

# DIETARY GUIDELINES FOR INDIANS



**icmr** | **NIN**  
INDIAN COUNCIL OF  
MEDICAL RESEARCH | NATIONAL INSTITUTE  
OF NUTRITION

**ICMR-National Institute of Nutrition**  
Hyderabad-500 007, Telangana



# DIETARY GUIDELINES FOR INDIANS



**ICMR-National Institute of Nutrition**  
Tarnaka, Hyderabad - 500 007, Telangana

© Copyright **DIETARY GUIDELINES FOR INDIANS-2024**

Revised Edition	2024
Second Edition	2011
Reprinted	1999, 2003, 2005, 2007
First Published	1998

**ICMR-National Institute of Nutrition**

Indian Council of Medical Research

Department of Health Research

Ministry of Health and Family Welfare, Government of India

Tarnaka, Hyderabad-500 007, Telangana State, INDIA

Website: [www.nin.res.in](http://www.nin.res.in); Email: [nin@nic.in](mailto:nin@nic.in)

Phone: +91-40-27197200

The use and dissemination of the data in this book is encouraged. This publication can be reproduced for personal use with full acknowledgment of the source citation. However, no part of this publication can be stored or reproduced in any electronic format for creating a product without the prior written permission of the National Institute of Nutrition, Hyderabad.

**Published by:** ICMR-National Institute of Nutrition

**Editor:** NIN Team

**ISBN No:**

**Price ₹**

**Disclaimer**

The National Institute of Nutrition (NIN) has exercised great care and diligence to ensure that the data provided in the *Dietary Guidelines for Indians* is as correct and accurate as possible. NIN makes no warranty of the data and in no event shall be held liable for any incidental or consequential event arising from the use of the data.



# EXPERT COMMITTEE MEMBERS

## CHAIRPERSON

**Dr. Hemalatha R**, MBBS MD  
Director, ICMR-NIN

## MEMBER SECRETARY

**Dr. P. Uday Kumar**, MBBS MD  
Scientist 'G', ICMR-NIN

---

## MEMBERS

---

**Dr. Kamala Krishnaswamy**, MBBS MD  
Former Director, ICMR-NIN

**Dr. B. Sesikeran**, MBBS MD  
Former Director, ICMR-NIN

**Dr. GNV. Brahmam**, MBBS, DPH  
Former Scientist 'F', ICMR-NIN

**Dr. S. Ahmed Ibrahim**, M.Sc, Ph.D.  
Scientist 'F', ICMR-NIN

**Dr. SubbaRao M Gavaravarapu**, MA, Ph.D.  
Scientist 'F', ICMR-NIN

**Dr. K. Damayanti**, M.Sc, Ph.D.  
Former Scientist 'E', ICMR-NIN

**Dr. D. Raghunatha Rao**, M.Sc, Ph.D, MPH  
Former Scientist 'F', ICMR-NIN

**Dr. K. V. Radhakrishna**, MBBS, D.Ch.  
Former Scientist 'E', ICMR-NIN

**Dr. K. Madhavan Nair**, M.Sc, Ph.D.  
Former Scientist 'F', ICMR-NIN

**Dr. N. Arlappa**, MBBS MD  
Scientist 'G', ICMR-NIN

**Dr. V. Sudershan Rao**, M.Sc, Ph.D.  
Former Scientist 'E', ICMR-NIN

**Dr. Y. Venkataramana**, M.Sc, Ph.D.  
Former Scientist 'G', ICMR-NIN

**Dr. Bharati Kulkarni**, MBBS, PhD  
Scientist 'G', ICMR, New Delhi

---

## CO-OPTED MEMBERS

---

**Dr. M. S. Radhika**, MSc. Ph.D.  
Scientist 'E', ICMR-NIN

**Dr. Sylvia Fernandez Rao**, MA, Ph.D.  
Scientist 'E', ICMR-NIN

# ACKNOWLEDGEMENTS

The authors thank

---

## REVIEW COMMITTEE

---

**Dr. Sheila C. Vir**, PhD

Public Health Nutrition Consultant  
Director, Public Health Nutrition and  
Development Centre, New Delhi

**Dr. Prema Ramachandran**, MBBS, MD

Director  
Nutrition Foundation of India  
New Delhi

**Dr. Raj Bhandari**, MBBS, MD

Member, National Technical Board of Nutrition  
and Health, NITI Aayog, Govt. of India  
New Delhi

**Dr. Anupa Siddhu**, PhD

Director  
Lady Irwin College  
New Delhi

**Dr. Janaki Srinath**, PhD

Asst. Professor, Professor Jayashankar  
Telangana Agricultural University  
Hyderabad

For their valuable suggestions in the preparation of this book

---

## TECHNICAL SUPPORT

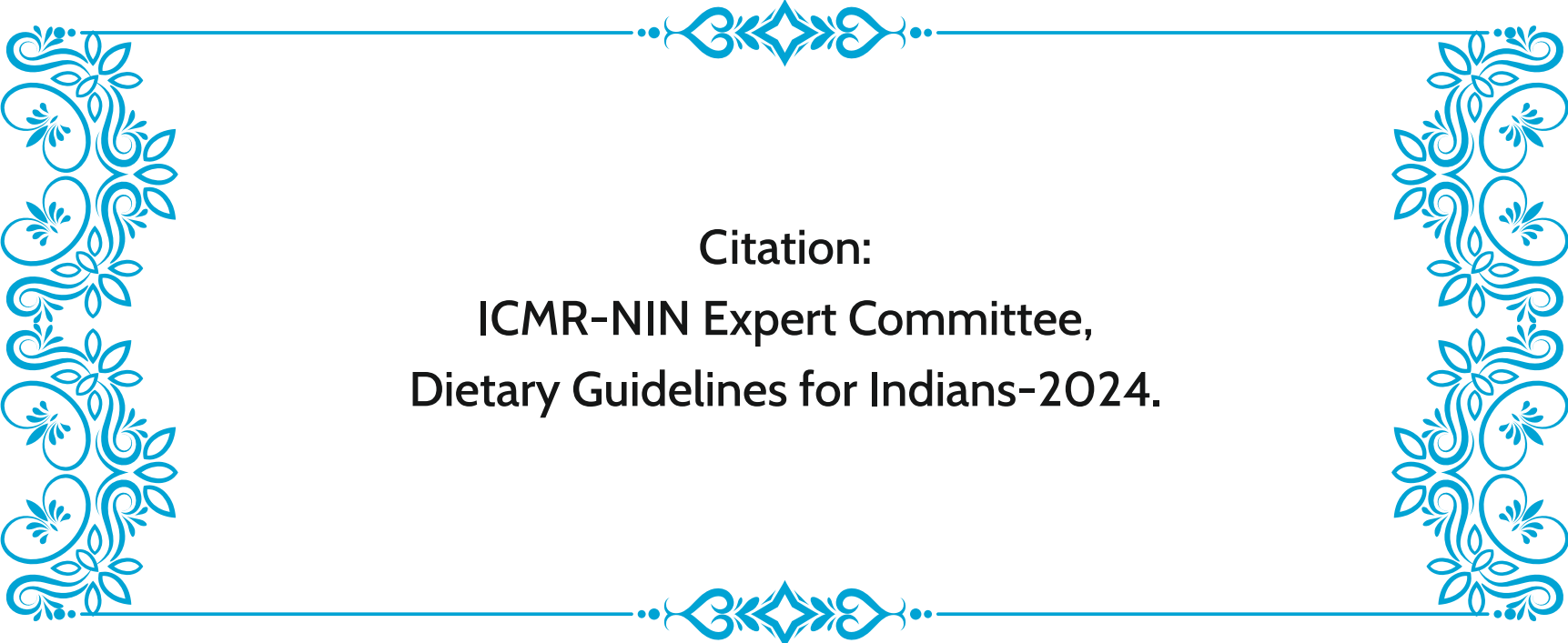
---

**Mr. S. Devendran**

Artist, ICMR-NIN

**Mr. PS. Rama Rao**

Technical Officer, ICMR-NIN



**Citation:**  
**ICMR-NIN Expert Committee,**  
**Dietary Guidelines for Indians-2024.**



# CONTENTS

Page No

Messages

Introduction

i

Current Diet and Nutrition Scenario

iii

## DIETARY GUIDELINES



**GUIDELINE 1** Eat a variety of foods to ensure a balanced diet

1



**GUIDELINE 2** Ensure provision of extra food and healthcare during pregnancy and lactation

13



**GUIDELINE 3** Ensure exclusive breastfeeding for the first six months and continue breastfeeding till two years and beyond

21



**GUIDELINE 4** Start feeding homemade semi-solid complementary foods to the infant soon after six months of age

26



**GUIDELINE 5** Ensure adequate and appropriate diets for children and adolescents both in health and sickness

37



**GUIDELINE 6** Eat plenty of vegetables and legumes

47



**GUIDELINE 7** Use oils/fats in moderation; choose a variety of oil seeds, nuts, nutriceals and legumes to meet daily needs of fats and essential fatty acids (EFA)

51



**GUIDELINE 8** Obtain good quality proteins and essential amino acids (EAA) through appropriate combination of foods and avoid protein supplements to build muscle mass

57



**GUIDELINE 9** Adopt a healthy lifestyle to prevent abdominal obesity, overweight and overall obesity

62

	<b>GUIDELINE 10</b> Be physically active and exercise regularly to maintain good health	69
	<b>GUIDELINE 11</b> Restrict salt intake	73
	<b>GUIDELINE 12</b> Consume safe and clean foods	77
	<b>GUIDELINE 13</b> Adopt appropriate pre-cooking and cooking methods	81
	<b>GUIDELINE 14</b> Drink adequate quantity of water	89
	<b>GUIDELINE 15</b> Minimize the consumption of high fat, sugar, salt (HFSS) and ultra-processed foods (UPFs)	93
	<b>GUIDELINE 16</b> Include nutrient-rich foods in the diets of the elderly for health and wellness	100
	<b>GUIDELINE 17</b> Read information on food labels to make informed and healthy food choices	106
<b>Annexure I</b> Suggested measuring katori/cups and spoons		111
<b>Annexure II</b> Raw food item measures using household utensils		113
<b>Annexure III</b> Glycemic index		125
<b>Annexure IV</b> Various foods categorized under different food groups		127



डॉ. विनोद कुमार पॉल  
सदस्य  
Dr. Vinod K. Paul  
MEMBER



भारत सरकार  
नीति आयोग, संसद मार्ग  
नई दिल्ली-110 001  
Government of India  
NATIONAL INSTITUTION FOR TRANSFORMING INDIA  
NITI Aayog, Parliament Street  
New Delhi-110 001  
Tele. : 23096809 Telefax : 23096810  
E-mail : vinodk.paul@gov.in

24 April, 2024

### MESSAGE

It is my pleasure to write a message for the latest edition of the Dietary Guidelines for Indians. These guidelines are a culmination of extensive research, consultation with experts, and a thorough review of the latest scientific evidence on nutrition and health.

The dietary habits of Indians have undergone significant changes over the past few decades, leading to an increase in the prevalence of non-communicable diseases while some of the problems of undernutrition continue to haunt us. These guidelines aim to provide evidence-based recommendations to help Indians make informed food choices to maintain good health and prevent malnutrition in all forms.

The guidelines are designed to be flexible, accommodating the diverse cultural and regional dietary practices of India. They provide practical advice on the consumption of a variety of foods from different food groups, emphasizing the importance of a balanced and diverse diet. The guidelines also provide recommendations for specific age and gender groups. I would like to thank the team of experts who contributed to the development of these guidelines. Their efforts will undoubtedly benefit the health and well-being of millions of Indians.

I urge all Indians to use these guidelines for making healthy food choices. By doing so, we can create a healthier India for ourselves and future generations.

(Vinod Paul)







सत्यमेव जयते

डॉ. राजीव बहल, एमडी, पीएचडी  
DR. RAJIV BAHL MD, PhD



**icmr**  
INDIAN COUNCIL OF  
MEDICAL RESEARCH

सचिव, भारत सरकार

स्वास्थ्य अनुसंधान विभाग  
स्वास्थ्य एवं परिवार कल्याण मंत्रालय एवं  
महानिदेशक

भारतीय आयुर्विज्ञान अनुसंधान परिषद

**Secretary, Government of India**

Department of Health Research  
Ministry of Health & Family Welfare

**Director-General**

Indian Council of Medical Research

### **FOREWORD**

I am pleased to write this foreword and extend my heartiest congratulations to team ICMR-National Institute of Nutrition (ICMR-NIN) for this stellar achievement of formulating the 'Dietary Guidelines for Indians' (DGIs). The institute has earlier brought out the nutrient requirements for Indians which in a way forms the basis for various national nutrition programmes and policies. With these new food-based guidelines, an excellent attempt has been made to simplify and express the principles of 'Good Nutrition' for Indians in terms of foods and food choices rather than specific nutrients.

This document provides practical advice and recommendations for individuals, families, communities, and policymakers to promote healthy eating habits and reduce the burden of diet-related diseases and disorders in India. The guidelines emphasize the importance of consuming a variety of foods from all food groups. In addition to dietary recommendations, the guidelines provide information on physical activity, hydration, healthy weight management, food safety and food labelling.

The Dietary Guidelines for Indians 2024 is an important tool for promoting healthy eating habits and preventing diet-related chronic diseases in India. I encourage everyone to use this document as a valuable resource for making informed decisions about their diets.

I commend the dedicated efforts of Dr Hemalatha and all the members who have contributed to the development of these guidelines and hope that this release will serve as a valuable resource for years to come.

*Rajiv Bahl*  
(Dr. Rajiv Bahl)





# INTRODUCTION

Adequate intake of all the essential nutrients through a well formulated balanced diet is needed to maintain good health. Nutrition plays an important role right from the time of the baby's presence in the mother's womb till he/she reaches old age. A balanced diet prevents all the adverse effects of nutritional deficiencies and also ensures optimal growth and development. It also minimizes the risk of diet related non-communicable diseases (DR-NCDs) occurring in later life. Sound optimal nutritional status of mother and child during the first 1000 days of life, starting from the conception till the child completes two years of age is closely linked to growth and learning in the initial stages of development and to the reduced risk of metabolic syndrome, diabetes and cardiovascular diseases later in life. Appropriate dietary habits and physical activity through all the stages of one's life are essential for the maintenance of holistic health.

A balanced diet fulfils all the nutritional needs of the body. There is no single food which can provide all the necessary nutrients and hence these need to be obtained through a judicious choice of a variety of foods. Such diets also provide a host of other bioactive substances and phyto-nutrients and thus exert a positive impact on health. Appropriate dietary habits promote optimal growth and development and prevent malnutrition occurring in all its forms- undernutrition, micronutrient deficiencies, overweight, obesity (including abdominal/central obesity) and DR-NCDs.

For ease of understanding, it would be appropriate to talk in terms of foods and food groups instead of specific nutrients. The guidelines focus on food-based approach for attaining optimal nutrition and represent the recommended amounts of nutrients that should be consumed through food. Food-related approaches are presented in both qualitative and quantitative terms. Emphasis has been laid on the recommendations which can maximize protective effects in accordance with traditional habits. The guidelines have taken into consideration food groups and food items derived from

common Indian diets such as whole grains, pulses, milk, vegetables and fruits to facilitate diet-related decision making. In order to capture the diverse cultural, culinary practices and food groups that exist in the country, the current guidelines categorizes foods into ten different food groups. Various kinds of cereals and millets are used as staple foods in the country alongside a variety of pulses. All those foods, which are accessible as well as affordable by the common man, have been recommended for the formulation of healthy diets.

The 17 dietary guidelines place firm emphasis on health promotion and disease prevention across all age groups, with special attention to the nutritionally-vulnerable segments like infants, children, adolescents, pregnant and lactating women and the elderly. The key-points pertaining to each of the guidelines discussed have been included at the end of each chapter. They also underscore the role of other related factors like physical activity, health care, safe water supply, environmental sanitation, personal hygiene and other socio-economic factors, which greatly impact nutrition and health outcomes. The use of dietary guidelines may require adaptation to social, economic, agricultural and other environmental conditions. The guidelines contain in them scientific evidence-based information that would facilitate the attainment of the goals stated in the National Nutrition Policy. The guidelines are also consistent with the goals set in the National Policies on Agriculture and Health.

These guidelines are meant for the benefit of the general population and for practicing nutritionists, dietitians, health professionals and other stakeholders. The translation of knowledge into action calls for the coordinated efforts of several government and non-government organizations as well as the academic world. The Dietary Guidelines need to be widely disseminated among the masses through effective information, education and communication (IEC) strategies and other large-scale behavior change communication (BCC) campaigns for improving the knowledge, attitudes and practices of all the stakeholders.

# CURRENT DIET AND NUTRITION SCENARIO

In India, severe forms of undernutrition such as marasmus, kwashiorkor and keratomalacia have largely disappeared, yet subclinical manifestations of undernutrition and anaemia persist as public health issues. A significant proportion of children suffer impaired nutritional status. Concurrently, there is a rising prevalence of overweight and obesity in several states, creating a dual burden of malnutrition where both undernutrition and overweight/obesity coexist within the same communities and even within households (Tables I & II).

Estimates show that 56.4% of total disease burden in India is due to unhealthy diets. Healthy diets and physical activity can reduce a substantial proportion of coronary heart disease (CHD) and hypertension (HTN) and prevent upto 80% of type 2 diabetes. A significant proportion of premature deaths can be averted by following a healthy lifestyle.

Data from the Comprehensive National Nutrition Survey 2019 (CNNS) highlights that a substantial number of children, exhibit early indications of non-communicable disease (NCD) and its related risk factors like diabetes and hypertension. The presence of altered metabolic biomarkers in over half of the undernourished and normal-weight children and adolescents (Table II) raises significant public health concerns.

Furthermore, the upsurge in the consumption of highly processed foods laden with sugars and fats, coupled with reduced physical activity and the limited access to diverse foods, exacerbate micronutrient deficiencies and the overweight/obesity problems. Research indicates that unhealthy, highly processed, high-fat, sugar and salt (HFSS) foods have become more affordable and accessible than the healthier alternatives. Aggressive advertising and marketing of these unhealthy foods through different media channels, including social media, are seen to influence dietary preferences among both children and adults, leading to

detrimental long-term effects. A large chunk of family income is spent on buying such unhealthy foods. This faulty dietary pattern contributes to deficiencies in iron and folic acid, resulting in anemia and in the higher prevalence of overweight and obesity among population groups.

Addressing the issue of anemia necessitates the adoption of the practice of dietary diversification among people and undertaking of measures to counter non-nutritional contributors. Placing emphasis on eating a variety of foods also aids in tackling the problem of overweight and obesity.

**Table I. Nutritional status and serum biomarkers of children aged 1 to 19 years**

Category	Age (years)		
	1–4	5–9	10–19
Anemia (%)	40.6	23.5	28.4
<b>Micronutrient deficiencies</b>			
Iron deficiency (%)	32.1	17.0	21.5
Folate deficiency (%)	23.4	28.2	36.7
Vitamin B12 deficiency (%)	13.8	17.2	30.9
Vitamin A deficiency (%)	17.5	21.5	15.6
25 Hydroxy vitamin D (%)	13.7	18.2	23.9
Zinc deficiency (%)	19.0	16.8	31.7
<b>Non-communicable diseases</b>			
Overweight (%)	-	3.7	4.9
Obesity (%)	-	1.3	1.1
Pre-Diabetes (%)	-	10.3	10.4
Diabetes (%)	-	1.2	0.6
Elevated HbA1c (>5.8 & ≤6.4%)	-	9.2	9.5
Elevated HbA1c (>6.4%)	-	0.1	0.2
High total cholesterol (%)	-	3.2	3.7
High LDL (%)	-	3.3	3.8
Low LDL (%)	-	26.1	28.2
High triglycerides (%)	-	34.0	16.1
High serum creatinine (%)	-	7.0	6.6
Hypertension (%)	-	-	4.9

(CNNS, 2019)



**Table II. Undernutrition, overweight/obesity (WHO-Asian Cut-Offs), hypertension and diabetes among 18–69 year adults in India as per NFHS 5, 2021**

Nutritional status/NCDs	Men		Women	
	2016	2021	2016	2021
CED	23.8	16.2	23.0	18.7
Overweight/obesity	21.9	22.9	28.7	24.0
Hypertension	20.2	24.0	15.3	21.3
Diabetes (Type 2)	10.5	15.6	9.7	13.5
Abdominal obesity (as per NNMB)	55.5	47.7	63.5	56.7

*CED: Chronic energy deficiency or undernutrition among adults*

The ICMR-NIN, 'My Plate for the Day' recommends sourcing of macronutrients and micronutrients from a minimum of eight food groups, with vegetables, fruits, green leafy vegetables, roots and tubers forming essentially half the plate of the recommended foods per day. The other major portion is occupied by cereals and millets, followed by pulses, flesh foods, eggs, nuts, oil seeds and milk/curd. Intake of cereals should be limited to 45% of the total energy, while for pulses, eggs and flesh foods, the total energy percentage should be around 14% to 15%; total fat intake should be less than or equal to 30% energy, while nuts, oilseeds, milk and milk products should contribute to 8%–10% of total energy per day respectively.

However, as per the data, cereals contribute to 50% to 70% of total energy per day. Pulses, meat, poultry and fish together contribute to 6% to 9% of the total energy per day as against the recommended intake level of 14% of total energy from these foods.

In a large segment of the country's population, the intake of micronutrient-dense foods (whole grains, pulses, beans, nuts, fresh vegetables, fruits, etc.) is found to be lower than the recommend levels, whereas, the intake of refined cereals is found to be higher. A steady increase in the intake of unhealthy

foods among people complicates the matters further. As a result, majority of the population including children suffer from malnutrition and its adverse health outcomes.

While overall food grain production, especially of cereals, has risen consistently over the past few decades, the per capita availability of food grains indicates adequacy in cereals (464g), with pulses remaining low. Due to the limited availability and high cost of pulses and meat, a significant proportion of the Indian population relies heavily on cereals, resulting in poor intake of essential macronutrients (essential amino acids and essential fatty acids) and micronutrients. Low intake of essential nutrients can disrupt metabolism and increase the risk of insulin resistance and associated disorders from a young age (Table I).

The most logical, sustainable, and long-term solution to all forms of malnutrition is ensuring the availability, accessibility, and affordability of nutrient-rich foods while promoting consumption of diverse foods from various food groups. Dietary guidelines play a pivotal role in guiding individuals toward selecting appropriate foods in adequate quantities across a range of food groups, thereby facilitating optimal nutrition throughout the lifetime.



# GUIDELINE 1

## Eat a variety of foods to ensure a balanced diet



### RATIONALE

**Nutritionally adequate diet or a balanced diet should be consumed through a wise choice of food items from a variety (diverse) of food groups.**

#### What is a 'Healthy Meal' or 'Healthy Food'?

A healthy meal (food) includes generous amounts of vegetables, adequate whole grains and pulses or beans, along with modest portions of nuts or seeds, complemented by a selection of fruits and plain fermented yogurt or curd. It is free of added sugars or contains very minimal amounts, and is seasoned with minimal oil/fats and salt for taste.

#### What can make a 'Healthy Snack'?

An ideal healthy snack consists of vegetable or fruit salads adorned with seeds or nuts, topped with yogurt. Additionally, roasted or boiled beans, lobia, chickpeas, and peanuts can serve as nutritious snack options.

#### What is a balanced diet and why do we need it?

A balanced diet provides required calories, proteins, vitamins, minerals and adequate fibre.

- A balanced diet is a wholesome and nutritionally adequate diet. It provides a variety of nutrients that perform a wide range of functions in the body.
- A balanced diet can be achieved by eating diverse foods since there is no single food item with all the essential nutrients.
- A balanced diet is needed for growth and development to

sustain life, maintain health, optimum brain function, immune function, etc.

- Nutrients must be obtained through a judicious choice and combination of a variety of foodstuffs from different food groups. Variety from wholesome foods is the key to achieve nutrient adequacy.
- Physical activity is also essential for appropriate utilization of all nutrients from a balanced diet.
- Exposure to sunlight for obtaining vitamin D is also recommended.

#### What is healthy eating habit?

- Inclusion of non-starchy fresh vegetables and green leafy vegetables in every meal. Take at least 30 grams of fruits in every meal.
- Consuming at least 50% of cereals and other grains as whole grains (minimally polished) for adequate nutrients and fibre.
- All cereal (or millet) based diets are accompanied with adequate pulses or beans for good quality protein and fibre.
- Consuming adequate quantities of nuts, oilseeds, fatty fish and restricting cooking oils to 25g to 30g per day.



- Restricting meal frequency to two to three times a day.
- Avoiding ultra-processed foods (UPFs) and foods high in fat, sugar and salt (HFSS).
- Avoiding sugar or restricting to 20g to 25g per day (adults).
- Not snacking in between and consuming healthy beverages (refer Guideline 9).

**Include variety within food groups:** For example, different types of cereals, millets and pulses have different nutrient profile; hence a variety of cereals, millets and pulses are recommended to be consumed on a daily basis for adequacy of different nutrients. This applies to other food groups such as vegetables and fruits as well.

**Add varieties of oilseeds and nuts in daily diet:** Foods such as nuts, oilseeds, fish, etc. are nutrient dense and are rich sources of good quality fats, proteins, vitamins and other nutrients. Different varieties of oilseeds and nuts are advised.

Foods such as fenugreek seeds, amaranth seeds, flax seeds, chia seeds and basil seeds have health promoting effects and can be consumed at least three to four times a week.

**Include a variety of fruits and vegetables in daily diet:** Vegetables and fruits are sources of protective nutrients such as vitamins, minerals, phytonutrients, antioxidants and fibre. Different varieties of vegetables and fruits should be consumed.

**Limit added fat, salt and sugar intake:**

- Limit intake of foods with added fat/oil and salt.
- Avoid foods and beverages with added sugars.

Avoid foods and beverages with added sugars.

**Nutrients of concern for vegetarians:** Achieving adequacy of essential Long chain n-3 poly unsaturated fatty acids (PUFA) and B12 is a challenge. May take foods fortified with these nutrients or must ensure adequate intake of n-3 PUFA rich foods (flax seeds, chia seeds, walnuts, vegetables and greens) as only a small amount of n-3 PUFA will be converted to EPA (Eicosa Pentaenoic Acid) and DHA (Docosa Hexaenoic Acid). For B12; milk has small amount of B12.

Requirements of essential nutrients vary with age, gender, physiological status and physical activity (Fig 1.2). Dietary intakes that provide lower or higher than the body requirements can lead to under-nutrition or overweight/obesity respectively. Eating too little food during certain significant periods of life such as infancy, childhood, adolescence, pregnancy and lactation and eating too much at any age can have harmful consequences.

Carbohydrates, fats and proteins are 'macronutrients,' which are needed in large amounts. Diets must provide adequate essential amino acids (EAA) and essential fatty acids (EFA) to achieve maximum growth potential among children. Vitamins, minerals and phytonutrients constitute the 'micronutrients' and are required in smaller amounts. Both macro and micronutrients are necessary for physiological and biochemical processes by which the human body acquires, assimilates and utilizes food to maintain health and activity (refer Tables 1.1 to 1.5 for nutritive values of different foods).

Physical activity is also essential for appropriate utilization of all nutrients from a balanced diet.



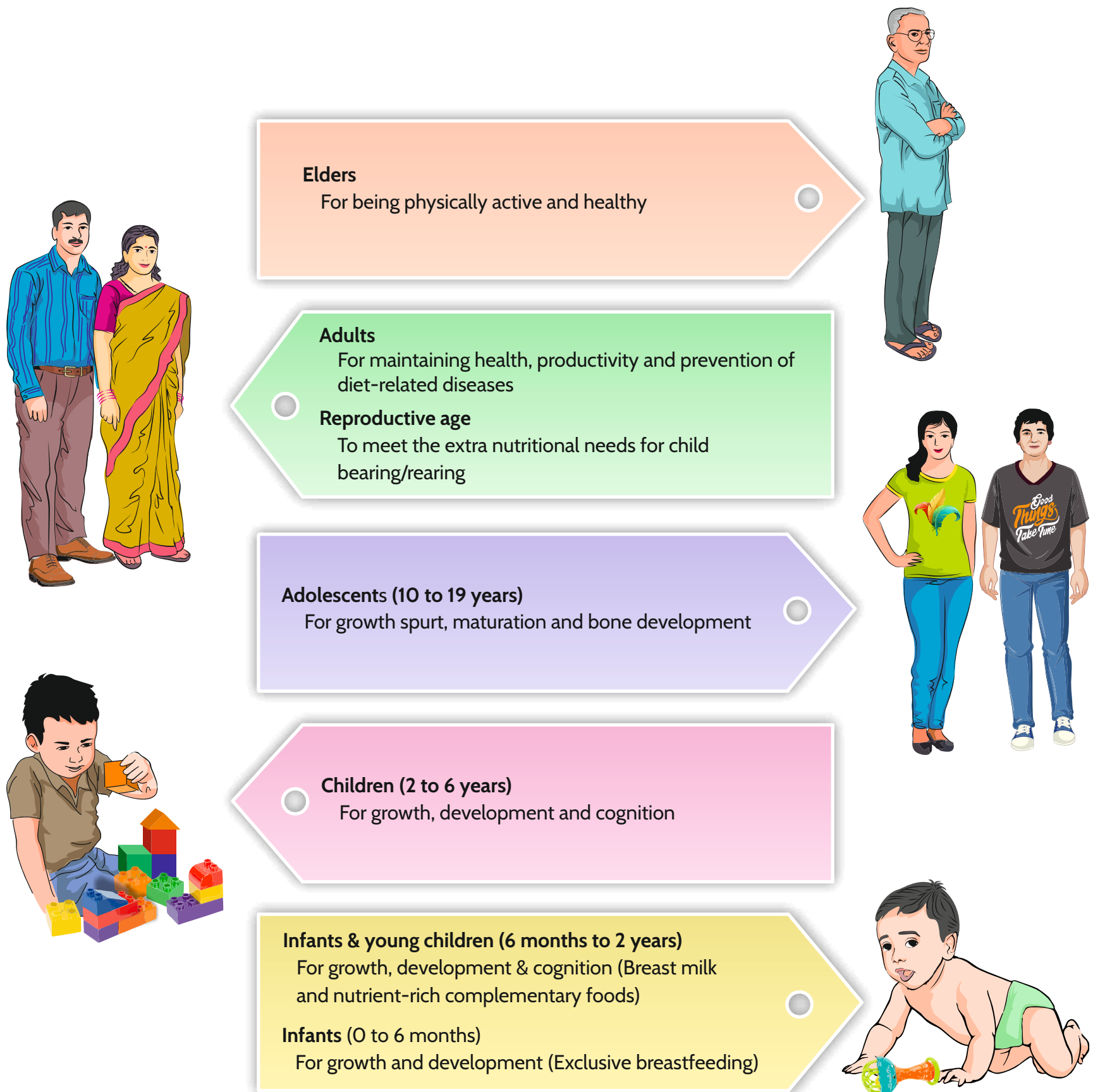
Figure 1.1. Food pyramid for balanced diet for 2000 Kcal







Figure 1.2. Importance of balanced diet during different stages of life







## What are food groups?

Foods have been categorized into 10 groups to help people make choices from different food groups. Adequate quantities of foods from at least 5–7 food groups should be consumed on a daily basis (Table 1.1). Other foods may be consumed at least two to three times a week. This method of ensuring diversity and variety within groups will meet adequacy of most nutrients such as essential amino acids (protein), essential fatty acids, vitamins, minerals, phytonutrients, fibre and bioactive substances. Spices like turmeric, cumin, ginger, garlic, cinnamon, pepper and cloves are rich in antioxidants and could be part of a balanced diet.

The quantities of foods needed to meet the nutrient requirements vary with age, gender, physiological status and physical activity. A balanced diet should provide not more than 45% calories (energy) from cereals and millets (Nutricereals: diversify staples with millets) and up to 15% calories from pulses, beans and meat (Table 1.2a & 1.2b). Rest of the calories should ideally come from nuts, vegetables, fruits and milk. In other words, this will ensure 50%–55% of total calories from carbohydrates, 10%–15% from proteins and 20%–30% from dietary fats.

**Adequate quantities of foods from at least 5–7 food groups should be consumed on a daily basis.**

**Table 1.1. Food Groups**

1	<b>Cereals and millets</b>	Rice, wheat, millets and other cereals, etc.	
2	<b>Pulses</b>	Lentil, green gram, chickpea, rajma, cowpea, etc.	
3	<b>Vegetables</b>	Seasonal vegetables	
4	<b>Nuts, oil seeds, oils and fats</b>	Peanuts, walnuts, almonds, pistachio, hazel nuts, and other nuts, vegetable oils, etc.	
5	<b>Green leafy vegetables (GLV)</b>	Seasonal GLVs	
6	<b>Fruits</b>	Seasonal fruits	
7	<b>Dairy</b>	Milk, curd and butter milk	
8	<b>Roots and tubers</b>	Beetroot, radish, carrot, tapioca, sweet potato, etc.	
9	<b>Flesh foods</b>	Marine fish, poultry and lean cut meat	
10	<b>Spices and herbs</b>	Turmeric (haldi), ginger, mustard, pepper, cumin, corriander (dhania), etc.	



The 'My Plate for the Day' (Figure 1.3) developed by the ICMR-National Institute of Nutrition provides a simple guidance to achieve a balanced diet sourcing energy from different food groups. Tables 1.2a & 1.2b show the percent calories from different food groups that would ensure appropriate balance of all nutrients. The plate typically illustrates proportion of foods from different food groups to be sourced for a 2000 Kcal Indian diet. The proportion of each of the food groups serve an important function. The plate recommends sourcing of macronutrients and micronutrients

from a minimum of 10 food groups with vegetables, fruits, green leafy vegetables, tubers and roots forming essentially half the plate of the recommended foods per day. At least half of the recommended cereals should be whole grains such as millets, which are rich sources of micronutrients such as vitamins and minerals, and also provide antioxidants, phytonutrients, fibre and bioactive compounds and induce favourable changes in the gut microbiota (microbes). Millets can be consumed to the extent of 30%–40% of total recommended cereals in raw weight.

Figure 1.3. My Plate for the Day for 2000 Kcal



The energy cut-off level is 250 Kcal for every 100g of cooked food.



