affordability among North-Eastern states. Overall, the incidence of obesity was higher in North-Western states compared to the North-Eastern states.

Central states/ UTs

The proportion of obese population in seven Central States/ Union Territories has relatively higher diverse pattern. States of Chhattisgarh, Jharkhand and Madhya Pradesh had considerably lower proportion of obese population in all categories compared to their respective national averages. Widespread poverty and higher proportion of vegetarian population (particularly in MP) could be the reasons for this. The higher percentage of obese people between the age group of 15-49 years was found in Dadra & Nagar Haveli and Odisha in all categories compared to their respective national averages. Urban population had higher percentage of obesity due to adoption of sedentary lifestyle and faulty eating habits (Table 6.6). However, the overall incidence of obesity in Central Indian states/ UTs was less than the national average.

South Indian & island states/ UTs

The incidence of obesity was the highest in this group of states. Except urban men population of Lakshadweep and rural women in Karnataka the incidence of

Table 6.6: Pattern of obesity in central states/ UTs of India

State/UT	Urban		Rural		Overall	
	Men	Women	Men	Women	Men	Women
Chhattisgarh	20.0	24.4	06.8	07.8	10.2	11.9
Dadra & Nagar Haveli	33.8	34.2	11.5	06.9	22.9	19.2
Daman & Diu	29.7	32.7	34.2	29.0	30.7	31.6
Jharkhand	19.8	21.7	07.5	05.9	11.1	10.3
Madhya Pradesh	17.6	23.8	07.8	09.1	10.9	13.6
Maharashtra	31.2	32.4	16.4	14.6	23.8	23.4
Odisha	32.4	32.0	13.3	13.2	17.2	16.5
India	27.22	31.36	16.82	18.16	18.6	20.7

Source: 2015-16-NFHS-4

obesity was higher in all these states under all categories compared to their respective national averages. Out of nine South Indian and Island states/UTs of India, the highest obesity was recorded among urban women in Andhra Pradesh (45.6 per cent) followed by urban men in the same state (44.4 per cent), urban women in Lakshadweep (42.4 per cent) and urban men in Pondicherry (40.5 per cent). The obesity might be due to higher purchasing power among the people and excess consumption of food (especially the non-vegetarian) by the people of these states (Table 6.7).

Table 6.7: Pattern of obesity in South Indian & Island States/UTs of India

State/UT	Urban		Rural		Overall	
	Men	Women	Men	Women	Men	Women
Andhra Pradesh	44.4	45.6	28.0	27.6	33.5	33.2
Andaman and Nicobar	38.0	38.3	38.3	26.6	38.2	31.8
Goa	35.3	36.3	28.2	28.5	32.6	33.5
Karnataka	28.6	31.8	17.1	16.6	22.1	23.3
Kerala	31.1	33.5	26.3	31.5	28.5	32.4
Lakshadweep	24.7	42.4	22.2	28.2	24.6	41.4
Pondicherry	40.5	38.1	30.8	33.6	37.1	36.7
Tamil Nadu	30.6	36.2	25.6	25.4	28.2	30.9
Telangana	31.9	39.5	17.9	18.5	24.2	28.1
India	27.22	31.36	16.82	18.16	18.6	20.7

Source: 2015-16-NFHS-4

Urban representative UTs

The Union Territory of Chandigarh and Delhi state have been considered representative states for the urban population as Chandigarh represents the affluent urban class while Delhi represents the mixed group of urban population. The proportion of obese population in Chandigarh (32 per cent men and 41 per cent women) was higher than Delhi (24.1 per cent men and 34.9 per cent women). The 2015-16-NFHS-4 report showed that the larger number of urban women population was suffering from obesity than men in both the states (Table 6.8). The obesity problems in these cities might be due to large working population of both men and women leading to better affordability and faulty eating habits especially the higher consumption of calorie packed junk food. However, many other states especially the South Indian states/ UTs have still higher incidence of obesity in corresponding categories.

Table 6.8: Pattern of obesity in Urban Representative/UTs of India

State/UT	Men	Women
Chandigarh	32.0	41.0
Delhi	24.6	34.9
India	27.22	31.36

Source: 2015-16-NFHS-4

Northern plain states

The two important northern plain states of India *i.e.* Bihar and Uttar Pradesh are the largest population contributing states of India and large proportion of people is living below poverty line in these two states. Percentage of obese population in both the states was well below the national average in all categories and the incidence of rural obesity was much lower than that of the urban obesity (Table 6.9). It might be due to less availability of food due to lower purchasing power of people residing in these two states. Both these states have more or less same incidence of obesity however, women obesity was slightly higher in the state of Uttar Pradesh than the state of Bihar.

Table 6.9: Pattern of obesity in Northern Plain states of India

State/UT	Urban		Rural		Overall	
	Men	Women	Men	Women	Men	Women
Bihar	20.1	23.5	10.9	09.7	12.6	11.7
Uttar Pradesh	20.6	27.1	09.0	12.6	12.5	16.5
India	27.22	31.36	16.82	18.16	18.6	20.7

Source: 2015-16-NFHS-4

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Chapter-7

Traditional Indian foods

Food can convey abundant biological function through dietary components in the human body. In India, traditional knowledge about food processing, preservation techniques and their therapeutic effects has been established since ages. Traditional Indian foods are also recognized as functional foods because of the presence of functional components such as antioxidants, body-healing chemicals, dietary fibres, and probiotics (Belge and Belge 2012). These functional molecules help in weight management and blood sugar level balance and support immunity of the body. The functional properties of foods are further enhanced by processing techniques such as sprouting, malting and fermentation (Hotz and Gibson 2007).

Classical description on nature of foods

Traditionally, Indian foods are classified into three main categories *viz.* Satvika, Tamsika amd Rajsika foods. Satvika foods include cooked vegetables, milk, fresh fruits, and honey meant for truly wise. Foods that introduce the lowest absurd virtues of human behaviour can be listed as meat, liquor, stale and processed foods, garlic, spicy and sour foods are classified as *Tamasika* foods. *Rajsika* foods are energetic foods that give enough energy to carry out daily work (Dubey 2010). Ayurvedic texts have classified food materials on the basis of their nature and use such as *Sukhadhanya* (cereals), *Samidhanya* (pulses), *Phala* (fruits), *Shakna* (vegatables), *Payovarga* (milk products), *Madhyavarga* (alcoholic beverages) and *Mamasavarga* (animal products) (Hegde *et al.* 2013).

Food beyond physical nourishment

In Ayurveda, food is not only meant for physical nourishment, but also forms a basic part of a cosmic birth-death cycle (Chopra and Doiphode 2002). In Rigveda, barley (*Hordeum vulgare*) has been acknowledged as the Aryans' initial staple food. Apupa is a form of cake prepared by frying barley. Aryans knew about rice cultivation; parched rice and cereals were common methods of processing during their period. Aryans used to consume amalgamation of pulses and rice as complementary nutritional elements. *Khichadi* made from rice together with dal (pulse) is highly

nutritious and is easily digested (Sen 2004).The literature of Buddhists and Jains also revealed the extensive use of rice and its gruel for preparation of value added products (Achaya 1994).

Diversity and occasional relevance of traditional foods in India

India is a diverse nation with abundant regional health foods that have been developed according to the climate, culture, season and cropping practices of a particular region. Moreover, certain foods have also evolved in certain regions according to the health condition of a population. Government has also initiated some purposeful endeavours to preserve the traditional knowledge pertaining to Indian foods. With regard to this, a national research project in India has been launched to document the health benefits of traditional health foods across various regions so that a database can be created for preservation of knowledge on processing, preservation and dietary guidelines on traditional foods for the benefit future generation.

History of traditional foods in India

There are several food products which are having quite old history and very popular in different parts of the country. The food products with a unique aroma, taste and fragrance are not only healthy but have therapeutic and medicinal value. The list of such products is countless but certain products are quite popular in specific region and also consumed throughout the country. While talking about Indian traditional foods, fermented food products took first place in Indian food history (Kumar *et al.* 2013). Some of these outstanding food products are mentioned such as *jalebi*, *dosa*, *idli*, *dhokla*, *khaman etc. Jalebi*, a fermented cereals-based pretzel-like product, has been known in northern Indian since 1,450 A.D. Dosa, a traditional fermented pancake food made from rice and black gram, was first documented in the Tamil Sangam literature as early as in 6 A.D. *Dhokla*, a fermented mixture of wheat and Bengal gram of western India, was first mentioned in 1,066 A.D (Prajapati and Nair 2003). *Idli* and *dosa* are the cultural foods of Tamil, Telugu, Malayalam, and Kannada people of Dravidian origins (Palanisamy *et al.* 2012). Besides its uses as breakfast, south Indians eat these cultural foods in every religious and social occasion. *Dhokla* and *khaman* are socially attached to the food culture of every Gujarati in India elsewhere. Similarly, *Siddu*, *Chilra* and *Marchu* are popular fermented foods consumed during customary occasions in Himalaya regions and have long history (Thakur and Bhalla Savitri 2004; Sarkar *et al.* 2015).

Development of dairy products has also been well documented in Indian history. *Dahi* has also been mentioned during 6,000-4,000 B.C and it is considered as one of the oldest fermented milk products available throughout of India (Sharma and Lal 1997). *Dahi* plays an important part in the socio-religious habits in India and is considered a sacred item in many festivals and religious ceremonies. Likewise, *Mishti dohi* (sweetened *dahi*) is a sweetened fermented milk product of Bengalis. *Shrikhand* is an ethnic concentrated sweetened fermented milk product of Gujarat and Rajasthan. Similarly, other Indian ethnic fermented milk beverages have also been consumed for more than 3,000 years. *Lassi*, butter milk, is a by-product obtained in the preparation of butter (*ghee*) from *dahi* using traditional methods, and is the most common energizing beverage (Patidar and Prajapati 1998). *Somar*, an ethnic fermented milk product from cows or yaks, is generally consumed by Sherpa highlanders in alpine regions of the Himalayas to increase the appetite and to cure digestive problems (Tamang 2016).

Traditional foods and changing socio-economic scenario

Indian ethnic fermented foods and beverages have biological functions that enhance several health-promoting benefits owing to the functional microorganisms associated with them. Most of these ethnic fermented foods are prepared in households by women folk, who unknowingly exploited the capabilities of microorganisms, thereby increasing in the shelf life of these foods. However, rapid urbanization and modernization have affected the time-tested traditional technologies for preparation of fermented foods. Besides, Indian herbs and spices like tulsi (*Ocimum tenuiflorum*), neem (*Azadirachta indica*), turmeric (*Curcuma longa*), Ajwain seed (*Trachyspermum ammi*), asafoetida (*Ferula assa-foetida*), bay leaves (*Laurus nobilis*), black pepper (*Piper nigrum*), cardamom (*Elettaria cardamomum*), cinnamon (*Cinnamomum verum*), cloves (*Syzygium aromaticum*), coriander seeds (*Coriandrum sativum*), cumin seeds (*Cuminum cyminum*), curry leaves (*Murraya koenigii*), fenugreek seeds (*Trigonella foenum-graecum*), fennel seed (*Foeniculum vulgare*), garlic (*Allium sativum*), ginger (*Zingiber officinale*), mint leaves (*Mentha piperita*), mustard seeds (*Brassica nigra*), nutmeg (*Myristica fragrans*), saffron (*Crocus sativus*) and sesame seeds (*Sesamum indicum*) are seen to not only lend flavor to bland meals but also have been well documented for their medicinal and therapeutic properties (Ravishankar and Shukla 2007). Therefore, it is the responsibility of our elders to disseminate knowledge regarding traditional food culture of India among their families and societies so that our future generation can relish the essence of tradition Indian foods and can help to

promote health benefits from these miracles. Also, there is an urgent need to document different recipes and protocols of traditional foods otherwise such important information may jeopardize.

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Chapter-8

Involving grandmothers to promote nutrition

Improving the nutritional status of infants and young children in developing countries depends to a significant extent on adoption of optimal nutrition-related practices within the context of the household (Lutter and Rivera 2003). Most policies, research and programmes on child nutrition focus narrowly on the mother-child relation . However, it is highly important to consider the wider household and community environments in which other actors, hierarchical patterns of authority and informal communication networks operate and influence child nutrition practices. In particular, the role and influence of senior women, or grandmothers, has received limited attention. However, Dr Judi Aubel, the founder of the Grandmother Project (2005) carried out an extensive review of the roles of grandmothers in more than 40 non-Western cultural contexts (Aubel 2012). This study has described the core roles of grandmother which comprise of advising, teaching and care-giving. The core roles of grandmothers accepted worldwide are to

- Transmit religious and cultural values and traditions to younger generations;
- Advise and guide younger generations on a variety of issues related to family life;
- Promote family health and provide home treatment for illnesses of children and other family members;
- Advise male family members on issues regarding the well-being of children and women;
- Support young mothers in child care and upbringing of children; and
- Advise pregnant women and young mothers after birth.

Description of the role

Basically, there is existence of three common patterns that are related to social dynamics and decision-making within households and communities (Pokhrel and Sauerborn 2004; Aubel 2012). First, grandmothers play a central role as advisers to younger women and as caregivers of both women and children on nutrition and health issues. Second, grandmothers exercise collective influence on maternal and child

nutrition-related practices, specifically during pregnancy, feeding and care of infants, young children and sick children. Third, men play a relatively limited role in day-to-day child nutrition within family systems. Within families, the role of grandmothers is to pass on traditions related to different facets of child health and nutrition. They play a central role in communicating the 'rules' or 'social norms' regarding child care, including how to massage an infant, how to toilet -train a young child, and when and what foods to give to young children. At the community level , it is the peer social networks of grandmothers that contribute to perpetuating traditional norms and practices (Moestue *et al.* 2007). Grandmothers are highly respected in Indian culture. They advise and guide younger generations on a variety of issues related to family life, including how to feed and care for pregnant women, infants and young children (Masvie 2006). Yet most health and nutrition programmes focus exclusively on children and women of reproductive age and either ignore grandmothers or view them as an obstacle rather than a resource.

Research inputs

In this context, a study conducted in India compared child care-giving and child's nutritional status among rural families where grandmothers are present and those where grandmothers were absent (Sharma and Kanani 2006). The core findings of the study revealed that grandmother's help enabled mother to practice more care-giving behaviours. Further, grandmothers appeared to play an important role in supporting some desirable child feeding practices and increasing the child's calorie intake from complementary foods. Further, the presence of grandmother also appeared to favour some other important desirable practices such as utilization of Anganwadi services. Therefore, there is explicit need to promote the role of grandmothers in childcare in Indian context so as to develop a healthy generation. So, Grandmother's active participation in interventions to improve maternal and child survival, its health and nutritional status needs to be encouraged in the present scenario of nuclear families. The key roles of grandmothers specific to support child care and nutrition have been listed below (Karmacharya *et al.* 2017).

Perpetual child care: Grandmothers are supposed to play this fundamental role through preparing children's food and feeding, practising home remedies for sick children, caring for sick children and also taking care of liquid or water requirements of the infants.

Compassionate mother care: Grandmothers need to provide child care to allow

mothers to do other tasks. They should also assist with domestic tasks to give mothers more time for child care. Besides, emotional support to young mothers may bring out miraculous outcomes of child care and upbringing.

Directing mothers for adequate feeding practices: Grandmother's traditional knowledge regarding healthy food habits can serve a significant role in positive upbringing of the children and maintaining well-being of pregnant and lactating mothers. Grandmothers are supposed to advise mothers for exclusive breastfeeding, feeding during childhood illness and timely introduction of complementary feeding. Also, they need to supervise essential dietary components in the diet of pregnant and lactating women and complement the diets with their wisdom pertaining to traditional foods.

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Chapter-9

Moving towards slow food to curb over nutrition

The quest to achieve faster economic growth has resulted in a competitive work environment in most parts of the world. Consequently, individuals are relying more and more on the ready to eat or quick service foods than ever before. The situation further aggravates when both husband and wife are working. Healthy nutritious foods have been replaced by the convenient food more popularly known as "Fast Food". Fast food comprises of quick, tasty, convenient and fashionable food items. It seems to have engulfed every age; every race and the new entrants are children. Colas, Pizzas and Burgers are suddenly becoming the most important thing. Unexpectedly, children seem to have stepped into a world of fast food (Ramachandran 2011). A study conducted by AIIMS, Delhi has revealed that children from the privileged class are easy victim of overnutrition. They eat more fats and calories in the form of fast and processed food, but their intake of vitamins and micro nutrients are far less than required. Another study stated that over nutrition is emerging as an epidemic in the country and may increase the risk of diabetes and cardiovascular diseases when these children reach adulthood (Tzioumis and Adair 2014). Moreover, the consumption of fast food affects our brain functioning too. Studies indicate that eating foods high in sugar and fat changes the chemical activity of the brain, making it more dependent on such foods. When these foods are discontinued, it creates withdrawal symptoms, which can lead to inability in dealing with stress. Studies have also proved that eating junk food for five days per week regularly can deteriorate memory (Grantham-McGregor and Ani 2001; Grossman *et al.* 2003; Kar *et al.* 2008; Nyaradi *et al.* 2013).

A consumer survey conducted by Indian Market Research Bureau (IMRB) across seven major cities says that nine out of 10 Indians consume less than adequate proteins daily. Another study by the World Health Organization (WHO) says Indian consumers across all income groups are consuming less than the recommended quantity of ($\geq$ 400 gm) fruits and vegetables (PROFAV 2011). As per the findings of NSSO, on an average, the Indian diet pattern is skewed towards cereals, and intake of fruits and vegetables accounts for only 9 per cent of the total calorie consumed (NSSO 2012). Lifestyle is considered the topmost reason for their inability to meet the

recommendation on intake of balanced diet (Table 11). Interestingly, lifestyle is a key reason for low consumption across all age groups but more so among the younger lot (18-35 years). With an increasing per capita income, people have more purchasing power and now opt for easy and quick food. Opening of a number of fast food chains also provides easy access to junk food (Anand 2011). India's fast food industry has doubled between 2013 and 2016, and is estimated to be worth $1.12 billion. Unlike China, which saw a decline in fast food sales last year, India's market is expected to grow due to changing consumer preferences and large young population (KPMG 2016). So, there is gigantic need to change and improve our food habits. The right foundation to good health is to choose food products rich in nutrients with a balanced amount of nutrients such as vitamins, minerals, protein, carbohydrates and a little bit of fat as well.

Indian traditional food and the concept of 'Slow Food'

India has a great culture and it would be a pity if the new trend of standardizing typical Indian dishes in fast food chains overcomes the real food culture and the diversity of Indian culinary products. Traditional Indian food habits were based on changing climates and the diverse crops that grew in the different seasons. So the food habits were adapted to natural cycles. The “Slow Food” movement is probably little known by most people in India. But internationally, it's a fairly well-developed movement founded by Carlo Petrini in 1986 which seeks to preserve the traditional cuisine of an area and encourages the farming of plants, seeds and livestock characteristic of the local ecosystem. The Slow Food Movement was born, with the intention of raising awareness about endangered local foods and traditions. It aims to save a model of food production without harming environment which can ensure quality, flavoursome and healthy food. At the same time, cost of food should be acceptable to both consumers and farmers. This movement believes food is linked to various aspects of life including politics, culture, agriculture and environment. Slow Food is fundamentally directly opposite to the fast food culture and fast pace of life. It is also about realising that humans are a strand in the larger web of life. The way human beings produce and consume food has a direct impact on not only our health, but also on the health of other organisms in the environment. Through right food choices, a collective influence on food cultivation, production and distribution can be shaped to bring about a realistic change in human health.

Spread of Quick Service Restaurants in India

In India, with the onset of fast, junk food and ready-to-eat food packages, the current generation is disconnected from its old food varieties and culinary traditions. Few decades ago, India's staple food was largely comprised of millets like *jowar*, *bajra*, *ragi*, *etc.* and the masses used to eat seasonal produce (Prabhavathi *et al.* 2014). But, rising Indian economy and changing lifestyle has brought a massive change in the eating behaviour of the Indians. There are over 2,700 fast food chain outlets in the country. This number covers mostly the metropolitan and smaller cities and towns, leaving almost all of the rural India untouched. The American pizza chain Domino's has 850 outlets across India, making it the largest fast food chain in the country. McDonald's has only around 400 stores, with plans to add 250 more in the next five years (KPMG 2016). To combat unhealthy eating habits, the government is also considering raising taxes on junk food and sugary drinks through a 'fat tax'. An 11-member team constituted by the government has suggested that the money collected from these taxes should go to the health services. FSSAI is also working on mechanisms to regulate consumption of junk food.

Action plan towards 'Slow Food'

The dietary and physical activity behaviours of children and adolescents are influenced by many sectors of society, including families, communities, schools, child care settings, medical care providers, faith-based institutions, government agencies, media, food & beverage industry and entertainment industry. Schools play a particularly critical role by establishing a safe and supportive environment with policies and practices that support healthy behaviours. Schools also provide ample opportunities for students to include healthy eating practices and encouraging physical activity behaviours. Parents can help their children maintain weight in the healthy range. In early childhood, children should be given healthy, low-fat snacks and encourage to take part in moderate to vigorous physical activity every day (Zakaria and Donato 2016). Older children can be taught to select healthy, nutritious foods and to develop good exercise habits. It is also important that present education system should stress this issue upon all the young children for adopting healthy diet and good food eating habits and also teach and train the young girls in formal healthy cooking. It may be a task but a nation's future is dependent on the good health and well-being of its younger generation. Thus, for a nation that is accelerating towards double digit

economic growth, the health of its human resource along with proper utilisation of abundant natural resources will be a deciding factor. So, it is high time to understand our responsibility to preserve Indian food history so as to feed our next generation in a healthy manner for active and productive life.

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Chapter-10

Glycaemic index of food items as precursor of hyperglycaemia and obesity

Hyperglycaemia is a condition in which blood glucose level is too high because the body isn't properly using glucose or does not make insulin in sufficient quantity or not at all leading to diabetes. Carbohydrates are the main source of glucose in our body. Carbohydrates are metabolised into glucose which is then transported to the cells through the bloodstream. Body needs insulin to regulate blood glucose levels. Insulin is a hormone produced by the pancreas and it helps transporting glucose into the cells, particularly the muscle cells. In people having type 1diabetes, insulin is not produced at all to help their bodies use glucose, so insulin injection/ supplementation becomes necessary, while people with type 2 diabetes may have enough insulin, but their body develops resistance against insulin. In some cases people with type 2 diabetes may also not produce enough insulin. People with diabetes become hyperglycaemic if their blood glucose levels are not regulated by appropriate meal planning, insulin management, and medication.

Hyperglycaemia is generally monitored after fasting and postprandial. Fasting hyperglycaemia is marked by the blood glucose levels more than 130mg/dL after at least eight hours of food intake. Fasting hyperglycaemia is a common diabetes complication. Whereas, postprandial or reactive hyperglycaemia occurs when blood glucose level is above 180mg/dL after 1-2 hours of food intake. Several factors such as faulty food habits, lack of physical activity and skipping glucose-lowering medication can contribute to hyperglycaemia in people with diabetes. However, people without diabetes may also suffer from hyperglycaemia due to certain medications and illnesses. People with hyperglycaemia may experience an increased thirst and/ or hunger, frequent urination, headache, blurred vision and fatigue as early symptoms of this disorder. In severe conditions, people may suffer from ketoacidosis (body produces high levels of blood acids called ketones) and Hyperosmolar Hyperglycaemic Nonketotic Syndrome (dangerously high blood glucose levels).

Ketoacidosis occurs when body fails to adequately regulate ketone production

causing severe accumulation of keto acids resulting in a condition where pH of the blood is substantially decreased and it can cause diabetic coma or even death in extreme cases (Umpierrez *et al.* 2002). Ketoacidosis affects people with type 1 diabetes more than the type 2 diabetic people. Many symptoms of ketoacidosis are similar to hyperglycaemia while other symptoms may include high level of ketones in the urine, shortness of breath, fruit-smelling breath and dry mouth. Besides, nausea, vomiting, stomach pain and confusion can also be caused by the ketoacidosis. Hyperosmolar Hyperglycaemic Nonketotic Syndrome (HHNS) is basically associated with type 2 Diabetics. Elderly and sick people are more prone to HHNS than the active young and adults. HHNS is mainly an outcome of dehydration as a result of frequent urination which in turn is caused by high blood glucose levels and sufferer becomes very thirsty. To avoid HHNS, a keen observance must be kept on blood glucose level during sickness. The signs and symptoms of HHNS include extremely high blood glucose level, dry mouth, high fever, sleepiness and vision loss.

Management of hyperglycaemia

Hyperglycaemia may be prevented or treated through proper meal planning, right food choices, exercise or physical activity and medication (Anees *et al.* 2013).

Diet management: Glycaemic index of food items has high correlation with chronic diseases associated with obesity and insulin resistance. The concept of a glycaemic index was basically evolved to categorize carbohydrate foods on the basis of their capacity to raise the blood glucose after assimilation. Glycaemic index provides an idea of the glycaemic response of a fixed amount of available carbohydrate from a test food to the same amount of available carbohydrate from a standard food consumed by the same individual. Initially, the standard food was glucose, but more recently it has been changed to white bread. Foods can be divided in to three categories based on their GI values such as High-GI foods (> 70), intermediate-GI foods (>55 to < 70) and low-GI foods (< 55). The glycaemic response to an ingested food is not only dependent on the GI but also on the total amount of carbohydrates ingested, and this led to the concept of glycaemic load (GL). GL accounts for the quantity of carbohydrates present in the food and how each gram of carbohydrate in the food raises blood glucose levels. GL is classified as low (< 10), intermediate (11-19) and high (> 20). GL can be calculated by the following formula given by Foster-Powel *et al.* 2002.

GL= {[GI] [available carbohydrate (g)]}/100

Available carbohydrate = total carbohydrate – dietary fibre

One unit of GL corresponds to the glycaemic effect of 1 g of glucose. GL is a measure used as a basis for weight loss, or diabetes control. The GL of a food is dependent on two factors: the GI of the food and the serving size. Therefore, a low GL food can be achieved by either decreasing the GI of the food or by reducing the quantity of carbohydrates from the diet.

Various factors that influence the glycaemic index of food items which tends to change the overall GL of the food consumed include the nature of the starch, insulin response, protein contents, processing techniques, variety, fat, acidity and storage of the food components. The major contributory factors have been discussed under the following heads.

Carbohydrate content: Different components of carbohydrates have been reported to cause variations in postprandial blood glucose responses after consumption of various carbohydrate containing foods by both healthy and diabetic individuals. Some dietary carbohydrates could increase blood glucose levels especially in the postprandial period. A diet rich in some carbohydrates could be harmful to glycaemic control resulting in micro and macrovascular complications. In addition, equivalents increase in plasma glucose, plasma insulin and triglycerides concentrations have also been reported with a high carbohydrate diet. These variations in glycaemic responses have been reported to arise from different components of carbohydrates present in foods and their properties such as starch, dietary fibre and sugars (Gabriele *et al.* 2008).

Starch: Starch contributes about 70-80 per cent of the total carbohydrates in normal diets. On the basis of their rate and extent of digestion, starches are classified into 3 categories, namely rapidly digestible starch (RDS), slowly digestible starch (SDS) and resistant starch (RS). RDS is the starch fraction that causes a rapid elevation of blood glucose leading to a subsequent occurrence of hypoglycaemia. SDS is the starch fraction that is digested slowly but completely in the small intestine to provide sustained glucose release with a low initial glycaemia and subsequently a slow and prolonged release of glucose which enables prolonged energy availability. RS is not digested in the upper gastrointestinal tract but is fermented by the gut microflora, producing short chain fatty acids that provide additional energy to the body.

Dietary fibre: Dietary fibre is broadly known as complex carbohydrate which can be categorized into three constituents 1) non starch polysaccharides (NSP) 2)

oligosaccharides (cellulose, hemicellulose, inulin, pectin, gums, mucilages, polufructoses, arabinogalactans and others), 3) analogous carbohydrates (indigestible dextrins, polydextrose, methyl cellulose and others). Several studies have reported that viscous soluble fibre plays an important role in controlling postprandial glycaemic and insulin responses due to its effect on stomach emptying and macronutrient absorption from the gut. Soluble as well as insoluble fibres have been known for reducing postprandial glycaemia. American Diabetes Association recommends that diabetic patients should consume 14 g/1000 kcal/ day of fibre because a high amount of fibre is necessary to improve glycaemic control (Bantle *et al.* 2008).

Sugar: GI is also influenced by the composition of sugar in a food. For example, sucrose which is made up of glucose and fructose has a lower GI than glucose because half of the sucrose molecule is made up of fructose, a type of sugar that elicits low blood sugar response. In addition, while the GI of sucrose is 68, the GI of glucose is 100. This variation in GI as a result of composition of sugar could also affect the GL.

Insulin response: Another factor that has been known to cause considerable effect on the blood glucose level of an individual after consumption of a carbohydrate rich diet is insulin response. Insulin is the primary hormone used by the body to maintain blood glucose levels within a healthy range.

Practicality of glycaemic index

The concept of glycaemic index becomes less useful because foods are generally consumed in a mixed meal and it becomes extremely difficult to quantify individual quantities of different foods in a meal as well as effect of food mixing on the overall digestibility/ glycaemic index of that meal. Therefore, an appropriate calculation of the mixed-meal glycaemic index is required. Likewise, small amounts of fat added to the meal have also been considered to greatly alter the glycaemic response. So, the glycaemic index can merely be considered as an effective tool for making the choices for a potential consumer to new starchy foods which may not be considered for eating otherwise. The GI of some commonly consumed foods in India has been provided in Table 10.1.