**Table 1.2a. Nutrients from 'My Plate for the Day' (Vegetarian)**

Food groups (2000 Kcal)	Foods to be consumed raw weight (g/day)	% of Energy from each food group/day	Total Energy from each food group/day (Kcal)	Total crude protein from each food group/day (g)	Total fat from each food group/day (g)	Total Carbohydrates from each food group/day (g)
Cereals (incl. millets)	250	42	~843	~ 25	~5	~172
Pulses	85	14	~274	~20	~3	~42
Milk/curd (ml)	300	11	~216	~10	~13	~16
Vegetables*, Green leafy vegetable (GLV)	400	9	~174	~10	~2	~28
Fruits#	100	3	~56	~1	~1	~11
Nuts & seeds	35	9	~181	~6	~15	~6
Fats & oils	27	12	~243	0	~27	0
<b>Total</b>	<b>1200</b>	<b>-</b>	<b>~2000</b>	<b>~72g (15% energy (Kcal) from total protein)</b>	<b>~ 66g (30% energy(Kcal) from total fat)</b>	<b>(55% energy (Kcal) from total carbohydrates)</b>

+ Prescribed amount of vegetables (excluding potato) may be consumed either in cooked form or salad # Prefer fresh fruits (avoid juices)

**Table 1.2b. Nutrients from 'My Plate for the Day' (Non-vegetarian)**

Food groups (2000 Kcal)	Foods to be consumed raw weight (g/day)	% of Energy from each food group/day	Total Energy from each food group/day (Kcal)	Total protein from each food group/day (g)	Total fat from each food group/day (g)	Total Carbohydrates from each food group/day (g)
Cereals (incl. millets)	260	45	~876	~ 25	~5	~178
Pulses*	55	9	~177	~ 13	~2	~27
Chicken/meat	70	5	~103	~15	~5	0
Milk/curd (ml)	300	11	~216	~10	~13	~16
Vegetables*, Green leafy vegetable (GLV)	400	8	~184	~10	~2	~21
Fruits#	100	3	~56	~1	~1	~11
Nuts & seeds	30	11	~155	~5	~12	~6
Fats & oils	27	12	~243	0	~27	0
<b>Total</b>	<b>1242</b>	<b>-</b>	<b>~2000</b>	<b>~ 79g (16 % Energy)</b>	<b>~ 67g (30 % Energy)</b>	<b>-</b>

+ Prescribed amount of vegetables (excluding potato) may be consumed either in cooked form or salad # Prefer fresh fruits (avoid juices)

Dietary fibre, antioxidants and phytonutrients have positive health benefits. Antioxidants such as vitamins C and E, betacarotene, riboflavin and selenium protect the human body from free radical damage. Other phytonutrients such as polyphenols, flavones, etc. also offer protection against oxidant damage.

Nutritive values (raw foods) of different food groups are provided in Tables 1.3–1.5. Model balanced diets for adult men, adult women and for adolescents, including information on quantity of different food groups for sample menu plans are presented in Table 1.6

### What are nutrient requirements, Recommended Dietary Allowances (RDA) & Estimated Average Requirements (EAR)

Nutrient requirements are the quantities of nutrients that healthy individuals must obtain from food to meet their physiological needs. The ICMR-NIN Nutrient Requirements-2020 Report (Updated-2023), defines the nutrient requirements for Indians, based on concepts related to the distribution of nutrient requirements in normal individuals. The mean of nutrient requirements distribution is called the Estimated Average Requirement (EAR) and the 97.5<sup>th</sup> percentile of the requirement distribution is called the





Recommended Daily Allowance (RDA). The EAR is used to assess the nutrient adequacy of individuals or population groups, and is also used for planning the dietary nutrient requirements for healthy individuals or population groups. However, while diet planning for individuals and populations is based on EAR, the RDA is intended for the purpose of supervised supplementation in deficient individuals. To prevent the risk of adverse side effects associated with excessive intake of nutrients, this report also provides Tolerable Upper Limit (TUL) for some important nutrients.

**Table 1.3. Average values of macronutrients and dietary fibre in various food groups** (Per 100g raw weight)

Foods	Protein (g)	Fat (g)	Carbohydrates (g)	Energy (Kcal)	Total dietary fibre (g)
Cereals	9.3	1.2	72	343	6
Millets	9.9	2.7	65	330	7
Pulses	22.8	3.0	49	323	12
GLVs	3.8	0.7	5	45	2
Roots & tubers	1.5	0.2	12	59	2
Vegetables	1.8	0.4	5	35	2
Nuts	17.5	41.3	18	516	9
Fruits	1.0	0.6	11	59	2
Meat & poultry	20.8	6.8	0	250	0
Fish & sea foods	18.4	3.1	2	110	0
Milk	3.1	4.2	5	72	0
Egg	13.3	10.0	1	147	0
Dry spices	8.5	10.0	31	240	17
Milk products	21.6	18.6	16	337	0
Dry fish	55.5	5.0	1	271	0
Cooking oil/fats		100.0		900	
Table sugar	0	0	100	400	0

Source: Indian Food Composition Tables 2017 & Nutritive Values of Indian Foods

The recommended level of nutrients depends upon the 'bioavailability' of nutrients from a given diet. The term 'bioavailability' indicates what is absorbed and utilized by the body. The nutrient requirements are presented for physiological groups such as infants, pre-schoolers, children, adolescents, pregnant women, lactating mothers and adult men and women, taking into account of their physical activity. However, in practice, fluctuations in intake may occur depending on the food availability and demands of the body. But the average requirements need to be satisfied over a period of time.

Diet planning for individuals and populations is based on EAR, the RDA is intended for the purpose of supervised supplementation in deficient individuals.

### Carbohydrates

The major sources of carbohydrates include cereals and millets. Other sources of carbohydrates are grains, pulses (lentils, beans and peas), nuts, milk, fruits and vegetables. All plant foods have carbohydrates.

Carbohydrates are either simple or complex, and are major sources of energy in all human diets. They provide energy of 4 Kcal/g. The simple carbohydrates, glucose and fructose are found in fruits, vegetables and honey. Sucrose and lactose are disaccharides; while lactose is found in milk, sucrose is the table sugar. Starches and fibre are the two forms of the complex carbohydrates, both are associated with most plant foods such as cereals, millets, pulses, vegetables and tubers. Fibre is the indigestible part of vegetables, fruits, whole grains, pulses, nuts and seeds. These (fibre) are cellulose in vegetables and whole grains, while gums and pectin are present in vegetables, fruits as well as cereals. Dietary fibre delays and retards absorption of carbohydrates and fats and increases the satiety value. Diets rich in fibre reduce glucose and lipids in blood, and improves insulin sensitivity. It also increases the bulk of the stools.

### Proteins

Proteins are primary structural and functional components of every living cell. About half the proteins in our



body is in the form of muscle and the rest is in bone, cartilage and skin. Proteins are complex molecules composed of 20 different amino acids. Nine of these 20 amino acids are termed 'essential' and have to be obtained from proteins in the diet, since they are not synthesized in the human body. The remaining non-essential amino acids can be synthesized in the body to build proteins. Proteins perform a wide range of functions and also provide energy (4 Kcal/g). Protein requirements vary with age, physiological status and stress. More proteins are required by growing infants and children, adolescents, pregnant women and individuals during infections, illness and physical stress. Animal foods like milk, meat, fish and eggs and plant foods such as pulses are rich sources of proteins. Animal proteins are of high quality as they are bioavailable and provide all the essential amino acids in right proportions, while plant or vegetable proteins are not of the same quality because of their low content of some of the

essential amino acids. However, a combination of cereals, millets and pulses provides most of the amino acids, which complement each other to provide good quality proteins and essential amino acids (refer Guideline 8 on protein).

**Fats** (also called lipids and cooking oils)

Dietary fats are derived from two sources viz. the invisible fat present in plant and animal foods, and the visible or added fats and oils (vegetable/cooking oils). Animal foods like fatty fish and plant foods such as nuts and oil seeds and certain beans are rich sources of fats. Grains and pulses are also sources of fats but have low quantities. Fats such as vegetable oils, butter and ghee constitute dietary visible fats. Fats are a concentrated source of energy providing 9 kcal/g, and are made up of fatty acids in different proportions. Fats serve as a vehicle for fat-soluble vitamins like vitamins A, D, E & K and carotenes, and promote their absorption. They are also sources of

**Table 1.4. Average values of micronutrients (vitamins) in various food groups** (Per 100gm raw weight)

Foods	Vitamin B1 (Thiamine) (µg)	Vitamin B2 (Riboflavin) (µg)	Vitamin B3 (Niacin) (µg)	Vitamin B6 (pyridoxine) (µg)	Vitamin B9 (Total folates) (µg)	Vitamin C (mg)	Vitamin A (Retinol) (µg)	Vitamin D (D2) (µg)
Cereals	238.46	84.6	2138.5	162.31	15.86	0	2.01	6.88
Millets	355.56	155.6	2177.8	113.33	24.17	0	1.02	6.10
Pulses	400.00	158.8	2123.5	215.53	157.06	0	8.32	8.69
GLVs	60.00	127.7	624.6	97.49	31.60	45.6	397.90	3.40
Roots & tubers	31.58	10.5	405.3	97.47	21.48	12.1	39.85	0.55
Vegetables	41.30	43.5	365.2	97.48	28.53	23.6	18.40	2.38
Nuts	390.00	140.0	3210.0	311.40	47.58	0.4	1.26	9.06
Fruits	34.78	21.7	369.6	65.04	11.41	36.7	35.48	3.62
Meat & poultry	81.82	109.1	2772.7	220.00	5.59	0	1.93	0
Fish & Sea foods	11.59	8.7	811.6	0	0	2.5	438.98	1.99
Milk	80.00	80.0	140.0	16.00	3.12	3.3	17.20	0.57
Egg	100.00	100.0	66.7	103.33	41.60	0	126.34	0
Dry spices	216.67	112.5	1066.7	213.75	28.34	4.9	38.06	19.43
Milk products	125.00	387.5	275.0	7.50	11.79	1.5	76.50	0.02
Dry fish	5.88	0	164.7	0	0	0	0.87	0.29
Cooking oil/ fats	0	0	0	0	0	0	0	0
Table sugar	0	0	0	0	0	0	0	0

Source: Indian Food Composition Tables 2017 & Nutritive Values of Indian Foods



essential poly unsaturated fatty acids (PUFA). It is necessary to have adequate and good quality fats in the diet with sufficient PUFA in proper proportions for meeting the requirements of essential fatty acids and health (refer Guideline 7). However, it is important to limit intake of cooking oils (vegetable oils), saturated fat (butter, ghee) and avoid partially hydrogenated vegetable oils (*vanaspathi*).

### Vitamins and minerals

**Vitamins** are nutrients required by the body in small amounts and must be present in the diet as these are not synthesized in the body. Vitamins are essential for numerous body processes and for maintenance of the structure of skin, bone, nerves, eye, brain, blood and mucous membrane. Vitamins are either water soluble or fat soluble. Vitamins A, D, E & K are fat soluble, while vitamin C and the B-complex vitamins such as thiamin (B1), riboflavin (B2), niacin, pyridoxine (B), folic acid (B9) and

cyanocobalamin (B12) are water soluble. Pro-vitamin like beta-carotene is converted to vitamin A in the body. Fat soluble vitamins can be stored in the body while water soluble vitamins are not stored (except vitamin B12 & folate) and get easily excreted in urine. Vitamins B-complex and C are heat labile vitamins and are easily destroyed by heat, air or during drying, cooking and food processing.

**Minerals** are nutrients found in body fluids and tissues. The important 'macro' minerals are sodium, potassium, calcium, phosphorus, magnesium and sulphur, while iron, zinc, copper, selenium, molybdenum, fluorine, cobalt, chromium and iodine are micro minerals. These minerals are required for maintenance and integrity of skin, hair, nails, blood and soft tissues. They also govern nerve cell transmission, acid/base and fluid balance, enzyme and hormone activity as well as the blood-clotting processes.

**Table 1.5. Average values of micronutrients (minerals) in various food groups**  
(Per 100g raw weight)

Foods	Calcium (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)
Cereals	18.1	69.1	2.73	1.71
Millet	60.4	73.9	3.20	2.122
Pulses	102.2	133.3	6.25	2.45
GLVs	279.3	35.7	8.07	0.31
Roots & tubers	28.5	19.4	0.61	0.20
Vegetables	38.1	21.3	0.95	0.22
Nuts	211.6	185.6	6.58	2.63
Fruits	28.2	10.3	0.59	0.10
Meat & poultry	18.7	11.7	1.49	1.82
Fish & sea foods	323.1	4.4	2.16	0.20
Milk	127.6	0.0	0.18	0.12
Egg	64.9	12.0	1.43	0.90
Dry spices	367.2	160.1	11.73	1.81
Milk products	755.0	7.3	1.86	0.28
Dry fish	1962.6	1.8	12.08	0.04
Cooking oil/fats	0	0	0	0
Table sugar	0	0	0	0

Note: Mean value of the nutrients have been derived using foods as per Annexure

Source: Indian Food Composition Tables 2017 & Nutritive Values of Indian Foods





**Table 1.6. Suggested food groups for a balanced diet to meet the daily nutrient requirements**

Age group	Category of work	Body wt	Cereals /Millets (g)**	^Pulses & Beans (g)	GLV (g)	Vege tables (g)	Roots & Tubers (g)	Fruits (g)	Nuts (g)	Milk/ Curd (ml)	Fats & oils (g)	Energy (Kcal) obtained from these food groups	Crude protein (g) Obtained from these food groups
Men	Sedentary	65	260	85	100	200	100	100	40	300	30	~2080	72
	Moderate		370	120	100	200	100	100	45	300	40	~2680	90
Women	Sedentary	55	190	60	100	200	100	100	30	300	25	~1660	57
	Moderate		270	90	100	200	100	100	40	300	30	~2125	72
Pregnant women		55+10	220	75	150	200	100	150	40	400	30	~2020	72
Lactating women	0–6 m		260	85	150	200	100	150	40	400	35	~2245	77
	7–12 m		250	85	150	200	100	150	40	400	35	~2200	78
Infants	0–6 m	5.8	Exclusive breastfeeding										
	7–12 m	8.5	25	12	20	25	20	40–60	7	*milk	10		
Children	1–3 yrs	12.9	100	50	50	100	50	60–75	10	350	20	~1110	38
	4–6 yrs	18.3	160	60	50	100	50	75	15	350	20	~1370	46
	7–9 yrs	25.3	200	65	100	150	100	100	20	400	25	~1710	59
Boys	10–12 yrs	34.9	280	90	100	200	100	100	30	400	35	~2230	76
Girls	10–12 yrs	36.4	250	85	100	200	100	100	30	400	30	~2060	70
Boys	13–15 yrs	50.5	390	130	100	200	100	100	40	400	45	~2860	95
Girls	13–15 yrs	49.8	300	100	100	200	100	100	35	400	40	~2410	81
Boys	16–18 yrs	64.4	450	150	100	200	100	150	50	400	55	~3300	107
Girls	16–18 yrs	55.7	315	105	100	200	100	150	40	400	40	~2490	85
Elderly	>60 yrs	Man	170	75	100	200	100	150	30	400	25	~1740	62
		Woman	140	70	100	200	100	150	30	400	15	~1530	56

\*\* 20% to 30% of Cereals (weight in raw) should be from millets for adults. 20% of cereals (raw weight) should be from millets for children upto 10 years of age.

^ For non-vegetarians, 30g of pulses may be substituted with meat.

\* Continue breast milk, which is roughly 580ml per day.

- Sugar should be less than 5% of the total energy requirements.
- No added sugar for children <2 years old.
- These suggested food groups are for children who are growing normally and for adults with normal BMI (18.5 to 23).
- The suggested diets provide around 30% energy from total fats and ~15% from protein.
- Age groups for children and boys/girls: e.g., 1 to 3 yrs means 1+ to 3 yrs 11 months; 4 to 5 yrs means 4+ to 5 year 11 months and so on.

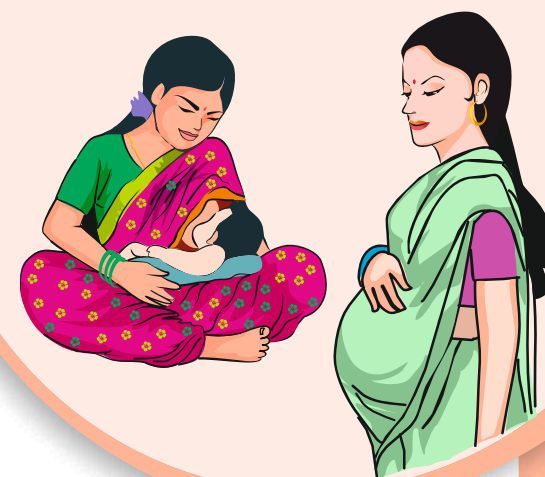
Source: Indian Food Composition Tables 2017  
Nutritive Values of Indian Foods  
Nutrient Requirements for Indians 2020

## POINTS TO REGISTER

- Choose a variety of foods in amounts appropriate for age, gender, physiological status and physical activity.
- Use a combination of whole grains of cereals, pulses and millets.
- Prefer fresh and a variety of locally available vegetables in plenty.
- Include foods of animal origin such as milk/eggs and meat, particularly for pregnant and lactating women, children & adolescents.
- Choose nutrient-rich foods such as pulses (lentils, beans, peas), lean meat, fish and low-fat milk for elders.
- Develop healthy eating habits and exercise regularly and be physically active to avoid a sedentary lifestyle.

# GUIDELINE 2

## Ensure provision of extra food and healthcare during pregnancy and lactation



### RATIONALE

#### Additional nutritious food and care are required during pregnancy and lactation

- Pregnancy is physiologically and nutritionally, a highly demanding period. Extra food is required to meet the nutritional requirements of the mother and development of fetus as well as for healthy pregnancy outcome.
- Regular physical activity and exposure to sunlight are important for appropriate utilization of nutrients and for vitamin D.
- Special focus should be given for certain nutrients such as iron, folic acid, B12, iodine and long chain n-3 poly unsaturated fatty acids (LCn-3PUFAs).
- Iron and folic acid supplements must be taken.
- Iodine is not an issue now as iodine fortified salt is available. B12 can be sourced from yoghurt or curd and flesh foods. Fatty fish is a good source of LCn-3PUFA. Vegetarian can get their LCn-3PUFA from green leafy vegetables, seeds and nuts.

#### Why additional nutrients are required during pregnancy and lactation and what is 1000 days nutrition?

The first 1000 days includes the period from women's conception to birth of the child (270 days) and from birth to her child's 2<sup>nd</sup> birthday (365+365 days). The first 1000 days is a crucial period that shapes the child's future. During this period,

the embryo in the mother's womb is growing very rapidly and draws nutrition from the mother. For this, the mother at the start of pregnancy, should be healthy and well-nourished to provide the required vitamins, minerals, fatty acids, amino acids and energy in adequate amounts to maintain her own health, and for nourishing the developing immune system, brain and other organs of the fetus in addition to the child's growth. Poor nutritional status of pregnant women and inadequate (low intake of calorie, protein and micronutrient-rich foods) or high fat, high sugar, high salt (HFSS) diets can have adverse impact on the growth and development of the fetus.

Undernourished women are at a higher risk of giving birth to small for gestational age (SGA)/low birth weight (LBW= $\leq 2.5$ kg birth weight) babies, and/or may deliver preterm (PT). SGA/LBW babies are at a higher risk of childhood infections and short stature (stunting: low height for age), and as adults they are at higher risk of metabolic diseases such as diabetes, hypertension, cardiovascular diseases (CVD-heart attack, stroke, etc.).

**Pregnant women receiving a balanced diet, and who gain appropriate weight during pregnancy (10 to 12 kg) have a higher chance to give birth to healthy babies.**



Pregnant women receiving a balanced diet, and who gain appropriate weight during pregnancy (10 to 12 kg) have a higher chance of giving birth to healthy babies with appropriate birth weight and organ development; these newborns have lesser risk of infections, morbidity and mortality. After birth, the diet/nutrition of infants, especially for the first two years, is also very important as most organs including brain are still developing. However, it is important to understand that to gain ideal weight and good health and nourishment during pregnancy, nutrition status of a mother should be in a good condition before pregnancy. This is called pre-pregnancy nutrition. For this, check BMI or body weight against height, hemoglobin status, blood pressure, thyroid status and blood glucose levels. In addition to these, a woman also needs to be at least 21 years old.

Learn about balanced, healthy diet (Guideline 1), which is crucial during all stages of life including pre-conception and pregnancy (Figure 2.1) Even a balanced diet cannot provide certain nutrients during pregnancy. For instance, additional iron as well as folic acid to meet the high demands of erythropoiesis (red blood cell formation and hemoglobin synthesis) and iodized salt to meet the requirements of iodine is required.

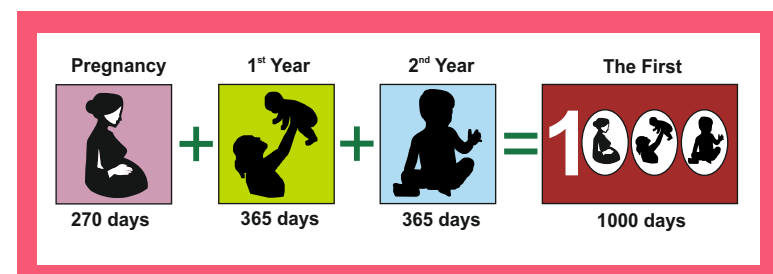
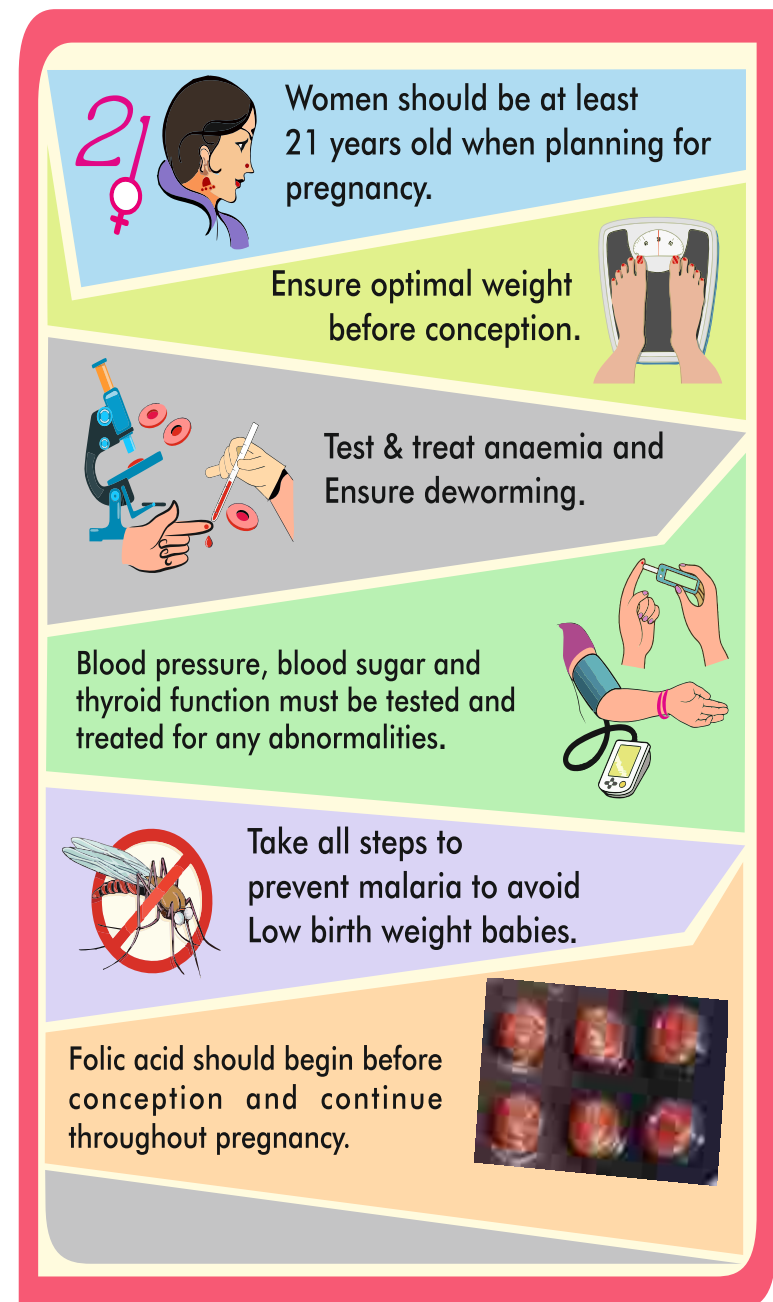
### How much weight gain is recommended during pregnancy?

If BMI of a pregnant woman is normal (BMI 18.5–23 kg/m<sup>2</sup>) at the time of conception, one should aim to gain at least 10–12kg. All underweight women (BMI <18.5 kg/m<sup>2</sup>) should increase the dietary intake and their weight gain should be monitored closely at ICDS or healthcare facilities. Women who are overweight (BMI 23–27.5 kg/m<sup>2</sup>) and those who are obese (BMI >27.5 kg/m<sup>2</sup>) should aim to gain not more than 5g–9 kg.

### What are the nutrients that require special attention during pregnancy and lactation?

The daily diet of a pregnant woman of normal weight for height should contain an additional 350 calories of energy from second to third trimester. An additional 8g of protein is required during second trimester and 18g during the third trimester of pregnancy. The requirement of micronutrients is also high during pregnancy. Hence, the required additional calories and proteins should ideally be obtained from micronutrient-dense foods and not from foods

**Figure 2.1. Pre-conception period**  
(Planning for pregnancy)





containing only calories (Guideline 1). A healthy balanced diet is more crucial during pregnancy. Highly processed and HFSS foods with poor nutrient content should be avoided.

**A healthy balanced diet is more crucial during pregnancy. Highly processed and HFSS foods with poor nutrient content should be avoided.**

During these physiological periods, some micronutrients are specially required in extra amounts. Folic acid, taken in the pre-pregnancy and the first 28 days of pregnancy reduces the risk of anemia. A mother as well as the growing fetus need additional iron as well as folic acid to meet the high demands of erythropoiesis (red blood cell formation). Calcium and vitamin D are essential (during pregnancy and lactation) for proper formation of bones and teeth of the offspring, for secretion of breast milk that is rich in these nutrients and to prevent osteoporosis in the mother.

In addition to LCn-3PUFA, adequate intake of folate-rich foods and iodine intake through use of iodized salt are essential for proper growth of brain of the growing fetus and during early period of infancy (Figure 2.2). Vitamin A rich food is required during pregnancy and lactation to improve child growth and development, in addition to foods containing vitamins B12 and C. Hence, foods rich in these nutrients must be consumed in adequate amounts (Figure 2.3).

#### **How can these additional nutritional demands be met?**

A pregnant woman should eat a wide variety of foods to make sure that her own nutritional needs as well as those of her growing foetus are met. It is important to take care of quantity, quality, diversity and frequency of foods. Grains such as cereals and millets are the major sources of energy, and 45% of the total energy requirement for the day could be contributed by them. Consumption of pulses would contribute in meeting the recommended daily allowance of proteins and also contribute to fibre and micronutrients. Nuts, oil seeds and sea foods would provide essential fatty acids in addition to micronutrients and fibre. In case of non-vegetarians, a portion of the total amount of pulses could be substituted with calorie proportionate

amounts of fish and flesh foods or eggs. High fat, sugar and salt (HFSS) foods should be avoided. Good quality protein is derived from an appropriate combination of cereals and pulses (3:1) and animal source foods such as milk, fish and flesh foods.

**In case of non-vegetarians, a portion of the total amount of pulses can be substituted with calorie proportionate amounts of fish, flesh foods or egg.**

Mineral and vitamin requirements are met by consuming a variety of beans, seasonal vegetables including green leafy vegetables, fresh fruits and animal source foods. Foods such as beans, dry fruits and flesh foods are good sources of iron. Bioavailability of iron can be improved by using fermented and sprouted grains and foods rich in vitamin C such as guava, oranges along with meals. Milk is the best source of biologically available calcium but is a poor source of iron. Adequate sunlight exposure is essential to meet the requirements of vitamin D. Though it is possible to meet the requirements for most of the nutrients through a balanced diet, pregnant women are advised to take daily supplements of iron and folic acid (IFA) tablets and use iodized salt.

#### **Why nutritional care during lactation is important?**

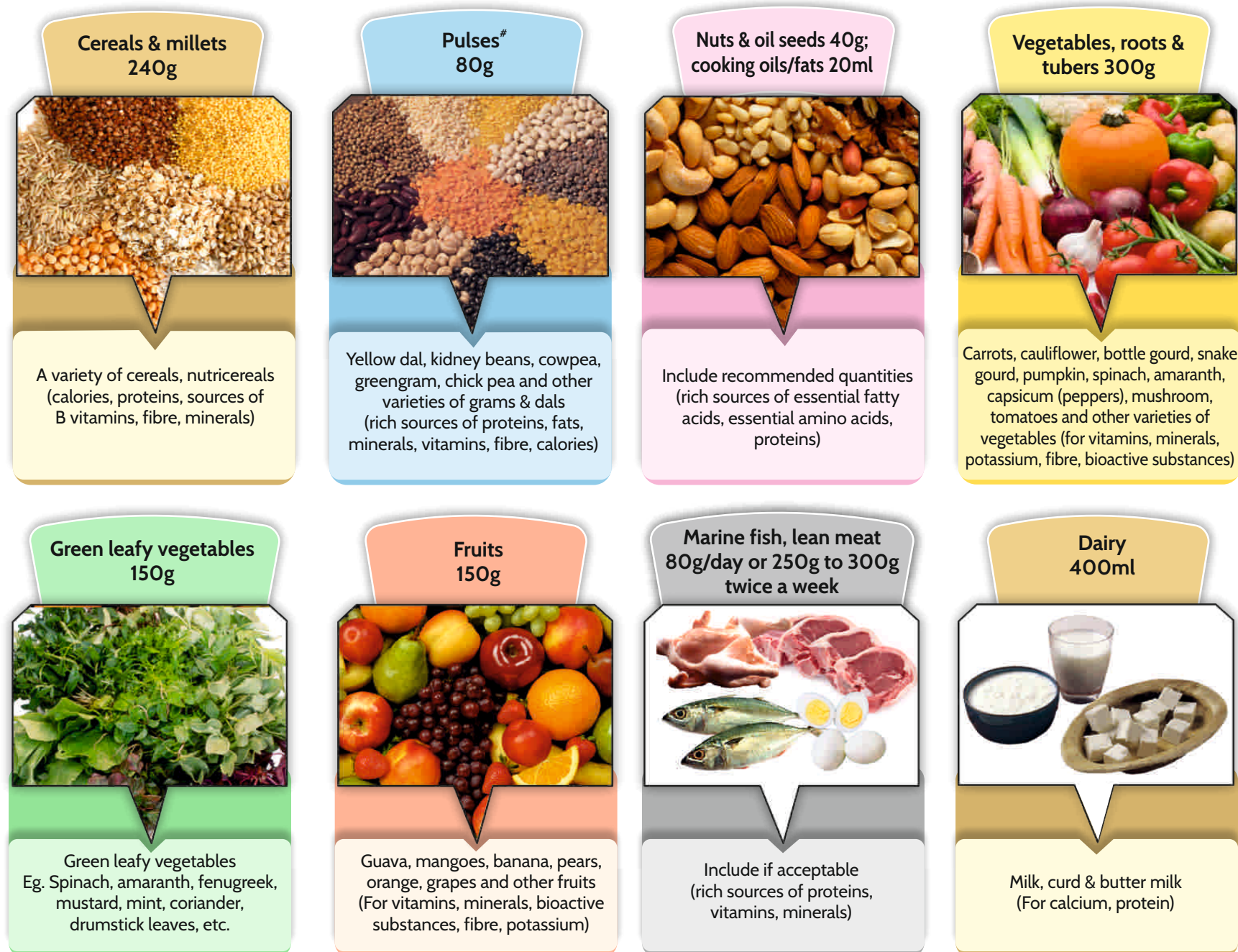
There is an additional demand for calories, proteins and micronutrients during the lactation period, in order to maintain the health of the mother and for optimum breast milk production. During the first six months of lactation, an additional 600 calories of energy and 13.6g of proteins are required in the daily diet. In the next six months, additional requirements are 520 calories of energy and 10.6g of protein. Though it is possible to meet the requirements for most of the nutrients through a balanced diet, lactating women are advised to take daily supplements of iron and folic acid.

Putting the baby to breast immediately after birth helps the uterus to contract firmly and reduces blood loss after delivery. Breast milk is the greatest gift to a child from a mother. The family will also be benefitted by spending less on health expenditure.





**Figure 2.2. Consumption of the following foods daily will be beneficial for a woman's health and fetal development during normal pregnancy**



*Note: The above chart is only suggestive. The quantities of all foods will remain the same as suggested in the above figure, however, quantity of cereals and pulses will increase or decrease based on the body weight, the total calorie requirement and physical activity level of the women.*

**First trimester:** Nutrient-rich balanced diet must be consumed.

**Second & third trimester:** An additional 350 Kcal must be added (calorie requirement of sedentary women) to the nutrient-rich balanced diet as suggested in the above figure. But for undernourished pregnant women, an additional 100 Kcal per day (total 350+100 = 450 Kcal/day) is recommended to be added to meet the additional energy requirement (Table 2.1).

**For overweight pregnant women:** Added sugars should be avoided. Refined cereals and edible oil intake should be reduced.

# A portion of pulse (dal) can be substituted with fish/chicken/meat/egg.




**Figure 2.3. Diet chart for normal sedentary pregnant women**  
(Weighing 55 kgs before conception with normal BMI 18.5–23)

**EARLY MORNING** **6 am**  
(110 Kcal)  
150ml Milk



**BREAKFAST** **8 am**  
(425 Kcal)


Whole grains 60g;  
Vegetable 75g;  
Pulses 20g;  
Nuts 20g;  
Oil-5g




Total calorie: ~2020 Kcal  
Crude protein: 72g

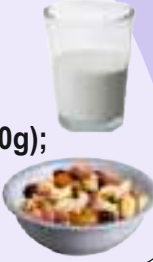
**LUNCH** (830 Kcal) **1 pm**

Rice (100g) or Phulka (100g);  
Pulses (30g); or meat  
Vegetable curry with roots 1¼ cup; Oil 15g  
GLV curry (75g),  
Curd 200ml;  
Fruits 100g



**EVENING** **4 pm**  
(135 Kcal)

Nuts (almond, walnut, peanut & other nuts) and oilseeds (Sesame etc.) (20g);  
Milk 50ml



**DINNER** (485 Kcal) **8 pm**

Rice or Phulka (60g);  
Red gram or chana (25g) (½ cup);  
GLV curry (75g) (½ cup);  
Vegetable curry with roots 1¼ cup; Oil 10g  
Fruit 50g



Increase the dietary intake

Undernourished Pregnant Woman



**Do's**

- Vitamin C rich fruits like gooseberries (amla), guava and orange should be included in the diet to improve iron absorption of plant foods.
- Add green leafy vegetables and other vegetables in your daily diet (Ex. fenugreek (methi) roti, spinach (palak) roti, vegetable idli, vegetable dosa).
- In case of nausea and vomiting, take small and frequent meals (4–6 times/day).
- Expose yourself to direct sunlight for at least 15 minutes to get sufficient vitamin D.
- Avail supplementary nutrition from AWC and micronutrient supplements as per doctor's advice.
- Add a variety of food items in your daily diet by which daily requirement of all the nutrients can be met.
- Green leafy vegetables, legumes and nuts are good sources of folic acid.