High versus low GI foods

A diet rich in carbohydrates and low in fat generally increases the glycaemic effect of that particular diet. Both the quantity and quality of a carbohydrate influence postprandial glycaemia, and the interaction between the two may be synergistic. In

Table 10.1: Glycaemic index of some commonly consumed foods

Low GI (<55)		Medium GI (>50-<70)		High GI (>70)	
Name of the food	**GI**	**Name of the food**	**GI**	**Name of the food**	**GI**
Chappathi	52±4	Wheat *roti*	62±3	White wheat bread	75±2
Sweet corn	52±5	Brown boiled rice	68±4	Whole wheat bread	74±2
Apple (raw)	36±2	Millet porridge	67±5	White boiled rice	73±4
Orange	43±3	French fries (potato)	63±5	Instant oat porridge	79±3
Banana	51±3	Popcorn	65±5	Rice porridge	78±9
Barley	28±2	Honey	61±3	Cornflakes	81±6
Mango (raw)	51±5			Watermelon (raw)	76±4
Carrots (boiled)	39±4			Potato (boiled)	78±4
Milk (full fat)	39±3			Glucose	103±3
Milk (skim)	37±4				
Chick peas	28±9				
Soya beans	16±1				
Lentils	32±5				
Chocolate	40±3				

Source: *Diabetes care,* December 2008

western countries, typical high carbohydrate diet is based on high-GI foods such as potatoes, breads, and low fat cereal products is digested and absorbed rapidly, resulting in a high glycaemic load and increased demand for insulin secretion. Thus, persons who are insulin resistant consumption of high-GI foods may cause postprandial hyperglycaemia and insulinemia which ultimately contribute to β cell exhaustion and the development of type 2 diabetes.

In contrast, low-GI, high carbohydrate foods may maintain insulin sensitivity and increase the weight-loss potential. Low-GI foods may contribute in weight reduction in two ways such as satiety development and accelerating fat oxidation at the expense of carbohydrate oxidation. These two traits of low-GI foods stem from the slower rates at which these are digested and absorbed and the corresponding effects are evident on postprandial glycaemia and insulinemia. Low-GI foods typically induce higher satiety than do their high-GI counterparts and are followed by less energy intake at subsequent meals. Moreover, a continuous refinement of carbohydrate rich foods

such as wheat grains is a stepwise increase in the food's GI value which ultimately decreases the individual satiety level.

However, a food producing a low blood glucose response is characterized by slower rates of digestion and absorption in the small intestine, nutrient receptors in the gastrointestinal tract are stimulated for a longer period of time, resulting in prolonged feedback through signals such as cholecystokinin and glucagon like peptide-1 to the satiety centre in the brain. Another mechanisms accounting for the satiating effects is insulin concentration. After the consumption of a high-GI meal, insulin concentrations raise which directly leads to a rapid decline in metabolic fuels such as glucose and fatty acid concentrations. Hence, post consumption concentrations of two major metabolic fuels circulating in the blood may become low simultaneously which can be interpreted by the central nervous system as 'low fuel status'.

Association of obesity with high GI foods

A high GI diet affects appetite and nutrient partitioning in a way that promotes body fat storage (Ludwig *et al* . 1999) . High GI foods produce lower fatty acid concentrations throughout the day and bring down the rates of fat oxidation as compared to low GI meals of similar composition (Kiens and Richter 1996). Postprandial hyperglycaemia and hyperinsulinemia are consequences of high GI food intake that are not seen in typical rural societies where low GI diets are consumed. Thus, faster digestion and absorption and higher insulin responses after high GI meals explain the differences in satiety and energy partitioning that promotes expansion of the fat stores. Therefore, the adequacy of low GI diets in the treatment and prevention of obesity have high significance.

Physical activity/ exercise

Regular physical activity in any form is the most vital supplement to diet which may play an inevitable role in the treatment of hyperglycaemia as well as control weight gain (Colberg *et al.* 2010). The brisk walking is the best form of exercise for mitigating hyperglycaemia as it involves large group of muscles of lower limb along with rhythmic upper body muscular work.

The maintenance of normal blood glucose at rest and during exercise depends largely on the coordination and integration of the sympathetic nervous and endocrine systems which are regulated by physical activity. With increasing exercise intensity,

glycogen provides the bulk of the fuel for working muscles. After depletion of glycogen stores, muscles increase their uptake and use of circulating blood glucose, along with free fatty acids. Thus, muscular lipid reserves are more rapidly used during longer-duration activities and glucose production also shifts from hepatic glycogenolysis to enhanced gluconeogenesis (Suh and Paik 2007).

There are two well-defined pathways that stimulate glucose uptake by muscles. At rest and postprandially, uptake of muscle glucose is insulin dependent at resting and postpradial conditions which primarily serves to replenish muscle glycogen stores whereas uptake is increased through muscle contractions during exercise which promotes intramuscular glycogenolysis (Richter *et al.* 1985). As the two pathways are distinct, blood glucose uptake into working muscle is normal even when insulin mediated uptake is impaired in type 2 diabetes. Thus, the most persons with type 2 diabetes can perform exercise safely as long as certain precautions are taken.

Precautions in an exercise programme

The essential aspect of any exercise program is to include 'warm up' and 'cool down' periods each lasting for 5 minutes. Also, the intensity of exercise should ensure 60-70 per cent increase in heart rate. Adults over the age of 20 years may commence a minimum of 30-45 minutes of physical activity of moderate intensity (such as brisk walking 5-6 km/hr) 5-6 days of the week. Long duration or more intense exercises such as jogging, running, cycling and swimming bring about greater health benefits. At the outset, sedentary people should take on a moderate intensity activity of short duration and gradually increase the duration or intensity. Other daily routine activities like walking, housework, and gardening may result in positive impact in weight reduction. Table 10.2 presents an account of calories stent in different activities at different intensities and hyperglycaemic/ diabetic person can make use of this information.

Simple adaptation in lifestyle like climbing up the stairs instead of using the lift and walking for short distance instead of using a vehicle could also help in increasing physical activity significantly. People at high risk for chronic diseases like heart disease and diabetes more specifically inactive men over the age of 40 years, women over the age of 50 years should first consult a physician before initiating any vigorous physical activity such as running and swimming.

Table 10.2: Calories spent during various physical activities

S. No.	Activity	Kcal/ hour
1.	Running 12 (Km/hr) 10 (Km/hr) 8 (Km/hr) 6 (Km/hr)	 750 655 522 353
2.	Cycling 15 (Km/hr)	360
3.	Gardening	300
4.	Cleaning/Mopping	210
5.	Walking 4 (Km/hr)	160

Source: ICMR (2011) Dietary guidelines for Indians.

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Chapter-11

Dietary fat-significance in human health and it's management

Traditional Indian food has generally been fat rich. However, due to changing lifestyle and growing health concerns such as diabetes, obesity and cardio-vascular diseases, more emphasis is being laid on eliminating all unhealthy components from regular diets. Indians have one of the highest prevalence of type 2 diabetes mellitus and coronary artery diseases, compared to other populations of the world. Recently, the overall prevalence of diabetes in 15 major states of India has been reported as 7·3 per cent. The prevalence of diabetes varied from 4·3 per cent in Bihar to 10·0 per cent in Punjab. Moreover, the prevalence has been observed as higher in urban areas (11·2%) than in rural areas (5·2%) (Anjana *et al.* 2017).

Cardiovascular diseases, specifically coronary heart disease (CHD), are epidemic in India. During 2001-2003 CHD had led to 17 per cent of total deaths and 26 per cent of adult deaths, which increased to 23 per cent of total and 32 per cent of adult deaths during 2010-2013. Over the last 60 years CHD prevalence has increased from 1 per cent to 9-10 per cent in urban populations and <1 per cent to 4-6 per cent in rural populations (Gupta and Narula 2016). The possibility to control the genetic factors causing these lifestyle diseases is almost negligible, but monitoring the role of diet, exercise and other environmental factors for cessation of these deadly diseases may bring a phenomenal improvement in the general health. The most crucial nutrient for mitigating sufferings from lifestyle diseases is however, the dietary fat and its management carries very high significance.

Dietary fat and fatty acids

Dietary fat constitutes an extremely important component of human diet. Fats serve as a source of energy as they provide much more calories compared to carbohydrates and proteins. Fat basically exists in three forms *viz*. invisible, hidden and visible fat. Invisible fat is present in small amounts as integral component in different items of food, the fat present in processed and ready to eat foods is recognised as hidden fat while the visible fat such as vegetable oils, ghee and butter *etc*. is used as

cooking oil or added as top dressing. All three kinds of fats jointly constitute total dietary fat intake by an individual (FAO 2008).

Dietary fat consists of heterogeneous mixtures of triacylglycerols (triglycerides TG) and small proportions of phospholipids, glycolipids, monoacylglycerols, diacylglycerols and unsaponifiable fraction composed of fat soluble chemicals collectively designated as non-glyceride components. Fatty acids, the building blocks of various lipids, are classified into 3 groups *i.e.* saturated fatty acids (SFAs), monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs). Further, the SFAs containing straight even-numbered chains of 4-24 carbon atoms are grouped in to three categories such as short (<10:0), medium (12:0 and 14:0) or long (16:0-24:0) chain fatty acids. MUFAs contain one double bond in the fatty acid chain with all of the remainder carbon atoms being single bonded. PUFAs with more than one double bond are grouped into two series (n-6 or n-3) depending on the location of the double bond closest to the methyl end which may be placed at C6 or C3 position (FAO 2008).

Humans can synthesize SFAs and MUFAs besides obtaining from the diet, while they cannot synthesize the parent PUFAs, namely, linoleic acid (LA, 18:2n-6) and alpha-linolenic acid (ALA, 18:3n-3) which makes them essential fatty acids for a diet. LA and ALA are metabolized by consecutive chain elongase and desaturase enzymes to long chain (LC) n-6 PUFAs (arachidonic acid AA) and LC n-3 PUFAs [eicosapentaenoic acid (EPA) docosapentaenoic acid (DPA) and docosahexaenoic acid (DHA)] respectively, which are present in lipid membranes. Indian diets usually are high in LA levels but low in ALA levels. Moreover, the elongation process of ALA to LCn-3 PUFAs is sluggish and variable due to competitive interactions among LA, ALA and the various intermediates formed during their metabolism to LC PUFAs. Also several other factors such as nutritional as well as hormonal factors can influence the metabolism of LA and ALA to their respective LC PUFAs (Mani and Kurpad 2016).

Functions of fatty acids in human health

Fatty acids play numerous roles such as biosynthesis of membrane lipids and lipid mediators, generation of cellular energy, development of central nervous system, modulation of lipoprotein metabolism. Besides, excessive intake of fatty acids also develops the risk for diet-related non-communicable diseases namely CHD, diabetes and cancer *etc*.

PUFAs in early growth and development of child: During early years of foetus development and infancy, there is a rapid accumulation of AA and DHA in infant brain, DHA in retina and AA in the whole body for meeting the demands of rapidly growing tissues/ organs (Hopiavuori *et al.* 2016). The foetus entirely depends on the maternal source of LA, ALA, AA and DHA which are deposited in maternal tissues and also provided by the diet and human breast milk is unique in that it provides AA and DHA in addition to other fatty acids and infant obtains these PUFAs through the breast milk. In view of the high variability in the formation of DHA from ALA and because of its crucial role in normal retinal and brain development in the human, DHA is considered conditionally essential during the early human development. Minute quantity of DHA is also present in cell membranes throughout the body (Vannice 2014). AA and DHA have different and specific roles in neural and behavioural functions. DHA is crucial for the function of rhodopsin for vision and postsynaptic receptors for neurotransmission.

Modulation of membrane structure and functions: Being an integral part of cell membranes, fatty acids affect membrane fluidity and lipid protein interactions which may alter activity of cellular receptors for hormones and neurotransmitters, membrane-related transport systems, ion channels and membrane bound enzymes. AA and EPA of membrane phospholipids also give rise to an array of potent bioactive eicosanoids (thromboxanes, prostacyclins and leukotrienes). The eicosanoids derived from AA have strong pro-inflammatory, pro-aggregatory and vasoconstricting effects as compared to the opposing or weak effects of eicosanoids derived from EPA (Sassa and Kihara 2014). Recent studies have identified that PUFAs of n-6 and n-3 series and their metabolic products regulate the production of lipid cellular mediators. In view of the potent role of essential fatty acids and their respective LC PUFAs in diversified biological effects, their absolute levels and their ratio (n-6: n-3) in diet is the most essential characteristic to consider. Although a dietary ratio in the range of 5:1 to 10:1 has been recommended, the emphasis should be on increase in the absolute levels of ALA and LCn-3 PUFAs (ICMR 2010).

CHD and other non-communicable diseases: A strong and consistent association has been documented between dietary fats and CHD. Elevated serum levels of total cholesterol, low density lipoprotein (LDL) cholesterol and total triglycerides; low serum levels of high density lipoprotein (HDL) cholesterol and increased ratios of total cholesterol to HDL cholesterol are associated with increase in risk of CHD (Szostak-

Wegierek *et al.* 2013). Dietary fatty acids modify the concentrations of plasma triglycerides and lipoprotein cholesterol fractions which affect CHD risk significantly. SFAs such as Lauric, myristic and palmitic acids increase serum LDL and total cholesterol. TFAs in addition to increasing serum LDL also decrease the protective effects of HDL cholesterol and increase the lipoprotein which further increases the CHD risk. Recent studies have shown that high intake of essential fatty acids and LC-PUFAs lower the risk of CHD. Interestingly, low fat-high carbohydrate diets as compared to higher fat intakes result in a metabolic syndrome. These changes include a reduction in serum HDL cholesterol and increase in the triglyceride concentrations, and show higher responses in postprandial glucose and insulin concentrations. Many studies have documented beneficial effects of LC n-3 PUFA on endothelial function, inflammation, vascular reactivity and ventricular arrhythmias (Kris-Etherton and Fleming 2015).

Non-glyceride components and their nutritional and health promoting effects

The non-glyceride components of fats from animal foods contain cholesterol whereas plant foods contain plant sterols and a wide range of other chemical compounds. Besides, fat soluble vitamins (A, D, E, K) and carotenoids also constitute the non-glyceride components. Vitamin E, carotenoids, sesame lignans, oryzanols and phenols have antioxidant effects and their unique role in lowering LDL cholesterol is also well documented. The synergistic effect of these components is greater than their individual effects in escalating the antioxidant potential of human diets and in the prevention of hypercholesterolemia. Therefore, increasing plant sterols and other non-glyceride components from natural plant foods and vegetable oils could provide an additional dietary means.

Dietary fat consumption pattern and requirements

In India very low-income and deprived groups, with inadequate intakes of 1,300 to 1,500 calories, get majority of their fat invisibly, and this constitutes about 8 per cent energy whereas this figure is 32 per cent energy in the high socioeconomic groups of many Indian regions. To maintain a good health, FAO/WHO suggested about 18-20 per cent energy from fats in developing countries (FAO/WHO 1977).

Fat requirements: The new recommendations by ICMR (ICMR 2010) has suggested that dietary fat should provide a minimum of 20 per cent of energy in a normal diet, which ensures <10 per cent energy from saturated fatty acids (SFAs) and 6-10 per cent

energy from polyunsaturated fatty acids (PUFAs) and 9-15 per cent energy from monounsaturated fatty acids. The proportion of trans-fats should be <1 per cent of fat energy in the diet. In India, about 1.1 million metric tonne of hydrogenated vegetable fat is being produced annually, and a large amount is utilized in confectionery, bakery and ready-to-eat foods (Nishida and Uauy 2009) hence the risk of trans-fats consumption in India is quite high.