**Don'ts**

- Don't smoke or chew tobacco or consume alcohol.
- Avoid carbonated beverages.
- Avoid foods made with hydrogenated fat.
- Don't sleep immediately after meal.
- Don't consume tea, coffee and other caffeinated drinks along with meals or soon after meals.
- Don't lift heavy objects or strenuous physical activity.

Overweight Pregnant Woman

Reduce sugar, cereal (esp. refined) and oil.



Note:

- An additional 350 Kcal has been added for normal weight gain during pregnancy. | Quantities indicated are for raw ingredients. | Added sugar must be restricted to less than 5% of daily energy.
- Food insecure pregnant women should access ICDS take-home food rations and their weight gain should be monitored. | A portion of dal can be substituted with fish/ chicken/ meat/ egg.

Refer: Annexure I & II for household measures



**Table 2.1. Recommended food groups and raw amounts (g/day) to meet dietary requirements of normal and undernourished pregnant women**  
(Parentheses indicate energy)

Food groups	Undernourished [g/day (Kcal)]
Cereals and millets	260 (876)
Pulses and legumes	90 (290)
Nuts & oil seeds	40 (206)
Vegetables	200 (70)
Roots & tubers	100 (58)
Green leafy vegetables	150 (67)
Fruits	150 (80)
Egg	50 (74)
Milk	400 (288)
Fats & edible oils	20 (180)
Energy requirement	~ 2120

### What additional care is required during pregnancy and lactation?

**Dietary care:** It is advised to consume plenty of fluids (over 2 litres per day). This amount of fluid includes water and other beverages. Excess intake of beverages containing caffeine like coffee and tea adversely affect fetal growth and hence should be minimized. The expectant mother should choose foods rich

in fibre (around 25g/1000 Kcal) like whole grain cereals, pulses and vegetables. Intake of these fibre containing foods and enough fluids prevents constipation.

**Food safety:** The most important food safety problem is microbial food-borne illness. Avoiding contaminated foods is an important protective measure against food-borne illness. Extra care needs to be exercised to avoid food-borne illness by following food safety practices.

**Health care:** In addition to satisfying dietary requirements, a pregnant woman should undergo a minimum of four antenatal checkups (ANC) for monitoring weight gain, blood pressure, testing for haemoglobin levels for prevention and treatment of anemia and immunization with tetanus toxoid. She requires enough physical exercise with adequate day time rest of 2–3hrs. Pregnant and lactating women should not indiscriminately take any drugs without medical advice, as some of these could be harmful to the fetus/baby. Smoking, chewing tobacco and consumption of alcohol should be avoided. There is no need to avoid consumption of any specific foods that may be based on wrong food beliefs and taboos.

**Pregnant and lactating women should not indiscriminately take any drugs without medical advice, as some of these could be harmful to the fetus/ baby.**





## EAT IRON-RICH FOODS

- Iron is essential for the synthesis of hemoglobin and prevention of anemia.
- Iron is also needed for brain development of fetus.
- Iron deficiency during pregnancy increases maternal mortality and may decrease birth weight of infants.
- In children, deficiency of iron increases susceptibility to infections and impairs learning ability.
- Iron bio-availability is poor from plant foods but is good from flesh foods such as meat, fish and poultry products. Plant food items such as green leafy vegetables, pulses and dry fruits contain iron.
- Consumption of rich sources of vitamin C fruits like guava, pineapple and citrus fruits (lemon, orange) improve iron absorption from plant foods,
- Beverages (like tea) bind dietary iron and make it unavailable. Tea should be avoided before, during or soon after a meal or while taking IFA supplements.
- Iron, folic acid supplementation comprising 60mg elemental iron, 0.5mg folic acid is recommended from the 12<sup>th</sup> week of pregnancy onwards up to the first six months of lactation.

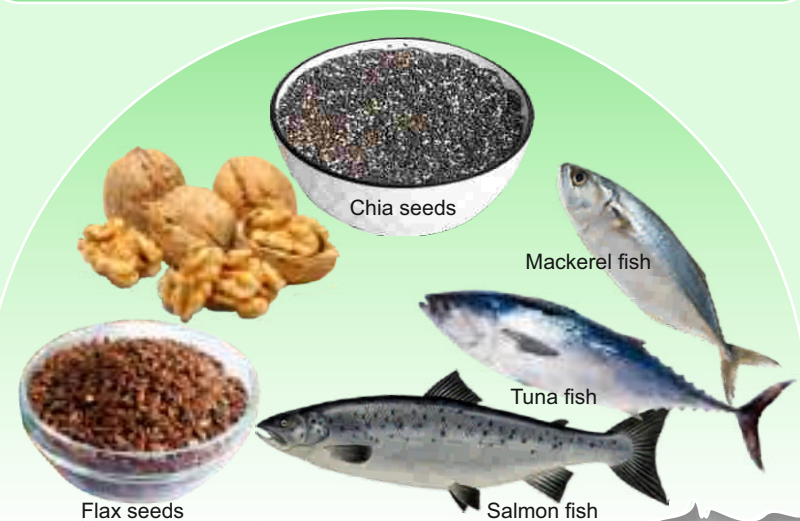


## EAT FOLATE-RICH FOODS

- Folic acid is essential for the synthesis of hemoglobin and prevention of anemia.
- During pregnancy, additional folic acid is required.
- Folic acid supplements in early period of pregnancy in the first 28 days is essential.
- Green leafy vegetables, legumes, nuts and liver are good sources of folate.



## LCn-3PUFA RICH FOODS



## POINTS TO REGISTER

- Follow healthy dietary habits and active lifestyle before conceiving, during pregnancy and lactation (Guideline 1).
- For health and wellbeing of a pregnant woman and her offspring, ensure the woman has appropriate BMI and normal hemoglobin levels.
- A woman must be at least 21 years of age at the time of her first pregnancy.
- Include a variety of pulses, nuts, fish as well as milk and eggs as part of the daily diet to ensure adequate intake of protein, minerals, vitamins, essential fatty acids and essential amino acids (protein).
- High sugar, high fat, high salt (HFSS) foods should be avoided.
- Do not use alcohol and tobacco in any form. Take medicines only when prescribed by a doctor.
- The recommended dosage of iron-folic acid and calcium supplements must be taken after the 12<sup>th</sup> week of pregnancy and should be continued during lactation. Daily recommended dosage of iron for prevention of anemia is one IFA tablet.
- Folic acid supplement (500µg or 0.5mg) is advised during the first trimester (first 12 weeks of pregnancy).

# GUIDELINE 3

## Ensure exclusive breastfeeding for the first six months and continue breastfeeding till two years and beyond



### RATIONALE

**Exclusive breastfeeding for the first six months ensures nutritional adequacy for infant growth and development and also the health of the mother.**

- Breast milk is the most natural and complete food for normal growth and healthy development of infants.
- Breast milk should be given within an hour of birth and no other feeds should be given.
- The first breast milk-Colostrum is secreted soon after birth and continues for 3–4 days and is rich in nutrients and has anti-infective factors.
- Breastfeeding reduces risk of infections and is associated with better cognitive development of children and provides long-term health benefits (prevention of obesity and diabetes).
- Breastfeeding establishes mother-infant contact and promotes mother-child bonding.
- Breastfeeding helps in retraction of the uterus and minimizes blood loss after delivery.
- Breastfeeding prolongs birth interval due to delayed return of menstruation.
- Risk of breast cancer is lower in mothers who breastfeed their children.

### When to start breastfeeding and how long to continue?

As soon as the baby is born, skin contact and breastfeeding must be established at the earliest (within one hour of birth). Such an early initiation of breastfeeding (EIBF) facilitates milk production and also helps in mother-infant bonding. Also, putting the baby to breast immediately after birth helps uterus to contract firmly and reduces blood loss after delivery. Colostrum is the first milk secreted during the first 3–4 days after birth; and should be fed to the newborn immediately after birth. Colostrum should not be discarded.

Avoid feeding honey, glucose, water, or dilute milk formula before initiation of breastfeeding and anytime during the first 6 months. The newborn should be encouraged to suckle at mother's breast which helps in increasing milk secretion. Emotional Quotient of the breastfed infants is better than the non-breastfed infants.

**As soon as the baby is born, skin contact and breastfeeding must be established at the earliest (within one hour of birth). Early Initiation of Breast Feeding (EIBF).**



Infant should be exclusively breastfed (EBF) for the first 6 months and exclusively breastfed infants do not need water. Feeding water reduces the breast milk intake and increases the risk of diarrhea and is to be totally avoided. Water is not required, even if the climate is hot. An enabling environment should be created for the mother, both at home (by family members) and elsewhere for promotion of optimal breastfeeding. Breastfeeding should be continued at least for two years.

**Avoid feeding honey, glucose, water, or dilute milk formula before initiation of breastfeeding and anytime during the first 6 months.**

**Giving water in addition to breastfeed in the first 6 months of EBF is not required, even if the climate is hot.**

### What ensures an adequate supply of breast milk?

On-demand feeding and frequent suckling ensure optimal breast milk production. Adequate growth of the baby indicates that there is adequate supply of breast milk. It is necessary that a woman is emotionally prepared during the pregnancy period for breastfeeding and is encouraged to eat a well-balanced diet. Anxiety and emotional disturbances must be avoided, and adequate rest should be ensured. Milk production of the mother is also influenced by appropriate feeding skills of the mother with respect to holding or positioning of the infant in her lap and latching the infant's mouth to the mothers' nipple.

Frequent suckling by the baby and complete emptying of one breast prior to offering the second one is important for feeding nutrient concentrate and higher fat content of hind milk as well as for sustaining adequate breast milk output. This will also facilitate optimum consumption by the young infant. It is necessary to prepare the mother's breast, particularly the nipples, for effective breastfeeding. Expressed milk can be fed to a young infant within a few minutes at room temperature. A

working mother can express her breast milk hygienically and store it safely under refrigerated conditions (2–4° C) for upto 8 hours.

**Frequent suckling by the baby and complete emptying of one breast prior to offering the second one is important.**

### What are the common myths and problems?

Mothers usually feel breast milk is watery and less in quantity. A newborn's capacity to drink milk is limited as the stomach size is small. Hence, inadequate secretion of breast milk is only a misconception and mothers should not discontinue breastfeeding. Also, on-demand-feeding and frequent suckling will ensure optimal breast milk production. Complete emptying of one breast is important prior to offering the second breast in order to sustain adequate milk production.

It is often misconstrued that breast milk should be discontinued when it appears stained with blood. However, breastfeeding should not be discontinued as the bloody stain will disappear gradually. In case pain is experienced while breastfeeding or blood staining persists consult healthcare personnel / doctor for treatment or advice. Breastfeeding should be continued during treatment and after.

**Inadequate secretion of breast milk is only a misconception and mothers should not discontinue breastfeeding.**

### What are the advantages of breast milk?

Breast milk contains all essential nutrients needed for an infant and protects from infections. Breast milk is natural and more easily digested and absorbed compared to formula milk prepared from other sources. Colostrum, which is the milk secreted during the first 3–4 days after birth, is rich in proteins, minerals, vitamins especially vitamin A and antibodies. In addition, breast milk adequately hydrates the baby, has a laxative effect and prevents constipation. Breastfeeding helps in birth spacing by delaying further pregnancies. Emotional





bond between mother and infant is positively influenced by breastfeeding. Evidence suggests that human milk confers long-term benefits such as lower risk of certain autoimmune diseases, inflammatory bowel disease, obesity, and related disorders and probably some cancers. Therefore, '*breast milk is the best milk*' for the newborn and growing infant. Breastfeeding is associated with better cognitive and brain development in infants.

In addition to providing nutrients, breast milk has several special components such as growth factors, enzymes, hormones, and anti-infective factors. The amount of milk secreted increases gradually in the first few days after delivery, reaching the peak during the second month and it is maintained until about six months. An average Indian woman secretes about 750ml of milk per day during the first six months and 600ml of milk per day subsequently up to one year.

#### How does breast milk protect against infections?

Diseases and death among breastfed infants are much lower than those among non-breastfed infants. Exclusive breastfeeding protects against diarrhea and upper respiratory tract infections. The gut flora and the low pH of breast milk (pH 6.36–7.36) inhibit the growth of pathogens. The prebiotic bifidus factor in breast milk promotes the natural gut flora. Breast milk has immunoglobulins (IgA), lactoferrin, complement factors and lactoperoxidase, which protect the infant from several infections. Antibodies to *E-coli* and some viruses are found in breast milk, which protect the gut mucosa. Breastfeeding also protects infants from vulnerability to allergic reactions.

#### What are the effects of maternal undernutrition on breast milk?

- The nutritional composition of breast milk is usually maintained well within the normal limits, even in mild to moderate undernutrition.
- However, if a mother is severely undernourished, quality and composition of breast milk as well as quantity may be affected.

- Undernourished mothers should be given additional allowance of foods that are rich in nutrients, good quality proteins and essential fats (Table 3.1).
- Provision of nutrition supplements should be initiated at the earliest to fulfill her requirements as well as the baby's nutritional needs.

#### Are medicines and addictive substances secreted in breast milk?

Many medicines (like antibiotics, painkillers and hormones) and addictive substances (caffeine, alcohol and psychotropic drugs) are secreted into breast milk and could prove harmful to breastfed infants. Hence, caution should be exercised by lactating mothers and appropriate medical guidance should be taken for the above referred medicines or addictive substances.

#### Should HIV positive women breastfeed their babies?

HIV may be transmitted from mothers to infants through breast milk. HIV positive mothers should be made aware of the risk of transmission of HIV through breast milk and its consequences. Based on the principle of informed choice, HIV infected women should be counseled about the risk of HIV transmission through breast milk and the risks and benefits of each of the feeding methods, with specific guidance in selecting the option that is considered to be most likely to be suitable in a specific situation. However, HIV positive mothers living in resource-poor settings may not have access to safe, hygienic and affordable replacement feeding options. In such situations, considering the important role of breast milk in child growth and development, every effort should be made to promote exclusive breastfeeding for up to four months followed by weaning and complete stoppage of breastfeeding at six months in order to restrict transmission through breastfeeding. In any case, mixed feeding i.e., breastfeeding along with other feeds should be strictly discouraged as it increases the risk of HIV transmission. This is in agreement with National AIDS Control Organization (NACO) guidelines.



### Should COVID-19 positive women breastfeed their babies?

At present, data to conclude vertical transmission of COVID-19 through breastfeeding is not sufficient. In infants, the risk of COVID-19 infection is low, the infection is typically mild or asymptomatic, while the consequences of not breastfeeding and separation between mother and child can be significant. The benefits of breastfeeding and nurturing mother-infant interaction to prevent infection and promote health and development are especially important when health

and other community services are themselves disrupted or limited. WHO recommends that mothers with suspected or confirmed COVID-19 should be encouraged to initiate or continue to breastfeed.

**WHO recommends that mothers with suspected or confirmed COVID-19 should be encouraged to initiate or continue to breastfeed.**

### RISK OF NOT FEEDING BREAST MILK

**For infants:** Not being breastfed is associated with an increased incidence of infections, higher risks of childhood obesity, type 1 and type 2 diabetes and leukemia. In some cases, it can also lead to sudden infant death syndrome.

**For mothers:** Breastfeeding reduces risk of breast cancer and ovarian cancer, obesity, type 2 diabetes, metabolic syndrome and cardiovascular diseases such as stroke and heart attacks.

## POINTS TO REGISTER

- Early initiation of breastfeeding (EIBF) i.e. within an hour of birth is crucial.
- Colostrum i.e. milk secreted in the first 3–4 days, is rich in nutrients and should not be discarded.
- Infants should be exclusively breastfed (EBF) for the first six months. Do not give any other feed, not even water.
- Infant should be breastfed frequently and on demand, to establish and maintain adequate breast milk supply.
- Breastfeeding should be continued in addition to nutrient-rich complementary foods (weaning foods), preferably up to two years.
- Lactating mothers with any disease should continue breastfeeding unless medically advised.
- The family should actively support breastfeeding.
- Ensure that the mother is counseled on how to hold a baby while breastfeeding. Additionally, mothers must be informed regarding the appropriate method of latching the baby to breast.
- Ensure nutritionally adequate diet is consumed both during pregnancy and lactation.
- During pregnancy and lactation period, medicines can be taken only on physician's advice.
- A lactating mother should avoid addictive substances like tobacco (smoking and chewing), alcohol and psychotropic drugs.



# GUIDELINE 4

## Start feeding homemade semi-solid complementary foods to the infant soon after six months of age



### RATIONALE

Home-made preparations are economical, easy to cook, safe and healthy for a growing baby.

- Breast milk alone is not adequate for the infant to sustain optimal growth beyond six months of age.
- Timely introduction of complementary foods with appropriate quality and adequate quantity will ensure optimal growth.
- Feeding of adequate and appropriate complementary foods along with breastfeeding is essential for meeting increased nutrient requirements of growing infants soon after completion of six months of age.
- Breastfeeding is recommended to be continued along with complementary foods for at least up to two years.
- During complementary feeding, hygienic practices should be followed while preparing food and feeding in order to prevent diarrhea and infections.
- Limit use of salt in complementary food preparations.
- Avoid feeding foods and beverages with added sugar.

Breast milk is the best and complete food for an infant. However, often, children are solely breastfed even beyond six months in the belief that breast milk alone is adequate for a child until the baby is able to pick up food and eat. Such a belief

leads to poor complementary feeding practice that causes undernutrition among young children, since breast milk alone is not enough to fulfill the increase in nutrition requirements for optimal growth and development from six months onwards. Therefore, complementary foods prepared appropriately should be fed soon after six months. Feeding practices comprising selection of foods, quantity to be fed, consistency of feed and frequency of feeding are crucial.

### What is complementary feeding?

Breast milk (mother's milk) alone or exclusive breastfeeding is not adequate for the growth and development of a baby when the baby turns six months. Hence, breast milk should be complemented with feeding semisolid foods to breastfed infants from 6 to 12 months.

### Why feed complementary foods and when?

During the first six months of life, mother's milk alone or exclusive breastfeeding is adequate for the growth and development of a baby. Requirements of all nutrients per kg of body weight are higher for infants as they are in a rapid growth phase. Moreover, the volume as well as nutrient concentrations of breast milk gets reduced from six months onwards. Hence, to



meet the higher nutrient requirements of infants from six months onwards and promote optimal growth in infants, breast milk feeding needs to be complemented with feeding of other foods. Such food items are known as complementary foods.

### What should be included in complementary foods?

The total energy and protein requirements for an infant from 6 to 12 months range is from 650 to 720 Kcal/day, and 9–10.5g/day respectively. But, on an average, after six months, breast milk provides about 500 Kcal and 5g protein per day, which is inadequate for optimal growth of infants after six months of age. Hence, introduction of complementary foods for six months old infants is crucial to prevent growth faltering. In addition, micronutrient needs of infants are higher, about five to ten times higher than adult requirements on body weight basis. This is a very big challenge; hence, foods that are fed to infants need to be micronutrient-dense and should have good quality protein.

Along with cereals, nutrient dense foods such as oil seeds, nuts, milk, vegetables and fruits must be included. Flesh foods and eggs or pulses such as lentils, chickpea, kidney beans, cowpea, black gram can be good source of proteins. Fresh fruit juices or fresh fruit purees can be given but fruit juices and sugar-sweetened beverages should be avoided. Sugar or salt need not be added to complementary foods.

Infants can be introduced to thoroughly cooked whole eggs, fish and meat in small quantities from eight months onwards. If these foods are not acceptable, adequate amounts of pulses should be added to meet the nutrient requirements. Infants should also be introduced to different types of green leafy vegetables (GLVs), non-leafy vegetables and fruits that are sources of vitamins and minerals. However, be remembered that these should be thoroughly cooked and mashed before feeding. A child should not be fed a diet that is of liquid consistency (flows in a plate or thali) but is semisolid (spreads in a plate or thali). At about one year of age, a child should be introduced to the family diet. However, a child's diet

should be nutritionally dense. Additional nutritious foods including milk, fruits, small amounts of nuts, oil seeds, oil/ghee are recommended to be added to enhance nutrient density of the family diet.

Adequate care should be taken when feeding a child during and after diarrhoea or any infection to prevent malnutrition.

### How to introduce complementary foods to infants?

While introducing complementary foods at six months, start with thin but not watery porridge (viz, dal gruel) for 4–5 days and gradually increase its thickness to slurry consistency (well mashed/pureed foods). Include new foods (viz, rice slurry, mashed potato, steamed and pureed apple etc.), one at a time, and continue feeding it regularly for 4–5 consecutive days to establish acceptance by the child. This will not only help the child to get acclimatized to the food introduced but will also inform if there is any associated food intolerance or allergy. If a child does not accept a specific food item, reintroduce after a few days. If a child shows an intolerance to a specific food item and the intolerance persists, seek medical advice for appropriate diagnosis and treatment. Once ensured and satisfied that an infant is accepting different foods and textures, appropriate and suitable food mixes can be fed regularly. Gradually, as a child grows, increase consistency of the feed from semi-solid to solid foods along with improving quantity, variety, and frequency of feeding.

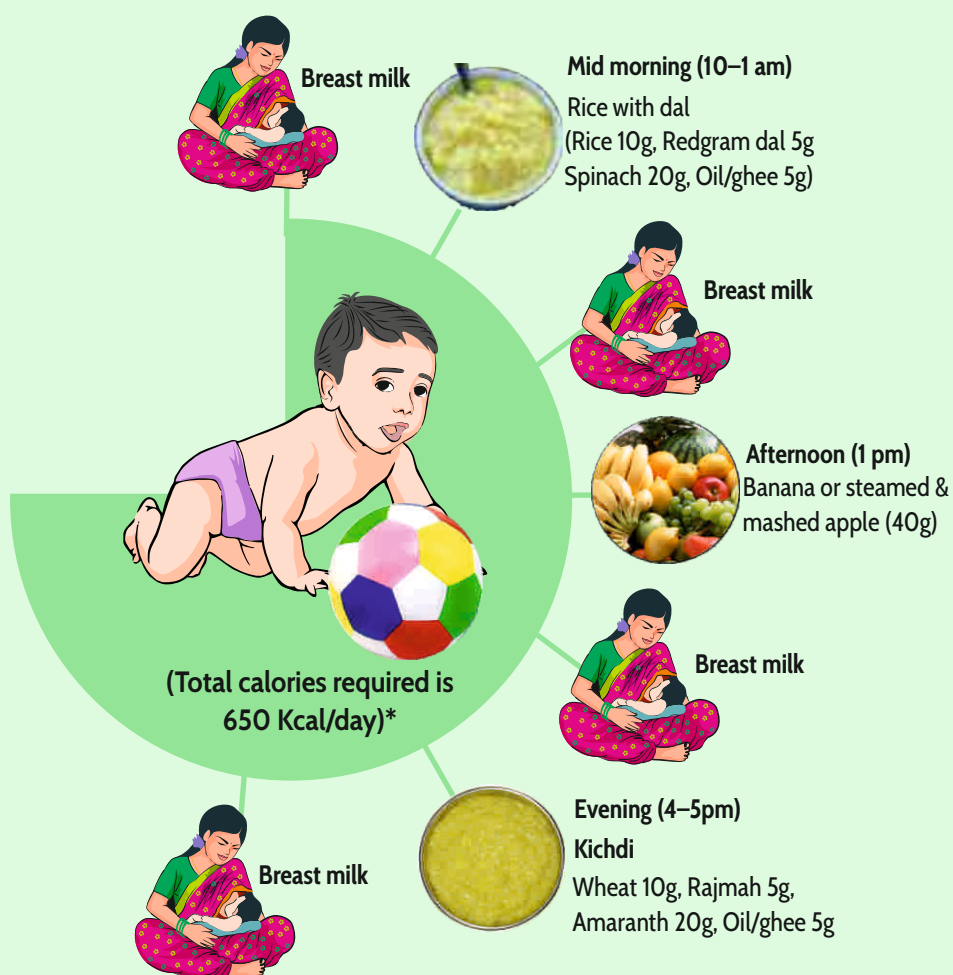
**Minimum acceptable diet and dietary diversity for infants and children in India:** A child is considered to have the minimum acceptable diet when, along with continuation of breastfeed, the child is fed adequate food items in terms of both quality and frequency of feeding. A child may be considered to have minimum dietary diversity (MDD) when the complementary foods include at least the following five foods everyday. 1) cereals / millets; 2) pulses / egg / meat; 3) nuts and oilseeds; 4) breast milk / milk and milk products; 5) vegetables / GLVs and fruits. It is recommended to avoid sugar and reduce salt intake to the bare minimum.



**Minimum meal frequency:** The minimum number of meals apart from breastfeeding needed for the child vary depending on the age of the child and whether the child is currently breastfed. During 6–8 months of age, a breastfed child needs to be given complementary feeds at least twice a day and during 9–24 months, this frequency needs to be increased to at least three times a day. Non-breastfed children aged 6–24 months need to be fed at least four times in a day in addition to milk (Figures 4.1 to 4.4).

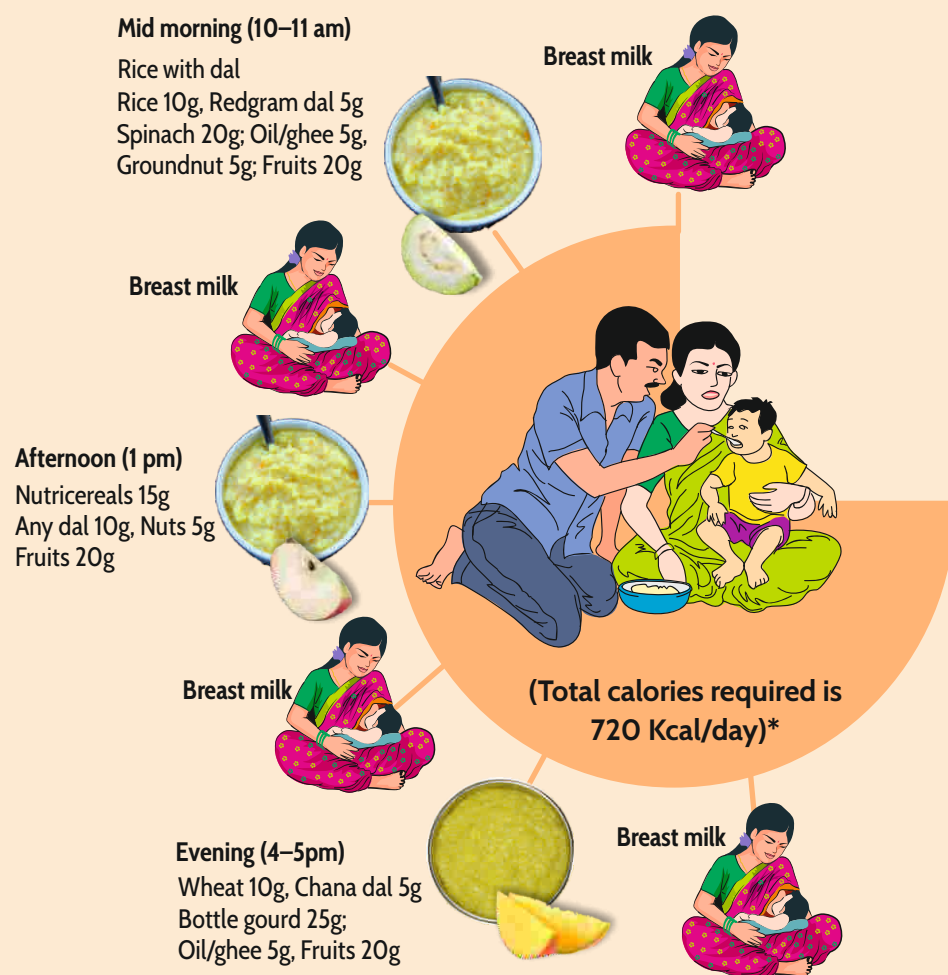
**Home-made complementary foods are nutritious:** Complementary foods can be prepared at home from commonly used ingredients (mentioned above). Home prepared foods are not only nutritious but are also easily digestible by infants and children. Benefits of home-made complementary foods outweigh that is provided by commercially prepared foods. Some examples of home-made complementary foods are given in Figures 4.5 & 4.6. Processed foods and foods that are high in fats, salt and sugar (HFSS) must be avoided (example: biscuits, chips).

**Figure 4.1. Diet chart for infants (6–8 months)**



\* Calories from suggested complementary foods is 230 Kcal/day. The balance 420 Kcal will be from breast milk, making a total of 650 Kcal/day

**Figure 4.2. Diet chart for Infants (9–12 months)**



\* Calories from suggested complementary foods is 385 Kcal/day. The balance 335 Kcal will be from breast milk, making a total of 720 Kcal/day



*Note: Avoid use of salt and sugar in the recipes | Quantities indicated are for raw ingredients.*

Timings mentioned are for suggestive purpose only. Complementary foods should be given along with breast milk

Refer: Annexure I & II for household measures



**Figure 4.3. Suggested complementary food menus for Infants (6–12 months)**

6–8 Months				9–12 Months			
	Mid morning (10–11 am)	Afternoon (1 pm)	Evening (4–5pm)	Mid morning (10–11 am)	Afternoon (1 pm)	Evening (6 pm)	
<b>Sun</b>	Rice 10g Red gram dal 5g Spinach 20g Oil/ghee 5g	Steamed & Mashed Apple (50 g)	Wheat 10g Chana 5g/ *egg 20g Bottle gourd 25g Oil/ghee 5g	Rice 10g, Red gram dal 5g Spinach 20g, Groundnut 5g Oil/ghee 5g; Fruits 20g	Cereals/Nutricereals 15g Any dal 10g Groundnut 5g, Fruits 20g	Wheat 10g Chana dal 5g/meat 20g Bottle gourd 25g Oil/ghee 5g, Fruits 20g	
<b>Mon</b>	Ragi 10g Cowpea 5g/*egg 20g Methi 20g Oil/ghee 5g	Orange (50 g)	Rice 10g Red gram dal 5g Beans 25g Oil/ghee 5g	Ragi 10g, Cowpea 5g/*egg 20g Methi 20g, Thil 5g Oil/ghee 5g, Fruits 20g	Cereals/Nutricereals 15g Any dal 10g Groundnut 5g, Fruits 20g	Rice 10g Red gram dal 5g Beans 25g Oil/ghee 5g, Fruits 20g	
<b>Tue</b>	Wheat 10g Chana 5g Colocasia leaves 20g Oil/ghee 5g	Mashed papaya (50 g)	Bajra 10g Green gram dal 5g Ridge gourd 25g Oil/ghee 5g	Wheat 10g; Chana dal 5g Colocasia leaves 20g Cashew nuts 5g Oil/ghee 5g, Fruits 20g	Cereals/Nutricereals 15g Any dal 10g Groundnut 5g, Fruits 20g	Bajra 10g Green gram dal 5g/ Fish 20g, Ridge gourd 25g Oil/ghee 5g; Fruits 20g	
<b>Wed</b>	Bajra 10g Chana dal 5g/*egg 20g Malabar Spinach 20g Oil/ghee 5g	Mashed mango (50 g)	Rice 10g Lentil 5g Beans 25g Oil/ghee 5g	Bajra 10g, Chana dal 5g/ Fish 20g; Spinach 20g Walnuts 5g Oil/ghee 5g; Fruits 20g	Cereals/Nutricereals 15g Any dal 10g Cashew nuts 5g, Fruits 20g	Rice 10g Lentil 5g, Beans 25g Oil/ghee 5g Fruits 20g	
<b>Thu</b>	Rice Flakes 10g Black gram dal 5g Mint leaves 20g Oil/ghee 5g	Mashed chikoo/sapota (50 g)	Maize 10g Kidney Beans 5g/ *egg 20g; Ivy gourd 25g Oil/ghee 5g	Rice Flakes 10g Black gram dal 5g Mint Leaves 20g, Thil 5g Oil/ghee 5g, Fruits 20g	Cereals/Nutricereals 15g Any dal 10g Almonds 5g, Fruits 20g	Maize 10g Kidney Beans 5g/Egg 20g Ivy gourd 25g Oil/ghee 5g, Fruits 20g	
<b>Fri</b>	Wheat 10g Rajmah 5g/ *egg 20g Amaranth 20g Oil/ghee 5g	Watermelon (50 g)	Rice 10g Black gram dal 5g Beans 25g Oil/ghee 5g	Wheat 10g, Rajmah 5g Amaranth 20g Pista 5g; Oil/ghee 5g Fruits 20g	Cereals/Nutricereals 15g Any dal 10g Coconut 5g, Fruits 20g	Rice 10g Black gram dal 5g/ Fish 20g; Beans 25g Oil/ghee 5g, Fruits 20g	
<b>Sat</b>	Ragi 10g Cowpea 5g Methi 20g Oil/ghee 5g	Mashed banana (50 g)	Wheat 10g Chana dal 5g/*egg 20g Bottle gourd 25g Oil/ghee 5g	Ragi 10g, Cowpea 5g Methi 20g Thil 5g; Oil/ghee 5g Fruits 20g	Cereals/Nutricereals 15g Any dal 10g Groundnut 5g, Fruits 20g	Wheat 10g Chana dal 5g/ chicken 20g Bottle gourd 25g Oil/ghee 5g, Fruits 20g	

Timings mentioned are for suggestive purpose only | Quantities indicated are for raw ingredients | Total calorie (energy) required is 650 to 720 Kcal/day and protein is 9 to 10.5 g/day | Suggested complementary food provides (Incl. fruits) provides 230 Kcal/day (6–8months) to 385 Kcal/day (9–12 months); The balance 420 Kcal (6–8m) and 335 Kcal (9–12m) will be from breast milk, making a total of 650 Kcal/day and 720 Kcal/day respectively | \* Soft boiled  
Total protein provided by complementary food is 9 to >10.5g/day | Added sugar must be totally avoided for children below 2 years

Note: Breast milk should be continued

Refer: Annexure I & II for household measures





**Figure 4.4. Suggested food groups to be included in daily menus of >1 year old children**  
(Energy 1110 Kcal & Protein 36.7g)



	Early morning (6–7 am)	Morning (8–9 am)	Lunch (1 pm)	Evening (4–5pm)	Dinner (7–8pm)
Sun		Bajra 40g, Red gram 15g Spinach 25g, Tomato 35, Oil/ghee 7g Fruits 25g	Wheat 40g, Chana 15g/egg 1/2 Bottle gourd 35g, Methi 25g Oil/ghee 7g, Fruits 25g		Rice 40g, Green gram 10g Ridge gourd 30g Oil/ghee 6g, Fruits 25g
Mon		Ragi 40g, Cowpea 15g / Chicken 25g Methi 25g, Tomato 35, Oil/ghee 7g Fruits 25g	Rice 40g, Red gram 15g Beans 35g, Malabar spinach 25g Oil/ghee 7g; Fruits 25g		Rice 40g, Red gram 10g Beans 30g, Oil/ghee 6g Fruits 25g
Tue		Wheat 40g, Chana 15g / mutton 25g Colocasia leaves 25g, Tomato 35g, Oil/ghee 7g; Fruits 25g	Bajra 40g, Green gram 15g Ridge gourd 35g, Spinach 25g Oil/ghee 7g, Fruits 25g	 Milk 150 ml   Nuts 10g	Wheat 40g, Chana 10g/ egg 1/2, Bottle gourd 30g Oil/ghee 6g, Fruits 25g
Wed	 Milk 150 ml	Jowar 40g, Chana 15g / Fish 25g Spinach 25g, Tomato 35, Oil/ghee 7g Fruits 25g	Rice 40g, Lentil 15g Beans 35g, Methi 25g Oil/ghee 7g; Fruits 25g		Rice 40g, Lentil 10g Beans 30g, Oil/ghee 6g Fruits 25g
Thu		Rice flakes 40g, Black gram 15g/ Fish 25g, Methi leaves 25g, Tomato 35g Oil/ghee 7g, Fruits 25g	Maize 40g, Kidney beans 15g / Egg 1/2 Ivy gourd 35g, Spinach 25g Oil/ghee 7g; Fruits 25g		Maize 40g Kidney beans 10g/ Ivy gourd 30g; Oil/ghee 6g Fruits 25g
Fri		Wheat 40g, Rajmah 15g / Chicken 25g Amaranth 25g, Tomato 35g, Oil/ghee 7g Fruits 25g	Rice 40g, Blackgram 15g Beans 35g, Malabar spinach 25g Oil/ghee 7g; Fruits 25g		Rice 40g, Black gram 10g Ridge gourd 30g Oil/ghee 6g, Fruits 25g
Sat		Ragi 40g, Cowpea 15g / Fish 25g Methi 25g, Tomato 35g, Oil/ghee 7g Fruits 25g	Wheat 40g, Chana 15g / egg 1/2 Bottle gourd 35g, Drumstick leaves 25g, Oil/ghee 7g, Fruits 25g		Wheat 40g, Chana 10g Carrot 30g, Oil/ghee 6g Fruits 25g

Suggested foods provide approximately 1110 Kcal/day | Total protein provides 13% Kcal/day from the suggested diet | Quantities indicated are for raw ingredients  
Timings mentioned are for suggestive purpose only | \*Soft boiled | Added sugar must be totally avoided for children below two years

Note: Breast milk should be continued

Refer: Annexure I & II for household measures



## How to feed an infant?

Infants cannot eat large quantities of food in a single meal. Hence, they should be fed at frequent intervals (at least four times a day). Also, the food prepared for feeding should be of semi-solid consistency for easy swallowing. Do not give watery food such as '*dal kaa pani*' instead give 'mashed pulse/dals' of a thicker consistency, when such semi-solid foods are offered initially, the infant appears to spit it out. This should not be mistaken as dislike for the food. The child is learning to swallow. The fact is that an infant cannot achieve full coordination needed for the act of swallowing and hence, brings out the food by movements of the tongue. Therefore, it is important to start feeding with semi-solid foods in small quantity (two or three teaspoons). Physiological maturity of swallowing of food of semi-solid consistency develops when such a food preparation is fed regularly. An infant should be first fed complementary food and this should be followed by breastfeeding. Breastfeeds are often well accepted and tolerated even by sick children and should be continued as long as it is acceptable. Breast milk is very beneficial for ill children since in addition to providing good amount of nutrients, breast milk promotes sodium and water transport across the gut and, thus, prevents dehydration and weight loss.