Vegetable oil consumption pattern in India

In India, the consumption of vegetable oil is influenced by the community preferences largely driven by the taste, availability and crops grown in particular region or state. For instance, palm oil is the most preferred oil in southern India due to the warmer climate (palm oil gets a cloudy appearance in colder climates) and easy availability from South-East Asia. Soybean oil is mainly used in northern and central regions of India due to the local availability of soybeans. Whereas, mustard oil is largely consumed in north-eastern, northern and eastern regions of India, as its pungency is a desired and inherent part of the local cuisine. Further, economics also have an impact in determining consumer choice, given that expenditure on edible oil constitutes a significant portion of the household budget (Hegde 2012). With regard to this, demand of oil is significantly increasing with an increase in per capita income. For instance, during 2016-17, the per capita consumption of vegetable oils was recorded to be 16.4 kg/ year whereas the corresponding figure in 1950 was 3 kg/ year.

Composition of major Indian cooking oils

The fatty acid composition broadly gives the content of SFAs, MUFAs and PUFAs present in oil. The highest amount of SFA *i.e.* 92 and 50 per cent is present in coconut oil and palm oil respectively (Table 11.1). They differ from all other commodity oils in their higher level of medium chain acids, especially lauric acid (48% and 45% respectively). Safflower oil, sunflower oil, flaxseed oil, soybean oil and cottonseed oil contain high amount of PUFA *i.e.* 78, 69, 69, 61 and 55 per cent, respectively. The highest percentage of essential fatty acids such as linoleic and linolenic acid is present in safflower oil (78%) and flaxseed oil (53%) respectively. The highest amounts of MUFA *i.e.* 73, 68 and 62 per cent are present in olive oil, mustard oil and canola oil, respectively. Groundnut oil contains 22 per cent SFA, 45 per cent MUFA and 33 per cent PUFA while rice bran oil contains 42 per cent MUFA, 34 per cent PUFA and 24 per cent SFA. Flaxseed oil followed by mustard oil and canola oils

has the lowest ratio of n-6 to n-3 (omega-6 to omega-3) ratio which is very crucial to maintained at low levels for being healthy (Table 11.2).

Table 11.1: Fatty acid composition of different vegetable oil

Vegetable oil	Fatty acids % by weight			SFA:MUFA:PUFA ratio
	SFA	MUFA	PUFA	
Palm Oil	50	40	10	1:0.8:0.2
Safflower Oil	9	13	78	1:1.4:8.6
Sunflower Oil	12	19	69	1:1.6:5.8
Flaxseed Oil	10	21	69	1:2.1:6.9
Soybean Oil	15	24	61	1:1.6:4.1
Coconut Oil	92	6	2	1:0.1:0.02
Cottonseed Oil	26	19	55	1:0.7:2.1
Olive Oil	16	73	11	1:4.6:0.7
Mustard Oil	3	68	29	1:22.6:9.6
Canola Oil	6	62	32	1:10.3:5.3
Groundnut Oil	22	45	33	1:2:1.5
Rice Bran Oil	24	42	34	1:1.8:1.4
Recommendations by WHO	27-33	33-40	27-33	1:1.5:1

Source: NIN (2005) Dietary Fats and Non - Communicable Diseases. National Institute of Nutrition (NIN), Hyderabad, India.

Table 11.2: Percentage of essential fatty acid present in different vegetable oil

Vegetable oil	Essential fatty acids		n-6/n-3 ratio
	n-6	n-3	
Palm Oil	10	0	infinite
Safflower Oil	78	0	infinite
Sunflower Oil	68	1	68
Flaxseed Oil	16	53	0.2
Soybean Oil	54	7	8
Coconut Oil	0	0	0.0
Cottonseed Oil	54	1	54
Olive Oil	10	1	10
Mustard Oil	15	14	1
Canola Oil	22	10	2
Groundnut Oil	32	1	32
Rice Bran Oil	32.5	1.5	22
Recommendations by WHO	20-26	3-7	5-10

Source: NIN (2005) Dietary Fats and Non - Communicable Diseases. National Institute of Nutrition (NIN), Hyderabad, India.

WHO and the American Heart Association have recommended Rice Bran Oil as the only edible vegetable oil with the fatty acid ratio (1:1.8:1.4) which is closest to their technical recommendation (1:1.5:1). Due to presence of high amount of MUFA (oleic acid) and PUFA (linoleic acid) vegetable oils like olive oil, cottonseed oil, groundnut oil, and sunflower oil amongst others are classified as oleic–linoleic acid oils. Other oils such as rapeseed and mustard seed oil fall under the category of erucic acid oils as their predominant unsaturated fatty acid is erucic acid (C22). Canola oil is a type of rapeseed oil with reduced erucic acid content.

Erucic acid controversy

Mustard oil is thought to be one of the healthiest vegetable oils owing to its fatty acid composition (rich in MUFA and PUFA). But at one time it was not considered fit for human consumption by the western world due to its high erucic acid levels and the role of erucic acid in decreasing the contractible force of heart muscle. Taking into account the toxic effects of erucic acid, ICMR has recommended using mustard oil in combination with some other oil so as to reduce the intake of erucic acid. However, later studies showed that mustard oil may be the best for heart health (Mishra and Manchanda 2012; Rastogi *et al.* 2004). The alpha -linolenic acid found in mustard oil reduces the adhesion-aggregation tendency of blood platelets which decreases the risk of a heart attack. Further, the consumption of mustard oil (rich in linolenic acid) as a cooking medium has also been found to reduce the incidence of heart disease by about 70 per cent in some studies (Singh *et al.* 1997).

Efforts have been made by many ICAR institutes and SAUs to evolve varieties of mustard having low erucic acid such as Pusa Karishma, Pusa Mustard 21, Pusa Mustard 22, Pusa Mustard 24, Pusa Mustard 29, Pusa Mustard-30, Pusa Double Zero Mustard-31, RLC-1, RLC-2, RLC-3, GSC-7 and GSC-6.

Stability issues of cooking oils

Vegetable oils' quality and stability are the main factors that influence its acceptability and market value. The quality of cooking oils may be degraded by numerous chemical mechanisms such as thermal degradation, hydrolytic rancidity, and oxidative rancidity (Vieira *et al.* 2015). Thermal degradation occurs due to heating of oils. Optimal frying temperatures are considered as 180ºC. Any vegetable oil having frying temperature more than recommendations can be used for frying. However, prolonged frying of oil triggers the free fatty acids formation which ultimately decreases the smoke point to the frying temperature. This problem can lead to the development of acrolein, a potentially toxic compound. Oils can also chemically

degrade by non thermal hydrolytic rancidity in the presence of water, at high temperatures, exposure to light, metal contact and at extreme pH.

Saturated lipids are much more stable to oxidation than unsaturated lipids, which make them desirable in foods very susceptible to oxidation such as frying oils. The oxidative rancidity of vegetable oil is directly proportional to the unsaturated fatty acids, more specifically PUFAs. The higher the proportion of PUFAs in vegetable oil, the greater would be its oxidation which is responsible for unpleasant odours and tastes, thus affecting the shelf life of the oil. This is why MUFAs are often preferable to PUFAs in processed foods.

Precautions in using cooking oils

The food application of edible oils mainly depends upon the two most important physicochemical properties *viz*. smoke point and rancidity. Deep-fat frying changes the physical and chemical properties of oil due to formation of non-volatile compounds as discussed in previous section. These non-volatile compounds affect flavour stability, quality and texture of fried foods during storage. The standard value of smoke point for any edible oil must be 200°C to make it suitable for deep frying. The smoke points of different vegetable oils given below (Table 11.3) may direct the selection of suitable oil for frying.

Table 11.3: Smoke points of different cooking oils

S. No.	Cooking oil	Smoke point
1.	Safflower oil	265°C
2.	Mustard oil	254°C
3.	Rice bran oil	254°C
4.	Sunflower oil	246°C
5.	Soybean oil	241°C
6.	Canola oil	238°C
7.	Corn oil	236°C
8.	Ground nut oil	231°C
9.	Olive oil (light)	242°C
10.	Olive oil (Pomace)	238°C
11.	Olive oil (Virgin)	199°C
12.	Olive oil (Extra virgin)	191°C

Source: Codex Alimentarius Commission (1999) Recommended International Standard for Named Vegetable Oils. Codex Stan 210-1999. FAO and WHO. Rome, Italy.

Choice of cooking oil for deep frying

Palm oil and its products, mainly palm olein, belong to the most important oils used for the preparation of fried food. The reason is that the oil is relatively cheap, it is available in huge amounts, it has a high oxidative stability and results in high-quality and tasty foods.

Groundnut oil is an ideal choice for deep-frying because it can be heated to a higher temperature. Sensory parameters such as colour, taste, crispiness and overall acceptability have been appeared well in the fried products prepared even after repeated frying. Rice bran oil is ideal cooking oil since it does not decompose at high temperatures to form toxic compounds and is suitable for deep-frying. Rice bran oil frying helps products absorb 12-25 per cent less oil than groundnut oil hence it is the best oil for deep-frying and everyday cooking (Gopal *et al.* 2005). An additional advantage of rice bran oil is that eatables fry faster in rice bran oil and absorb less oil while it also has an excellent keeping quality and oxidative stability due to presence of unique antioxidant oryzanol.

Dual purpose oils for cooking and salad dressing

Fully refined soybean oil can be used directly as a salad oil or as cooking oil. Soybean oil is a major ingredient in commercially produced mayonnaise and salad dressings. However, the type of oil used to produce mayonnaise and salad dressings is likely to vary depending on the availability of different vegetable oils in specific regions or countries. Similarly, sunflower oil is also used in spreads, salad dressing as well as in cooking. Olive oil known as MUFA rich oil is used as both a cooking oil and a salad oil in many parts of the world. Olive oil is usually used for cooking operations while extra virgin olive oil is used as salad dressing. The virgin olive oils may be consumed raw in toasts, salads and other food stuffs. Canola oil is widely used as cooking and salad oils, in table spreads, for baking and in a variety of other prepared foods. Salad dressing with vinegar and canola oil can also reduce the possible bacterial load associated with the green leafy vegetables, including Salmonella. Cottonseed oil also has many food applications and besides a good quality cooking oil it is used in mayonnaise, salad dressings, sauces, and marinades.

Conclusion

With the changing consumption pattern of dietary fat the nutritional recommendations for fats and oils will continue to evolve based on new researches and findings on the impact of fatty acids on human health. However, most organizations

working in this area have given unanimous recommendation that the consumption of saturated fats should be decreased whereas the intake of essential fatty acids should be increased. However, making major alterations in the lipid composition of foods can be quite challenging because solid fats have important physical properties whereas polyunsaturated oils are very susceptible to oxidation, leading to development of off-flavours, loss of nutrients, and formation of potentially toxic compounds. Therefore, the substitution of highly unsaturated fats for solids fats could have negative nutritional consequences in largely tropical/ subtropical countries like India unless technologies are utilized to prevent their oxidation. All these challenges are motivating food manufacturers, oil producers as well as consumers to utilize oils high in MUFAs because they have higher smoking points and have more oxidative stability. MUFAs have neutral effects on heart health so this alteration in fat source might be beneficial to consumers' health.

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Chapter-12

Nutritional Anaemia-causes and management

Healthy living necessitates adequate nutritional balance in the body as created by the amount of food ingested in proportion to the amount of nutrients utilized by the body so that a normal functioning is ensured and sufficient nutrient reserves are also maintained in the body. This balance may be depleted under diverse situations such as decreased intake of balanced diet and nutrients, increase in nutritional losses, increased demands for nutrition, decreased absorption and changed utilization of nutrients. When this disturbance takes place due to one or more of these reasons, a nutrient deficiency occurs and the body uses its nutrient reserves to meet the demand. When these nutrient reserves are exhausted, all the physical functions of human body in which that nutrient plays a part are affected. Nutritional anaemia also takes place in the body due to cessation of the production of red corpuscles haemoglobin. Amongst the elements which contribute to the formation and development of red corpuscles and to the synthesis of haemoglobin, iron occupies the foremost place followed by other minerals like copper, zinc, magnesium, cobalt and molybdenum *etc*. while folic acid and vitamin B12 are the most specific among vitamins which are responsible for this function (Hercberg and Rouaud 1981). Basically, anaemia is the decreased ability of the red blood cells to provide adequate oxygen to the body tissues. It may be due to reduction in red blood cells (RBCs) count and decreased amount of haemoglobin in RBCs which is an oxygen carrier substance. The World Health Organization (WHO) has defined anaemia as a haemoglobin concentration below 7.5 g/dl in women (12 g/dl is normal) and below 8.1 g/dl in men (13 g/dl is normal) (WHO 2011; Table 12.1).

Table 12.1: Haemoglobin levels to categorize anaemia (g/dl[#])

Age group	Non-anaemia	Anaemia		
		Mild	Moderate	Severe
Children				
6-59 months	= 11.0	10.0-10.9	7.0-9.9	<7.0
5-11 years	= 11.5	11.0-11.4	8.0-10.9	<8.0
12-14 years	= 12.0	11.0-11.9	8.0-10.9	<8.0
Non-pregnant women (= 15 years)	= 12.0	11.0-11.9	8.0-10.9	<8.0
Pregnant women	= 11.0	10.0-10.9	7.0-9.9	<7.0
Men (= 15 years)	= 13.0	11.0-12.9	8.0-10.9	<8.0

Source: WHO (2011); [#]: g/ dl = grams per decilitre

Common factors leading to anaemia

Overall common factors responsible for causing anaemia are massive loss of blood, nutritional anaemia and excessive destruction of RBCs.

Massive blood loss: The body may lose enough blood from a wound or other lesions to cause severe and acute anaemia. The reasons for blood loss may include excessive menstrual flow (among women), or slow loss of blood from an ulcer/ cancer of the gastrointestinal tract. Such anaemia generally disappears when the contributory causes are identifies and propertly treated.

Nutritional deficiencies and abnormalities of RBC synthesis: Anaemia may develop if the diet is deficient in the nutrients required for the synthesis of haemoglobin and the formation of erythrocytes such as iron, folic acid, vitamin B12, and other associated vitamins and minerals. The combination of poor diet and chronic loss of blood makes for particular susceptibility to severe anaemia. Anaemia associated with iron-folic acid deficiency is very common under Indian conditions.

Excessive destruction of Red Blood Cells: Anaemia may also develop due to haemolysis which in turn is caused by trauma, chemical agents/ medications, infectious disease, isoimmune haemolytic reactions and autoimmune disorders *etc*.

Nutrients associated with nutritional anaemia in India

Under Indian conditions, the deficiency of three nutrients *i.e.* iron, vitamin B9 and vitamin 12 is largely responsible for nutritional anaemia.

Iron deficiency: Iron deficiency is the most prevalent nutritional deficiency in India. The causes of iron deficiency include poor dietary iron intake, poor absorption of iron by the body, and loss of blood (heavy menstrual bleeding or wounds). In children, iron deficiency may also be due to the lead poisoning. Iron deficiency develops gradually after the depletion of normal stores of iron in the body and in the bone marrow. Women are generally at higher risk of this deficiency due to lower reserves of iron (due to increased loss through menstruation) as compared to men of same age group. However, at later stages such as post menopause in women, anaemia is generally due to gastrointestinal blood loss associated with ulcers, the use of aspirin or nonsteroidal anti-inflammatory medications, and parasite infestations. The same factors can also become reasons for iron deficiency in males. The most vulnerable group affected by iron deficiency include infants, children, and adolescents in rapid growth phases; women of child-bearing age who have blood loss through menstruation; pregnant or

lactating women who have an increased requirement for iron; and people with vegetarian food habits for sustained period of time (UNICEF 2002).