**Responsive feeding:** Responsive feeding refers to the mutual interaction between a parent/caregiver and a child while feeding. Such interaction is often noted in Indian tradition and should be actively promoted. Responsive feeding provides emotional support to a child and influences a child's behavior by promoting attentiveness and interest in feeding. It helps in successful progression to effort at eating independently by a child. Responsive feeding involves an active interaction and not feeding passively while watching TV, playing with the phone. At the same time, a child should not be controlled or force fed. A child should be fed slowly and patiently. One should pay attention to a child's signals of hunger (sucking on the fist, drooling, looking at food, etc.) and satiety (turning away, getting distracted and so on).

## What are the 'hygiene practices' to be adopted?

Most often, diarrhea is caused by unhygienic practices followed by mothers/caregivers. It is important to ensure that hygienic practices are scrupulously followed. All the dietary ingredients should be thoroughly cleaned. Vegetables should be washed well to remove contaminants/parasites/pesticides before cutting. Vegetables should preferably be steam-cooked to reduce nutrient losses due to cooking. At the time of preparation of food or while feeding a child, mothers/caregivers should observe proper personal hygiene. Utensils used for cooking and feeding should be thoroughly washed. As feeding is likely to be time consuming, cup or plate or any other feeding utensils used for feeding a child should be kept covered to protect it from flies and insects.

A variety of home-made ready to cook foods can be prepared for use as complementary foods and such prepared foods should be stored in clean bottles or tins. These food items should be consumed within the safe shelf life of the food product.

## What should be done in 'lactose intolerance'?

During acute or chronic diarrhea, lactose intolerance is a mild and transient problem. This is due to deficiency of the enzyme lactase in intestinal cells, which is needed for digestion of lactose in the milk. This problem can be overcome by reducing the quantity of milk taken at a time or taking milk along with a cereal-pulse meal or taking milk in the form of curd. There is no need to stop milk intake in acute diarrhoea situation. In chronic diarrhoea, some children may develop lactose intolerance. In such children, milk may be stopped temporarily based on doctor's advice. A diet based on cereals and pulses or chicken and egg would allow gut to recover and following recovery, milk can then be slowly re-introduced.

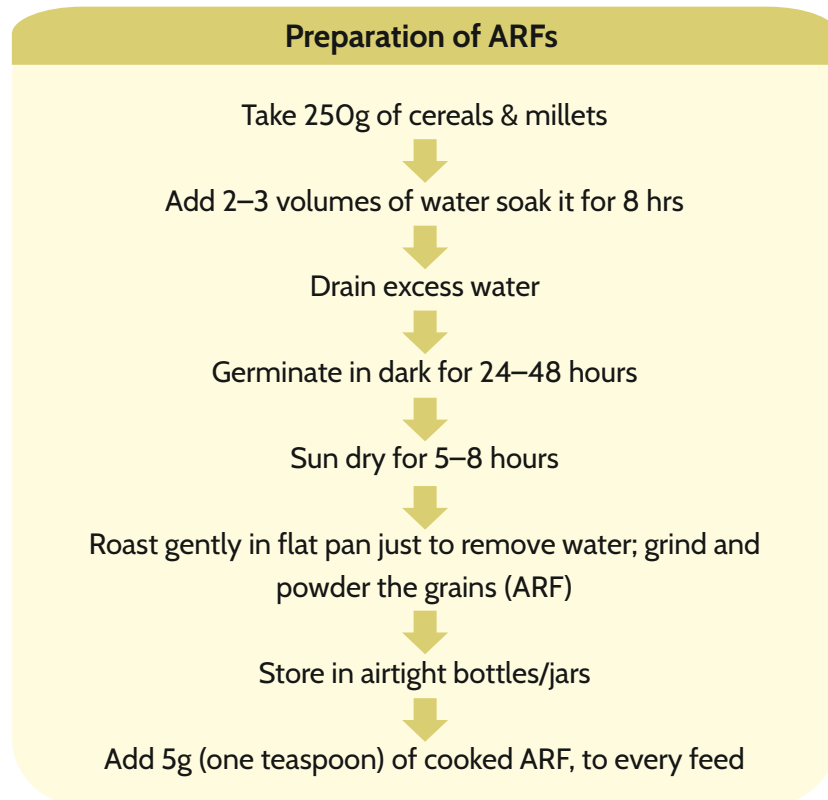
## Amylase-Rich Foods (ARFs)

Flours of germinated cereals, which are rich in the enzyme alpha-amylase, constitute ARFs. Even small amounts of this type of foods liquefy and reduce the bulk of the cereal-based





diet. Thus, ARFs help in increasing the energy density of weaning gruels as well as in reducing bulk. Mothers can add ARF to increase the digestibility of the low-cost weaning foods prepared at home. As presented below, preparation of ARF is very simple and can be done by mothers at home.



### How to prepare selected recipes for complementary foods

A number of different age specific recipes and snacks are given in the Figures 4.5 & 4.6. The nutrient content in terms of energy (calories), protein, zinc and iron from each recipe is also presented. Following process could be followed.

- Roast cereals and pulses separately under low flame and grind them coarsely like rawa.
- Mix all the ingredients together before preserving them in airtight container (ingredients should be coarse in texture and not like atta). This can be preserved for 10 to 15 days under room temperature.
- One or two tablespoons of rawa/suji to be cooked in water for about 10 to 15 minutes under low flame.
- Clean and grate/cut fresh vegetables or meat into small

pieces and add them to the gruel of rawa and cook them.

- Eggs can be cracked and added to the rawa and cooked. Alternatively, eggs can be boiled separately, grated and added to the rawa gruel after cooking.
- Feed the child once it is cool. Milk is optional and can be added to enhance taste and nutrients. Alternatively, peanut powder or gingelly seed powder can be added to enhance energy and taste.
- The cooked porridge should be used within one to two hours under hygienic condition.

### Egg pudding

- Beat the egg and whisk it uniformly. Not peaks are required.
- Add milk, cardamom and nutmeg powder and mix till well combined.
- Steam the moisture in a steamer or pressure cooker (without whisk) for 15-20 minutes.
- Cold it to room temperature and serve.

### Egg nog

- Whisk the egg in a bowl and keep aside.
- In a heavy bottom sauce pan add the whole milk, heat the milk on low and stir occasionally until it begins to boil but do not let it boil completely.
- Remove from the stovetop; pour the whisked egg drop by drop. This is called tempering the eggs so they don't scramble.
- Once combined, pour the mixture back into the sauce pan and let it simmer on low heat. It's done when the egg mixture coats the back of a spoon.
- Turn off the heat and set the mixture aside. Grate the nutmeg into the egg nog and stir to combine.
- Pour the eggnog through a strainer into another bowl to remove any lumps and serve.








#### Note:

*This is the time when infants develop taste; hence, discourage them from developing taste for foods high in salt or sugar | Salt can be avoided or very little may be added, i.e. less than 50% of what you would like to add for your taste.*

*Sugar should be avoided.*



**Figure 4.5. Complementary food recipes for 6–8 months old infant babies with nutrient composition**

<p><b>Carrot puree</b> (Energy 110 Kcal, Protein 4.85g, Iron 1.01mg, Zinc 0.71mg)</p>  <p>Rice rawa-15g, *lentil rawa or green gram/ red gram/black gram dal rawa-15g Carrot puree-25 Water-200ml <b>Total ingredient weight-55g</b> (without water)</p>	<p><b>Pumpkin puree</b> (Energy 108 Kcal, Protein 4.89g, Iron 0.95mg, Zinc 0.67mg)</p>  <p>Rice rawa, small-15g, *Lentil rawa or green gram/ red gram/black gram dal rawa-15g Pumpkin puree-25g Water-200ml <b>Total ingredient weight-55g</b> (without water)</p>	<p><b>Spinach puree</b> (Energy 1080 Kcal, Protein 5.22g, Iron 1.60mg, Zinc 0.76mg)</p>  <p>Rice rawa-15g, *Lentil rawa or green gram/ red gram/black gram dal rawa-15g Spinach puree (2 tablespoons)-25g Water-200ml <b>Total ingredient weight-55g</b> (without water)</p>	
<p><b>Potato puree</b> (Energy 117 Kcal, Protein 5.02g, Iron 1mg, Zinc 0.74mg)</p>  <p>Rice rawa, small-15g *Lentil rawa or green gram/red gram/ black gram dal rawa-15g Potato puree-25g Water-200ml <b>Total ingredient weight-55g</b> (without water)</p>	<p><b>Apple puree</b> (Energy 118 Kcal, Protein 4.75g, Iron 0.93mg, Zinc 0.67mg)</p>  <p>Rice rawa, small-15g *Lentil rawa or green gram/red gram/ black gram dal rawa-15g Apple puree-25g Water-200ml <b>Total ingredient weight-55g</b> (without water)</p>	<p><b>Grated boiled egg</b> (Energy 122 Kcal, Protein 6.67g, Iron 1.32mg, Zinc 0.95mg)</p>  <p>Rice rawa, small-15g *Lentil rawa or green gram/red gram/ black gram dal rawa-15g Grated boiled egg-15g Water-200ml <b>Total ingredient weight-45g</b> (without water)</p>	<p><b>Mashed fish</b> (Energy 133 Kcal, Protein 9.43g, Iron 0.94mg, Zinc 0.78mg)</p>  <p>Rice rawa, small-15g *Lentil rawa or green gram/red gram/ black gram dal rawa-15g Cooked &amp; mashed fish-25g Water-200ml <b>Total ingredient weight-55g</b> (without water)</p>

\* Varieties of dals can be included depending on the availability. 15g of one or more dals can be used for the preparation of the above recipes. Well-cooked and mashed lobia / kidney beans / chickpea can be added to infants' diet | Quantities indicated are for raw ingredients

Note: Breast milk should be continued

Refer: Annexure I & II for household measures

Source: Indian Food Composition Tables 2017; Nutritive Values of Indian Foods  
Nutrient Requirements for Indians 2020



**Figure 4.5 (contd..) Complementary food recipes with nutrient composition**

**9 to <12 months old babies**

**Grated mixed vegetables**  
(Energy 114 Kcal, Protein 4.98g, Iron 1.02mg, Zinc 0.73mg)



Rice rawa, medium-15g  
\*Lentil rawa/green gram/  
red gram/black gram dal rawa-15g  
Carrot-10g  
Potato-10g  
Pumpkin-10 g, Water-150ml  
**Total ingredient weight-60g** (without water)

**Egg pudding**  
(Energy 126 Kcal, Protein 9.25g, Iron 1.66mg, Zinc 1.28mg)



Egg-50g  
Milk-80ml  
**Total ingredient weight-130g**


**Eggnog**  
(Energy 133 Kcal, Protein 9.58g, Iron 1.68mg, Zinc 1.34mg)



Egg-50g  
Milk-90ml  
**Total ingredient weight-140g**


**Above 12 months old babies**

**Plain dalia + Boiled egg**  
(Energy 102 Kcal, Protein 4.68g, Iron 0.86mg, Zinc 0.64mg)



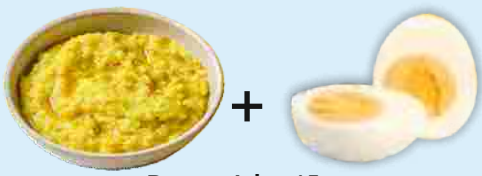
Rice rawa, large-15g  
\*Lentil rawa/green gram/  
red gram/ black gram dal rawa-15g  
Water-130ml  
**Total ingredient weight-30g**  
(without water)

**Egg, boiled**  
(Energy 46 Kcal, Protein 3.61g, Iron 0.43mg, Zinc 0.31mg)



Raw weight-25g

**Plain khichdi + Boiled egg**  
(Energy 152 Kcal, Protein 8.02g, Iron 1.28mg, Zinc 0.93mg)



Raw weight-45g

**Vegetable khichdi**  
(Energy 150 Kcal, Protein 7.24g, Iron 1.18mg, Zinc 0.93mg)



Rice, raw, milled-20g  
Green gram dal-20g  
Carrot-10g  
Tomato-10g  
green peas-10g  
Water-160ml  
**Total ingredient weight-70g** (without water)

\* Varieties of dals can be included depending on the availability. 15g of one or more dals can be used for the preparation of the above recipes. Well-cooked and mashed cowpea/kidney beans/chickpea can be added to infants' diet | Quantities indicated are for raw ingredients

Note: Breast milk should be continued

Refer: Annexure I & II for household measures

Source: Indian Food Composition Tables 2017; Nutritive Values of Indian Foods  
Nutrient Requirements for Indians 2020

Figure 4.6. Preparation of 'Healthy snacks' for infants (6 months to above 12 months)

**Cow pea**

(puree for <12 month and  
boiled for ≥12 month children)  
(Energy 32 Kcal, Protein 2.15g,  
Iron 0.51mg, Zinc 0.36mg)



**Green peas**

(puree for <12 month and  
boiled for ≥12 month children)  
(Energy 8 Kcal, Protein 0.75g,  
Iron 0.16mg, Zinc 0.11mg)



**Papaya (Ripe)**

(Energy 6 Kcal, Protein 0.10g,  
Iron 0.05mg, Zinc 0.03mg)



**Banana (Ripe)**

(Energy 27 Kcal, Protein 0.33g,  
Iron 0.08mg, Zinc 0.03mg)



**Curd**

(Energy 15.0 Kcal, Protein 0.78g,  
Iron 0.05mg)



**Egg (Boiled)**

(Energy 34 Kcal, Protein 3.32g,  
Iron 0.77mg, Zinc 0.52mg)



**Pomfret fish, boneless  
(Boiled and mashed)**

(Energy 30 Kcal, Protein 4.75g,  
Iron 0.08mg, Zinc 0.14mg)



**Murrel fish, boneless  
(Boiled and mashed)**

(Energy 21 Kcal, Protein 4.76g,  
Iron 0.06mg, Zinc 0.17mg)



Energy, protein etc. mentioned are obtained for quantities provided above

Non-vegetarian foods such as soft-boiled egg, minced meat may be introduced at the age of six months

Note: Breast milk should be continued

Refer: Annexure I & II for household measures

Source: Indian Food Composition Tables 2017; Nutritive Values of Indian Foods  
Nutrient Requirements for Indians 2020



## POINTS TO REGISTER

- Breast milk alone is not enough to meet the increase in requirements for a child after six months of age.
- Complementary foods should be introduced soon after six months of age, in addition to breastfeeding should be continued till two years of age.
- Prefer home-made complementary foods.
- Feed complementary food at least 2–4 times a day depending upon the child's age.
- Provide milk, locally available fruits and vegetables as well as eggs and meat.
- Observe hygienic practices while preparing and feeding complementary foods.
- Complementary feeding along with breastfeeding should be continued even during diarrhea or other common illnesses to prevent malnutrition.
- Limit use of salt in complementary food preparation.
- Avoid foods (biscuits, cakes) and beverages (fruit juices and cool drinks) with added sugar.



# GUIDELINE 5

## Ensure adequate and appropriate diets for children and adolescents both in health and sickness



### RATIONALE

Balanced diets for children above two years and adolescents help optimum growth and boosts their immunity.

- A nutritionally-adequate and balanced diet is essential for optimal growth and development.
- Appropriate diet and physical activity during childhood is essential for optimum body composition, BMI, prevention of vitamin and mineral deficiencies and reduction in the risk of diet-related chronic diseases in later life.
- Malnutrition contributes to increased morbidity (infections) and mortality.
- A child needs to eat adequately during and soon after episodes of infections to maintain good nutritional status.
- Nutrition care during adolescence is crucial since it is the period of accelerated growth.

### Why do children and adolescents require more food?

A new born baby grows rapidly at the rate of about 28g per day during the first two months, and 450g per month thereafter; and the birth weight doubles by five months and triples by one year of age. During the second year, a toddler will gain about two kg, and between 2–10 years age the child gains 1.5–3 kg in weight every year. Infants gain about 25 cms during the first year, and 10–15 cms height from 1–2 years age.

Between 2–10 years the child grows on an average 6–7 cms in height. Height at four years is about double the birth length. Most boys reach half their adult height by about age two years. Most girls reach half their adult height at about age 19 months. During this period, development and maturation of various tissues and organs also take place (Tables 5.1 to 5.4).

Adolescent period (10–19 years of age) is characterized by rapid increase in height and weight, hormonal changes, sexual maturation and wide swings in emotion. Adolescent growth spurt starts at about 10–12 years in girls and two years later in boys. During this phase, the annual peak rates for height and weight are 9–10 cm and 8–10 kg. Development of critical bone mass is essential during this period. Bone development during this period is crucial for maintaining mineral integrity of the bone in later life. The pattern and proportion of various body components like body water, muscle mass, bone and fat, increase during the entire childhood and adolescence to reach adult levels by about 19 years. With the onset of menstruation, adolescent girls are at greater physiological stress than boys. Nutritional care of adolescent girls is of particular importance for their own health and in preparation for motherhood in future. All these rapid anabolic changes require more nutrients per unit body weight.



Growing children and adolescents require more calcium. Though recommended dietary allowances for calcium are about 850–1050mg/day, it is desirable to give higher quantities of calcium for adolescents to achieve optimal peak bone mass. To achieve optimal peak bone mass, it is recommended to consume calcium-rich foods like milk and milk products, foxtail millet, finger millet (ragi), sesame, etc. Young children below the age of five years should be given less bulky foods, rich in energy, protein, vitamin and minerals such as pulses, nuts, edible oil/ghee milk and eggs. Vegetables including green leafy vegetables and locally available seasonal fruits should be part of their daily menu. Healthy snacks made from wholesome ingredients and less in fat, sugar and salt, make a useful contribution to their nutrient requirements, particularly in older children and adolescents. Frequent changes in the menu are often liked by children.

Older children and adolescents should consume adequate milk to fulfill high calcium requirements and to obtain quality protein. Bengal gram, tofu and paneer are also good sources of protein. Nutrient dense foods such as nuts, oilseeds and marine fish that are rich sources of good quality fats, proteins, vitamins and minerals must be consumed frequently. Foods such as fenugreek seeds, amaranth seeds, flax seeds, chia seeds, basil seeds, etc., which have health-promoting effects can be consumed at least three to four times a week.

Avoid packaged foods and foods containing excess oil, salt, sugar, added colors and other additives. Over indulgence in foods high in fats, sugar and salt should be avoided. Adolescence is a vulnerable stage for developing unhealthy food preferences as well as harmful habits like smoking, chewing tobacco or drinking alcohol. These unhealthy habits should be avoided. In addition to consumption of a nutritious well-balanced diet, appropriate lifestyle practices and involvement in physical activities such as games/sports should be encouraged among children and adolescents. Balanced diet for children and adolescents is presented in Figures 5.1 to 5.4.

**Avoid packaged foods and foods containing excess oil, salt, sugar, added colors and other additives.**

### How do infections in children lead to malnutrition?

Common childhood infections like diarrhoea, pneumonia and poor nutrition care during illness and post illness cause malnutrition and contribute to about 20% mortality. During periods of infection, children tend to eat less due to reduced appetite. Many children vomit frequently. Nutrients are also lost in urine and feces. The unhealthy practice of restricting diet, during any sickness could further aggravate the problem. Hence, extra care is needed in feeding the child normally during and after any illness to prevent subsequent nutritional deficiencies. Appropriate feeding practices during illness and post illness is essential and may demand a lot of patience from mothers/caretakers.

### How should a child be fed during illness?

For older children, consuming an adult diet, soft nutrient-dense foods may be offered at frequent intervals. The quantity of the feeds may be increased, after the illness has subsided, till the original body weight is regained.

### What should be done during diarrhea in children?

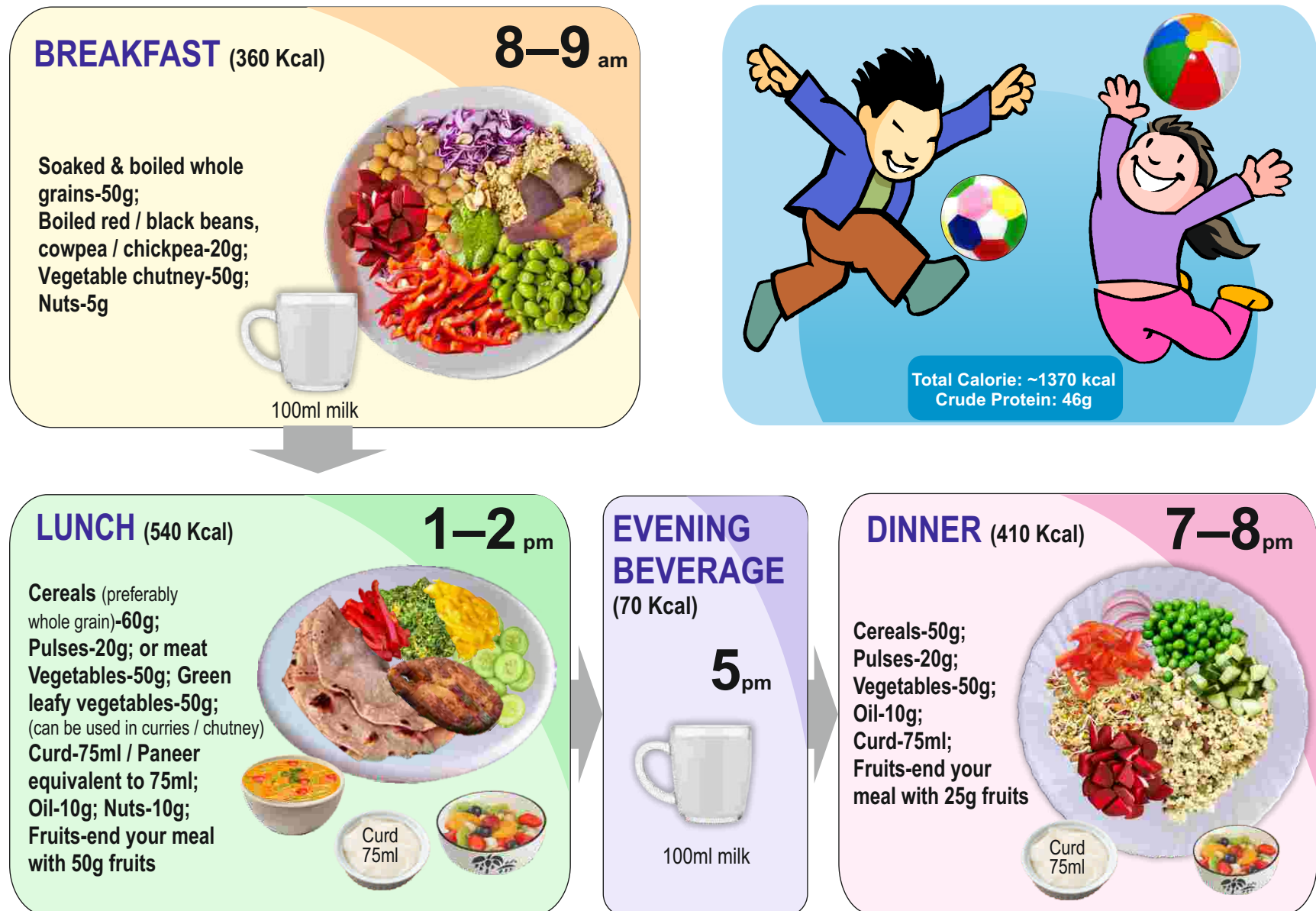
Diarrhea is a common childhood disease which leads to dehydration and sometimes death. The child requires prompt correction of fluid and electrolyte loss using oral rehydration solution (ORS) along with adequate feeding.

Calorie-rich, semi-solid, soft diets may be prepared from a variety of cereals and pulses. Sprouted and cooked grain or pulses flours are easily digestible and can be used (ARF-given in guideline 4). Milk may be mixed with cereal and pulse diet. If milk is not tolerated, it may be replaced by an equal volume of curd/yogurt. Mashed vegetables and fruits may be incorporated in the diets. Feeding becomes easier after the infection subsides. During recovery, if weight loss is noticed, additional feeds (depending on the child's ability to consume) should be given to meet the extra food requirements for catch up growth. Overeating should be avoided not only to prevent overweight/obesity but also metabolic disorders such as insulin resistance, diabetes, PCODs etc. apart from other diet related NCDs.



**Figure 5.1. Suggested diet for normally nourished physically active children aged 4–6 yrs as recommended in ICMR-NIN-RDA**

(The menu is for reference children weighing 18kg and with adequate physical activity)



Total calorie from the above diet is 1360 Kcal/day | Total protein provides 13.8% Kcal/day from the suggested diet

Non-veg items like fish / egg / chicken can be consumed as per social acceptability & availability | Quantities indicated are for raw ingredients

In the meal preparation 25g oil and 5g iodized salt can be used | Prefer at least 50% cereal / millet as whole grain

Every meal should be accompanied by dal and vegetables | Added sugar must be restricted to less than 5% of daily energy.

Note: Energy requirement depends on body weight and physical activity

Refer: Annexure I & II for household measures

Source: Nutrient Requirements for Indians 2020





**Figure 5.2. Suggested diet for normally nourished physically active children aged 7–9 yrs**  
(The menu is for reference children weighing 25 kg and with adequate physical activity)

**BREAKFAST** (400 Kcal) **8–9 am**

Soaked & boiled whole grains-50g;  
Boiled red / black beans, lobia / chickpea-20g;  
Green leafy vegetables-50g;  
Vegetables-50g;  
Nuts-10g

100ml milk

**Total Calorie: ~1710 kcal**  
**Crude Protein: 59g**

**LUNCH** (730 Kcal) **1–2 pm**

Cereals (preferably whole grain)-90g;  
Pulses-25g;  
Vegetables-100g; Green leafy vegetables-50g (can be used in curries / chutney);  
Oil-15g; Nuts-10g;  
Curd-100ml / Paneer equivalent to 100ml;  
Fruits-end your meal with 50g fruits

Curd 100ml

**EVENING BEVERAGE** (70 Kcal) **5 pm**

100ml milk

**DINNER** (510 Kcal) **7–8 pm**

Cereals-60g;  
Pulses-20g;  
Vegetables-100g;  
Oil-10g;  
Curd-100ml;  
Fruits-end your meal with 50g fruits

Curd 100ml

Total calorie from the above diet is 1710 Kcal/day | Total protein provides 13.8% Kcal/day from the suggested diet

Non-veg items like fish / egg / chicken can be consumed as per social acceptability & availability | Quantities indicated are for raw ingredients

In the meal preparation 25g oil and 5g iodized salt can be used | Prefer at least 50% cereal / millet as whole grain

Every meal should be accompanied by dal and vegetables | Added sugar must be restricted to less than 5% of daily energy.

Note: Energy requirement depends on body weight and physical activity

Refer: Annexure I & II for household measures

Source: Nutrient Requirements for Indians 2020



**Figure 5.3. Suggested balanced diet for physically active girls (16–18 years) (weighing 56 Kg) (Energy ~2490 Kcal)**



**Figure 5.4. Suggested balanced diet for physically active boys (16–18 years) (weighing 64 Kg) (Energy ~3300 Kcal)**



Source: Nutrient Requirements for Indians 2020



### EAT IRON-RICH FOODS

- Plant foods like green leafy vegetables, pulses and dry fruits contain iron.
- Iron is also obtained through meat, fish and poultry products.
- Vitamin C rich fruits like guava, amla, pineapple and citrus fruits or chutneys made with coriander and green chillies improve iron absorption from plant foods, when consumed as part of a regular meal.
- Beverages like tea bind dietary iron and make it unavailable. Hence, they should be avoided for at least an hour before, during or soon after a meal.

### EAT CALCIUM-RICH FOODS

- Children require higher level of calcium for growth and bone development.
- Milk, curd, sesame seeds, *ragi* and GLVs like amaranth are good sources of calcium.
- Regular exercise reduces calcium loss and strengthens bones.
- Exposure to sunlight (about 30 minutes preferably between 11.00 am to 2.00 pm) maintains vitamin D status which helps in calcium absorption.

### DURING ILLNESS

- Feed energy-giving nutrient-rich cereals-pulse diet with milk and mashed vegetables and fruits during recovery and post illness.
- Feed small quantities at frequent intervals.
- Give plenty of water and other fluids.



**Table 5.1 & 5.2. Median height for age for boys and girls (2–5 yrs) (WHO)**

**Table 5.1**

Boys			
Age (Months)	Median Height (cm)	Age (Months)	Median Height (cm)
24	87.1	43	100.4
25	88.0	44	101.0
26	88.8	45	101.6
27	89.6	46	102.2
28	90.4	47	102.8
29	91.2	48	103.3
30	91.9	49	103.9
31	92.7	50	104.4
32	93.4	51	105.0
33	94.1	52	105.6
34	94.8	53	106.1
35	95.4	54	106.7
36	96.1	55	107.2
37	96.7	56	107.8
38	97.4	57	108.3
39	98.0	58	108.9
40	98.6	59	109.4
41	99.2	60	110.0
42	99.9		

[https://cdn.who.int/media/docs/default-source/child-growth/child-growth-standards/indicators/length-height-for-age/hfa\\_boys\\_2\\_5\\_zscoresba2ba0820f064f4abf5915abac01e894.pdf?sfvrsn=4d77e340\\_9](https://cdn.who.int/media/docs/default-source/child-growth/child-growth-standards/indicators/length-height-for-age/hfa_boys_2_5_zscoresba2ba0820f064f4abf5915abac01e894.pdf?sfvrsn=4d77e340_9)

**Table 5.2**

Girls			
Age (Months)	Median Height (cm)	Age (Months)	Median Height (cm)
24	85.7	43	99.7
25	86.6	44	100.3
26	87.4	45	100.9
27	88.3	46	101.5
28	89.1	47	102.1
29	89.9	48	102.7
30	90.7	49	103.3
31	91.4	50	103.9
32	92.2	51	104.5
33	92.9	52	105.0
34	93.6	53	105.6
35	94.4	54	106.2
36	95.1	55	106.7
37	95.7	56	107.3
38	96.4	57	107.8
39	97.1	58	108.4
40	97.7	59	108.9
41	98.4	60	109.4
42	99.0		

[https://cdn.who.int/media/docs/default-source/child-growth/child-growth-standards/indicators/length-height-for-age/hfa\\_girls\\_2\\_5\\_zscores.pdf?sfvrsn=9d3a6c08\\_9](https://cdn.who.int/media/docs/default-source/child-growth/child-growth-standards/indicators/length-height-for-age/hfa_girls_2_5_zscores.pdf?sfvrsn=9d3a6c08_9)



**Table 5.3. Median weight (kg) for height (cm) for boys (2–5 yrs) (WHO)**

Height (cm)	Median weight (Kg)	Height (cm)	Median weight (Kg)	Height (cm)	Median weight (Kg)
65.0	7.4	83.5	11.3	102.0	15.9
65.5	7.6	84.0	11.4	102.5	16.1
66.0	7.7	84.5	11.5	103.0	16.2
66.5	7.8	85.0	11.7	103.5	16.4
67.0	7.9	85.5	11.8	104.0	16.5
67.5	8.0	86.0	11.9	104.5	16.7
68.0	8.1	86.5	12.0	105.0	16.8
68.5	8.2	87.0	12.2	105.5	17.0
69.0	8.4	87.5	12.3	106.0	17.2
69.5	8.5	88.0	12.4	106.5	17.3
70.0	8.6	88.5	12.5	107.0	17.5
70.5	8.7	89.0	12.6	107.5	17.7
71.0	8.8	89.5	12.8	108.0	17.8
71.5	8.9	90.0	12.9	108.5	18.0
72.0	9.0	90.5	13.0	109.0	18.2
72.5	9.1	91.0	13.1	109.5	18.3
73.0	9.2	91.5	13.2	110.0	18.5
73.5	9.3	92.0	13.4	110.5	18.7
74.0	9.4	92.5	13.5	111.0	18.9
74.5	9.5	93.0	13.6	111.5	19.1
75.0	9.6	93.5	13.7	112.0	19.2
75.5	9.7	94.0	13.8	112.5	19.4
76.0	9.8	94.5	13.9	113.0	19.6
76.5	9.9	95.0	14.1	113.5	19.8
77.0	10.0	95.5	14.2	114.0	20.0
77.5	10.1	96.0	14.3	114.5	20.2
78.0	10.2	96.5	14.4	115.0	20.4
78.5	10.3	97.0	14.6	115.5	20.6
79.0	10.4	97.5	14.7	116.0	20.8
79.5	10.5	98.0	14.8	116.5	21.0
80.0	10.6	98.5	14.9	117.0	21.2
80.5	10.7	99.0	15.1	117.5	21.4
81.0	10.8	99.5	15.2	118.0	21.6
81.5	10.9	100.0	15.4	118.5	21.8
82.0	11.0	100.5	15.5	119.0	22.0
82.5	11.1	101.0	15.6	119.5	22.2
83.0	11.2	101.5	15.8	120.0	22.4

[https://cdn.who.int/media/docs/default-source/child-growth/child-growth-standards/indicators/weight-for-length-height/wfh-boys-2-5-zscores.pdf?sfvrsn=66c3e6fe\\_9](https://cdn.who.int/media/docs/default-source/child-growth/child-growth-standards/indicators/weight-for-length-height/wfh-boys-2-5-zscores.pdf?sfvrsn=66c3e6fe_9)



**Table 5.4. Median weight (kg) for height (cm) for Girls (2–5 yrs) (WHO)**

Height (cm)	Median weight (Kg)	Height (cm)	Median weight (Kg)	Height (cm)	Median weight (Kg)
65.0	7.2	83.5	11.0	102.0	15.8
65.5	7.4	84.0	11.1	102.5	16.0
66.0	7.5	84.5	11.3	103.0	16.1
66.5	7.6	85.0	11.4	103.5	16.3
67.0	7.7	85.5	11.5	104.0	16.4
67.5	7.8	86.0	11.6	104.5	16.6
68.0	7.9	86.5	11.8	105.0	16.8
68.5	8.0	87.0	11.9	105.5	16.9
69.0	8.1	87.5	12.0	106.0	17.1
69.5	8.2	88.0	12.1	106.5	17.3
70.0	8.3	88.5	12.3	107.0	17.5
70.5	8.4	89.0	12.4	107.5	17.7
71.0	8.5	89.5	12.5	108.0	17.8
71.5	8.6	90.0	12.6	108.5	18.0
72.0	8.7	90.5	12.8	109.0	18.2
72.5	8.8	91.0	12.9	109.5	18.4
73.0	8.9	91.5	13.0	110.0	18.6
73.5	9.0	92.0	13.1	110.5	18.8
74.0	9.1	92.5	13.3	111.0	19
74.5	9.2	93.0	13.4	111.5	19.2
75.0	9.3	93.5	13.5	112.0	19.4
75.5	9.4	94.0	13.6	112.5	19.6
76.0	9.5	94.5	13.8	113.0	19.8
76.5	9.6	95.0	13.9	113.5	20.0
77.0	9.6	95.5	14.0	114.0	20.2
77.5	9.7	96.0	14.1	114.5	20.5
78.0	9.8	96.5	14.3	115.0	20.7
78.5	9.9	97.0	14.4	115.5	20.9
79.0	10.0	97.5	14.5	116.0	21.1
79.5	10.1	98.0	14.7	116.5	21.3
80.0	10.2	98.5	14.8	117.0	21.5
80.5	10.3	99.0	14.9	117.5	21.7
81.0	10.4	99.5	15.1	118.0	22.0
81.5	10.6	100.0	15.2	118.5	22.2
82.0	10.7	100.5	15.4	119.0	22.4
82.5	10.8	101.0	15.5	119.5	22.6
83.0	10.9	101.5	15.7	120.0	22.8

[https://cdn.who.int/media/docs/default-source/child-growth/child-growth-standards/indicators/weight-for-length-height/wfh-girls-2-5-zscores.pdf?sfvrsn=3dc8f085\\_9](https://cdn.who.int/media/docs/default-source/child-growth/child-growth-standards/indicators/weight-for-length-height/wfh-girls-2-5-zscores.pdf?sfvrsn=3dc8f085_9)

## POINTS TO REGISTER

- Include pulses, nuts, oilseeds, vegetables, seasonal fruits, eggs and flesh foods in regular diet.
- Give adequate milk or curd or yogurt to children and adolescents.
- Promote physical activity and appropriate life style practices.
- Discourage overeating as well as indiscriminate dieting.
- Restrict consumption of foods high in fat, salt and sugar and ultra-processed foods.
- Include more fibre-rich foods such as whole grains, millets, pulses, nuts and vegetables in the diet.



# GUIDELINE 6

## Eat plenty of vegetables and legumes



### RATIONALE

**Vegetables and green leafy vegetables provide several vitamins and minerals and offer protection from micronutrient deficiencies and various diseases.**

- Include fresh vegetables and fruits, which are store houses of micronutrients. Fresh fruits are nutritionally superior to freshly prepared fruit juices.
- Fruits and vegetables are sources of phytonutrients and fibre which are of vital health significance.
- They are also sources of prebiotics and thus help in improving intestinal flora and gut health.
- They enhance immune function and reduce the risk of infections.
- They help in prevention of micronutrient malnutrition and certain chronic diseases such as HTN, CHD, stroke, DM, cancer, etc.

### Why should we eat vegetables, green leafy vegetables and fruits?

Fresh vegetables and fruits are sources of micronutrients, phytonutrients, bioactive substances and fibre. The micronutrients present are minerals and vitamins and the macronutrients present are complex carbohydrates and fibre and hence adequate intake of these promote health. Most vegetables (<20 Kcal/100g raw) and fruits (<60 Kcal/100g) provide very low calories, whereas some roots/tubers such as potato, sweet potato, tapioca and yam (70–100 Kcal/100g raw) as well as fruits like banana are rich in starch, which provide energy in good amount. Leafy vegetables also provide carotenoids, iron, folate, calcium and other important

nutrients. Prebiotics present in various vegetables and fruits induce favorable changes in the gut microbiota (microbes) and enhance microbial diversity with beneficial effect on health.

The micronutrients present are minerals and vitamins whereas, the macronutrients present are complex carbohydrates and fibre and hence adequate intake of these promote health.

### Vegetables- A rich source of vitamins and minerals

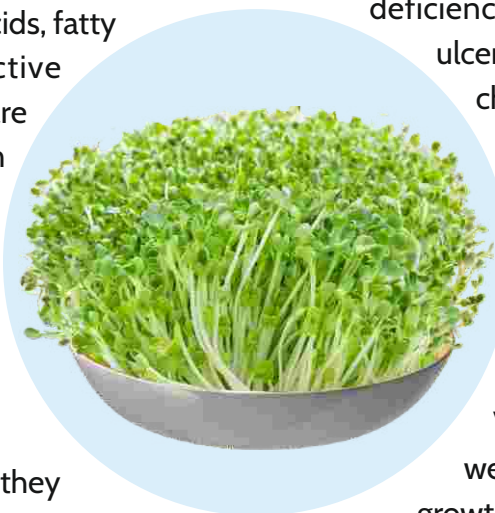
- **Vitamins-** vitamin A, vitamin C, and vitamin E, some B vitamins such as folate.
- **Minerals-** iron, copper, zinc, calcium, magnesium and potassium.
- Phytochemical compounds (carotenoids, alkaloids, terpenoids, flavonoids, phenolics and bioactive peptides).
- Antioxidants
- High-fibre content
- Low in fat and calories-prevents overweight

In India, intake of vegetables and fruits is extremely low. People in India eat merely 100g to 200g of vegetables and fruits per day while the recommendation is 500g per day. Intake of recommended amount of vegetables and fruits decrease the risk of chronic NCDs such as diabetes, hypertension, stroke, coronary heart disease and cancer.



## What are microgreens?

Microgreens are young, tender plants of herbs, vegetables or even grains, with just one to two sets of leaves. Alternatively, microgreens are young plants that are harvested within a week to ten days after sowing the seeds. Microgreens are rich sources of nutrients such as amino acids, fatty acids, micronutrients and various bioactive compounds and phytochemicals. These are emerging functional foods which when consumed even in small quantity have the potential to prevent various deficiencies and diseases. These microgreens can be used in salads, soups, sandwiches and minimally processed dishes to embellish various recipes/cuisines.



Research on microgreens shows that they are high in aliphatic glycosylates, polyphenols and serve as dietary carriers to provide naturally occurring antioxidant compounds with strong antioxidant capacity e.g. amaranth, basil, mustard, peas, parsley, beet, coriander, broccoli, celery, etc. The microgreens of red cabbage have been shown to modulate the lipid profile favorably and that of fenugreek show anti-diabetic activity.

## What functions do the nutrients and phytonutrients in vegetables and fruits perform in our body?

**Iron** is an essential element necessary for the formation of hemoglobin, the red pigment present in the red cells of blood. Hemoglobin plays an important role in the transportation of oxygen to the tissues. Reduction in hemoglobin in blood leads to anemia, a condition characterized by paleness and easy fatigue and increased susceptibility to infections. Iron is available in plenty in green leafy vegetables, but the absorption is limited. Vitamin C rich foods like guava or orange must be consumed after meals to improve iron absorption.

**Vitamin A:** Carotenoids (precursors of vitamin A) are plentiful in fruits and vegetables that are green or deep yellow / orange in colour, such as green leafy vegetables, carrots, tomatoes, capsicum, orange-flesh, sweet potatoes, papaya, mango, etc.

This fat-soluble vitamin is necessary for clear vision (even in dim light) and for maintenance of the integrity of epithelial tissues. In vitamin A deficiency, the white of the eye (conjunctiva) loses its luster, becomes dry and could manifest as Bitot's spots (foamy white patches). In severe vitamin A deficiency, the black area of the eye (cornea) gets ulcerated, leading to irreversible blindness in young children. Vitamin A also has a role in maintaining resistance of the body to common infections.

**Vitamin C** is abundantly available in fresh citrus fruits, guava, amla and certain vegetables such as tomatoes. Vitamin C is an essential nutrient required for healthy bones and teeth. It also promotes iron absorption. Vitamin C deficiency is characterized by weakness, bleeding gums and defective bone growth. However, it is very susceptible to destruction by atmospheric oxidation. It is for this reason that when vegetables become dry and stale or cut and exposed to air or cooked and consumed, most of the vitamin originally present is destroyed.

**Folates /Folic acid:** Green leafy vegetables are good sources of folates. It is a B vitamin essential for multiplication and maturation of red cells in our body and its deficiency also leads to anemia. Folic acid intake during pregnancy prevents neural tube defects in the fetus. It also promotes the birth weight of infants. Folic acid deficiency increases homocysteine levels in blood, thereby increasing the risk of stroke and heart disease.

**Calories:** Many of the vegetables and fruits have low calories ( $\leq 20$  Kcal/100gm). Large intake of such vegetables and fruits can help in reducing calories in diet and help in obesity management. On the other hand, vegetables like colocasia, potato, tapioca, yam, sweet potato and fruits like banana, avocado, pear and mahua (buttercup) have 70 to 100 or more than 100 Kcal per 100g and should be consumed in moderate amounts.

**Phytonutrients:** Vegetables provide phytonutrients and are of considerable health significance. Among these, dietary fibre,



antioxidants and other bio-active constituents require special mention. These phytonutrients delay the effects of ageing and prevent diseases such as cardio-vascular diseases, stroke, diabetes and cancer.

**Dietary fibre:** Fresh fruits and vegetables are rich sources of dietary fibre. Dietary fibre is important for proper bowel function and reduces constipation and risk of developing piles. It also reduces the absorption of cholesterol, and has a protective role in coronary heart diseases, diabetes and obesity. The protective role of dietary fibre against colon cancer has long been recognized.

**Antioxidants:** Vegetables and fruits are rich sources of antioxidants and restrict the damage to cell and cellular components. Raw and fresh vegetables like green leafy vegetables, carrots, fresh fruits including citrus and tomatoes have been identified as good sources of antioxidants. Vitamin C and carotenoids that are present in these vegetables are also potential antioxidants. Different colored vegetables provide different antioxidants. Green and orange colored vegetables provide beta-carotene, red vegetables provide lycopene, deep red ones provide anthocyanins, blue and purple ones provide anthocyanins, etc. Vegetables and fruits play a major role in protecting from certain diseases, such as damage to blood vessels, cancer, inflammatory joint diseases, asthma and diabetes.

### How much fruits and vegetables should one consume?

Taking into consideration the nutrient requirements, it is recommended that every individual should consume at least 400g of vegetables (GLV: 100g; Other vegetables: 250g; Roots

and Tubers: 50g) and 100g of fresh fruits every day. During pregnancy, requirements of iron and folic acid are higher and therefore pregnant women should consume an additional 100g of leafy vegetables daily. Intake of tubers such as potato, yam, colocasia and cassava must be restricted.

### Which vegetables and fruits should be preferred?

We should consume fresh, locally available and preferably seasonal vegetables and fruits. These have higher level of micronutrients and are also tastier. However, no single fruit or vegetable provides all the nutrients one needs. The key lies in eating a variety of them and with different colors. Include commonly consumed leafy greens, tomatoes, berries and other vegetables, apart from those which are yellow, orange, red, deep red and purple. Colored citrus fruits, being vitamin C rich enrich the diets significantly. Root vegetables like carrots, radish, beetroot, knol-kohl, and turnip should be preferred to tubers like potato, yam, colocasia and cassava.

### How to prevent cooking losses?

Vegetables should be washed before cutting or peeling to prevent nutrient loss. Further, proper methods of cooking should be adopted to reduce the losses. Nutrient loss is high when the vegetables are washed after cutting or when they are cut into small pieces for cooking.

Root vegetables like carrots, radish, beetroot, knol-kohl, and turnip should be preferred to tubers like potato, yam, colocasia and cassava.

## POINTS TO REGISTER

- Include fresh vegetables and green leafy vegetables in daily diet.
- Incorporate GLVs in complementary feeds of infants.
- Eat a variety of vegetables and fruits in all your meals in various forms (raw salad, curry, dry cooked vegetables, soups, as raita mixed with curd or added to pulse and cereal preparations).
- Increase intake of vegetables and fruits during pregnancy.
- Prefer root vegetables to tubers.



# GUIDELINE 7

## Use oils/fats in moderation; choose a variety of oil seeds, nuts, nutriceals, and legumes to meet daily needs of fats and essential fatty acids (EFA)



### RATIONALE

Using a diverse variety of oil seeds, nuts and whole grains, provides a balance of all fatty acids (lipids). Refined or extracted oils are processed products; hence it is best to use them in moderation.

- Fats are also known as 'lipids'.
- There are three types of fatty acids (FA) in our diets, saturated fatty acids (SFA), mono unsaturated fatty acids (MUFA) and poly unsaturated fatty acids (PUFA).
- Our body can synthesize SFAs, MUFAs besides obtaining them from the diet, while the PUFAs, namely, linoleic acid (also known as n-6 or omega 6 or LA) and alpha linolenic (also known as n-3 or omega 3 or ALA) cannot be synthesized. Hence, n-6 and n-3 are termed essential fatty acids (EFAs).
- Our body depends on dietary sources for n-3 and n-6 FA as they are not made in our body.
- High intake of saturated fats (SF) enhances calorie intake and increases the risk of heart diseases and stroke.
- Trans fats (TF) are harmful and should be avoided.
- Intake of oils and fats should be in moderation. Cooking methods such as sautéing, steaming, grilling, boiling or baking should be used instead of frying.

- To enhance nutrition and flavor, oilseeds and nuts-paste (wholesome and nutritious) can be used in place of extracted refined oils/fats.

**Trans fats (TF) are harmful and should be avoided.**

### Why do we need fats/oils?

- Lipid or fatty acids perform several important physiological and metabolic functions in the body.
- Lipids constitute major components of many hormones and cell membranes along with proteins and are involved in many important cell-signalling functions and gene expression.

### What are the components of fat?

Fatty acids are the simplest types of lipids. Triglycerides, phospholipids, glycolipids and cholesterol are all lipids.

**Fatty acids:** All fats in foods provide mixtures of three types of fatty acids (SFA, MUFA, PUFA), which are the 'building blocks' of fats. Fatty acids are the primary constituents of all dietary fats in





the form of triglycerides. Based on their structure, fatty acids are broadly grouped as saturated fatty acids (SFA), monounsaturated (MUFA) and polyunsaturated (PUFA). Coconut oil, palm oil, ghee, butter, lard, tallow, milk, milk products and meat contain SFA.



Cholesterol is found only in animal-source foods. Cholesterol is synthesized in the liver from carbohydrates and fats in our diet. Liver cholesterol synthesis increases when the cholesterol intake in our diet is low; and the synthesis is suppressed when our intake is increased. Cholesterol is carried by lipoproteins in our blood: low density lipoprotein (LDL) and high density lipoprotein (HDL).

### What are the physiological/health implications of different fats/oils?

**PUFAs (n3 and n6):** PUFAs are essential components of cell membranes. While n-6 PUFAs are predominant in all cells, the brain cells and nerve tissue have high levels of n-3 PUFA. The long chain PUFAs of n-3 (Docosa Hexaenoic Acid–DHA and Eicosa Pentaenoic Acid–EPA) and n-6 (Arachidonic acid–AA) are essential during growth and development. During the fetal and early infant development, there is a rapid accretion 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. Small amounts of DHA are also present in cell membranes throughout the body. AA and DHA have different and specific roles in neural and behavioral functions. DHA is crucial for the function of rhodopsin for vision and post-synaptic receptors for neurotransmission.

Fish, sea foods and micro algae provide long chain n-3 fatty acids such as DHA and EPA. These are biologically more active than short-chain alpha-linolenic (n-3) fatty acid present in plant foods. These long chain n-3 fatty acids are important for vision and brain growth and development during fetal life.

**MUFA:** MUFA decreases clot formation and atherogenesis.

**Saturated fatty acids:** SFA are known to increase serum total and LDL-cholesterol levels, increase inflammation, reduce insulin sensitivity and enhance the tendency of clot formation (thrombogenicity) and increase the risk of heart attack and stroke.

**Cholesterol (lipid from animal source):** Cholesterol plays an important role in the body cell membrane's fluidity and permeability. Cholesterol is also a precursor of many hormones and vitamin D. Cholesterol aids in cell signalling function and hormone activity. It is actively synthesized in the liver whenever required.

**High density lipoproteins (HDL)** remove and transport excess cholesterol from the tissues to the liver for degradation, and are therefore, anti-atherogenic. However, high blood levels of LDL cholesterol result in accumulation of lipids in the cells and causes atherogenic effect. A healthy diet (balanced diet) and physical activity improve HDL and decrease LDL.

**Trans fatty acids (TFA):** TFAs are fats that are produced during hydrogenation of vegetable cooking oils (example, vanaspati). TFA consumption alters lipid profile (dyslipidemia), endothelial dysfunction, decreases insulin sensitivity and increases risk of diabetes, breast cancer, colon cancer, preeclampsia, disorders of nervous system and vision in infants. Hence, one must avoid processed foods or bakery foods containing TFA.

- Fats, also called lipids, promote absorption of fat-soluble vitamins (A, D, E and K).
- In addition to important functions, fats contribute to energy, texture, flavor, taste and increase the palatability of the diet and impart a feeling of fullness and satisfaction and thus delay the onset of hunger.



- Fats increase the energy density of food as each gram of lipid gives energy of 9 Kcal, while protein or carbohydrates give only 4 Kcal for every gram.

Dietary fats also contain minor components such as tocopherols, tocotrienols, sterols, etc. The natural flavor of fats/oils is largely due to these minor components. Since, most of the minor components are antioxidants, they prevent fats from going rancid. Tocotrienols in palm oil, lignans in sesame oil and oryzanol and tocotrienols in rice bran oil reduce blood cholesterol. Refining of oils, though does not alter their fatty acid composition. It modifies the composition of minor components; for example, crude palm oil is extracted from the pulp of the fruit of oil palms. The color of the pulp is red as it is rich in beta carotene (precursor of vitamin A). These carotenes are lost during refining of crude palm oil.

#### What are the sources of fats?

Plant foods have no cholesterol and are fairly good sources of MUFAs and PUFAs. Some plant foods also have SFAs. In most cereals, millets, beans and pulses the fat content ranges between 1.5%–3%. In cereals, millets and most oilseeds, n-6 is the major PUFA. Pulses, beans, green leafy vegetables and oilseeds such as soyabean, rapeseed/mustard, flax seeds, perilla and fenugreek seeds are good sources of both n-6 and n-3 PUFAs. Animal foods such as butter, ghee, whole milk, cream, fatty cheese and fatty meats are sources of cholesterol and SFAs along with some quantities of MUFAs and PUFAs. Egg has cholesterol but is a good source of n-6 and n-3. Marine fish is a good source of LC n-3 PUFA. Oil seeds, nuts, fenugreek seeds, beans, cereals, millets, leafy vegetables, if consumed adequately, can meet the requirements of both n3 and n6 essential fatty acids.

- Omega-6 is commonly found in most foods, while n-3 is available in walnuts, flax seeds, chia seeds, soyabean, fenugreek seeds, mustard and leafy vegetables (Table 7.1).
- Marine fish, other sea foods and eggs are good natural sources of long chain PUFAs (DHA, DPA, EPA).

Figure 7.1



Table 7.1. Approximate quantity of foods required to furnish minimum 100mg n-3 PUFAs

Plant foods (ALA)	g	Vegetable oils (ALA)	g
<b>Cereal/Millet</b>		Mustard/Rapeseed	0.7
Wheat & Bajra	70	Soyabean	1.5
Oats	70	Canola	0.5
Wheat	1.4	Flaxseed	0.2
<b>Pulses</b>		<b>LC n-3 PUFAs from animal foods</b>	
Black gram, Rajmah & Cowpea	20	Fish	
Soyabean	7	Low/medium fat fish	20–50
Other pulses	60	Oily fish (>5% fat)	10
<b>Vegetables</b>			
Green leafy	60		
Purslane	25		
Radish seed (sprouted)	14		
Spirulina (dried)	12		
<b>Spices</b>		<b>Poultry egg</b>	
Fenugreek seed	5	Standard	2–3 eggs
Mustard seed	2	DHA enriched (flaxseed)	1 egg
		DHA enriched (meal from marine sources)	1/3 <sup>rd</sup> egg
<b>Nuts</b>		<b>Chicken</b>	100
Walnuts	2		
Almonds	25		
<b>Unconventional oilseeds</b>		<b>Lean meats</b>	
Flaxseed (linseed)	0.5	Lamb, sheep, goat, beef, pork	150
Perilla seed	0.5		



Fats/oils that are used for cooking (vegetable oils, vanaspati, butter and ghee) or added to foods at the time of consumption/dressing, are termed as 'visible' fats. Fats that are present as integral components of various foods (such as nuts, seeds, pulses, cereals and millets) are referred to as 'invisible' fats. Cereals contain only 2%–3% of invisible fat, however, their contribution to overall fat intake is significant as they contribute to bulk of our Indian diets. Most animal foods provide high amounts of saturated fat; hence it is advisable to choose lean cut meats.

### How much visible fats do we need?

If one consumes adequate amounts of nuts, oilseeds, pulses and beans, the required amounts of 6.6g of n-6 PUFA and 2.2g of n-3 PUFA are easily met for all the essential functions in the body; and hence, there is no need for visible fats. However, today's dietary patterns and consumption habits are such that almost all recipes are made with visible fats. Therefore, visible fats cannot be avoided, but can be limited. The visible fat (cooking oil) must be limited to 20–50g (4–10 teaspoon full) per person/ day depending on the level of energy (calorie) requirement, which is based on physical activity and physiological status. (For example, not more than 27–30g visible fat/cooking oil is required for a 2000 Kcal diet/day).

It is recommended that adult women or men with sedentary lifestyle limit daily fat intake to 20g and 30g of visible fat, respectively. Adult men with moderate and heavy physical activity may consume visible fat up to 40g and 50g respectively, while adult women with moderate and heavy physical activity may consume up to 30g and 40g respectively. During pregnancy and lactation, intake of oil seeds, nuts, beans and fish consumption must be encouraged to meet the daily needs of the higher fat and EFA requirement of fetus and infants. During these periods, visible fat should be restricted, while TFA should be avoided.

## Requirement of fatty acids (FA) for health

### PUFA (Essential FA)

- **n-6 PUFA:** Minimum requirement is 3% energy/day. This implies 60 Kcal or 6.6g n-6 PUFA for a 2000 Kcal diet.
- **n-3 PUFA:** Minimum requirement is 0.6% to 1.2% energy/day. This implies approximately 20 Kcal or 2.2g n-3 PUFA for a 2000 Kcal diet.
- The above requirement is met from a balanced healthy diet and adequate intake of nuts and oil seeds (refer My Plate for the Day & Table 6).
- Additional cooking oils/fats containing MUFA, PUFA or ghee/butter can be added for taste and flavor, upto 27 to 30g for a 2000 Kcal diet.
- Limit ghee or butter to just 1 to 2 teaspoons/day or avoid, if possible.

### Does processing alter the quality of oils?

In general, all extracted seed (vegetable) oils must be used in moderation as extraction procedures (whether crude or refined) may contain undesirable substances. Crude vegetable oils are likely to contain several undesirable compounds, hence, the crude oil is subjected to a series of 'refining process' (using chemicals) to remove these undesirable compounds so that vegetable oils are suitable for human consumption. 'Refining' also removes the odor and extends the shelf life of vegetable oils. During the refining process, small amounts of minor components such as antioxidants, phytosterols etc. are also removed without altering the fatty acid composition. Processing or refining of extracted oils removes undesirable compounds found in crude extracted oils, but the refining process adds several additives including preservatives that are not good and hence, must be taken in moderate amounts.

'Crude vegetable oils' are the vegetable oils extracted



from seeds (sunflower, soyabean, mustard, sesame, etc.) or fruits like palm and olive by mechanical expelling. Crude vegetable oils are likely to contain several undesirable compounds such as free fatty acids, gums, waxes, mono and diacylglycerides, phospholipids, hydrocarbons, pesticide residues, aflatoxins and allergens.

'Virgin oils' are produced by mechanical procedures, (expeller pressing) and the application of heat. However, virgin oils also contain undesirable compounds (details above), similar to crude oil. Nutrients such as antioxidants and phytonutrients are preserved, since use of mechanical procedures does not alter the nature of the oil.

'Cold pressed oils' (*Kachi ghani tel*), also contain undesirable compounds, similar to crude oil. However, nutrients such as antioxidants and phytonutrients are preserved as they are obtained without altering the nature of the oil by mechanical procedures, (expeller pressing), without the application of heat.

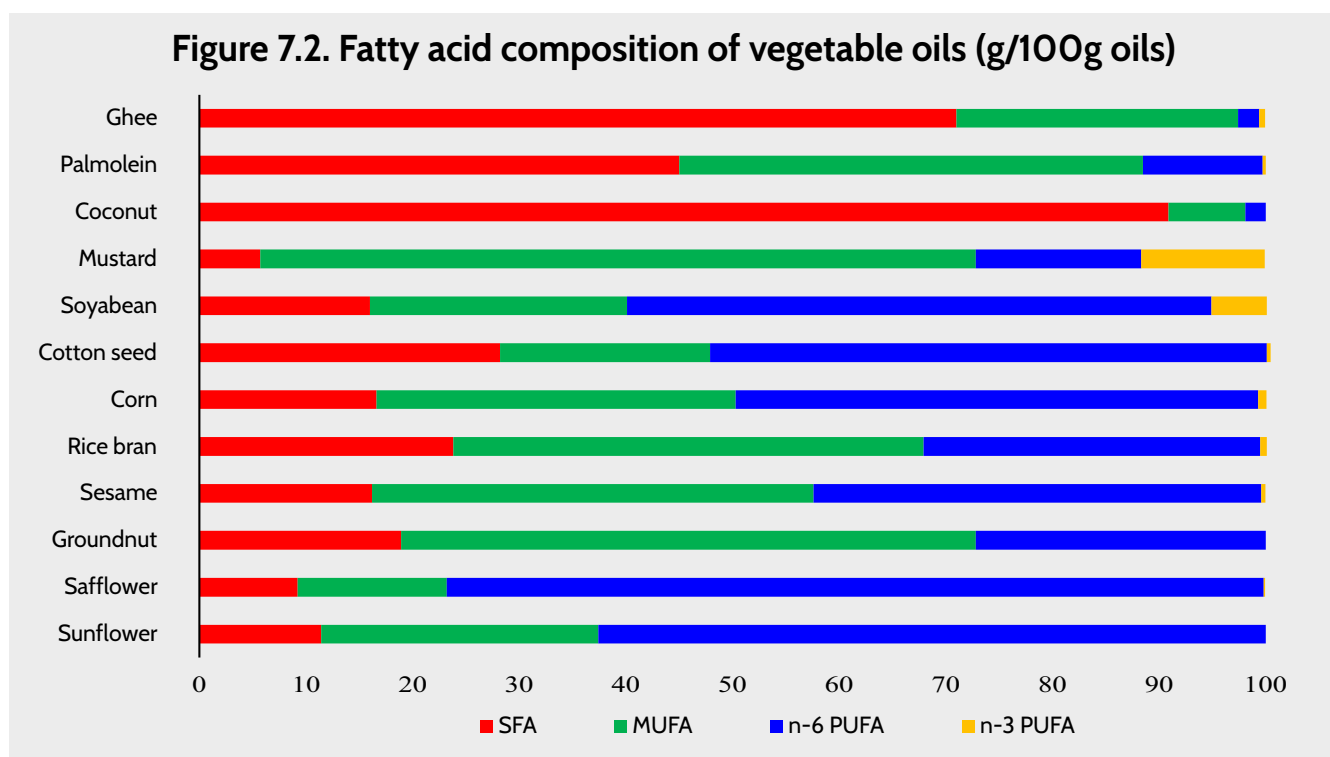
### What about hydrogenated fat?

Hydrogenated fat is prepared by partial hydrogenation of vegetable oils (often referred to as 'vegetable shortening').

During hydrogenation, the liquid oils become solid because MUFA and PUFA are converted into SFA and isomers called *trans* fatty acids. *Vanaspati* is used as a substitute for ghee/butter in cooking and the preparation of sweets, snack foods and bakery products. Current evidence indicates that intake of *trans*-fatty acids can increase the risk of heart disease and stroke and are more harmful than SFA.

### Repeated heating of oils

The practice of 'reusing' vegetable oils for cooking, (which have been repeatedly heated during food preparations) is very common, both at homes and in commercial establishments. Repeated heating of vegetable oils/fat, results in oxidation of PUFA, leading to the generation of compounds which are harmful/toxic and may increase the risk of cardiovascular diseases and cancer. At household level, vegetable oil once used for frying, should be filtered and may be used for curry preparation but using the same oil for frying again should be avoided. Also, such oils should be consumed in a day or two. Storing 'used' oils for a long time should be avoided, as the rate of deterioration is high in such oils.





## POINTS TO REGISTER

- Include foods rich in alpha-linolenic (ALA)/n-3 PUFA such as nuts/oil seeds, soyabeans, grains/millet, green leafy vegetables and fenugreek seeds.
- Prefer marine fish such as salmon, mackerel, trout and tuna (~200gm/week) which are good sources of preferred LC n-3 fatty acids.
- Moderate the use of high n-6 PUFA containing oils.
- Limit the use of high saturated-fat containing oils/fats such as ghee, butter etc.
- Minimize consumption of ready-to-eat fast foods, bakery foods and processed foods which may contain *trans* fats and saturated fats.
- Avoid using partially hydrogenated fats (*vanaspati*) as the cooking medium as they contain trans-fats and saturated fats.
- Repeated heating of cooking oils generates harmful oxidative (polar) compounds and hence must be avoided.



# GUIDELINE 8

## Obtain good quality proteins and essential amino acids (EAA) through appropriate combination of foods and avoid protein supplements to build muscle mass



### RATIONALE

**Maintaining good muscle mass is crucial for good health. Consuming good quality protein (that provides all the EAA) and following resistance exercise routine for greater muscle mass development and preservation.**

- Daily diet of an adult often provides 60g to 70g of protein a day, which is higher than what we require.
- However, quality of protein and meeting requirements of all essential amino acids (EAA) is the primary challenge.
- Of the twenty amino acids (AA) that are required for all the functions in the body, nine are essential; which cannot be synthesized in our body. Hence, it is important to consume diverse groups of foods to obtain all the essential nine AA.
- Of the nine, four amino acids are the ones which are limiting in plant foods (vegetarian) (Table 8.1).
- Vegetarian diets with appropriate combination of cereals and pulses and with the inclusion of nuts and seeds can provide all the EAA. Inclusion of milk in daily diet would further enhance protein quality.
- Non-vegetarian diets can provide quality protein by appropriate combination of cereals, pulses, nuts along with

recommended level of fish/poultry/meat/egg (flesh foods and egg contain all the EAA).