Folic acid (vitamin B9) deficiency

Vitamin B9 is found in two forms *i.e.* folate and folic acid. Folate is in natural form while folic acid is synthetic form of vitamin B9 and collectively, it is known as folacin. Folate is abundantly present in the foods of plant origin. This abundant vitamin is under consumed by people whose food habits do not emphasize plant foods. Folate or vitamin B9 deficincay has been considered one of the major factors in the development of megaloblastic anaemia (a condition in which the bone marrow produces unusually large, structurally abnormal and immature RBCs).

The primary cause of folate deficiency is low intake of folate rich foods and bioavailability impairment (Allen 2008). Due to structural differences, bioavailability of both folate and folic acid differs from each other. The number of glutamate molecules affects the absorption and metabolism of folate or folic acid in the body. The folate food form has many glutamate molecules attached to it as compared to folic acid containing only one molecule of glutamate. Enzymes in the intestine have to remove these glutamate molecules until there is only one left, before folate can be absorbed into the bloodstream. Additionally some inhibitory factors may slow down folate absorption and negatively affect the benefit of folate from foods such as deficiency in the mineral zinc on which enzymes are dependent, excess intake of foods such as legumes, cabbages and oranges as they provide fibre which can inhibit enzyme activity and last one is alcohol consumption whereas supplemental folic acid is not affected by these factors.

Other situations in which the risk of folate deficiency increases include losses due to food preparation and prolonged lactation. Folate is relatively unstable to oxidation and heat which causes 50-80 per cent loss in green leafy vegetables and 50 per cent loss in legumes (Dang 2006). Whereas, some preparation techniques in cooking like chopping and grinding have been proved to increase folate bioavailability in spinach. Moreover, ascorbic acid in foods improves folate stability. Besides, prolonged lactation may be a cause of folate depletion of some women in developing countries. No doubt, breast milk contains good folate concentrations and reserves are maintained even when maternal intake and status are poor but long duration of breastfeeding may develop it's deficiency.

Vitamin B12 (Cobalamin) deficiency

The most common reasons for vitamin B12 deficiency consist of a diet completely lacking in foods of animal origin, their relatively high cost, lack of their availability, and/or cultural and religious beliefs and factors impairing the absorption of vitamin B12. Vitamin B12 absorption is a complex process, involving a series of steps that can be affected adversely by many factors. Cobalamin mixes with haptocorrin which is a cobalamin binding protein produced by salivary and esophageal glands during chewing and swallowing of food (Carmel 2003). After its release from proteins in food by gastric acid and pepsin, it is bound to haptocorrin in the acid pH of the stomach, then released from haptocorrin by proteolytic enzymes in the alkaline pH of the small intestine, and bound to intrinsic factor secreted by the stomach. Subsequently, the vitamin is absorbed as a cobalamin-intrinsic factor complex by binding to specific receptors in the ileal mucosa. The complex is taken into lysosomes, where the cobalamin-intrinsic factor complex is disintegrated and intrinsic factor is degraded. The cobalamin is metabolized to its methyl and deoxyadenosyl forms, and released into plasma mainly in the methyl form. In plasma, cobalamin is transported and transferred to body cells bound to transcobalamin, which carries about 25 per cent of the cobalamin in plasma.

Absorption of this vitamin can be hampered by intestinal disease, infections, and medications (Gueant *et al.* 1990). Most of the times, this impairment is marked by food-bound cobalamin malabsorption due to gastric atrophy in the elderly, and probably as a result of Helicobacter pylori infection. Also, there is burgeoning evidence of gene polymorphisms in transcobalamins that may affect vitamin B12 concentrations in plasma. Deficiency symptoms appear within 2 to 5 years when malabsorption is due to lack of intrinsic factor or to intestinal abnormalities, because absorption of the enterohepatically recirculated vitamin is also impaired. However, when malabsorption is caused by poor release of the vitamin from food, as in gastric atrophy, the efficiency of enterohepatic recirculation may be normal, but the quantity reabsorbed is low once liver stores become depleted.

Vitamin B12 has been identified as the anti-pernicious anaemia principle. The persistent deficiency of which may cause development of pernicious anaemia (a condition in which RBCs decrease due to inability of the body to absorb enough vitamin B12). Fundamentally, pernicious anaemia is an inherited disorder manifested by lack of intrinsic factor, and accompanied by cobalamin malabsorption. The parietal

cells of the stomach lining fail to secrete enough intrinsic factor to ensure intestinal absorption of vitamin B12. This is the result of atrophy of the glandular mucosa of the fundus of the stomach and is associated with absence of hydrochloric acid.

Symptoms and outcomes of nutritional anaemia

Initially anaemia often shows mild symptoms such as easy fatigue or a lack of energy, however, at later stages, more severe symptoms may appear. For instance, there could be shortness of breath, a rapid pulse rate caused by the inability of blood to supply the body tissues with enough oxygen and this might lower the productivity of an individual considerably. Besides, pale coloured skin, lips, tongue and inner surface of eyelids (conjunctiva); sore tongue, brittle nails, concave nails, unusual food cravings (called pica), decreased appetite (especially in children) and frontal headache etc. might also indicate anaemia. But in chronic conditions, swelling of the ankles and other evidence of heart failure may appear. Thus, nutritional anaemia ultimately leads to impaired cognitive performance at all stages of life, a significant reduction of physical work capacity and productivity, an increased morbidity from infectious diseases, a greater risk of death of pregnant women during the perinatal period and negative foetal development such as intrauterine growth retardation, low birth weight and premature deliveries may occur.

Measures to prevent nutritional anaemia

An integrated approach to mitigate nutritional anaemia has always been recommended and following imperative components need to be focussed towards this goal.

Dietary measures: Dietary sources of iron and folic acid include vegetarian and non-vegetarian foods whereas; vitamin B12 is present only in the foods of animal origin. Vegetarian sources of iron include lentils/ beans, whole grains/ products made from these foods, while the non vegetarian sources of iron are red meat, fish, liver, and egg yolks. Moreover, iron being present as ferrous in non-vegetarian dietary sources is better absorbed than in ferric form (available in vegetarian sources). Sprouted grains and beans have enhanced the bioavailability of the iron and consuming iron-rich foods along with the foods that contain vitamin C (Ascorbic acid) help in better absorption of iron (ICMR 2010). Iron inhibitors, such as tannin, caffeine and some essential minerals, prevent iron from being absorbed and should be consumed separately from iron rich foods.

The food sources of folate are leafy vegetables such as spinach, asparagus, turnip greens, lettuces, dried or fresh beans and peas, fortified grain products (pasta, cereal, bread), sunflower seeds and certain other fruits (orange juice, grapefruit juice, banana, raspberry, grapefruit, strawberry) and vegetables (beets, broccoli, corn, tomato juice, vegetable juice, Brussels sprouts). Vitamin B12 is found only in animal-source foods, so intake is entirely dependent on the amount of animal source foods in the diet, except where foods are fortified with the vitamin.

Supplementation: During different physiological conditions, the requirements of nutrients increased. Hence, supplementation of nutrients along with regular diet becomes necessary to prevent any deficiency (Johnson-Wimbley and Graham 2011). During pregnancy and lactation, dietary requirement of iron is increased so intake should also be increased and women should take iron supplements. Iron supplements are generally combined with folate or folic acid, since both play a synergistic role in RBCs synthesis. Iron supplements, along with improved diet and eating habits, healthier hygiene and sanitation practices, deworming, and other solutions are generally required. Oral iron supplements are in the form of ferrous sulfate. The best absorption of iron is on an empty stomach, but many people are unable to tolerate this and may need to take the supplement with food. Milk and antacids containing calcium may interfere with absorption of iron and should not be taken at the same time when iron supplements are taken. Taking vitamin C supplements or eating vitamin C rich foods at the same time when iron supplements are taken can increase absorption and is essential in the production of haemoglobin.

Management of parasitic infection: Parasitic infestation is one of the most often cause of iron losses in the developing countries. The best way to avoid getting intestinal parasites is to maintain personal and environmental hygienic conditions. This can be achieved through developing the hygiene maintaining habits in daily regime like frequent hand washing *viz.* after using the toilet and before eating food using soap and clean water. Further, utensils and raw materials like vegetables and fruits used for cooking need to be thoroughly washed and cleaned, and stored in hygienic conditions. Keeping the environment clean and free from excreta (human and animal) is also important to prevent parasites. Dwelling areas should be cleaned regularly and animals should be kept separate, preferably in fenced areas, to avoid contamination of areas where children are likely to play. Since malaria increases the

risk of anaemia, bed nets should always be used where malarial mosquitoes are prevalent. In areas with high rates of parasitic infestations, de-worming should also be carried out on regular basis at least every six months or more frequently if necessary.

Government's input for anaemia prevention in India

Taking into consideration the incidence of anaemia, National Anaemia Prophylaxis Programme for iron and folic acid supplementation started in India through the primary health care system is focussing on majority of adolescents and pregnant women of the country. The major components of the anaemia prophylaxis programme are to provide supplementation of 20 mg elemental iron and 100 µg folic acid to pre-school children and 60 mg elemental iron and 500 µg of folic acid to pregnant women. In the revised programme *i.e.* National Anaemia Control Programme, non anaemic women are also covered to get iron (100 mg) and folate (500 µg) and those with anaemia should get two tablets daily. Integrated Child Development Services projects are also engaged in implementation of this programme. Under this programme, the expectant mother is given a pack of 100 iron-folic acid tablets with an instruction to take one tablet a day after food as a prophylactic measure and if mother has visible signs of anaemia, she is advised to take two tablets a day as a therapeutic measure.

Besides, a multipronged strategy having two vital aspects for the control of anaemia in pregnancy has also been suggested. First aspect is fortification of common food items like salt with iron to increase the dietary intake of iron. Moreover, fortification with iron has been successfully tried for wheat flour, rice, sugar, milk, fish, sauce and curry powder. Second aspect is to create awareness among mothers about the adverse effects of anaemia and its dietary management through nutrition education. Therefore, above mentioned strategies may go a long way in reducing adverse consequences of anaemia as a prospective approach for improving maternal and child health. Further, for efficient management of nutritional anaemia under Indian conditions the readers could repeatedly refer to the Table 12.2 for knowing the recommended dietary allowances of nutrients associated in combating anaemia. Recently launched mega programme 'National Nutrition Mission' (see Chapter-3) has been targeting mitigation of anaemia very seriously.

Table 12.2: Recommended Daily Dietary Allowances for Indian population

Group	Particulars	Body weight (kg)	Iron (mg/d)	Ascorbic acid (mg/d)	Dietary folate (µg/d)	Vitamin B12 µg/d
Men	Sedentary work	60.0	17	40	200	1.0
	Moderate work	60.0	17	40	200	1.0
	Heavy work	60.0	17	40	200	1.0
Women	Sedentary work	55.0	21	40	200	1.0
	Moderate work	55.0	21	40	200	1.0
	Heavy work	55.0	21	40	200	1.0
	Pregnant woman	55.0	35	60	500	1.2
	Lactating (0-6 months)	55.0	25	80	300	1.5
	Lactating (6-12 months)	55.0	25	80	300	1.5
Infants	0-6 months	05.4	46 µg/kg	25	25	0.2
	6-12 months	08.4	05	25	25	0.2
Children	1-3 years	12.9	09	40	80	0.2-1.0
	4-6 years	18.0	13	40	100	0.2-1.0
	7-9 years	25.1	16	40	120	0.2-1.0
Boys	10-12 years	34.3	21	40	140	0.2-1.0
Girls	10-12 years	35.0	27	40	140	0.2-1.0
Boys	13-15 years	47.6	32	40	150	0.2-1.0
Girls	13-15 years	46.6	27	40	150	0.2-1.0
Boys	16-17 years	55.4	28	40	200	0.2-1.0
Girls	16-17 years	52.1	26	40	200	0.2-1.0

Source: ICMR (2010)

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Chapter-13

Nutrition indicators for ATARI Zone-1 states and strategies for further improvement

The jurisdiction of ICAR-Agricultural Technology Application Research Institute (ATARI) Zone-1, Ludhiana includes the states of Punjab, Haryana (before restructuring in 2017), Himachal Pradesh, Jammu & Kashmir and Uttarakhand (included after restructuring in 2017). This zone is a mix of hilly states (HP, J&K and Uttrakhand) as well as agriculturally most advanced states (Punjab and Haryana). This chapter has encapsulated current status of nutrition indicators in these states and key strategies planned and implemented by the state governments to improve nutritional status of their inhabitants.

Punjab

Punjab is one of India's richest and agriculturally most developed states. This food abundant state, helped India achieve food self sufficiency during the Green Revolution. The state is well known as the "Bread Basket" of India which creates an apparent impression that problems related to availability aspect of food security don't exist here. But the recent situation analysis is showing contrary reality of this affluent state. As per the latest report of 2015-16-National Family Health Survey-4 (NFHS-4), wasting (low weight to height ratio) among children of Punjab has increased from 9.2 per cent in 2005 to 15.6 per cent in 2015 and one in four children is still stunted (low height to age ratio). Punjab has India's fourth lowest proportion of children younger than five who are underweight (21.6%). Infant and child mortality rates are considered as the most reliable indicators of quality of life health/ nutrition and socio economic conditions of any state or country. Punjab has shown an improvement in both these indices. In 2015-16, the Infant Mortality Ratio (IMR) at 29 per 1000 live births and Under 5 Mortality Rate (U5MR) at 33 per 1000 live births are much lower than the previous years. Further, anaemia seems to be a major problem amongst children in Punjab. But, a little decrease in the figures of children has been observed under five years of age who are anaemic (56.6%) as per 2015-16-NFHS-4 report as compared to 2005-06-NFHS-3 report (66.4%).

The proportion of anaemic men has more or less doubled between 2005-06-NFHS-3 (13.6%) and 2015-16-NFHS-4 (25.9%), and the proportion of anaemic women has also gone up from 38 to 53.5 per cent during this period in the state of Punjab. The occurrence of anaemia is on higher side among non-pregnant women of 15-49 years of age (54.0 per cent) too. This matter is of serious concern for the state government. Simultaneously, Punjab is also facing problem of obesity which is growing at alarming rate. In the decade to 2015, obesity among men (27.8%) and women (31.3%) increased by 5.6 and 1.4 percentage putting more Punjabis than before at risk of different non-communicable diseases. In view of the incidence of under and over nutrition prevailing in Punjab, redesigning the health and nutrition strategies may be necessary so as to restrain communicable and non-communicable diseases among the dwellers of this state.

Haryana

Haryana is a state which is also a part of 'granary bowl' and a 'focal' area of agriculture and livestock husbandry in India. At the same time, the issue of hunger is also presuming significance in this economically affluent state. But this state has shown an improvement in the nutritional status of the children. The 2015-16-NFHS-4 data reveals that the proportion of stunted children under five years of age (34%), wasted (21.2%) and underweight (29.4%) has decreased from the levels of one decade earlier. The IMR at 33 and U5MR at 41 have also shown a decline in the state as compared to earlier levels documented by NFHS-3. A reduction in prevalence of under-nutrition among adult women (15.8%) has also been observed. Iron deficiency Anaemia (IDA) in Haryana is a serious public health problem and is a reflection of undernourishment and poor dietary intake of iron, an essential micronutrient. According to WHO (2017), 40 per cent and above prevalence of anaemia in a population has been classified as a severe public health problem. Haryana have seen an increase in the prevalence of anaemia and it is all persistent among children (71.7%) followed by women (62.7%). Haryana is a leading state with high per capita income and low poverty rates but still witnessing poor nutritional status of vulnerable groups which shows that in spite of being adequate food production, its availability has to be ensured to satisfy everyone's dietary needs. A multipronged strategy, as suggested towards end of this chapter, needs to be adopted to bring about improvements in public health.

Himachal Pradesh

Interestingly, Himachal Pradesh is one of the three leading states in India on the basis of four indicators *viz.* life expectancy; literacy rate; sex ratio; and lower

percentage of population living below poverty line (BPL). Based upon sex ratio, female literacy and life expectancy women are favourably placed in the state. But, a distressing sign has come to notice in the latest 2015-16-NFHS-4, according to which more than half the number of women between 15-49 years of age, including pregnant women, are anaemic. Equal number of children in the age category of 6-59 months in this hill state also has lesser haemoglobin. The most serious aspect is that the incidence of anaemic women in Himachal (53.5 per cent) has increased by 10 per cent from 43 per cent in last one decade. The percentage of anaemic women in Himachal is not only higher than the national average, but is against the trend of decline in anaemic women at country level. In Himachal, 50.2 per cent pregnant women are anaemic. Anaemia in men has also increased slightly from 18 to 20.1 per cent over that period of ten years.

Besides, Himachal Pradesh is also known as endemic regions for iodine deficiency. School age children (6-12 years), pregnant mothers and neonates are the most vulnerable groups as they are especially sensitive to even marginal iodine deficiency. However, there are only few reports to support the incidence of iodine deficiency in the state. The 2015-16-NFHS-4 only reported the household iodized salt consumption in India. But, a recent study conducted in three districts of Himachal Pradesh namely Kangra, Kullu and Solan has documented the data on indicators of iodine deficiency *viz.* Total Goitre Rate (TGR), Urinary Iodine Concentration (UIC), Thyroid Stimulating Hormone (TSH). In school age children, TGR has been reported as 15.8 per cent (Kangra), 23.4 per cent (Kullu) and 15.4 per cent (Solan) (Chander *et al.* 2013). Whereas, the analogous values among pregnant women were 42.2, 42.0 and 19.9 per cent in Kangra, Kullu and Solan, respectively (Sareen and Kapil 2017).

Uttarakhand

In terms of per capita income, this state falls at sixth rank, but, the nutrition situation is still poorer in Uttarakhand than many poor states with its infant mortality rate (IMR) ranking 18th among 29 states. Over 10 years to 2015-16, the IMR has decline at 40 deaths per 1,000 live births but still worse than other poor states such as Himachal Pradesh. A fifth of all children below five years of age are wasted. A quarter of newborn babies are underweight, compared to 36 and 28 per cent in Rajasthan and Jharkhand, respectively for the year 2012-13. The proportion of stunted children has come down relatively faster from 44 to 34 per cent in a decade ending 2015-16. A proportion of underweight has also reduced from 38 to 27 per cent in the decade. Iodine deficiency is also prevailing in this state. A study conducted in three districts of Uttarakhand namely Udham Singh Nagar, Nainital amd Pauri Garhwal has revealed

that the TGR among these three districts is 13.2 per cent (Udham Singh Nagar), 15.9 per cent (Nainital) and 16.8 per cent (Pauri Garhwal) (Sareen and Kapil 2017). Whereas, among pregnant women the figures are observed as 16.1, 20.2 and 24.9 per cent in Udham Singh Nagar, Nainital and Pauri Garhwal, respectively. TSH levels of >5mIU/L have been found 55.3 per cent (Udham Singh Nagar), 76.4 per cent (Nainital) and 72.8 per cent (Pauri Garhwal) of neonates in Uttarakhand (Kapil 2015).

Jammu & Kashmir

Jammu & Kashmir, a land of magnificent beauties is well known as paradise on earth, but the overall nutrition related data have also revealed worrisome depiction of the health scenario even in this beautiful state. The current IMR and U5MR of the state are at 32 and 38 respectively, but providentially these figures have shown a decline as compared to NFHS-3 report given in the year 2005-06. Similarly, the percentage of wasting (27.4%), stunting (12.1%) and underweight (16.6%) has also shown a reduction as per the current scenario given by 2015-16-NFHS-4 for the children under five years of age. A positive sign is that the proportion of anaemic in the state has also come down in the dwellers of all age groups from the previous years. The incidence of anaemia has reduced to 38.1 per cent in 2015-16 from 55.7 per cent in 2005-06. Further, the proportion of obesity both in men (20.5%) and women (29.1%) has shown higher incidence of over nutrition compared to the proportion of underweight (under nutrition) which is 12.1 and 11.5 per cent among women and men of the state.

Key nutrition strategies

ATARI Zone-1 states are comprised of varied geographical localities, food habits & cultures and nutritional deficiency patterns. The problems relating to malnutrition can be tackled using two pronged strategy of following an integrated and uniform approach in all the states and a precise need based location specific approach as explained under following points.

- The community-based approach for health and nutrition services is the key strategy to ensure that services reach those for whom they are meant. To promote community led action in the field of nutrition, community monitoring is considered as an important aspect. There is need to bring an improvement in the community contribution through advocacy and capacity building so as to create a favourable environment for utilization of available health and nutrition services and enhancing quality of services locally.

- Considering the incidence of health indicators of these states, a successful planning and execution of National Health Programmes seeks a serious attention of the aligned departments related to health and nutrition as the nutritional status of mother and child is of utmost importance to build a healthy society. To attain this target, proper training of Accredited Social Health Activist (ASHAs), development of Self Help Groups at local level and involvement of Panchayati Raj Institutions (PRIs) is very much crucial to frame a strong network amongst beneficiaries and health care providers. Besides, strengthening of Village Health Sanitation and Nutrition Committees and proper utilization of Village Health and Nutrition Days (VHNDs) as a platform for assured and predictable package of outreach services should be the major activities for improving maternal and child health.
- Further, interpersonal communication is needed to be encouraged for the adoption of good maternal and child health care practices through strengthening community participation. This can be achieved through local level health functionaries like ASHA, Auxiliary Nurse Midwifery (ANM), Anganwari workers; extensive use of print and electronic media and widespread contribution of local leaders to reach the community. Health promotional programmes including advertisement of key concepts using the local health celebrities (*e.g.* renowned body builders/ players) by the Health Department and its aligned other departments is expected to bear desirable fruits.
- An extensive approach such as mapping of the neediest as well as hard and remote districts, blocks and villages among the states should be adopted for successful implementation of nutrition programmes. Moreover, motivation of the health staff should also be a vital component of any health programme. As, most of the employee aspire to serve at places that have easy accessibility and where the proper facilities to lead a comfortable lifestyle are available. In order to provide a stimulus to the workforce and attract them to such areas it is essential to provide better incentives for personnel posted at such locations.
- In addition, the convergence of different departments such as the Department of Health and Family Welfare, Department of Women and Child Development, Department of Medical Education, Department of Education, Department of Urban Development and Department of Rural Development can play a key role to pave way for an unbeaten nutrition policy. It has been observed more often than not that different departments are carrying out various activities in isolation and with the result there is duplication of same activities in some areas while simultaneously

there exist serious implementation gaps due to the time and money constraints of an individual department.

- In hilly states such as Himachal Pradesh and Uttarakhand, iodine deficiency is prevailing to higher extent which can lead to disabilities and psychomotor impairment among children. So, special focus should be given on universal household consumption of adequately iodised salt and community based monitoring- especially through salt testing in schools, health centres and panchayats.
- Besides, the state governments should also take in to consideration the location specific research area pertaining to health and nutrition so as to enrich the program delivery and to enhance uniformity of better health standards in all the states..
- Viewing child nutritional role beyond mother-child relation in a comprehensive family atmosphere assigning higher important to other family members particularly the grandmothers needs to be seriously followed.
- Health of people being paramount important for any nation to progress, Government of India should ensure higher budgetary allocation to this sector as most of the institutions/ agencies related to health and nutrition are facing severe paucity of funds.
- There needs to be a focused approach in targeting vulnerable groups particularly the downtrodden communities, homeless and migrant people who have been cut-off from the mainstream and feel socially alienated.
- Government of India has been putting a lot of emphasis on girl child development schemes like *"Beti Bachao-Beti Padhao"*. In order to empower girl children comprehensively, the health and nutritional programmes should also be linked to such mega schemes.
- Significance of low cost food alternatives needs to be vigorously promoted in a country like India where very large proportion of people is poor and several commonly known health foods are beyond their affordability. Nutrient/ vitamin wise low cost health options such as *amla*, *ber*, guava, kinnow, millets, local fruits/ vegetables *etc.* need to be identified and popularized through various awareness programmes.

All ATARI Zone-1 states, except Uttarakhand, have reasonably better health standards than the national average. However, health standards in all these states are lagging far behind the ideal standards. This chapter, particularly the nutritional strategies, provides highly potent recommendations for tackling the problem of malnutrition in all these states.

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Chapter-14

Delivering nutrition awareness in ATARI Zone-1 states through National Nutrition Week celebration

Awareness about nutrition can make a lot of difference in the health of the society and country as a whole. Nutritional deficiencies can render significant population of a country unproductive. The persistence level of under-nutrition and over-nutrition and the slow pace of its decline in our country is a major cause of concern. Though the urban population of the country seems a little better off in terms of awareness on nutrition, yet they are nowhere near to the desirable nutritional levels in countryside India. Under-nutrition, vitamin and mineral deficiencies, obesity, over-nutrition and diet-related chronic diseases do exist side by side in our country. Whether food supplies are scarce or abundant, it is essential that people should know how best to make use of their resources to ensure nutritional wellbeing. To be adequately nourished, individuals need to have access to sufficient and good quality food and they need an understanding of what constitutes a good diet for health, as well as the skills and knowledge to make good food choices (FAO 2016).

About the National Nutrition Week

Nutritional awareness and education involve people gaining knowledge about nutrition and being encouraged to bring about desired changes in their food habits. The aim is to bring awareness in individuals about the importance of adequate and proper nutrition, provide psycho-educational materials that reinforce messages about healthy eating skills, promote healthy food essential for making dietary change and provide information on how to sustain eating behaviour change. The goal of nutritional awareness is to motivate individuals to eat healthy and balanced diet. Thus, to promote healthy living among individuals, it was considered necessary to promote healthy eating habits by increasing people's awareness on the nutritive value of foods and proper dietary practices by organizing various programmes aimed at improving knowledge about what we are eating and what should we include or exclude and restrict in our diet.

National Nutrition Week has been regularly celebrated in India from 1 to 7

September (first week) since 1982 to intensify nutrition awareness through various modes and widespread outreach programmes even in the far flung areas of the country. Nutritional education focused on practical aspects of nutritional knowledge, has been playing an important role in raising public awareness and ultimately improvement in the health of society.

Theme for year 2017

This week is organized on specific themes with the active cooperation of respective State Governments, Educational Institutions, Research Organizations, KVKs and NGOs with wide coverage in print and electronic media. Every year, the theme for the National Nutrition Week is given by National Nutrition Board of India so that the various problems related to nutrition and health can be tackled in a better way. During 2017 the theme of the nutrition was "Optimal Infant & Young Child Feeding Practices: Better Child Health" and was focused on the essential feeding practices of the infant and young children that must optimally be carried out to ensure proper growth, development and nourishment of the infants and young children. At the centre of the theme for National Nutrition Week 2017 were issues revolving around adequate maternal nutrition including before, during and after pregnancy, the benefits of breastfeeding, and awareness on how to begin introducing complimentary feeding items (solid food items) to a child's diet. A series of awareness programmes related to proper maternal and child nutrition care to be taken were conducted in order to mitigate various health risks (MoWCD 2017).

Child feeding practices

While the Indian children are malnourished to multiple dimensions, the ultimate aim is for all children to be free from malnutrition in all its forms. However, large proportion of infants and children do not receive optimal feeding in our country. Important measures to promote better child health through optimal infant and young child feeding practices are as following:

(a) Adequate maternal nutrition before and during pregnancy and lactation

(b) Promotion of breast feeding by promoting following points

1. Early initiation of breastfeeding within 1 hour of birth ,
2. Exclusive breastfeeding for 6 months of child's age, and
3. Continue breastfeeding during illness (WHO 2017a)

Mothers and families need to be supported for their children to be optimally breastfed. Introduction of nutritionally-adequate and safe complementary (solid) foods at the age of 6 months together with continued breastfeeding up to 2 years of age or beyond. This is a critical period of growth during which nutrient deficiencies and illnesses contribute higher under-nutrition and mortality among children of less than five years of age.

Complementary foods should be adequate and need to be given in adequate amount at right frequency and having a variety of foods to fulfil the nutritional needs of the growing child while maintaining breastfeeding. Feeding young infants requires active care and stimulation, where the caregiver should be responsive to the child's signs for hunger and he/ she should also encourage the child to eat. This is referred as active or responsive feeding (WHO 2017b).

Role of KVKs

For creating awareness on different issues related to agricultural, animal husbandry and nutrition and health of rural population at district level, Krishi Vigyan Kendras (KVKs) are working under ICAR, State Agricultural Universities (SAUs) and Non Governmental Organizations (NGOs). These KVKs are working for upliftment of the rural and peri-urban stakeholders. The scientists of Home Science discipline are working for the empowerment of women in the areas of nutrition & health, income generating activities, drudgery reduction at household and farm level, food processing and conservation of rural crafts *etc*.

Sixty seven KVKs of ICAR-ATARI, Zone-I celebrated the National Nutrition Week during 2017 The KVKs of Punjab, Himachal Pradesh, Jammu & Kashmir and Uttrakhand states working under the technical guidance of ICAR-ATARI, Zone-I conducted various programmes during the week. Convergence and linkages were established with Anganwari workers and Child Development Project Officers at district level for making the nutrition programme more visible and large number of farm women were contacted during this week. Demonstrations were organized or implemented as per the needs of the farm women as this method ensures very high level of learning. Although complete demonstrations require considerable effort, the payback comes when women adapt practices in higher proportion they perceive to be appropriate for their conditions under the principal of “seeing is believing”. Stakeholders who observe demonstrations of the latest practices, apply that knowledge to improve overall health of their all family members.