### Why do we need proteins and EAA?

Every part of our body including all the organs have proteins. Proteins are essential for many functions such as making enzymes, hormones, cell membrane components and carrier proteins such as hemoglobin (carries oxygen to tissues). Proteins are also required to replace tissues that are broken down. In addition to the above, growing children require dietary protein for growth to build muscles and bones. Human body requires only 20 AA. Thousands of different types of proteins are made from these 20 AA. Of the 20, nine amino acids are not synthesized in the body, hence these should be obtained from the dietary sources, and these are termed essential amino acids (EAA). A diet with all 20 amino acids, including 9 EAA referred to as good quality proteins, is essential in the maintenance of good muscle mass.



**Table 8.1. Limiting amino acids (AA) in plant foods**

Foods	Limiting essential amino acids	Compliment with other foods to obtain the limiting AA
Grains (cereals, millets)	Lysine, Threonine, Tryptophan	Pulses, chickpea & beans which are rich in lysine, threonine and tryptophan
Pulses	Methionine	Cereals, millets, nuts and seeds which are rich in methionine
Nuts/seeds	Lysine	Pulses, chickpea, beans (kidney beans, cowpeas)

*Note: A meal containing both pulses and grains supplies all amino acids and is of higher quality than a diet containing pulses alone or grains alone.*

### Why should we maintain good muscle mass and how to maintain?

- Maintaining higher muscle mass keeps the bones strong.
- Strong and good muscle mass helps joints move freely, and there is less strain on knee or hip joints; and protects joints from damage.
- Maintaining higher muscle mass improves insulin sensitivity and decreases the risk of diabetes, stroke and heart attacks.
- Maintaining higher muscle mass delays ageing.
- Regular physical activity (including strength exercise) along with a good diet is important for maintaining good muscle mass and muscle function (ref. Guideline 10).

Maintaining higher muscle mass improves insulin sensitivity and decreases the risk of diabetes, stroke and heart attacks.

### How much proteins do we need?

- The estimated average requirement (EAR) for protein intake is 0.66g of protein per kg/day for healthy men and women.
- The recommended dietary allowance (RDA) for protein intake is 0.83g protein/kg/day for healthy men and women (requirements of 97.5% of the population).
- This translates to an EAR of 43g protein/day or RDA of 54g/day for a person weighing 65kg, regardless of physical activity or gender. The protein energy (P:E) ratio should be

ideally 10% to 15%; that is, 10% to 15% energy should be from proteins in our daily diet.

- The required quantity of protein and the PE ratio are easily met from the daily diet, but the challenge is the quality; the diets may not provide all the essential amino acids (good quality protein). Hence, food-based allowance is the ideal one for protein recommendation as given below.

### How to obtain good quality protein from our diet?

- Of the EAAs, cereals have lower levels of lysine but higher levels of sulphur-containing amino acids (methionine and cysteine). In case of pulses, the reverse is true; pulses have higher levels of lysine and lower levels of methionine and cysteine.
- Therefore, an appropriate combination of cereals with pulses in the ratio of 3:1 (raw food weight) can meet the requirements of all EAA including other amino acids. Addition of 250ml milk in our daily diet can further enhance intake of EAA and in meeting the requirements of all the EAA.
- Non-vegetarians can easily source their proteins from recommended level (700g to 900g/week; marine water fish, poultry or lean meat) of flesh food or egg consumption.
- One should be physically active and ensure that the

Regular physical activity (including strength exercise) along with a good diet is important for maintaining good muscle mass and muscle function.



protein consumed is utilized (muscle atrophy sets in with low physical activity).

### Will just protein consumption help build muscle mass?

- No, the dietary protein is not utilized efficiently even if one takes high proteins of good quality without adequate carbohydrate and fats in the diet. Hence, adequate energy from carbohydrates and fats is essential for dietary amino acids (proteins) to be utilized for muscle mass synthesis and for amino-acid related functions in the body.
- In addition, without adequate physical activity, proteins are unlikely to be used for muscle building. One should be physically active and perform strength exercises and ensure that the protein consumed is utilized (muscle atrophy sets in with low physical activity).

### How do vegans get enough protein?

- Vegans eating varied diets containing vegetables, beans, grains, nuts, and seeds will have no difficulty in obtaining enough protein from regular diet.
- Appropriate combination of cereals with pulses in the ratio of 3:1 (raw) is the most efficient way to obtain all the nine essential amino acids from a vegan diet.

### What are the sources of proteins?

Dietary proteins can be derived from plant and animal sources. Some proteins, especially animal source (meat, poultry, fish, egg and milk) proteins contain all twenty amino acids, including nine EAA, required to make new proteins in the body. Pulses such as lentils, green gram, horse gram, black gram, chickpeas, kidney beans, cowpeas, soyabean and green peas are all rich sources of proteins. Nuts and seeds such as almonds, pistachios, cashews, walnuts, hazelnuts, chia seeds, pumpkin seeds, flax seeds, and sesame seeds also contain substantial quantity of protein.

Flesh foods, eggs and milk are good sources of quality proteins. Pulses are very important sources of protein in balanced vegetarian Indian diets. Protein obtained from pulses is less expensive compared to meat-based, eggs or milk

proteins. Protein quality of a diet is enhanced when pulses are eaten in combination with cereals or cereals are eaten in combination with flesh food, eggs or milk. Pulses are low-fat and high-fibre foods and also contain important vitamins and minerals like iron, potassium, zinc and magnesium.

Most of the vegetarian foods have a protein digestibility range of 70%–85% and a balanced vegan diet for a moderately active man, provides more than 80g crude protein/day. This translates to approximately 60g of quality protein that meets the requirements of all the EAAs.

### What are protein powders or protein supplements?

Protein powders are made from either eggs or dairy milk or whey (a byproduct of cheese or paneer) or plant sources such as soyabeans, peas and rice. Some protein powders, marketed in packages as protein supplements, contain protein from multiple sources. Protein powders may also contain added sugars, non-caloric sweeteners and additives such as artificial flavoring, hence, are not advisable to be consumed on a regular basis. Whey protein is rich in branched chain amino acids (BCAAs). Recent evidence suggests that BCAAs may increase the risk of certain non-communicable diseases (NCDs). As mentioned above, adequate non-protein energy from carbohydrate and fat is essential for dietary proteins/AA to be utilized for protein synthesis and for related functions in the body. Consuming high level of protein, especially in the form of protein supplement powders, is therefore not advisable.

Many athletes consume very high amounts of protein, often as protein powders. Protein requirements are not as high as commonly perceived. In fact, research findings indicate that dietary protein supplementation is associated with only a small increase in muscle strength and size during prolonged resistance exercise training (RET) in healthy adults; and protein intake levels greater than ~1.6g/kg/day do not contribute any further to RET-induced gains in muscle mass.

Consuming high level of protein, especially in the form of protein supplement powders is not advisable.



Most athletes can get the recommended amount of protein through food alone, without the use of supplements. Protein powders are not required. Moreover, prolonged intake of a large amount of protein is associated with potential dangers, such as bone mineral loss and kidney damage.

As can be seen from the table 8.2, all the amino acids can be easily met if one consumes a healthy balanced diet, whether vegetarian or non-vegetarian. Appropriate combination of cereals: pulses in a ratio of 3:1 or by substituting 30g of recommended level of pulses with 80g meat per day would improve quality of protein to fulfill the needs of a normal person.

**Table 8.2. Essential amino acid profile of vegetarian and non-vegetarian diets  
“ICMR-NIN, My Plate for the Day”**

Amino acids	ICMR-NIN, 2020 Nutrient recommendation (mg/g protein)	Protein (mg/g) from vegetarian diet	Protein (mg/g) from non-vegetarian* diet
Histidine	15	24.1	24.8
Isoleucine	30	41.2	42.8
Leucine	59	84.0	86.6
Lysine	45	49.0	50.0
Methionine	16	17.2	18.8
Cysteine	6	11.2	12.4
Methionine + Cysteine	22	28.4	31.2
Threonine	23	35.5	37.8
Phenylalanine + Tyrosine	38	87.9	89.6
Tryptophan	6	10.8	11.3
Valine	39	51.3	53.4

## POINTS TO REGISTER

- Cereals have lower levels of lysine and higher levels of sulphur-containing amino acids (methionine and cysteine). The reverse is true for pulses.
- Combining cereals with pulses in the ratio of 3:1 will improve the quality of protein in a meal.
- Most athletes can get the recommended amount of protein through appropriate selection of food items. Protein powders are unnecessary and can cause harm.
- Prolonged intake of large amount of protein powders or consumption of high protein concentrate has been associated with potential dangers, such as bone mineral loss and kidney damage.
- Non-vegetarians can meet their quality protein needs by taking recommended level of fish/poultry/meat/egg.



# GUIDELINE 9

## Adopt a healthy lifestyle to prevent abdominal obesity, overweight and overall obesity



### RATIONALE

Besides overweight and general or overall obesity, abdominal obesity (increased waist circumference) that is indicative of excess fat in the peritoneum (abdominal cavity) with accumulation of fat in and around the internal organs is associated with risk of lifestyle diseases.

- Marked increase in the prevalence of abdominal obesity (increased waist circumference), overweight, and obesity among all the age groups in rural and urban areas has occurred in the last few decades.
- About 25% of Indians are either overweight or obese.
- Excess energy intake and reduced physical activity leads to excess accumulation of fat in the body.
- Individuals with abdominal obesity (adiposity) and overall obesity are at an enhanced risk of lifestyle diseases (chronic non-communicable diseases-NCDs) including type 2 diabetes, fatty liver disease, gallstones, joint disorders (osteoarthritis), hypertension, other cardiovascular diseases, certain cancers, and psycho-social problems.
- As age advances, one needs fewer calories each year as the metabolism slows down and lean (muscle) mass decreases. However, inactivity slows down metabolism more rapidly and muscle mass atrophy is faster. Thus, one can maintain muscle mass and increase metabolism by being active.
- Eat healthy (Guideline 1): Avoid or restrict foods containing high sugar, fat, salt and ultra-processed foods. These foods hasten the process of adiposity/obesity.
- Being physically active and following a healthy diet will help reduce abdominal obesity (Figures 9.1 & 9.2).

### What is Body Mass Index (BMI)?

BMI is the ratio of weight and height, which estimates total body mass and correlates highly with the percentage of body fat. It is computed by dividing the weight in kilograms by the square of the height in meters [BMI=Weight (Kg)÷Height (M)<sup>2</sup>]. The ideal ranges of weights for a given height are provided by WHO which is useful for categorizing persons as normal (ideal), undernourished and overweight or obese. The cut-off levels for categorizing overweight and obesity in children and adolescents are different since growth spurt in boys and girls occurs in different ages. Age and gender specific BMI Z-scores of reference population are used to assess their nutritional status.

Being physically active and following a healthy diet will help reduce abdominal obesity.

### What is overweight and obesity?

The definition of overweight and obesity is based on BMI. In general, BMI for adults, as per WHO, ranging from 18.5 to 25 Kg/M<sup>2</sup> is considered to be normal. However, for Asians it is



recommended that the BMI should be between 18.5 to 23Kg/M<sup>2</sup>, since, they tend to have higher percentage body fat even at a given BMI compared to Caucasians and Europeans, which leaves them at a higher risk of NCDs.

**Central/abdominal obesity:** Fat accumulation especially the distribution of fat around the abdomen (central obesity) and

internal organs is now considered to be more harmful. Central obesity, as indicated by higher waist circumference, is considered as a risk factor for lifestyle diseases such as NCDs.

**Overweight:** BMI ranging over 23 to 27.5 Kg/M<sup>2</sup> is defined as overweight as per Asian cut-offs. Over 31% of urban and 16% of rural adults are overweight (NNMB).

### Figure 9.1. Suggested diet for normally nourished sedentary men

(The menu is for reference individual weighing 65Kg & BMI 18.5–23 and with adequate physical activity)



Total calorie from the above diet is 2100 Kcal/day | Total protein provides 13.7% Kcal/day from the suggested diet | Quantities indicated are for raw ingredients

\* Measures: 1 cup/Katori =200ml | \*Non-veg items like fish/egg/chicken can be consumed as per social acceptability & availability

In the meal preparation 30g oil and 5g iodized salt can be used | Prefer at least 50% cereals/millet as whole grain.

It is preferable to take only two meals per day as per individual preferences & needs; Timing and meal proportion given above are only indicative.

Note: Energy requirement depends on body weight and physical activity | Added sugar must be restricted to less than 5% of daily energy

Individuals with different body weight may refer to Table 1.6, Page no. 10

Refer: Annexure I & II for household measures



**Obesity:** BMI above 27.5 Kg/M<sup>2</sup> is defined as obesity as per the Asian cut-offs. Over 12% urban and 5% rural adults are obese (NNMB).

The waist circumference is useful for assessment of central obesity. Several studies have shown direct correlation of central obesity with chronic lifestyle diseases or NCDs. Waist circumference of >90cm for men and >80cm for women is associated with increased risk of several chronic lifestyle diseases. Abdominal obesity is prevalent in 53% of urban and 19% of rural adults.

### What causes abdominal/overall obesity?

It is well known that overeating along with decreased physical activity predisposes an individual to overweight/obesity, but solely depending on highly refined grains, processed foods and high sugar intake deranges our metabolism and predisposes to obesity. Unhealthy dietary practices during infancy and childhood (such as overfeeding) play an important role in predisposing individuals to overweight/obesity in adulthood. Low and high birth weight (<2500g and >4000g), obesity during childhood and adolescence are also likely to cause overweight/obesity in adulthood. In addition, women are at higher risk of becoming overweight/obese around pregnancy and after menopause. Genetic (familial) factors as well as complex behavioral and psychological factors that may influence eating patterns, may also contribute to overweight/obesity, but the effect of dietary and physical activity behavior is more profound than genetics.

Several studies have suggested that inadequate and improper sleeping habits, along with more hours of screen time (spent in watching television / mobile phone) is strongly associated with weight gain in childhood, adolescence and adulthood. This is mostly due to the sedentary behavior, tendency to consume unhealthy foods during screen time and decreased sleep hours. In addition, regular consumption of unhealthy processed foods, influenced by aggressive marketing and advertising, also contributes to

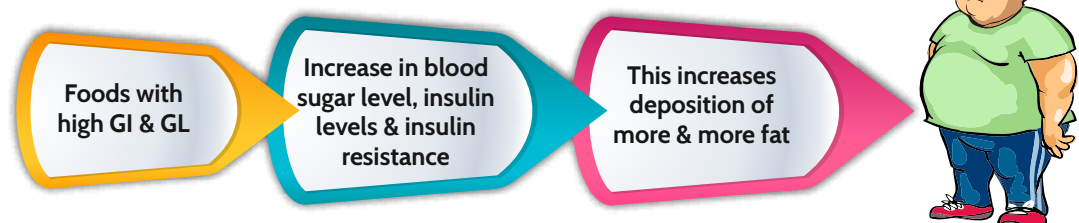
unhealthy dietary practices leading to overweight/obesity. It is necessary to maintain appropriate abdominal circumference and a desirable body weight by consuming just enough calories and being physically active. Body weight must be monitored periodically.

### Why should we prevent abdominal/overall obesity?

There are several negative health consequences of obesity. Excessive body weight causes low-grade chronic inflammation and increases the risk of heart disease, hypertension, diabetes, gallstones, fatty liver disease, certain types of cancers, osteoarthritis, psycho-social problems and also impairs immunity. Obesity is often associated with increased levels of low-density lipoproteins ('bad' cholesterol), and triglycerides, apart from abnormal increase in glucose and insulin resistance. Considering the increasing trend in the prevalence of non-alcoholic fatty liver disease (NAFLD), coronary artery disease, hypertension and diabetes in India, it is important to maintain desirable body weight for height and prevent overweight and obesity.

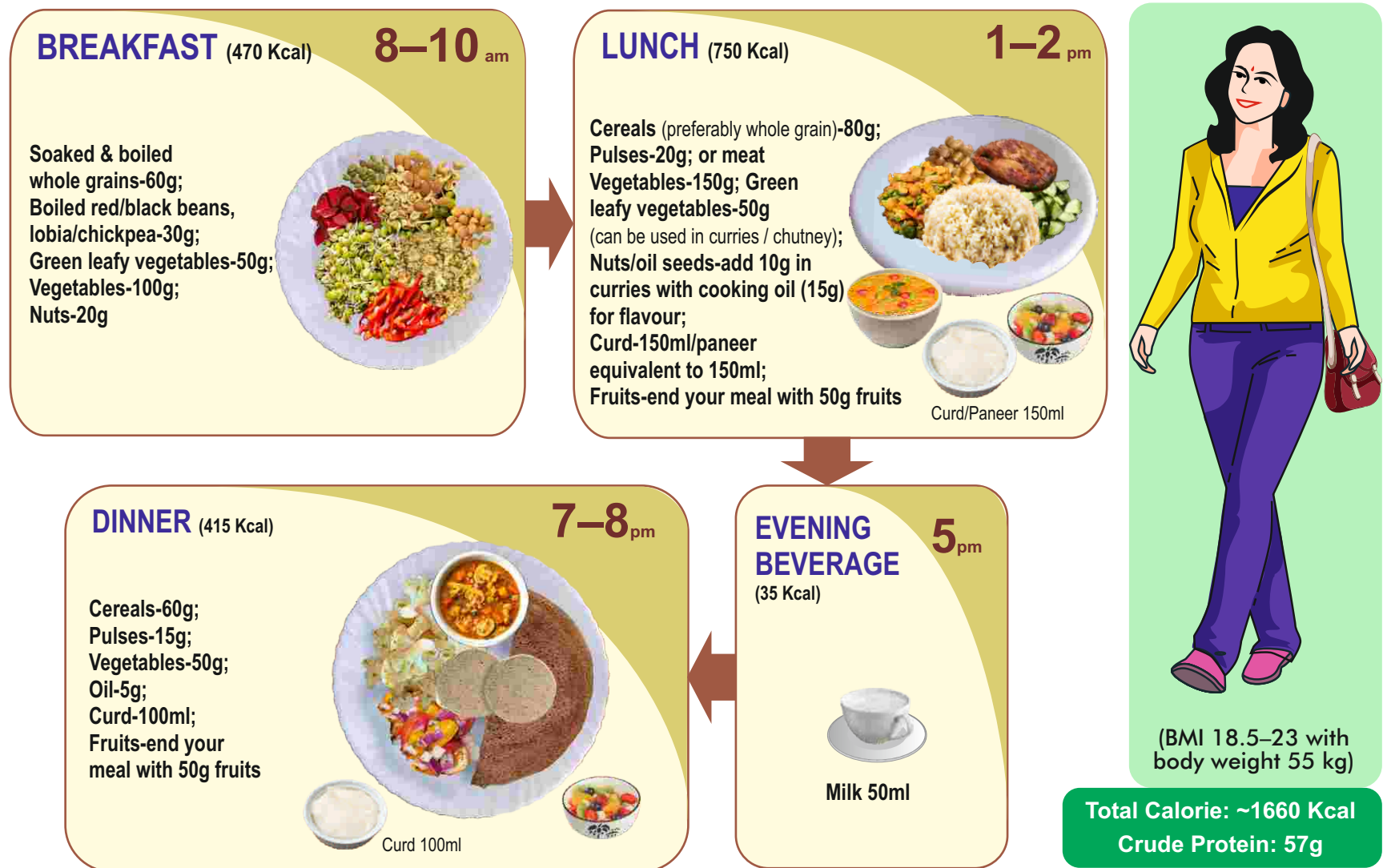
### How to maintain appropriate body weight and waist circumference (abdominal adiposity/obesity)?

To maintain appropriate weight and waist circumference, one must include fresh vegetables in every meal, consume whole grains, pulses and beans; and must avoid sugar, processed products, fruit juices and HFSS foods (refer to Guideline 15). Regular physical activity and yoga are crucial to maintain good health and weight. Weight reduction should be gradual. Weight reduction diets should not be less than 1000 Kcal/day and should provide all nutrients. A reduction of half a kilogram body weight per week is considered to be safe. Approaches of rapid weight loss and use of anti-obesity drugs should be avoided.





**Figure 9.2. Suggested diet for normally nourished sedentary women\***  
(The menu is for reference individual weighing 55Kg & BMI 18.5–23 and with adequate physical activity)



Total calorie from the above diet is 1660 Kcal/day | Total protein provides 13.8% Kcal/day from the suggested diet | Quantities indicated are for raw ingredients

\* Measures: 1 cup/Katori =200ml | \* non-veg items like fish/egg/chicken can be consumed as per social acceptability & availability

In the meal preparation 20g oil and 5g iodised salt can be used | Prefer at least 50% cereals/millet as whole grain.

It is preferable to take only two meals per day as per individual preferences & needs; Timing and meal proportion given above are only indicative.

Note: Energy requirement depends on body weight and physical activity | Added sugar must be restricted to less than 5% of daily energy

\* Non-pregnant and non-lactating | Individuals with different body weight may refer to Table 1.6, Page no. 10

Refer: Annexure I & II for household measures





However, consuming higher amounts of protein (15% energy from protein) may be important during typical energy-deficient weight loss diets (i.e., 500–750 Kcal/day deficit) to preserve muscle mass. Nevertheless, the protective effect of higher-protein diets on muscle mass is compromised if the energy deficit is more than 40% of daily energy needs, and the dietary proteins are oxidized for energy production. Hence, it is advisable not to go beyond 40% energy deficit of daily energy needs to support muscle mass maintenance and protein balance.

Weight-reducing diets should be nutrient rich and nutritionally balanced. Foods containing high sugar/salt/fat/refined cereals such as sweets, biscuits, cakes, candies, fruit juices or cool drinks (carbonated beverages) provide high calories and nil or low nutrients and hence should be avoided. Foods containing sugar or refined carbohydrates have high glycemic index (GI) and therefore promote rapid absorption of glucose, and increase glycemic load (GL). There is a sharp rise in insulin when high sugar / refined cereal foods are consumed. Regular intake of foods high in sugar at frequent intervals increases and maintains insulin at a higher than normal level. High insulin impairs metabolism, increases adipogenesis and promotes deposition of fat in and around organs, especially when physical activity is low.

Adequate intake of micronutrients and fibre-rich foods such as pulses, nuts, chia seeds, flax seeds, whole grains including millets, vegetables and fruits improves satiety and helps to maintain levels of blood glucose, insulin, cholesterol as well as triglycerides. Pulses, nuts and moderate quantity of lean meat will also help maintain weight and health. Consumption of plenty of fruits and vegetables would not only result in satiety but also help maintain adequate fibre and micronutrient intake.

### How to choose healthy options?

Please refer to figure 9.3 to choose healthy food options over unhealthy foods made of refined grains or containing high levels of added sugar and added cooking oils.

**Plan balanced meals with sufficient vegetables:** Include whole grains like minimally processed rice, whole wheat roti, millets (nutricereals), barely, bamboo rice and include legumes like beans and lentils in the recommended cereal pulse ratio (3:1 or 5:1). They are rich in fibre and nutrients. They provide sustained energy and help you feel full, reducing the need for extra calories.

**Take more helpings of vegetables:** In addition to salads, incorporate a variety of colorful vegetables into your meals. They are low in calories but high in vitamins, minerals, and fibre. Roasting, steaming, or stir-frying vegetables can enhance their flavor without adding much cooking oil.

**Practice portion control:** Be mindful of portion sizes and prevent overeating.

**Snack smart:** When snacking, reach for nutrient-dense options like a handful of nuts, plain yogurt, or cut vegetables with some spice added.

**Opt for lean meat,** such as skinless poultry, lean cuts of meat and fish. These meat sources are lower in calories and saturated fats compared to fatty cuts of meat.

**Use healthy cooking methods:** Opt for cooking methods like grilling, baking, steaming, or sautéing with minimal oil instead of frying. This reduces the energy density of your meals.

**Limit sugary beverages:** Cut down on sugary drinks like soda, fruit juices, and energy drinks. Choose water, herbal tea, or unsweetened beverages instead.

**Read food labels:** Check food labels for information on calories, saturated fats, added sugars, and sodium. Opt for products with lower amounts of these components.

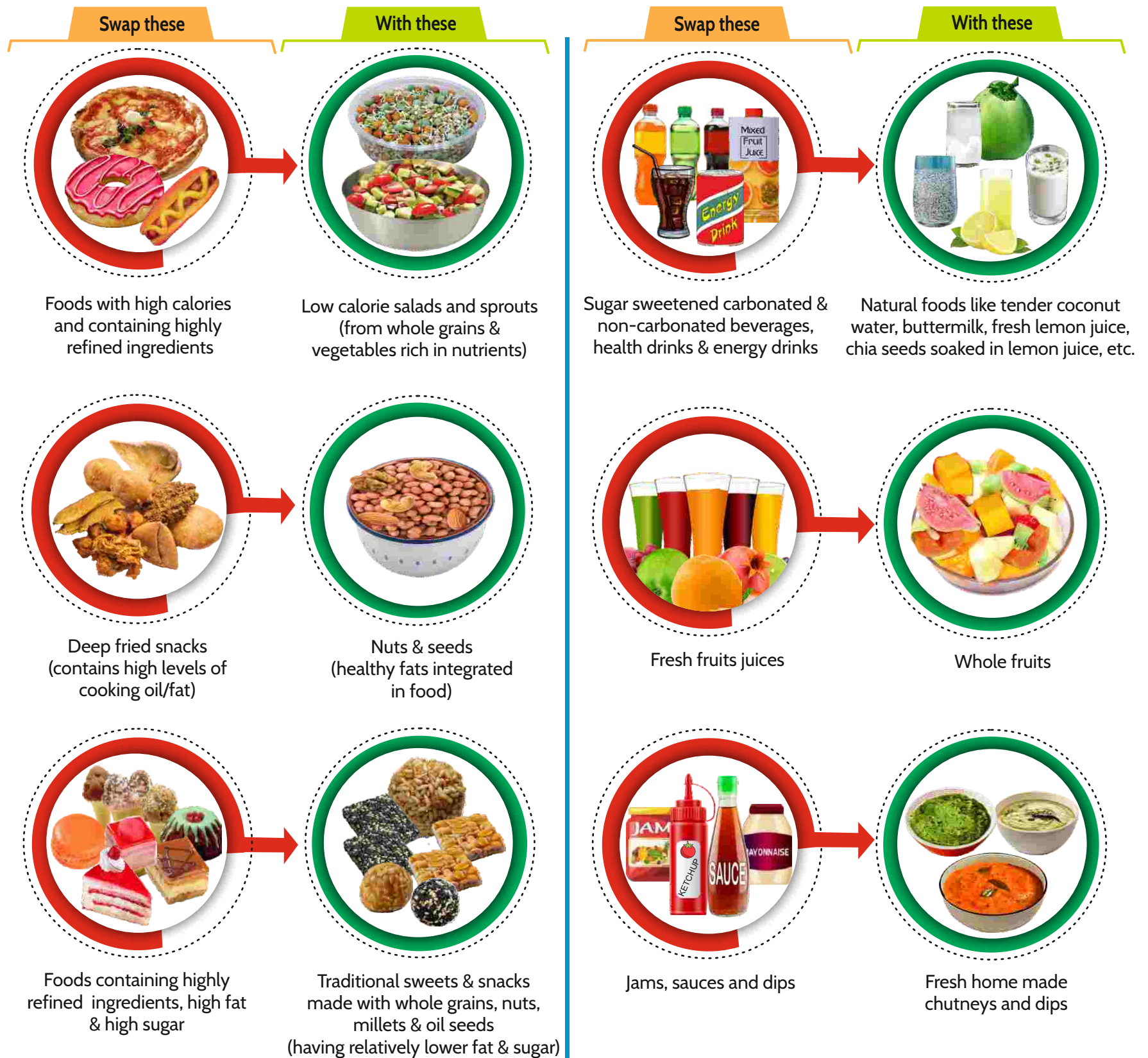
### Adopt to healthy balanced diet and regular physical activity

- For reducing weight, cut down on calorie from refined carbs and cooking oils and undertake physical activity on a regular basis.





Figure 9.3. Swap high calorie foods with healthier foods



Note: The foods circled in **RED** color if consumed may be taken occasionally in moderation

## POINTS TO REGISTER

- Prevention of overweight/obesity is important.
- There is a tendency to gain weight mostly around 20 years of age; and among women after childbirth because of less physical activity and excess calorie intake. Obesity is also rapidly increasing among children and adolescence and therefore, one should be watchful during these periods.
- Eat healthy (refer Guideline 1) and maintain appropriate body mass index or weight for height.
- Regular yoga and physical activity are essential.
- Slow and steady reduction in body weight is advisable. Extreme approaches for weight loss may lead to health hazards.
- Cut down consumption of sugar, salt, excess refined oil, deep fried foods and refined foods. Avoid soft drinks and alcohol.
- Increase consumption of fruits, vegetables and pulses. Prefer whole grains and millets to refined grains / ultra-processed foods.
- Minimize non-essential screen time.
- Healthy sleeping patterns (7–8 hrs/day) is necessary to avoid unhealthy eating behaviors and resultant weight gain.

# GUIDELINE 10

## Be physically active and exercise regularly to maintain good health



### RATIONALE

**Regular physical activity, yoga and exercise keep one physically and mentally fit and promote good health.**

- Regular physical activity, yoga and exercise of moderate intensity are recommended for good health and wellbeing.
- These help in maintaining desirable body weight, muscle strength, bone health, flexibility of joints and appropriate body mass composition, which are of vital significance for health.
- Regular physical activity, yoga and exercise reduce the risk of non-communicable chronic diseases.
- Lack of physical exercise impairs health but over exertion could be detrimental.

### What is physical activity?

Physical activity can be classified as structured or incidental:

- Structured activity is planned and repetitive in nature and includes exercises such as aerobics, stretching and strengthening activities (brisk walk, gym workouts, swimming, jogging, skipping, cycling, etc.).
- Yoga is a holistic, structured and planned physical activity that also includes breathing exercises (pranayama) as well as physical and mental relaxation (meditation).
- Incidental activities include a broad range of routine activities such as household chores, walking around for daily tasks, climbing up the stairs, gardening, leisure activities, work place activities, leisure games and sports.

### Types of physical activity and health benefits

A combination of physical activities is recommended for overall health and improved cardio-respiratory and muscular fitness. It can be broadly classified into four types: endurance, strength, balance and flexibility.

**Aerobic /Endurance activity:** This activity tends to increase the heart rate and breathing, resulting in greater improvement in the heart and lung functioning. Most often it is called cardio activity or endurance activity. The activities range from brisk walking (moderate) to running or jogging or swimming or bicycling (vigorous).

**Muscle and bone strengthening activity:** These activities come under resistance training or weightlifting or weight loading or weight bearing. These activities include lifting heavy objects/ weights, carrying a child, working with elastic bands, pushups, crunches, squats, jumping rope, etc. Weight-bearing exercises can improve muscle and bone strength.

**Balance activity:** These activities improve flexibility, agility, gait and include exercises such as lunges, walking backward, dancing, stretching and martial arts, etc.

A combination of physical activities is recommended for overall health and improved cardio-respiratory and muscular fitness.



**Flexibility / Yoga:** Includes all the above three categories of activities along with flexibility and breathing exercises as well as physical and mental relaxation exercises.

Based on their intensity and the level of physical activity, activities can be classified into the following categories:

**Sedentary activity:** Those who are engaged in activities with postures of sitting, standing up and walking around in the home, workplace or community. These activities cause a slight increase in breathing rate than when being at rest. Light activities include walking at <3km per hour on level ground, cleaning the house, cooking, etc.

**Moderate activity:** Those involved in activities requiring some effort, like walking at a brisk pace of 3–6 km/hour on a level firm ground, aerobic activities, gardening, hiking, yogasanas and pranayama, gentle swimming, playing outdoor/indoor games such as badminton, tennis, table tennis, etc. It is described by a noticeable increase in depth and frequency of breathing, while continuing to be able to talk.

**Vigorous (Heavy activity):** Those engaged in activities requiring significant effort, like aerobics, running, jogging at  $\geq 7$  km/hour, jumping rope, participating in some competitive sports, quarrying, mining, etc. These activities are described by a greater increase in depth and rate of breathing, making it harder to breathe and not allowing the individual to talk freely.

#### Guidelines for physical activity

- If one follows sedentary life style, it is wise to consult a doctor before starting an exercise program.
- Exercise intensity and duration should be increased gradually over a period of time. Shortness of breath, pain, nausea, vomiting, and headache are warning signs that your body needs rest.







**Children and adolescents (>5–19 years):** It is recommended to do a minimum of 60 minutes per day of moderate-to-vigorous intensity activity. Vigorous intensity activities and

strength training should be included for at least three days per week.

**Adults ( $\geq 19$ –60 years):** It is recommended to do a minimum of 30–60 minutes of moderate-intensity aerobic physical activity per day for at least five days in a week; or 15 minutes of vigorous-intensity aerobic physical activity per day for at least five days in a week depending on age and health condition; or an equivalent combination of moderate and vigorous-intensity activity. Muscle strengthening exercises, activating all muscle groups should be performed for a minimum of two days in a week.

**Elderly ( $\geq 60$  years):** The recommendations for this group are similar to that of adults. They are required to include additional activities that enhance strength and functional balance for three days or more in a week.

**Table 10.1. Recommended Physical Activity: Duration for good health**

Activity		Duration (min.)
Sleep		480
Occupation (work)		480
Household chores (cleaning, cooking or washing utensils)		220
Personal care / eating / watching TV		180
Leisure time physical activity (different yoga postures, walking, gardening, dancing etc.)		60
Aerobic exercise (brisk walking, running, Swimming, cycling etc.)		20





### Some tips to keep physically active even when on a busy schedule

- At work, use a standing desk or stand every half hour.
- Walk for 5–10 minutes every few hours.
- Take all phone calls walking, both at work place or home.
- Use stairs instead of lifts/elevator.
- Park vehicle away from work place.
- While watching TV, move around every few minutes or during commercial breaks.
- As you get up in the morning, do some simple yoga and stretches to keep your muscles active and joints flexible.
- Regular strength training with weights is necessary to maintain muscle mass and improve metabolism. Not using muscles causes muscle atrophy.
- Perform two to three weight-bearing exercise per week to delay age-related muscle loss.
- Certain yoga postures (asanas) combined with breathing exercises are known to speed up the metabolism and help burn fat and facilitate weight loss.

Regular strength training with weights is necessary to maintain muscle mass and improve metabolism. Not using muscles causes muscle atrophy.

### General tips for physical activity

- Reduce the time involved in sedentary activities and increasing time spent in moderate-to-vigorous intensity activities.
- Increase the time in movement at work place or at home.
- Parents and schools should encourage children to involve in 60 minutes of moderate-to-vigorous intensity of activities every day.
- Adults and older population should involve in around 20–40 minutes per day of moderate-intensity and 10–20 minutes per day of vigorous-intensity activities.
- People with illnesses or chronic diseases like heart disease, high blood pressure, diabetes, asthma, osteoporosis and obesity should consult a physician before taking up an exercise program.
- Men and women over 40 years of age should also consult a doctor or healthcare provider before starting a vigorous physical activity program.

Certain yoga postures (asanas) combined with breathing exercises are known to speed up the metabolism and help burn fat and facilitate weight loss.



## POINTS TO REGISTER

- A minimum 30–45 minutes brisk walk / physical activity of moderate intensity among adults helps in maintaining good health.
- Regular physical activity of 60 minutes per day among children can prevent overweight / obesity.
- Physical activity controls body weight, reduces fat mass, increases muscle mass and improves immune function.
- Physical activity builds strong muscles, bones, joints and improves flexibility.
- Being physically active can reduce the risk of chronic diseases such as diabetes, high blood pressure, heart disease, osteoporosis, arthritis and certain types of cancer.
- Even among people with chronic diseases, physical activity helps in maintaining health.
- It creates a sense of wellbeing, increases confidence and avoids depression.
- Yoga is a holistic, structured and planned physical activity that also includes breathing exercises as well as physical and mental relaxation (meditation).

# GUIDELINE 11

## Restrict salt intake

### RATIONALE

**Increased salt (sodium chloride - NaCl) intake poses a health risk and may lead to hypertension and related heart diseases and stroke.**

- All foods contain sodium. Sodium requirements can be met with minimal added salt intake.
- Sodium plays an important role in nerve conduction and it is primarily involved in maintenance of water and fluid balance in the body.
- Maintenance of sodium balance depends on kidney function.
- High intake of salt is associated with high blood pressure and related vascular and heart diseases.
- High intake of salt may also increase the risk of stomach cancer.

From times immemorial, salt has been used as a preservative. All food substances contain sodium. Common salt or edible salt is sodium chloride (40% sodium and 60% chloride) and is the major source of sodium in daily diet. Sodium along with potassium is essential for water and fluid balance and electrolyte equilibrium; and also electro-physiological functions of all cells. Sodium intake needs to be balanced with potassium intake.

### What are the sources of sodium and potassium?

Habitual diets provide about 300–400mg of sodium per day. Cereals, pulses, vegetables, milk, animal and sea foods are the major sources of sodium. Foods like beans, lentils, banana, dry fruits and coconut water are good sources of potassium.

Indian food intake data indicates that average consumption of salt ranges from 3g to 10g/day in different states with about 45% of population consuming more than 5g/day. Since, the taste for salt is acquired, its consumption could be restricted right from an early age. Sodium is rapidly absorbed from the gastrointestinal tract and a positive balance can be achieved with intakes of not more than 5g of salt per day (equivalent to 2g of sodium). Sodium requirements depend on its losses through urine, feces and sweat. The sweat loss varies according to climatic conditions. High ambient temperatures and vigorous physical activity increase sodium loss through sweat.

### How do sodium and potassium interact in the body?

Balance of sodium (Na) and potassium (K) in diets is essential for good health. While potassium intake has been decreasing gradually, there is simultaneous increase in sodium intake, either as table salt used while cooking in meals or through processed foods. This has resulted in a higher sodium:potassium (Na:K) ratio.

High sodium and low potassium intakes are reported to be independently associated with an increased risk of developing high blood pressure. In adults, a stronger association exists with



High intake of salt is associated with high blood pressure and related vascular and heart diseases.



blood pressure outcomes, when the sodium-to-potassium ratio is considered as against considering either sodium or potassium alone. For optimal health benefits, individuals need to decrease their sodium intake and increase their potassium intake, leading to a decreased Na:K ratio.

The current Indian as well as WHO recommendation for sodium intake is 2300mg per day, which translates to around 5000mg or 5g (1 teaspoon) of common salt per day. At this level of intake of sodium, the potassium requirement would be around 3800mg per day. It can be easily met by consuming recommended level of vegetables (400g) and fruits (100g) per day which will also lower the Na:K ratio. Along with fruits and vegetables, nuts and flesh foods are also good sources of potassium.

Though all foods contain some amount of sodium, the contribution to total dietary intakes from food sources is less than 10% and a major amount comes from added salt either through cooking or processing. Hence, sodium intake can be restricted easily by changing food habits. Further, since taste for salt is an acquired habit, salt consumption should be restricted from an early age for health benefits in later life.

### What are the health problems associated with excessive salt/sodium intake?

Existing evidence reveals a deleterious impact of high salt intake on blood vessels, blood pressure, bones and gastrointestinal tract. There is a strong association between salt intake and blood pressure. Prevalence of hypertension is low in populations consuming less than 3g salt per day. The usual increase in blood pressure with age is also not seen with such

intakes. The amount of salt consumed is reflected in urinary sodium levels. Restriction of dietary salt decreases the risk of hypertension. Potassium-rich foods such as fresh vegetables and fruits decrease blood pressure. In fact, it is the ratio of sodium to potassium in the diet which is important.

Besides increasing blood pressure, excessive salt may also affect stomach mucosa and increase the risk of gastritis, atrophy and gastric cancer. Higher sodium intake leads to greater calcium excretion, which may result in reduction in bone density.

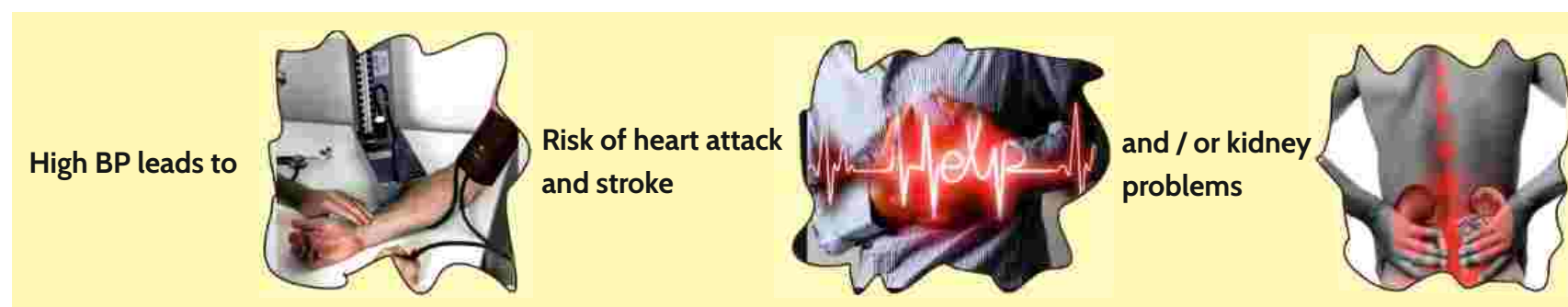
Salt intake in our population generally exceeds the requirement. It should not be more than 5g per day.

### How to avoid excess salt intake?

Processed foods such as snack foods, savouries, soups, sauces, ketchup, salted butter, cheese, canned foods, papads, and salted dry fish, salted nuts/dry fruits contribute to higher intake of salt. Preserved meats/vegetables and ready-to-eat foods contain a lot of salt and sodium. Additives like baking soda (sodium bicarbonate), baking powder (mixture of sodium carbonate and sodium bicarbonate) and monosodium glutamate are other sources of sodium in processed foods. Hence their consumption should be limited.

### Are other varieties of salt any better?

Technically, all salt come from sea salt - even edible salt, table salt or sodium chloride. Salt is available in two forms i.e. refined and unrefined salts, which are consumed with the purity of 99% and 96 % respectively. The most common form of salt used is finely grounded and processed with an anti-





caking agent that helps salt granules from falling apart. Salt often contains some essential trace minerals such as Magnesium, Calcium, Iron, Sulfur and Nitrogen.

In addition to common white refined or non-refined salts, rock salt is also used for specific recipes or occasions. Rock salts are of two types; pink salt (*sendha namak*) and the other one is black salt (*kala namak*). Pink and black salts can be easily distinguished by their color, texture and smell. Pink salt is one of the purest forms of salts. Black salt upon storage grows darker. Assorted spices, charcoal, seeds and tree bark are used in the preservation of this salt. Therefore, irrespective of the variety of salt, their consumption should be limited as the sodium content in them is almost similar.





## POINTS TO REGISTER

- Use iodized salt
- Restrict the intake of added salt (sodium chloride) to a maximum of 5g per day.
- Develop a taste for foods/diets that are low in salt from an early age.
- Restrict intake of processed and preserved foods such as snack foods, sauces, ketchup, biscuits, chips, cheese and salted fish.
- Eat plenty of vegetables and fruits. These are good sources of potassium, which helps in excretion of sodium and helps maintain the blood pressure.

# GUIDELINE 12

## Consume safe and clean foods

### RATIONALE

**Contaminated and adulterated foods cause several food-borne illnesses, chronic diseases and may also contribute to malnutrition.**

- Consumption of safe and hygienic foods is essential for maintaining good health.
- Environmental contaminants and adulterants in foods are health hazards.
- Consumption of unsafe foods can lead to food-borne illnesses, intestinal damage as well as undernutrition.

### What makes food unsafe?

Safety of foods can be compromised due to microbial contamination, chemical contamination and adulteration. Natural enzymes present in food also lead to its deterioration over time. Besides, insects, rodents, adulterants, natural toxins and various chemical residues, present beyond permissible levels, make the food unsafe. In addition, moisture present in the food and some environmental conditions like humidity, temperature, storage time also influence the quality of the food.

**Microbial contamination** (bacterial, viral, fungal and protozoan) can occur due to unhygienic practices.

**Chemical** (pesticides, fluoride) **and heavy metal** (lead, cadmium, mercury and arsenic) contamination can occur due to environmental pollution or presence of chemicals and heavy metals in soil and water in endemic areas.

**Adulteration** could be intentional or incidental and can adversely affect the nature, substance and quality of foods. It can be due to addition, removal, abstraction, substitution or modification of a food item. Adulteration may make the food 'unsafe' or substandard. It may happen at any stage of food production, processing and handling from farm to plate.

### How do we select safe food?

Selection of safe food is the first step to ensure a healthy and good quality diet. Food items purchased from reliable sources increase the chances of getting good quality and fresh food. Food should be free from infestation, moulds and foreign matter like rodent excreta and insect remains. It should be free from artificial colors. Some pre-packaged foods carry certification marks assuring good quality and purity. For example, AGMARK on some agricultural products like oils, spices, atta and honey, etc., and Bureau of Indian Standards (ISI) mark on additives like food colors and bottled drinking water.

Selection of safe food is the first step to ensure healthy and good quality diet.





**Vegetable cooking oils:** There is a risk of adulteration when fats/oils are purchased loose from unsealed containers. Therefore, it is always safer to purchase from a reliable source.

**Milk and milk products:** Butter, ghee and *khoa* should be purchased from reliable sources only. It is advisable to buy pasteurized milk only.

**Spices:** Since powdered spices are more likely to be adulterated, whole spices, uniform in color, size and shape should be preferred. Always buy certified products.

**Fruits and vegetables** that are discolored, physically damaged, shrunken, bruised or wilted and decayed, with visible evidence of insects and moulds, should be avoided.

**Eggs** should be fresh and free from cracks.

**Meat/Poultry/Fish** must be examined for their characteristic color, odor and texture and should be purchased fresh or frozen. Freshness of fish is indicated by a stiff body, bright, clear and bulging eyes, reddish gills, tight scales and absence of stale odor or discoloration. Fresh fish will not show any pitting on finger pressure.

### What are the best practices of storage?

Food grains should be dried adequately and stored in airtight containers to protect them from moisture and to prevent damage from microbes like bacteria and toxin-producing moulds. Rodent attacks, and the presence of insects and microbes render the foods unsafe. Frequent and careful disinfestation of food storage areas is essential. Some traditional household practices such as placing dried *neem* leaves in storage bins are known to prevent some infestations.

### Why do food-borne illnesses occur?

Food-borne illnesses are common particularly with consumption of foods prone to spoilage/contamination such as milk products like *khoa*, meat, poultry and even improperly stored cooked foods (like rice). Improper processing, handling and cooking, and keeping cooked food in warm conditions for several hours promote bacterial growth and bacterial toxin

production, which when consumed can cause food-borne illnesses.

### How should perishable foods be handled?

Perishable foods like milk, meat, fruits, vegetables and cooked foods, are prone to spoilage due to microbes. These foods should be refrigerated, preferably at a temperature of less than 5°C, which retards multiplication of microorganisms.

However, even refrigerated foods, if stored for long, can get stale. In case of cooked food that has to be stored for some time prior to consumption, it should be kept either hot (more than 60°C) or be cooled quickly (below 5°C). Most microorganisms multiply at temperatures between 5°C and 60°C. Refrigerated, cooked food should be heated thoroughly before consumption. However, repeated heating of stored, cooked food should be avoided.

Bacterial contamination from raw foods such as greens, vegetables, meat, fish can occur if cooked food is not kept separately in the refrigerator.

### Why is personal hygiene of food handlers important?

Traditionally in India, food is touched with bare hands while preparing and serving. Clean spoons and ladles should be used to serve food and to avoid contamination. Those who prepare and handle foods should observe good personal hygiene to maintain food safety. Washing hands well with soap and water, for at least 20 seconds, prior to touching cooking utensils or food is essential. In addition, hands should be free from obvious signs of poor hygiene such as dirty nails, wounds and sores.

Hands should be washed thoroughly with soap and water (for at least 20 seconds) before preparation of food and after every interruption, as well as before consumption. Keep domestic animals away from places where food is cooked, stored and served.

Refrigerated cooked food should be heated thoroughly before consumption. However, repeated heating of stored, cooked food should be avoided.



### What are the common adulterants?

Foods may be adulterated with non-food material or inferior quality products. Frequently adulterated food items are milk and milk products, cereals, pulses and their products, edible oils and spices. At times, spoilt, stale or poor-quality food is made attractive and fresh in appearance by adding harmful colors or other chemicals. The different classes of adulterants include non-permitted colors like metanil yellow; non-edible oils like castor oil; extraneous matter like husk, sand and sawdust in spices; and metal contaminants like aluminum foil on sweets or iron filings in tea.

### How to minimize pesticide residue in foods?

Pesticides, used during cultivation of crops, can remain as residues in foodstuffs, especially vegetables and fruits. Exposure of the population to pesticide residues may be harmful and can be minimized by washing the food stuffs thoroughly in running water or by peeling. Cooking and other processes can also reduce such residues. Insect control operations such as disinfestation in the kitchen by spraying pesticides is another source of contamination. Utmost care should be taken to ensure that food is well covered and protected from exposure to such harmful agents.

### How to ensure safety of foods stored in refrigerators?

- Store raw and cooked food items in refrigerator separately in different compartments.
- Cut the roots of green leafy vegetables before storing in refrigerator.

- Preserve eggs in refrigerator after washing them thoroughly.
- Maintain safe refrigerator temperature at  $<5^{\circ}\text{C}$ .
- Store cooked food in refrigerator in containers with lids, preferably in small portions.
- Clean the refrigerator once a fortnight.

### Safe use of cookware

A variety of cookware used in the kitchen are made of different materials like aluminum, iron, brass or copper. Small amounts of these materials that are likely to leach into food during cooking or storing need not be a cause of concern. However, storing acidic foods like pickles, *chutneys*, *sambar*, *solkadi*, *khatta dal* and others in aluminum, iron, untinned brass or copper vessels for prolonged time can make consumption of such foods unsafe.

Non-stick pans coated with Teflon are a risk if they are heated to temperatures greater than  $170^{\circ}\text{C}$ . This might happen if an empty pan is left on a burner for some time. In this case, the coatings can give off irritating or poisonous fumes, which when inhaled over long periods of time can also cause health hazards (refer to Guideline 13 for more details).

## POINTS TO REGISTER

- Wash hands with soap and water before touching food, utensils or cooking.
- Buy food items from reliable sources after careful examination.
- Wash vegetables and fruits thoroughly before use.
- Wash the surface of eggs thoroughly before preserving and before preparation.
- Wash and cook meat thoroughly.
- Store raw and cooked foods separately and properly to prevent cross-contamination.
- Refrigerate perishable food items.
- Maintain good personal hygiene and keep the cooking and food storage areas clean and safe.
- Always use thoroughly cleaned utensils, knives, chopping boards.
- Consume cooked foods within 4–6 hours of preparation. If left at room temperature, reheat thoroughly before consuming.



# GUIDELINE 13

## Adopt appropriate pre-cooking and cooking methods

### RATIONALE

#### Healthy cooking practices are important for good health

- Regional and socio-cultural practices influence cooking and dietary practices.
- Good pre-cooking practices help in retaining nutrients and reducing contaminants.
- Cooking makes food palatable, helps in easy digestion, and destroys harmful germs.
- Cooking at high temperatures can destroy nutrients and form harmful substances as well.

#### Why is pre-cooking process important?

Foods in their natural state contain different nutrients in varying amounts. In the course of food preparation, depending on the recipe, foods are subjected to various processes such as washing, cutting, grinding, fermentation, germination, and cooking. In Indian cuisine, fermentation (*idli, dosa and dhokla*) and germination (sprouting) are common practices. These methods improve the digestibility and bioavailability of micronutrients. In addition, sprouting also increases the content of certain vitamins.

Foods should be washed well, but not repeatedly, before cooking or consumption to remove contaminants like pesticide residues, parasites, and other extraneous material. Vegetables and fruits should be washed thoroughly with potable water before peeling or cutting. However, certain precautions need to

be taken while washing and/or cutting, to minimize the loss of nutrients:

- Avoid repeated washing of food grains like rice and pulses as it will result in loss of certain minerals and vitamins.
- Cutting vegetables into small pieces exposes a greater surface area of the foodstuff to the atmosphere, resulting in loss of vitamins due to oxidation.
- Cut vegetables and fruits should be consumed as early as possible as their shelf-life and nutrient contents reduce drastically.
- Cut vegetables, leafy vegetables, and fruits should not be soaked in water as water-soluble minerals and vitamins tend to get lost.

#### Are there any household methods of processing to improve and help retain nutrients in food?

Soaking, popping, puffing, sprouting/germinating, malting and fermenting are some of the established household methods that improve the digestibility and bioavailability of nutrients from wholegrains and legumes. Sprouted whole grains and legumes contain all of the original bran, germ and endosperm. The nutrients present in

Cut vegetables, leafy vegetables and fruits should not be soaked in water as water-soluble minerals and vitamins tend to get lost.





sprouts are more bioavailable than those in whole grains and can meet the requirements of vitamins and minerals.

When sprouting grains for human consumption, the optimum growth of the sprout should be only as long as the grain kernel itself. If grown any longer, the sprout begins to use up the power-house of nutrients that were stored in the grain, and the nutrient content declines.

### Method for sprouting

The common procedure for sprouting grains and legumes at households is given below:

- Place the cleaned grains in a strainer, rinse well, and drain the water.
- Soak the grains in a bowl with excess water so that the grain is completely submerged overnight at room temperature or at least for 12 hours.
- Drain the water in a strainer. Rinse well and collect the grains.
- Place the grains in a moist cotton cloth or a double layer of clean muslin moist cloth in a jar and cover. Cloth should cover the grains loosely to allow air circulation.

- Keep it out of direct light and keep at room (warm) temperature. The grains should sprout in 1–3 days.
- Sprouts can be consumed without further processing or by adding some garnish.

### Blanching or steaming, which is better?

**Blanching** involves putting vegetables in boiling water or steam for a short time and cooling them immediately in cold water to stop enzyme actions which could cause loss of flavor or color or texture. This process increases the shelf life of the vegetables, but the nutrients might be lost along with water. Hence, steaming the vegetables and cooling them immediately in the refrigerator is advisable instead of blanching. This way the vegetables are not soaked in water and therefore there is no loss of nutrients. Steaming is better than blanching of vegetables as the nutrient content is better retained.

Steaming is better than blanching of vegetables as the nutrient content is better retained.





## What are the various cooking methods?

Cooking improves the digestibility of most foods. Foods get softened on cooking and become easily chewable. Proper methods of cooking make foods palatable by improving their appearance, taste, flavor, and texture, thereby enhancing acceptability. In addition, they help in destroying disease-causing organisms and eliminate natural inhibitors of digestion.

**Open and closed lid cooking:** In open lid cooking, food takes a longer time to get cooked and exposure to air accelerates nutrient loss. While in closed-lid cooking food gets cooked quickly and nutrients are better retained because of the shorter cooking time. Green vegetables and green leafy vegetables change color during closed lid cooking but minimize nutrient loss.

**Boiling and pressure cooking:** Boiling or pressure cooking is the best way to improve the nutritional quality of pulses since anti-nutritional factors (enzyme inhibitors that do not allow nutrients to get digested) are destroyed during boiling and pressure cooking. Hence, these methods increase the digestibility and therefore protein availability. The concentration of phytic acid in cereals and legumes (which hinders the absorption of minerals) decreases to a great extent after boiling or pressure cooking making important minerals like iron, calcium, magnesium, and zinc absorbable on consumption. Boiling with just enough water, without having to drain the water, is the best method to retain folate in legumes. This method of cooking improves the palatability of pulses. However, pulses should not be overcooked or boiled for too long as this reduces the quality of proteins. Longer cooking causes a drop in the nutritive value of pulses as it results in the loss of lysine.

Remember to add only the required amount of water during boiling. B complex vitamins and vitamin C may be lost if the cooking water after boiling is discarded. Prolonged boiling also results in the loss of vitamins. Mineral content is not dramatically altered with boiling.

**Steaming:** In contrast to boiling, during the process of steaming, the food merely comes into contact with steam. Direct contact between vegetable tissue and water is thus avoided, which significantly minimizes the loss of water-soluble vitamins and phytochemical compounds through leaching. Steaming is the best cooking method to increase the level of both antioxidants and polyphenols (which have antioxidant activity) in vegetables and greens. Further, this process makes many nutrients like beta carotene, and lutein more readily available to the body.

It is well known that cooking alters the nutritional value of foods as the chemical structure of the nutrient is damaged to a certain degree depending on the method of cooking adopted. However, cooking also makes many nutrients more available to the body. Further, cooking kills several microbes and decreases the chance of food contamination. Some cooking methods are discussed below.

### Open and closed-lid cooking



### Pressure cooking



B complex vitamins and vitamin C may be lost if the cooking water after boiling is discarded.

### Steaming







**Frying:** Due to the high temperatures in the frying process, changes occur in nutrients, such as proteins, vitamins, and antioxidants. Some water-soluble vitamins, such as vitamin C can be lost during water evaporation. Overall, there will be a moderate loss of vitamins, and antioxidants and a small loss of minerals. Extended exposure of oil to high temperatures and atmospheric air can generate highly oxidized, potentially toxic products. The main disadvantage of this method, if used often, is that it increases the consumption of fats and oils. High consumption of food rich in fat has been linked with an increased risk of heart disease, stroke, and type 2 diabetes. These conditions include increased blood pressure, high blood sugar, excess body fat around the waist, and abnormal cholesterol or triglyceride levels. Repeated use of oils used for frying should be avoided. Further, already used oils should not be mixed with fresh oils and reused.

Repeated use of oils used for frying should be avoided. Further, already used oils should not be mixed with fresh oils and reused.

**Shallow frying:** Shallow frying has higher nutrient loss. Compared to deep frying, there is a lot more exposure to ambient oxygen (due a high surface-to-volume ratio as the cooking fat or oil is present in a very thin layer in the cooking vessel). This causes fats and oils to degrade significantly when combined with high temperatures; the rate of Polymeric Triglycerides (PTG) generation is higher than in deep frying. However, shallow frying only lasts a short while and the frying medium is usually not recycled or reused.

**Stir-frying:** The process of cooking cut pieces of vegetables or meat with a little oil on high heat while constantly stirring is called stir-frying. Cooking for a short time without water prevents the loss of B vitamins and the addition of fat improves the absorption of plant compounds, antioxidants, and fat-soluble vitamins. This method preserves nutrients when compared to cooking in liquid. The rapid cooking and high temperature seals in the nutrients but heat-labile (easily destroyed by heat) vitamins will still begin to degrade. Vitamin C may be lost during stir-frying. Cooking time affects vitamin C losses more than the cooking method. The longer the cooking time the greater the loss of vitamin C.

**Microwave cooking:** There are minimal nutritional differences between foods prepared by conventional and microwave methods. As cooking time is very less microwave cooking is one of the least likely forms of cooking to damage nutrients. The microwave uses a small amount of water and steams food from the inside-out. This retains more vitamins and minerals than any other cooking method as no leaching of nutrients occurs. Further, as the cooking time in the microwave is shorter, it helps preserve vitamin C and other nutrients that break down when heated. The nutritional effects of microwaves on protein, lipid, vitamins, and minerals are minimal. It is preferable to use glass or microwave safe ceramic vessels and to avoid plastic vessels.





**Roasting:** Roasting is generally an intense temperature treatment, where food is heated at temperatures in a 150–300°C range or higher in an oven. The use of the constant oven temperature of 150–160° C throughout the cooking period results in lower cooking loss when compared to a high starting temperature. Heat-labile vitamins are, of course, destroyed in large amounts. Minerals remain intact with roasting. Roasting has beneficial and detrimental effects on various components, and the reason for such an eclectic outcome can be accredited to the product treated and processing conditions employed.



**Barbecue and grilling:** In the barbecue method of cooking, low indirect heat is used. In grilling, high direct heat is used for cooking. Charcoal and wood are commonly used in this method of cooking \*Polycyclic Aromatic Hydrocarbons (PAHs) are compounds that can be found in foods that have been grilled or barbecued, notably meats. The type of heat source used for barbecuing has a significant impact on PAH concentrations and the final PAH profile in the barbecued meat products. Continuous barbecuing with the same charcoal results in higher concentration of certain carcinogens. Grilling helps lower calorie intake and may even help with weight loss. While grilling does not remove all the fat from meats, it causes the excess fat to melt and drip off the racks. Other cooking methods allow the meat to cook in its own fat, which can be reabsorbed. Grilling also helps food keep more of its vitamins and minerals and seals in moisture without the added fats.



Charring foods, specifically meats, on the grill should be avoided by continuously turning them over. Grilled meat preserves more of the vitamins and minerals in the meat including vitamin A, vitamin D, zinc, magnesium and iron, riboflavin and thiamine (essential B vitamins that help your body process food into the fuel your body needs). The same goes for grilled vegetables, where vitamins and minerals are better kept by grilling rather than any other cooking method, especially those with low water content like broccoli and asparagus. Grilling with too much marinade is not good as this may mean consuming too much salt or sugar. A by-product of grilling meats is known as advanced glycation end products (AGEs), or glycotoxins. As food is grilled, the AGEs multiply and this when ingested, leads to increased levels of inflammation.

**Slow cooking:** During slow cooking cell walls break down and there is a release of powerful antioxidants from vegetables like tomatoes, corn, spinach, etc. making them more available to the body. Boiling peanuts increases their antioxidant concentration up to four times more than that of raw and roasted peanuts. Further, cooking meat in a liquid at low heat can help reduce the number of cell-damaging compounds known as AGEs (advanced glycation end products) that are produced in the meat by 50 percent when compared to broiling or grilling.



*\*PAHs have toxic, carcinogenic properties. PAHs are highly fat soluble and thus readily absorbed from the gastrointestinal tract. They are rapidly distributed in a wide variety of tissues and tend to stay in body fat.*





**Air frying:** Air frying simulates deep frying without the excess use of oil. Air frying significantly decreases the amount of oil absorbed into foods compared to deep frying. Less oil generally leads to less calories, which can reduce the risk of weight gain and obesity. An air fryer may be particularly helpful when cooking starchy foods like potatoes. Air-frying fish may lower the amount of polyunsaturated fatty acids (heart-healthy omega-3 fats) in them, and potentially increase the number of inflammatory compounds. Adding herbs to fish may help reduce the fat oxidation that happens when fish is air-fried.



### How to safely use cookware?

#### Earthen pots

These are the safest cookware. When using earthen pots, very little oil is required. They are environment-friendly and keep the food's nutritional content intact. Heat can circulate through the food in earthen pots, preserving the nutrition.



#### Metal cookware

We use a variety of cookware, which are made of different materials. Some of these materials like aluminum, iron, brass or copper can enter the food when we cook or store food in them. Storing acidic foods like pickles, *chutneys*, *sambar*, sauces in aluminum, iron, unlined brass or copper vessels will make foods unsafe.



#### Stainless steel cookware

These are generally considered safe for cooking purposes if used properly. It is widely used in kitchens around the world due to its various benefits, including its durability, resistance to corrosion, and non-reactivity with foods. It doesn't leach or react with acidic or alkaline foods, which means it is unlikely to impart metallic flavors or harmful substances to cooked foods.



#### Non-stick pans coated with polytetrafluoroethylene (PTFE) (Teflon)

Non-stick pans coated with teflon are a risk if they are heated to temperatures greater than 170°C. This might happen if an empty pan is left on a burner for a long time. In this case, the coatings can give off irritating or poisonous fumes. The usage and cleaning instructions should be strictly followed for non-stick cookware, and they should be discarded when the coating is worn-out or damaged.





### Granite stone cookware

These cookware nowadays are substantially lighter than granite stone cookware from earlier generations. Granite stone cookware save time and energy. These cookware also retain heat well, even after the heat source is turned off. Unless the cookware contains teflon coating such as Perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS) and polytetra-fluoroethylene (PTFE), it is regarded as safe. When using granite cookware, set the cookware's temperature to a maximum of medium-high, as the non-stick coating gets damaged at a high temperature. The non-stick coating will be protected at medium-high heat.



## POINTS TO REGISTER

- Do not wash food grains and legumes repeatedly before cooking.
- Do not wash vegetables and fruits after cutting or peeling.
- Do not soak the cut vegetables in water.
- Do not cook in excess water and discard it after cooking. Use only enough water for cooking.
- Always cover cooked foods with lids.
- Prefer pressure/steam cooking instead of deep frying/roasting.
- Consume more sprouted or fermented foods.
- Do not use baking soda while cooking pulses and vegetables as it adds to the sodium content (just like salt) of foods.
- Avoid reheating and reuse of left-over heated oils.
- Prefer earthen cookware over others.

# GUIDELINE 14

## Drink adequate quantity of water

### RATIONALE

Adequate water is important for maintaining good health.

- Water is the major constituent of the human body.
- Water and other beverages such as tender coconut water or lemon water are useful to relieve thirst and meet the fluid requirements of the body.

### Why do we need water?

Water accounts for 70% of our body weight. It is a constituent of blood and other vital body fluids. Water plays a key role in the elimination of body wastes and regulation of body temperature. The body loses water through sweat, urine and feces. This loss must be constantly made good with clean and potable water. A normal healthy person needs to drink about eight glasses (approximately two litres) of water including beverages per day. During very hot weather and while undertaking vigorous physical activity, this requirement increases as a considerable amount of water is lost through sweat.

A normal healthy person needs to drink about eight glasses (approximately two litres) of water including beverages per day.

### When is water considered safe?

Water can be considered safe if it is free from disease-causing agents like bacteria, viruses, parasites, etc., and harmful chemical substances like pesticides, industrial wastes, heavy metals, nitrates, arsenic, silica and excess of fluoride. Fluorosis,

a disease that causes bone deformities and dental problems, results from drinking water containing an excess of fluoride over long periods. Generally, a concentration of 1–1.5 mg of fluoride per litre of drinking water is considered safe.

### How is water rendered safe?

The simplest and efficient method of rendering water safe is straining and keeping the water boiling for 10–15 minutes. The boiling process kills all disease-causing organisms and also removes temporary hardness. However, boiling will not remove chemical impurities. Tablets each containing 0.5g of chlorine can be used to disinfect 20 litres of water. There are many modern gadgets which could help in rendering water safe.

**Tender coconut water:** Tender coconut water is a good hydrating beverage which contains several minerals and provides 15 Kcal/100ml. However, in patients prone to hyperkalemia (in kidney and heart diseases), tender coconut water should be avoided.



### What about consuming milk?

Milk is a well-accepted and wholesome food and a beverage for all age groups. Milk is especially useful for feeding infants, toddlers, growing children, adolescents, expectant women and nursing mothers. Milk is a rich source of several nutrients necessary for growth and development. Milk is a good







source of calcium but not iron. All macro and micronutrients present in milk are easily digestible and absorbable. Since it is likely to get contaminated, use pasteurized or boiled milk to ensure safety.

### What are soft drinks?

Soft drinks are non-alcoholic beverages either carbonated or non-carbonated, and may contain sugar or artificial sweetening agents, edible acids (malic acid, citric acid or vinegar, etc.) natural or artificial flavors and sometimes fruit juice. Compared to fresh fruit juices, most commercially available fruit juices may contain varying amounts of fruit pulp (as low as 7%).

Synthetic soft drinks are not substitutes for water or fresh fruits and therefore should be avoided.

Carbonated beverages contain phosphoric acid and may damage the enamel of teeth, and affect appetite if taken in excessive amounts. Synthetic soft drinks are not substitutes for water or fresh fruits and therefore should be avoided. Beverages like buttermilk, lemon water, whole fruit juice (without added sugar) and coconut water are excellent alternatives to synthetic drinks. Consumption of soft drinks or commercially available fruit juices increases one's sugar and salt intake and hence must be avoided.

**Fresh fruit juices:** Orange, lemon, grape, mango, pineapple, apple, pomegranate, etc., are generally used in making fruit juices. Fresh fruit juices (without added sugar) provide vitamins (like beta-carotenes and vitamin C) and minerals (potassium, calcium, etc.). However, they cannot be equated to whole fresh

**Figure 14.1. Avoid carbonated beverages, fruit juices with added sugar and replace them with whole fruits or freshly made juices\***



\* Whole fruits are preferable as they contain fibre & other nutrients. Freshly made juices for one normal individual should be from not more than 100–150gm fruits



fruits which in addition to vitamins and minerals provide dietary fibre and should be preferred to fresh fruit juices from not more than 100 to 150g whole fruits can be consumed occasionally by adults. Sugarcane juice, which is extensively consumed in India, particularly during summer, is high in sugar (13–15g/100ml) and hence its consumption should be minimized.