Programmes/ activities of KVKs

Scientists in all KVKs across the four states *i.e.* Himachal Pradesh, J&K, Punjab and Uttrakhand worked hard during this week to make this programme successful. Various off campus as well on campus method demonstrations were conducted for the farm women by the scientists. The off campus demonstrations focussed the farm-women, who are unable to visit the KVKs, can be benefitted at the level of their respective villages. The demonstrations included preparation of nutritional diet for women, adolescent girls, children, weaning foods for children, integrated nutrition garden, low cost nutritious recipes, discussions on importance of growth monitoring and child nutrition and awareness on new WHO growth and health standards *etc*. Organization of mini exhibitions at district level, nutrition quiz competitions, nutrition rally, poster competition, slogan making competition, recipes competition, puppet shows/ street play *etc*. were also undertaken to further strengthen the movement. Video clipping for creating mass awareness about the nutritional problems faced by the various stakeholders were prepared to understand and address the problem more efficiently.

Various activities were carried out during the week and these were telecasted/ broadcasted through All India Radio (Doordarshan), Facebook, WhatsApp, other websites and press media during the celebration period. Short Messaging Service (SMS) was also used during this period to mobilize larger number of farm women so that the messages could be reached to farm-women in remote and hilly area who could not be able to participate in these programmes due to paucity of time. Apart from the above mentioned activities, dissemination of nutrition information to the masses was also undertaken by organizing exhibitions on nutrition in the various Kisan Melas/ fairs at state and regional level.

The main components of National Nutrition Week celebrations at KVK level were as follow:

- Empowering mothers with nutrition and health education,
- Reaching the adolescent girls,
- Ensuring better coverage of expectant and lactating mothers,
- Improving dietary pattern of infants and children,
- Ensuring health and family welfare, and
- Ensuring community participation in various programmes organized by KVKs.
- Harnessing traditional knowledge of grandmothers

Method demonstrations

The Subject Matter Specialists (Home Science) organized demonstrations on Amylase Rich Food (ARF) for infants, nutritious *pinni* using multigrain atta, sprouted pulses, *raita* and other products for improving protein supply in the diet of children which are also easy to digest. Besides this, many other demonstrations were conducted on iron rich recipes having green leafy vegetables, weaning diets for children like nutritious *poha*, *halwa*, *khichari*, soup of vegetables, cutlets prepared from cereals vegetables, pulses, finger and barnyard millet *namkeen*, snacks prepared from vegetables, pulses and various recipes from *ragi*, along with improved methods of cooking and processing *etc*. The demonstrations on integrated nutrition/ kitchen garden occupy a key position in the farming system which enables us to grow safe and healthy vegetables at home with an opportunity to make use of clay flower pots and backyard space. This activity saves our money in addition to ensuring availability of fresh and nourishing food for entire family. Special emphasis was also given on identification and popularization of nutrient/ vitamin wide locally available cheap foods for ensuring nutritional security of people who lack adequate purchasing power to buy popular health foods. Various millets, fruits and vegetables were suggested to combat specific deficiencies of different nutrients and vitamins.

Kitchen gardens

For promotion of health and prevention of malnutrition, there is need to create awareness among farmers and farm women to develop kitchen gardens in order to grow fresh and clean vegetables for making them a part of our daily diet. Based on the concept that the human diet in India is mainly cereal based food and the consumption of even low cost protective foods is far below the satisfactory levels. Vegetables, fruits and pulses constitute the major source of all types of protective elements like vitamins, minerals and proteins, hence their inclusion in everyday diet is absolutely necessary. An adult requires 400 g vegetables, 30-50 g fruits and 85 g pulses for normal maintenance of health. But survey suggested that in villages, on an average, the intake of pulses is around 40 grams, vegetables 180 g and insignificant quantity of fruits was part of their daily diet. Majority of the farmers are buying vegetables, fruit and pulses from the market at exorbitant prices to meet their family needs. These food items may be laden with pesticides which aggravates the health problems. The poor farmers are inadequately nourished although they have the land and resources. Creation of kitchen gardens is considered to be a significant step to mitigate these problems.

KVKs are playing very important role to guide farmers by laying out demonstrations in selected households and model kitchen gardens in KVKs so that the visiting farmer(s) can visualize and replicate the same model in their backyard. KVKs distributing free vegetable kits and plants to women during National Nutrition Week. A total of 9821 participants from targeted farm-families participated in the method demonstrations conducted by KVKs of Zone-1 during this week. The highest number of farm women of Punjab (4705) participated in these demonstrations conducted by 20 KVKs of the state followed by farm women of Jammu & Kashmir (3078) during this week. Anganwari workers and Child Development Project Officer and other extension officials related to nutrition collaborated with the KVK scientists in organizing this programme. The highest number of participation of Anganwari and CPDO/ other officers was from Punjab (586 & 159) (Table 14.1). This encouraging participation in the programmes conducted during the week and collaboration with the KVK personnel played important role to make this week a success in their respective districts.

Demonstration on kitchen gardening

Preparation of nutritious biscuits for children

Preparation of nutritious snacks for pregnant and lactating mothers

Preparation of nutritious weaning food for infants

Demonstration on low cost weaning food for children

Preparation of nutritious recipes

Low cost nutritious snacks

Preparation of nutritious snacks

Explaining nutritional importance of green leafy vegetables

Preparation of multi-grain atta pinni

Other extension activities

The principal goal of extension programmes is to provide necessary information to farmers/ farm women and assisting them to assimilate this information, impart skill and attitude to adopt the technology. The Subject Matter Specialists (Home Science) helped the women in developing a nutrition plan (innovative plans based on available resources and socio-economic considerations) for their families for obtaining the appropriate and necessary nutrition to remain healthy, be physically fit,

Table 14.1: Details of method demonstrations conducted by KVKs during National Nutrition Week celebration

State	Method of Demonstrations	Farm women participated	Anganwari workers	CPDO, Other officers
Punjab	Nutritional diet for women	647	102	64
	Weaning foods among the children	993	232	18
	Nutritional recipes for pregnant and lactating women	631	108	61
	Nutritious and low calories food for young women and children	513	36	4
	Integrated Nutrition Garden	1126	64	7
	Iron rich recipes	795	44	5
	Total	4705	586	159
Uttrakhand	Nutritional diet for women	162	9	1
	Weaning foods among the children	78	7	24
	Nutritional recipes for pregnant and lactating women	83	19	6
	Nutritious and low calories food for young women and children	107	21	9
	Integrated Nutrition Garden	236	14	4
	High Iron rich recipes	213	19	5
	Total	879	89	49
Himachal Pradesh	Nutritional diet for women	298	53	4
	Weaning foods among the children	130	14	0
	Nutritional recipes for pregnant and lactating women	187	34	2
	Nutritious and low calories food for young women and children	138	95	3
	Integrated Nutrition Garden	103	3	0
	Iron rich recipes	303	39	2
	Total	1159	238	11
Jammu & Kashmir	Nutritional diet for women	445	89	16
	Weaning foods among the children	307	75	16
	Nutritional recipes for pregnant and lactating women	433	105	12
	Nutritious and low calories food for young women and children	1419	105	14
	Integrated Nutrition Garden	140	90	13
	Iron rich recipes	334	92	11
	Total	3078	556	82
Grand total of Zone-I		9821	1469	301

and lead a healthy life. Various extension techniques were employed during the week by scientists for educating the masses about the importance of nutrition in diet. The various extension activities such as preparation of nutritious weaning foods, snacks, recipes *etc.*, educating members of farm-families on nutritional management, creation of nutrition gardens, distribution of nutritious foods to vulnerable sections of the society and preparation cum distribution of literature on nutritional management, were conducted for educating the members of farm families especially the women.

Discussions were also held with rural women regarding daily intake of food and nutrients and how to improve their family's diet. Young children in schools were educated about nutrition through slogan making, poster making and essay writing competitions. Product development competitions for farm-women and quiz competitions were also organized to widespread the message of nutrition and health during this week. These competitions helped children to enhance their interest in food and nutrition and finally the prizes were also distributed to the winners. Lectures/ lecture cum demonstrations on nutrition and lifestyle diseases, diet during pregnancy and lactation, use of oats and *alsi* in diet, importance of green leafy vegetables, fruits and dry fruits in diet *etc*. were organized during the week. Film shows, exposure visits, recipe competition *etc*. were also held for improving not only diet but also cleanliness/ sanitation of their homes and their surrounding areas.

Overall 15515 farm women and children participated in the extension activities organized by the KVKs of this Zone during this week. The highest participation was observed from the women and children from Punjab followed by Jammu & Kashmir. A total of 243 extension personnel from line departments also participated in these programmes and the highest participation (149) was observed from the state of Punjab (Table 14.2).

Distribution of nutritious food to school children

Explaining nutritional requirements of pregnant women

Table 14.2: Extension activities conducted by KVKs during National Nutrition Week celebration

State	Extension Activities	No. of farm women participated	No. of Anganwari workers	CPDO, Other officers
Punjab	Awareness camps	1229	684	42
	Recipes Competition	59	15	0
	Group meeting/*Mahila Ghosti*	1248	110	30
	Lecture	691	213	24
	Lecture & demonstration	1889	193	40
	Poster /Slogans competition	364	186	10
	Essay Writing	38	50	3
	Film show (2)	@	@	@
	Distributed plants and vegetable kits	22	14	0
	Total	5540	1465	149
Uttrakhand	Awareness camps	1540	67	4
	Essay Writing	120	0	0
	Group meeting	336	28	4
	Lecture	281	13	0
	Lecture &demonstration	433	28	4
	Poster/Slogans competition	176	29	5
	Total	2886	165	17
Himachal Pradesh	Awareness camps	1531	113	15
	Declamation contest	224	12	0
	Essay Writing	200	32	0
	Exhibition/Exposure visit	182	31	0
	Group meeting	206	32	8
	Nutrition quiz	206	45	2
	Recipes Competition	85	31	0
	Skit	30	6	0
	Slogans	70	142	5
	Total	2734	444	30
Jammu & Kashmir	Awareness camps	1339	342	10
	Debate competition	0	116	12
	Exposure visit/*Mahila Ghosti*	520	65	8
	Group meeting	89	6	0
	Lecture	1657	348	0
	Lecture & demonstration	685	96	17
	Recipe competition	65	1	0
	Total	4355	974	47
	ICAR-ATARI, Zone I	15515	3048	243

@: not applicable as the films were shown to large number people irrespective of any specific group

Awareness on anaemia mitigation

Distribution of vegetables kits

Checking health status of women

Haemoglobin-level testing for school girls

Group discussion on anaemia management

Anaemia prevention through diet

Distribution of literature for nutritional management

Inculcating knowledge on nutritional management

Stressing importance of traditional millets

Measurement of children's height

School level poster competition on nutritional awareness

Poster presentation by school children

Publications

Publications being an important part in disseminating technological information among different categories of stakeholders were prepared and distributed during method demonstrations and extension programmes in the form of leaflets, pamphlets, handouts and folders. This printed material contained the information on specific topics discussed during the programme organized during the week. The literature was provided to the educated women so that it can be read repeatedly and as and when the stakeholder wishes he/ she can refer to it again and again. The literature was published in the regional languages for better understanding of the message disseminated to the farm women. A total of 17676 documents were distributed among farm women of Zone-I during the awareness generation about nutrition. The highest number of documents (5342) were distributed by the KVKs of Punjab to the farm women during the programmes conducted in National Nutrition Week (Table 14.3). These documents were primarily on recipes of Amylase Rich Food, how to reduce anaemia, layout of kitchen gardens, low cost nutritious recipes, iron rich recipes and weaning foods for children *etc*.

Table 14.3: Documents developed & distributed to farm women during the nutrition week

State	No. of documents distributed to farm women				
	Folders	Handouts	Leaflets	Pamphlets	Total
Punjab	229	2253	898	1962	5342
Uttarakhand	584	602	458	338	1982
Himachal Pradesh	143	131	221	248	743
Jammu & Kashmir	486	216	200	640	1542
Total	2398	6188	3354	5736	17676

Utilization of mass media

Mass media were also utilized by the scientists of KVKs of Zone-I during this week for reaching to the farmers who were not able to attend the programmes conducted during this week. Mass media helps to reach the stakeholders in a shot span of time without disturbing the daily schedule of the targeted farmers as it is the best way to reach and disseminate the information to the stakeholders these days. During this week, 6 radio talks as well as 3 television talks were conducted on various topics related to nutrition to create mass awareness about improving their daily diet (Table 14.4).

Table 14.4: Details of mass media utilization by KVKs of Zone-1 during the National Nutrition Week celebration

SI. No.	Media	Name of KVK	Date
1	Radio talk	Faridkot, Punjab	05/09/2017
2	Radio talk	Hamirpur, HP	07/09/2017
3	Radio talk	Srinagar, J&K	06/09/2017
4	Television talk	Srinagar, J&K	07/09/2017
5	Television talk	Dehradun, Uttrakhand	04/09/2017
6	Television talk	Dehradun, Uttrakhand	06/09/2017

Dr. Jaswinder Kaur Brar from KVK, Faridkot delivered radio talk at AIR Bathinda

Dr. Kalpana Arya delivered radio talk at AIR Hamirpur

Reaching the unreached through mobile phone

Mobile phones are the novel tool for improving information dissemination as it an easy way of repeatedly sharing information with the target groups. This solution is increasingly affordable and effective due to the availability of mobile phones already in the hands of most of us. However, simple education of often illiterate and un-schooled mothers, especially in rural communities, could make an enormous and cost-effective difference and as UNICEF points out that: "As many as 40 per cent of child deaths could be prevented with improved family and community care – not high-tech health equipment, but access to solid knowledge, support and basic supplies". When this information is on educational health and nutrition material, a door is opened for the transfer of life-changing, and life-saving, knowledge directly to and amongst women, families and communities. The women can be educated through messages and even small videos in the mobile phones can be uploaded about the care of pregnant women and children under two years of age, breastfeeding, the importance of balanced diet, simple ways to enhance nutrition levels and a spectrum of relevant health topics.

Nowadays with the ease of access to internet services many KVKs are not only using mKisan portal for sending the messages to farmers/ farm women but they are also using this facility of various other free of cost portals to send their messages to the farmers. During this week, KVKs have used WhatsApp application for sending the informative messages and small videos to farm women having this facility so that they can read the information in their homes itself. The advisories reached the highest number of farm women (810504) were sent by KVKs of HP followed by Punjab (95210) using the facility of mKisan portal during the week (Table 14.5). The messages sent were related to nutrition, weaning food, harmful effects of junk food *etc*.

The messages were sent in regional languages for better understanding of the information for the farm women.

Table 14.5: Details of Kisan Mobile Advisory inputs during the National Nutrition Week

Sr.	State	No. of SMS recipients
1	Punjab	95210
2	Himachal Pradesh	810504
3	Jammu & Kashmir	2015
	Total	907729

Print media coverage

Print media having one of the widest reach among common people especially in rural areas was specially targeted and as explained in the following clips the National Nutrition Week celebration by the KVKs of Zone-1 got adequate coverage in the print media in the interest of communities.

Conclusions

During this week KVKs adopted all the extension methods to reach the farm women to educate them about the nutrition problems country is facing and how to tackle the problem with the possible solutions. During the week with the linkage of Child Development Project Officers at district level joint programmes were conducted so that it could benefit a large number of families at district level. Print media and

ਤਰਸਿੱਕਾ 'ਚ ਪੌਸ਼ਟਿਕ ਆਹਾਰ ਸਪਤਾਹ ਮਨਾਇਆ

सरकारी स्कूल में न्यूट्रीशियन कैंप लगाया

कैंप दौरान जानकारी देते कृषि विज्ञान केंद्र के सहायक प्रोफेसर अवनीत कौर व अन्य।

ਕੌਮੀ ਪੋਸ਼ਣ ਹਫਤੇ ਤਹਿਤ ਵੱਖ-ਵੱਖ ਪਿੰਡਾਂ 'ਚ ਸਮਾਗਮ

हिमाचल की 53 फीसद
महिलाओं में खून कम

पहाड़ी प्रदेश की 53 फीसद महिलाओं को खून की कमी है। इनमें जनजातीय जिला किन्नौर व लाहुल-स्पीति की ज्यादा महिलाएं हैं। यह खुलासा भारत सरकार के स्वास्थ्य एवं परिवार कल्याण मंत्रालय द्वारा करवाए गए नेशनल फैमली हेल्थ सर्वे-चार में हुआ है। सर्वे के मुताबिक प्रदेश में अल्प पोषण के कारण करीब 21 प्रतिशत पांच वर्ष से कम आयु के बच्चों का वजन कम है व लगभग 53 फीसद छह से 59 माह के बच्चों में भी खून की कमी पाई गई है। यही नहीं प्रदेश में 49 साल तक की गर्भवती महिलाएं 50 तथा 53 फीसद महिलाएं अनीमिया की शिकार हैं। सर्वे के मुताबिक कम वजन के बच्चे सोलन जिले में ज्यादा हैं। चंबा जिले में अनीमिया ग्रसित गर्भवती महिलाओं का आंकड़ा सबसे ज्यादा है।

रजनीश हिमालयन ● सुंदरनगर

सुझाव

- बच्चों का वजन बढ़ाने के लिए उन्हें छह माह तक मां का दूध पिलाना जरूरी है। छह माह बाद प्रोटीनयुक्त आहार जैसे सोयाबीन आधारित व्यंजन, मूंगफली, तिल, चना, मूंग दाल, अंकुरित अनाजों के आटे का पाउडर भोजन में सम्मिलित करना चाहिए।
- अनीमिया से प्रभावित बच्चों को हरी पत्तेदार सब्जियां जैसे पालक, मेथी, चौलाई, फल, मूंगफली, तिल, गुड़ और अंकुरित दालें देनी चाहिए।
- गर्भवती महिलाओं को गर्भ के शुरुआती महीनों से ही दैनिक आहार में हरी पत्तेदार सब्जियां, अंकुरित दालें, दूध व दूध से बने उत्पाद, अंडा, मांस, मछली आदि का सेवन करना चाहिए साथ ही प्रतिदिन एक मौसमी फल अवश्य खाना चाहिए।
- भोजन के साथ आयरन और फोलिक एसिड की गोलियां 100 दिन तक प्रतिदिन खाएं।

- स्वास्थ्य एवं परिवार कल्याण मंत्रालय के नेशनल फैमिली हेल्थ सर्वे-चार में हुआ खुलासा
- किन्नौर व लाहुल-स्पीति में अनीमिया ग्रसित महिलाएं व बच्चे सबसे ज्यादा
- 21 फीसद बच्चों का वजन कम, सोलन जिले में ज्यादा संख्या

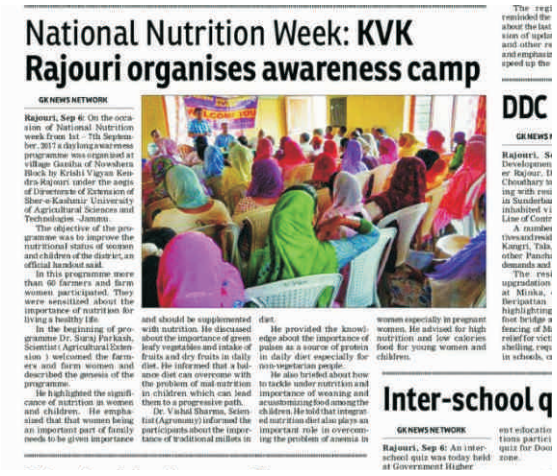
कम वजन अनीमिया ग्रसित बच्चों और महिलाओं का ब्योरा (प्रतिशत में)

जिला	5 वर्ष से कम आयु तक के कम वजन के बच्चे	6 से 59 माह वाले अनिमिया ग्रसित बच्चे	49 वर्ष तक की अनिमिया ग्रसित गर्भवती महिलाएं	15 से 49 वर्ष तक की अनिमिया ग्रसित कुल महिलाएं
मंडी	16.2	37.8	42.2	39.7
कुल्लू	11.0	54.9	44.7	59.5
कांगड़ा	23.3	47.3	46.9	59.7
हमीरपुर	19.4	41.2	--	35.8
बिलासपुर	23.4	28.3	38.1	39.3
चंबा	22.5	66.3	65.8	51.2
शिमला	24.8	70.0	--	68.6
सोलन	29.4	71.8	62.4	67.5
सिरमौर	25.3	65.1	46.3	48.0
किन्नौर	15.9	83.1	--	80.8
ऊना	14.6	56.6	--	46.9
लाहुल-स्पीति	16.1	94.7	--	83.2

आजकल की बदलती जीवनशैली व भोजन संबंधी बदल रही हमारी आदतें बहुत सी स्वास्थ्य संबंधी समस्याओं का कारण बन गई हैं। ऐसे में यह आवश्यक हो जाता है कि लोगों को पोषण संबंधी ज्ञान दिया जाए, ताकि वे अपने खाने की थाली व संतुलित आहार के बारे में जागरूक हो सकें। पोषण शिक्षा द्वारा अच्छे स्वास्थ्य व स्वस्थ जीवन को बढ़ावा देने के लिए इस अभियान की शुरुआत भारत सरकार द्वारा 1982 में की गई थी। भारतीय कृषि अनुसंधान परिषद नई दिल्ली द्वारा संचालित देश के करीब 680 कृषि विज्ञान केंद्रों के माध्यम से राष्ट्रीय पोषण सप्ताह एक से सात सितंबर तक स्कूली बच्चों, किशोरियों, महिलाओं खासतौर पर गर्भवती व स्तनपान कराने वाली महिलाओं को पोषण संबंधी जानकारी दी जाएगी।

-डॉ. कविता शर्मा, प्रधान वैज्ञानिक (गृह विज्ञान) कृषि विज्ञान केंद्र सुंदरनगर।

राष्ट्रीय पोषण सप्ताह पर विशेष



National Nutrition Week: KVK Rajouri organises awareness camp

GK NEWS NETWORK

Rajouri, Sep 6: On the occasion of National Nutrition week from 1st - 7th September, 2017 a day long awareness programme was organized at village Gandia of Nowshera Block by Krishi Vigyan Kendra Rajouri under the aegis of Directorate of Extension of Sher-e-Kashmir University of Agricultural Sciences and Technologies Jammu.

The objective of the programme was to improve the nutritional status of women and children of the district, an official handout said.

In this programme more than 60 farmers and farm women participated. They were sensitized about the importance of nutrition for living a healthy life.

In the beginning of programme Dr. Suraj Parkash, Scientist (Agricultural Extension) welcomed the farmers and farm women and described the genesis of the programme.

He highlighted the significance of nutrition in women and children. He emphasised that that women being an important part of family needs to be given importance and should be supplemented with nutrition. He discussed about the importance of green leafy vegetables and intake of fruits and dry fruits in daily diet. He informed that a balance diet can overcome with the problem of mal-nutrition in children which can lead them to a progressive path.

Dr. Vishal Sharma, Scientist (Agronomy) informed the participants about the importance of traditional millets in diet.

He provided the knowledge about the importance of pulses as a source of protein in daily diet especially for non-vegetarian people.

He also briefed about how to tackle under nutrition and importance of weaning and acustomizing food among the children. He told that integrated nutrition diet also plays an important role in overcoming the problem of anemia in women especially in pregnant women. He advised for high nutrition and low calories food for young women and children.

DDC

Inter-school q

GK NEWS NETWORK

Rajouri, Sep 6: An inter-school quiz was today held at Government Higher

Information and Communication Technologies were utilized to reach large number of stakeholders through TV, radio and mobile. This week celebrated by KVKs has not only addressed current nutritional situation with great zeal but it will create positive impact on the overall nutritional security of targeted families in the long run too.

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Chapter-15

A pursuit to make India healthy

First and fourth of the eight Millennium Development Goals (MDPs) -2015 of the World Health Organization of UN are directly related to eradication of hunger and reduction in child mortality rate while the fifth one targets improvement in maternal health (WHO, 2017). Nourishment, therefore, is an imperative constituent to depict the overall health. To achieve these goals, improvement in food environment and strengthening the ties between rural and urban areas are of utmost importance. For addressing these goals various governments around the world are implementing programmes to improve food and nutritional security of their people. International Food Policy Research Institute, suggested the NOURISHING policy framework during 2017 (see the Box and six vital elements for healthy commencement to support improvement in nutritional practices related to infants and young children have been described in Table 15.1.

Balanced diet

Diet is one of the most important contributing factors for ensuring good health. Nutrition is a complex phenomenon and different elements, minerals and vitamins can be sourced from different groups of food items in adequate quantity. Because it is highly difficult for a common person to remember nutrient wise source of food items hence research organizations working on human nutrition have devised general guidelines about the daily diet. Such guidelines are also presented in the form of a balanced diet chart. National Institute of Nutrition has issued such balanced diet chart for Indian adults having different types of work and lifestyles (Table 15.2).

Key recommendations

The changing socio-economic scenario including gender disparity warrants concerted efforts on the following crucial recommendations.

- Increase access of the poor to healthy, nutritious, and safe foods and stimulate demand for high-quality diets through targeted interventions and policies to create a more enabling environment for healthy choices.

Table 15.1: Six vital elements for a healthy commencement to support improved nutritional practices related to infants and young children

Sr.	Element	Consideration
1.	Adopt a family-focused approach	The unit of analysis for both formative research and program design should be the family rather than the mother-child relation in isolation.
2.	Build on the roles of women, grandmothers, and men	Programs should build on and strengthen the capacity of different household actors to assume their culturally designated roles. Objectives and indicators to reflect this family-centred approach should be expanded.
3.	View grandmothers and men as resources, not obstacles	The benefits of promoting grandmothers and men in infant and young child feeding practices should be emphasized within programs.
4.	Focus health training on family and cultural systems	The curriculum of basic health training should be revised to give greater attention to family and cultural systems and to methods for understanding and incorporating elements of both into health service programs.
5.	Train health workers to use non-directive communication	To engage grandmothers and men and to encourage them to support child and mother nutrition requires a skilled health-sector staff. The staff should motivate the community through non-directive communication and education approaches which are based on adult learning theory.
6.	Recommend an influential research to develop ethnically based intervention	In each cultural setting, a rapid formative assessment should be carried out in order to determine: (1) the knowledge, attitudes, and practices of key household actors related to infant and young child nutrition; and (2) the roles, communication networks, and decision-making patterns within household and community settings related to child nutrition.

- Promote and support agriculture to increase food access and allow the dwellers to cope with price and income shocks.
- Regulate the production of safe, affordable, and nutritious street foods; and provide regular food-safety trainings for informal food retailers and street food vendors.
- Enhance linkages between rural and urban areas to achieve MDPs. Strong rural-urban linkages help propel economic development and improvements in food security and nutrition.
- Support and manage the informal sector economy and harness its potential to protect the livelihoods of the poor and help them to strech out of poverty.
- Alleviate rigid working environment for mothers by providing safe, affordable, and accessible childcare options.
- Address the severe inequalities in access to healthcare, water, sanitation and waste removal services.

The NOURISHING policy framework

POLICY AREA	
Food Environment	**Food Systems and Behaviour Change**
N	Nutrition label standards and regulations on the use of claims and implied claims on food
O	Offer healthy foods and set standards in public institutions and other specific settings
U	Use economic tools to address food affordability and purchase incentives
R	Restrict food advertising and other forms of commercial promotion
I	Improve nutritional quality of the whole food supply
S	Set incentives and rules to create a healthy retail and food service environment
H	Harness food supply chain and actions across sectors and ensure coherence with health
I	Inform people about food and nutrition through public awareness
N	Nutrition advice and counseling in health care settings
G	Give nutrition education and skills

- Provide opportunities for physical activity (to prevent overweight, obesity, and non communicable diseases) through smart urban development that eases access, affordability, and safety constraints related to recreational facilities and public transport.
- Zinc, iron and vitamin A have been identified crucial for fighting global malnutrition and existing but neglected sources of these nutrients (*e.g.* Chandel *et al*. (2014) reported that minor millets are rich in iron and Zn while Low *et al*. (2007) demonstrated that orange fleshed sweet potato is rich in vitamin A and has tremendous health benefits for children) should be popularized and promoted especially in their areas of production. However, in order to combat the deficiency of these crucial nutrients among general masses bio-fortification of these nutrients should be targeted through a concerted research effort (Low *et al*. 2004, Prasad 2010, Reddy *et al*. 2014).

Table 15.2: Balanced diet for adults having different types of work and lifestyles

Food Groups	Type of work/ lifestyle					
	Sedentary		Moderate		Heavy	
	Man	Woman	Man	Woman	Man	Woman
Cereals & millets (g)	375	270	450	330	600	480
Pulses (g)	75	60	90	75	120	90
Milk & milk products (g)	300	300	300	300	300	300
Roots & tubers (g)	200	200	200	200	200	200
Green leafy vegetables (g)	100	100	100	100	100	100
Other vegetables (g)	200	200	200	200	200	200
Fruits (g)	100	100	100	100	100	100
Sugar (g)	20	20	30	30	55	45
Fat (g)	25	20	30	25	40	30

Source: NIN (2011)

Conclusion

To sum up and to conclude the outline of nutrition situation of India presented in this document has revealed that a considerable section of the country's population is malnourished and anaemic owing to several factors directly or indirectly responsible for this grim situation. The most noteworthy among these are scarcity of nutritious food availability and accessibility; poverty; unawareness and illiteracy; unemployment; unhealthy lifestyle; lack of safe drinking water, insufficient sanitation

and hygiene and poor functioning and laxity in monitoring of government programmes. Moreover, people who are either undernourished or obese, underperform in various aspects of life, missing out on opportunities to become productive members of society. Hence, the numerous reasons which entail to occurrence of malnutrition and the strategies to combat the challenge are well known. As the country aspires to fulfil its economic and social development goals, there is need to pay attention towards understanding what hinders the nation from conquering its goals related to health and nutrition. In addition, the nutritional status of women and children is of utmost importance to almost every aspect of human development and progress so as to attain the development aspirations of the country as well as the social development goals. Certainly, the organizations working under State and Central governments have to implement an inclusive and synchronized multi-sectoral approach which is developed by taking into consideration the diverse character of local-level challenges by exhibiting enhanced governance. For its accomplishment, people need a training to behave in a compliant and responsible manner. There is an urgent need to pay attention on area specific need assessment regarding nutrition and then, designing the interventions based on identified needs. It is imperative to address neighbourhood health and nutrition needs along with personal household ones to build a healthy generation. A healthy generation superimposes the foundation for a successful economy and a welfare nation. Thus, nutrition and wellbeing are vital to sustain political stability, creative way of life and social harmony.

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