Fresh fruit juices from not more than 100 to 150g whole fruits can be consumed occasionally by adults.

### What about tea and coffee?

Tea and coffee contain caffeine, which stimulates the central nervous system and induces physiological dependence. A cup (150ml) of brewed coffee contains 80–120mg of caffeine, instant coffee contains 50–65mg and tea contains 30–65mg of caffeine. Moderation in tea and coffee consumption is advised so that caffeine intake does not exceed the tolerable limits (300mg/day). Tannin is also present in tea and coffee and is known to interfere with iron absorption. Hence, tea and coffee should be avoided at least for one hour before and after meals.



Besides caffeine, tea (green or black) contains theobromine and theophylline, which are known to relax arteries and thereby promote blood circulation. They also contain flavonoids and other antioxidant polyphenols, which may reduce the risk of coronary heart disease and stomach cancer. These benefits can be best obtained if milk is not added to tea and if it is taken in moderation.

Excessive consumption of coffee is known to increase blood pressure and cause abnormalities in heartbeat. In addition, an association between coffee consumption and

elevated levels of total and LDL cholesterol ('bad' cholesterol), triglycerides and heart disease has been demonstrated. Similarly, excessive consumption of tea should also be avoided due to its caffeine content.

### Avoid alcoholic beverages

Alcoholic beverages contain ethyl alcohol in varying proportions. Beer contains 2–5% and wine 8–10% of alcohol, while brandy, rum and whisky contain much higher concentrations (30–40%). Alcohol provides higher calories (7 Kcal/g) than carbohydrates and proteins and thus, can contribute to abdominal obesity. Ironically, excessive intake of alcohol is known to suppress appetite and interfere with absorption and metabolism of nutrients, leading to various nutritional deficiencies. Alcohol has been extensively abused as a sedative-hypnotic drink. Alcohol intake, which is usually initiated as an innocent social habit can gradually result in a serious addiction.

People who regularly consume more than two measures (containing 30ml of ethyl alcohol in each measure) are at a higher risk for hypertension and stroke. Alcohol also increases serum triglyceride levels.

Alcohol intake has also been shown to increase the risk of cancers of the mouth, larynx, oesophagus, prostate and of the breast in women. Excessive alcohol intake weakens the heart muscle (cardiomyopathy) and also causes fatty liver, damages the liver (cirrhosis), brain and peripheral nerves.



## POINTS TO REGISTER

- Drink adequate quantities of safe water to meet the daily fluid requirements.
- Boil water, when safety of the water is in doubt.
- Consume fresh fruits rather than in juice form.
- Prefer butter milk, tender coconut water, lemon water etc., as beverages in hot weather. Avoid synthetic soft drinks and carbonated beverages.
- Synthetic soft drinks are not substitutes for water and therefore should be avoided.
- Avoid alcoholic beverages.

# GUIDELINE 15

## Minimize the consumption of high fat, sugar, salt (HFSS) and ultra-processed foods (UPFs)



### RATIONALE

Ultra-processed foods (UPFs) are often high in fat, sugar and salt (HFSS). Regular consumption of UPFs or HFSS are known to increase the risk of non-communicable diseases like diabetes, hypertension, cardiovascular diseases, etc.

#### How do you define 'HFSS'?

HFSS foods are those foods that are prepared with excessive cooking oils/fats or more added sugar and salt. The exact values of added oils/fats, sugar and salt are given below. Also refer to Table 15.2; HFSS foods are classified into three categories. Food category 1 indicates energy, fat, sugar and salt within normal level from 100 grams food eaten. While categories 2 and 3 indicate higher levels of energy and fats or sugar or both along with excessive salt. Categories 2 and 3 fall under HFSS foods.

**High fat diet:** The total fat intake should not exceed 30% of total energy (WHO). Taking into consideration the inherent fats (fats naturally present in foods) which have several health benefits, an allowance of at least 15% energy should be given for inherent fats and the rest of 15% energy may come from visible fat or cooking oils/fats. Hence, HFSS foods is defined as a food or diet that contains more than 15 percent of energy from any cooking vegetable oils or

HFSS foods is defined as a food or diet that contains >15% of energy from any cooking vegetable oils or ghee, butter (visible or added oil/fat) etc.

ghee, butter (visible or added oil/fat), etc. In other words, diets that contribute more than 30g visible or added oils/fats per day for a 2000 Kcal diet. High fat foods include all deep-fried foods and foods prepared with high quantity of oil/fat such as french-fries, *samosa*, *kachori*, *puri*, *savories*, *desserts*, *biscuits*, *cookies*, *cakes*, *parathas* or even some curries.

**High saturated fats (SF):** Apart from ghee or butter, which are SFs, coconut oil, palm oil and *vanaspati* also contain SFs. Hidden sources of saturated fats include food items that have high level of SF such as red meat (beef, mutton, pork, etc.) and high fat dairy products (full cream milk, cheese, etc.).

Use of SF is considered high when more than 10g/day of visible saturated fats (for a 2000 Kcal diet/ day) is consumed in the form of ghee, butter or due to excessive use of palm oil, coconut oil in the preparation of snacks or sweets. Alternatively, use of SF is considered excessive when it contributes to more than 5% total calories (energy) consumed per day.

**High salt:** The intake of salt above 5g/day (sodium >2g/day) is considered 'high'.

The intake of salt above 5g/day (sodium >2g/day) is considered 'high'.





**Foods high in salt:** Processed/pre-packaged foods like chips, sauces, biscuits, bakery products, etc., home prepared foods like savory snacks, *namkeen*, papads and pickles as well as beverages where salt is added by the manufacturer/cook/consumer.

**High sugar:** Consumption of sugar in quantities that contribute over 5% of total energy intake per day or 25 g/day (based on average intake of 2000 Kcal/day) is defined as 'high' sugar. WHO is considering revising its recommendation and reducing calories from sugar to <5% Kcal/day. Limiting sugar to 25g/day is better for health. If possible, added sugar may be completely eliminated from one's diet as it adds no nutritive value other than calories. Calories are healthy only when accompanied by vitamins, minerals and fibre.



#### What are 'added' sugars?

Added sugars refer to sugars and sugar syrups added to foods and drinks during processing and preparation and they include sucrose (table sugar), jaggery, honey, glucose, fructose, dextrose etc. Adding sugar over and above what is naturally/inherently present in foods increases the total calorie intake, but adds no nutritive value. Refined extracted sugars have no vitamins or minerals.

#### What are 'naturally' occurring simple sugars?

Naturally occurring simple sugars refers to those that are inherently present in the food. For example, monosaccharides are simple sugars with single sugar molecules such as glucose or fructose in fruits. Disaccharides are two simple sugar molecules like sucrose (sugar) or lactose in milk.

#### What are 'sugar substitutes'?

Sugar substitutes are sweetening agents used to sweeten foods/beverages like aspartame, saccharin, sugar

alcohols, sativose, etc. They are low in calories (energy) compared to regular table sugar. Studies have indicated that long term consumption of non-calorie sugar substitutes could lead to overweight/obesity, diabetes, hypertension and other NCDs. Studies also indicate disruption in beneficial intestinal bacterial flora. Hence, pregnant and lactating women and children should avoid sugar substitutes.



#### Why HFSS foods are unhealthy?

High fat foods and high sugar foods are energy dense (high calorie foods and poor in vitamins, minerals & fibre). Regular consumption of these foods not only causes overweight and obesity but also deprives one from taking healthy foods that provide essential macronutrients (amino acids and fats), fibre and micronutrients such as vitamins, minerals, phytonutrients, bio-active substances. Lack of essential amino acids, fatty acids and micronutrients in the diet can cause anemia, affect cognition, learning ability, memory and increase the risk of NCDs. High fat or high sugar foods cause inflammation and affect gut microbiota, which changes quickly with diet. This increases the risk of NCDs. Foods with high salt increase the risk of hypertension and tax the kidneys; hence, high salt intake is unhealthy.

Lack of essential aminoacids, fatty acids and micronutrients in the diet can cause anemia, affect cognition, learning ability, memory and increase the risk of NCDs.



## What are processed foods?

Most of the foods that we consume are processed some way or the other to make them suitable for consumption. Minimum food processing is necessary to preserve highly perishable products like milk, meat, fish, vegetables and fresh fruits. Food processing increases the seasonal availability of foods and enables easy transportation and distribution over long distances. Depending upon the extent of processing, they have been classified into various categories- *primary, secondary, tertiary, minimally processed and ultra-processed foods*. While '*primary processing*' includes basic cleaning, grading and packaging as in the case of fruits and vegetables; '*secondary processing*' involves alteration of the basic product to a stage just before the final preparation (as in the case of milling of paddy to rice), whereas, '*tertiary processing*' leads to almost ready-to-eat foods like bakery products, instant foods, health drinks and so on.

'*Minimally processed*' foods are the ones that are slightly altered for the main purpose of preservation but which do not substantially change the nutritional content of the food. This allows the food to be stored for a longer time and remain safe. In addition to primary processing, this may involve grinding, refrigeration, pasteurization, fermentation, freezing, and vacuum-packaging. Many fresh fruits, vegetables, whole grains, nuts, meats and milk may undergo these processes.

## What are Ultra-processed foods (UPFs)?

UPFs refer to food and beverage products that have undergone extensive industrial processing and contain a high number of additives such as preservatives, sweeteners, colorings, flavorings, emulsifiers, and other substances that are not commonly used in culinary preparations (refer Table 15.2). These additives play a role in enhancing the food's taste, appearance, and shelf life. The extensive processing involved often results in depletion of fibre and micronutrients, rendering them unhealthy for regular consumption. These are added to promote shelf stability, preserve/ alter texture, and increase palatability. These foods are typically ready-to-eat with minimal additional preparation, and a large number of these

foods tend to be low in fibre and nutrients. Research suggests that a diet high in ultra-processed foods may be associated with negative health outcomes.



## Why are UPFs unhealthy?

Lack of fibre and poor micronutrients makes them unhealthy. Also, UPFs contribute to high calorie (energy) intake as they are often high in fat. UPFs are consumed in larger quantities by a large population since these have unique taste, high palatability and low cost as well as are easily available even in remote areas. Some of them are extruded products, sugary drinks, ice-creams, cookies, cakes, some frozen processed foods, cold cut meats and instant foods (described below). UPF consumption is associated with overweight/obesity and higher risks of coronary heart disease (heart attack), cerebrovascular diseases (stroke) and diabetes. UPFs also hasten the process of ageing.

For more clarity, refer to table 15.2, Category A indicates minimal processing, Category B indicates moderate level of processing, but Category C falls under UPF. Within the level of processing, foods are also classified based on the level of added fats, sugar and salt (HFSS).

## What are instant foods, fast foods and street foods?

Depending on the process and extent of convenience of preparation, foods are often divided into instant foods, fast foods, street foods etc. Instant foods such as instant noodles,



breakfast cereals, soup mixes, cake mixes and others fall under UPF category as they have multi-ingredients which are processed and are high in salt/sweeteners/fat along with artificial colors and flavors and preservatives.

Fast foods are those which are cooked within minutes of order for consumption. Most of these are fresh and do not fall under UPF. However, some fast-food items such as milk shakes, chips, pizzas, burgers and fries are considered unhealthy because of HFSS or ultra-processing. Street foods comprise of a wide range of foods and beverages prepared and/or sold by vendors and hawkers, especially on streets and other public places. These are generally wholesome and fresh. Apart from looking out for HFSS and ultra-processed ingredients, it is also important to pay attention to the possible contamination that can arise due to food handling and poor hygiene practices.

### Does fortification and enriching UPFs with nutrients make them healthy?

If the foods are ultra-processed or high in fat/sugar/salt, then enriching them with nutrients or fortifying cannot make them wholesome or healthy.

If the foods are ultra-processed or high in fat/sugar/salt, then enriching them with nutrients or fortifying cannot make them wholesome or healthy.

Fortification of staples, cooking oils, salt is a measure to combat specific nutrient deficiencies at community level. As per the regulations in India, guidelines have been issued for fortification of specific food items with specific nutrients. Consumption of wholesome and minimally processed foods are encouraged in order to ensure the consumption of safe, right balance of the required nutrients. Such a food-based approach is a long-term and sustainable strategy for good health.

### Categorisation of foods based on level of processing & HFSS

Based on the extent of food processing, availability of nutrients, additives used and nutrients of concern (fat, sugar and salt) as well as the concept of 'My Plate for the Day', there is a need to make informed food choices. Threshold values for

energy, added sugar, total fat and salt for 100g cooked or packaged food are given in Table 15.1. Classification of foods based on the level of processing and the level of nutrients of concern (HFSS foods) using the threshold mentioned in Table 15.1 is provided with some examples in Table 15.2. The list of foods is exhaustive but not limited to the mentioned foods.

Category A indicates minimal processing, category B indicates moderate level of processing, but category C falls under excessive processing with many additives added (UPF). Within the level of processing, foods are also classified based on the level of added fats, sugar and salt (HFSS). HFSS foods are classified into three categories. Food category 1 indicates energy, fat, sugar and salt within normal level from 100 grams food eaten. While category 2 and 3 indicate moderate and higher levels of energy and fats or sugar or both along with excessive salt. Category 2 and 3 fall under HFSS foods.

**Table 15.1. Nutrients of concern threshold criteria for foods and beverages**

Nutrients per 100g or ml <sup>1</sup>	Liquids <sup>2</sup>	Solids
Calorie (kcal)	70	250
Salt (g)	–	0.625
Added sugar (g)	–	3
Total fat (g)	–	4.2

<sup>1</sup> Nutrient threshold criteria applies to all cooked/packaged foods and beverages with added sugar, added salt or added fat.

<sup>2</sup> Liquids includes any product such as carbonated beverages, fruit juices, coconut water, butter milk, lassi, coffee and tea.

### Some examples of extensively processed foods

**Category C level of processing:** To enhance shelf life, palatability and flavours processing may include many additives. Moreover, there may be extensive loss of native fibre and nutrients of the foods due to excessive processing techniques involved. Few examples are given below:

1. Extensive processing of grains to make refined flours.
2. Fruit Juices with additives: Extracting juice from fruits and vegetables often involves removing the fibrous pulp,



resulting in a liquid product with reduced fibre content compared to consuming the whole fruit or vegetable.

3. *Extrusion and Processing Techniques:* High pressure and temperature involved in these products contribute to the breakdown of nutrients, including some vitamins, minerals and fibre. Additionally, the mechanical forces exerted during extrusion can alter the structure of fibre, potentially

reducing its functionality. Additionally, these formulations rely on refined or processed ingredients that inherently have lower levels of minerals and fibre, and hence the overall nutrient content of the extruded product may be very low.

4. *Canning and Preservation:* While canning, the heat treatment involved can lead to the degradation of some vitamins and minerals.

**Table 15.2. ICMR-NIN food categorization based on extent of processing, and nutrients (fat, sugar, salt) of concern**

Degree of alteration of edible portion	Definition	Examples	Calorie based classification
<b>Group A foods</b>	<p>Edible portion is unaltered for consumption, Nutrient losses are minimal.</p> <p>These products are foods prepared with common ingredients such as spices, salt, sugar and oils.</p> <p>To be consumed soon after preparation.</p> <p>These foods do not have any additives (like preservatives, homogenizers, coloring agents or artificial flavors, bleaches, improvers etc.,).</p>	<ul style="list-style-type: none"> <li>All whole grains and legumes-minimally polished/hand pound rice, puffed rice, whole dal, whole wheat, whole millets, corn, oats, other cereals and legumes, fresh flours of whole cereals, millet and legume made from local mills.</li> <li>All preparations made from above mentioned whole grains, pulses and flour, including dosa &amp; idly batter, snacks, chips and other savories.</li> <li>Freshly cooked curries with lentil, beans, vegetables, roots, tubers, greens, mushrooms, fresh herbs etc.</li> <li>Freshly cooked fish, meat and egg.</li> <li>Frozen foods without preservatives pasteurized milk, curd prepared at home or from market, fermented cheese or paneer made at home</li> <li>Fruits and vegetables-fresh or frozen (without chemical), cut fruits, fresh juices (just made with no ingredients except water), cut vegetable salads etc.</li> <li>Whole nuts and seeds</li> </ul>	<p><b>A1</b> (Energy &amp; nutrients for 100g cooked/packageged food) Energy: ≤ 250 Kcals Added fat: ≤ 4.2g (≤15% energy) Added sugar: ≤3g (&lt;5% energy) Salt: ≤0.625g</p>
			<p><b>A2 (HFSS)</b> (Energy &amp; nutrients for 100g cooked/packageged food) Energy: &gt;250 to 500 Kcals, due to excessive added sugar or fat Salt: MAY BE MORE</p>
			<p><b>A3 (HFSS)</b> (Energy &amp; nutrients for 100g cooked/packageged food) Energy: &gt;500 Kcals due to excessive added sugar or fat Salt: MAY BE MORE</p>





**Table 15.2. ICMR-NIN food categorization based on extent of processing, and nutrients (fat, sugar, salt) of concern (contd..)**

Degree of alteration of edible portion	Definition	Examples	Calorie based classification
Group B foods	Edible portion may be altered, but do not have additives. Nutrient losses are minimal like group A, but some fibre is also lost.	<ul style="list-style-type: none"> <li>All highly polished rice, dal, maida or refined wheat flour, polished millets, corn, oats, other cereals and legumes.</li> <li>All preparations made with the above food stuffs including snacks, chips and other savories.</li> <li>Frozen curries, fermented and pickled vegetables</li> <li>Frozen fish and meat.</li> <li>Commercially available yoghurt, paneer, butter, savories, papads, pickles, sweets and chips</li> </ul>	<b>B1</b> (Energy & nutrients for 100g cooked/packageg food) Energy: ≤ 250 Kcals Added fat: ≤4.2g (15% energy) Added sugar: ≤3g (5% energy) Salt: ≤0.625g
	These foods are sun dried, dried, snap frozen, blanched, fermented, baked, canned, dehydrated, High Temperature Short Time (HTST), deep fried or roasted.		<b>B2 (HFSS)</b> (Energy & nutrients for 100g cooked/packageg food) Energy: >250 to 500 Kcals, due to excessive added sugar or fat Salt: MAY BE MORE
	Have long shelf life ranging from few weeks to years		<b>B3 (HFSS)</b> (Energy & nutrients for 100g cooked/packageg food) Energy: >500 Kcals, due to excessive added sugar or fat Salt: MAY BE MORE
Group C foods	These foods do not have any additives, (like preservatives, homogenizers, coloring agents or artificial flavors, bleaches, improvers, etc).	<ul style="list-style-type: none"> <li>Commercially produced bread, breakfast cereals, cakes, chips, biscuits, fries, jams, sauces, mayonnaise.</li> <li>Commercially produced ice cream, protein packs powders, peanut butter, soy chunks, tofu and frozen foods with additives.</li> <li>Commercially produced cheese, butter, paneer with additives, meat, plant-based meat, refined flours of cereals, millets and legumes. ** culinary ingredients such as cooking oils, refined sugars, salt and spices etc.</li> <li>#Energy drinks, health drinks added to milk, beverages and fruit juices.</li> </ul>	<b>C1</b> (Energy & nutrients for 100g cooked/packageg food) Energy: ≤250Kcals Added fat: ≤4.2g (15% energy) Added sugar ≤3g (5% energy) Salt: ≤0.625g
	Edible portion completely altered. These foods do not resemble their original state. Extensively processed with heavy loss of micronutrients & fibre.		<b>C2 (HFSS)</b> (Energy & nutrients for 100g cooked/packageg food) Energy: >250 to 500 Kcals, due to excessive added sugar or fat Salt: MAY BE HIGH
	Mass produced with additives (like preservatives, homogenizers, coloring agents or artificial flavors, bleaches, improvers antimicrobials and other substances).		<b>C3 (HFSS)</b> (Energy & nutrients for 100g cooked/packageg food) Energy: >500 Kcals, due to excessive added sugar or fat Salt: MAY BE HIGH
	These foods usually are very low in micronutrients and are fibre depleted.		

# The maximum allowable energy content for 100 grams of solid cooked food should be no more than 250 Kcals.

The maximum allowable energy content for 100 ml of liquids or beverages should be no more than 70 Kcals.

\*\* To enhance the sensory qualities and appearance cosmetic food additives such as flavors, colors and emulsifiers are used in the processing of cooking oils, refined sugars and refined

salt. These ingredients (fats/cooking oils, sugar, salt) are typically used in small quantities to enhance taste, but excessive use of these is harmful for health.

• All foods categorized under A2, A3; B2, B3; C2, C3 are high calorie HFSS foods. But foods naturally high in energy such as nuts and seeds are not classified as HFSS.

• All foods under Group C are depleted in fibre, nutrients and contain many additives and therefore are classified as UPFs.

**Note:** The 'My Plate for the Day' roughly provides 200 Kcal for every 100g of raw food or approximately 100 Kcal for 100g of cooked food. However, an allowance of 250 Kcal for 100g of cooked/packageg food is given as the cut-off in the Table 15.2.

## POINTS TO REGISTER

- Ultra-processed foods are usually high in fats/sugar/salt and or low in micronutrients and fibre and mostly calorie dense.
- Restrict consumption of HFSS and UPF foods: sauces, cheese, mayonnaise, jams, fruit pulps, juices, carbonated beverages, biscuits, cookies, cakes, pastries, breakfast cereals, cool drinks, health drinks, packaged fruit juices, etc.
- Always prefer fresh and minimally processed foods: whole grains such as cereals, millets, pulses and fresh vegetables, fruits, nuts and seeds.
- Even home-made foods may become unhealthy if prepared with high fat, high sugar or salt.
- Choose carefully when consuming foods prepared outside the home.
- Avoid deep fried, fatty, sugary and salty foods and bakery products.
- Food with high salt increases the risk of hypertension and burden the kidneys. Hence, it is unhealthy.
- Enriching and fortifying UPFs with nutrients does not make them wholesome or healthy.

# GUIDELINE 16

## Include nutrient-rich foods in the diets of the elderly for health and wellness



### RATIONALE

To remain healthy and active, elderly persons need foods rich in vitamins and minerals along with adequate physical activity.

- Healthy food habits and regular physical activity are required to maintain good health and improve the quality of life.
- As age advances people become less active, their metabolism slows, and their energy requirement decreases.
- Aging is often accompanied by a loss of appetite and changes in taste and smell, which can lead to lower intake of required foods.
- For healthy ageing the elderly need nutrient dense foods that are rich in vitamins and minerals with adequate amounts of good quality proteins, complex carbohydrates and dietary fibre.
- Ensure adequate water intake to avoid dehydration, which is common among elderly.

### Who is an elderly person?

An elderly person is an individual of 60 years and over. As per the census 2011, the absolute number of elderly population has crossed the 100 million mark constituting 8.6 percent (Men: 8.2% and Women: 9%) of the total population of India

and this number is expected to increase to 323 million by 2050, constituting 20% of the total population.

### What are the reasons for special nutritional needs for the elderly?

The body of an ageing adult undergoes multiple physiological changes such as impaired digestion, and protein utilization, altered body composition, insulin resistance, inflammation and decreased bone density. The metabolism slows down after 60 years of age. Recent study found a 0.7 percent decrease in metabolism per year (i.e. energy expenditure). An elderly person needs fewer calories but more micronutrients than someone in mid-life. Hence, elderly people require less energy but more micronutrient rich foods such as vegetables, fruits, beans, nuts, eggs and fish.

### What are the health benefits of nutritionally adequate diets (balanced diet) and physical activity?

In the elderly population, regular physical activity, healthy food choices and balanced diets have the potential to reduce the risk of most of the diseases like osteoporosis, diabetes, cardiovascular diseases (stroke and heart diseases), and certain neurological problems like parkinson's, dementia as well as



muscle wasting (sarcopenia) that may occur due to ageing. For healthy ageing and to reduce health risks, minimize or avoid highly or ultra-processed and HFSS foods.

For healthy ageing and to reduce health risks, minimize or avoid highly ultra-processed and HFSS foods.

### What type of diet should the elderly consume?

Elderly population is advised to consume foods rich in proteins, calcium, micronutrients and fibre. Every day, apart from cereals (with at least one-third as whole grains) and pulses, at least 200–400ml of low-fat milk or milk products, a fist full of nuts and oilseeds and 400–500g of vegetables (including leafy vegetables) and fruits are recommended. Such a balanced diet has the potential to provide essential macronutrients, micronutrients, antioxidants and fibre. Inclusion of pulses, legumes, milk, fish, minced meat or egg increases protein quality and micronutrient intake. It is recommended to consume well cooked, soft food preparations with less salt and moderate amounts of spices (Tables 16.1 & 16.2 and Figures 16.1 & 16.2). Minimizing or avoiding highly or

ultra-processed and HFSS foods will delay age-related diseases. Adequate water (two litres/day) should be consumed to avoid dehydration and constipation.

### Why is regular physical activity important?

Regular physical activity along with moderate exercise is an integral part of maintaining healthy life. Regular physical activity helps to maintain muscle mass, bone density, maintains body weight, improves brain function and also reduces risk or progression of degenerative diseases. Yoga, meditation and other indoor/outdoor physical exercises are advisable. Exercise schedule should be decided in consultation with a physician.

Regular physical activity helps to maintain muscle mass, bone density, maintains body weight, improves brain function and also reduces risk or progression of degenerative diseases.





**Table 16.1. Food groups and nutrient content of suggested balanced diet for an elderly man weighing 65 kgs**

Composition of food groups	Amount (g/day)	Nutrient values of suggested food groups	
Cereals & Millets	180	Energy (kcal)	~ 1710
Pulses (a portion of pulses can be replaced with egg/flesh foods)	80	Total Protein (g)	~ 62
		Visible fat (g)	~ 20
Green leafy vegetables	100	Calcium (mg)	~ 844
Other Vegetables	200	Iron (mg)	~ 22.1
Roots & Tubers -Vegetables (excluding potatoes)	100	Zinc (mg)	~ 10.2
Fruits	150	Magnesium (mg)	~ 653
Milk	400	Vitamin A (µg)/	~ 162
Fats & Oils	20	β-Carotene (µg)	~ 9634
Oil seeds & Nuts (gingelly seeds & peanuts)	30	Thiamine (mg)	~ 1.4
Spices	10	Riboflavin (mg)	~ 1.5
		Niacin (mg)	~ 11.9
		Vitamin B <sub>6</sub> (mg)	~ 1.9
		Vitamin C (mg)	~ 220
		Total Folates (µg)	~ 445
		Vitamin B <sub>12</sub> (µg) <sup>2</sup>	~ 1.5

**Table 16.2. Composition and nutrient content of suggested balanced diet for an elderly woman weighing 55 kgs**

Composition of food groups	Amount (g /day)	Nutrient values of suggested food groups	
Cereals & Millets	140	Energy (kcal)	~ 1500
Pulses (a portion of pulses can be replaced with egg/flesh foods)	70	Total Protein (g)	~ 56
		Visible fat (g)	~ 20
Green leafy vegetables	100	Calcium (mg)	~ 844
Other Vegetables	200	Iron (mg)	~ 22.1
Roots & Tubers -Vegetables (excluding potatoes)	100	Zinc (mg)	~ 10.2
Fruits	150	Magnesium (mg)	~653
Milk	400	Vitamin A (µg)/	~162
Fats & Oils	15	β-Carotene (µg)	~9634
Oil seeds & Nuts (gingelly seeds & peanuts)	30	Thiamine (mg)	~1.4
Spices	10	Riboflavin (mg)	1.5
		Niacin (mg)	~11.9
		Vitamin B <sub>6</sub> (mg)	1.9
		Vitamin C (mg)	220
		Total Folates (µg)	445
		Vitamin B <sub>12</sub> (µg) <sup>2</sup>	1.5



**Figure 16.1. Suggested diet for normally nourished elderly men (>60yrs)**  
(The menu is for reference individual weighing 65Kg & BMI 18.5–23 and with adequate physical activity)



Total Calorie from the above diet is 1740 Kcal/day | Total protein provides 14.3% Kcal/day from the suggested diet.

\*non-veg items like fish/egg/chicken can be consumed as per social acceptability & availability | \* Measures: 1 cup/Katori =200ml.

In the meal preparation 20g oil and 5g iodised salt can be used | Prefer at least 50% cereals/millet as whole grain.

Quantities indicated are for raw ingredients | Individuals with different body weight may refer to Table 1.6, Page no. 10.

Note: One may consume sugar, but it must be restricted to 25–30 grams per day. To adjust the total calories, cereals must be reduced if sugar is taken.

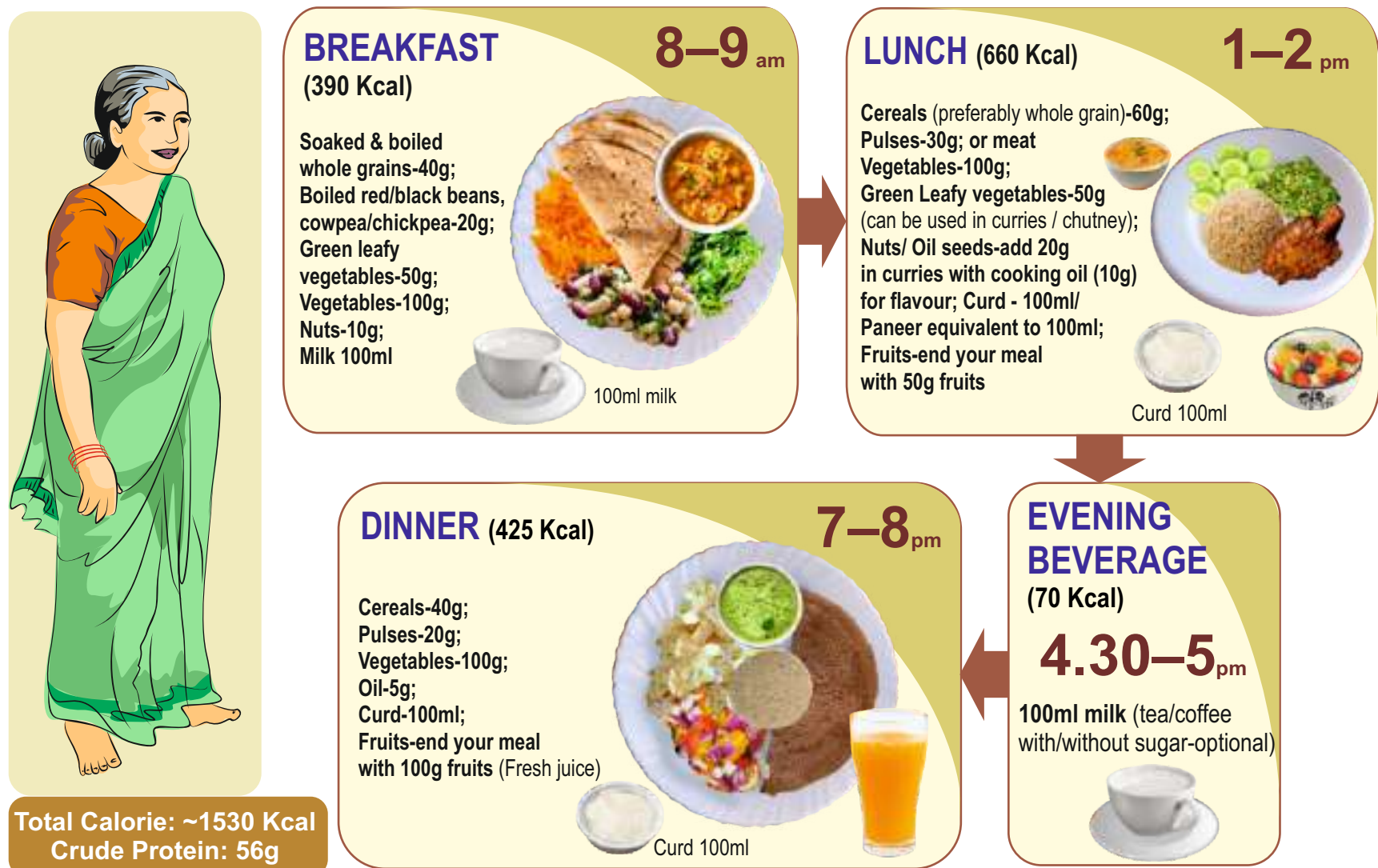
Energy requirements depends on body weight and physical activity | Added sugar must be restrict to less than 5% of daily energy.

Refer: Annexure I & II for household measures



## Figure 16.2. Suggested diet for normally nourished elderly women (>60yrs)

(The menu is for reference individual weighing 55Kg & BMI 18.5–23 and with adequate physical activity)



- ◆ Total Calorie from the above diet is 1530 Kcal/day.
- ◆ Total protein provides 14.7% Kcal/day from the suggested diet.
- ◆ Measures: 1 cup/Katori=200ml.
- ◆ Non-veg items like fish/egg/chicken can be consumed as per social acceptability & availability.


- ◆ In the meal preparation 15g oil and 5g iodised salt can be used.
- ◆ Prefer atleast 50% cereal/millet as whole grain.
- ◆ Quantities indicated are for raw ingredients.
- ◆ Individuals with different body weight may refer to Table 1.6, Page no. 10.

Note: One may consume sugar, but it must be restricted to 25–30 grams per day. To adjust the total calories, cereals must be reduced if sugar is taken.  
Energy requirements depends on body weight and physical activity | Added sugar must be restrict to less than 5% of daily energy.

Refer: Annexure I & II for household measures



## POINTS TO REGISTER

- Eat a variety of nutrient-rich foods.
  - Ensure regular physical activity.
  - Avoid HFSS and UPF foods with high amounts of salt, sugar and fats.
  - Consume adequate water to avoid dehydration.
- 



# GUIDELINE 17

## Read information on food labels to make informed and healthy food choices



### RATIONALE

- Most of the food items are now available in pre-packaged form. Therefore, the consumer needs to know what is inside the pack.
- Food labels on a package provide information about contents, ingredients and nutritional information as well as shelf life.
- Reading the label can help to make an assessment of the nutritional quality and safety of the foods and make an informed choice.

### What does the label information inform us about the food?

Food labels display the name of the food, a list of the ingredients, the net weight, brand name, name and address of the manufacturer, date of manufacture, use-by/expiry dates, storage instructions, allergen declaration and shelf-life of the food. In case of imported foods, the country of origin and complete address of the importer and packing premises are provided.

The ingredient declaration informs of all the ingredients that are in the food product. These are displayed in descending order with the ingredient that is highest in quantity appearing first.

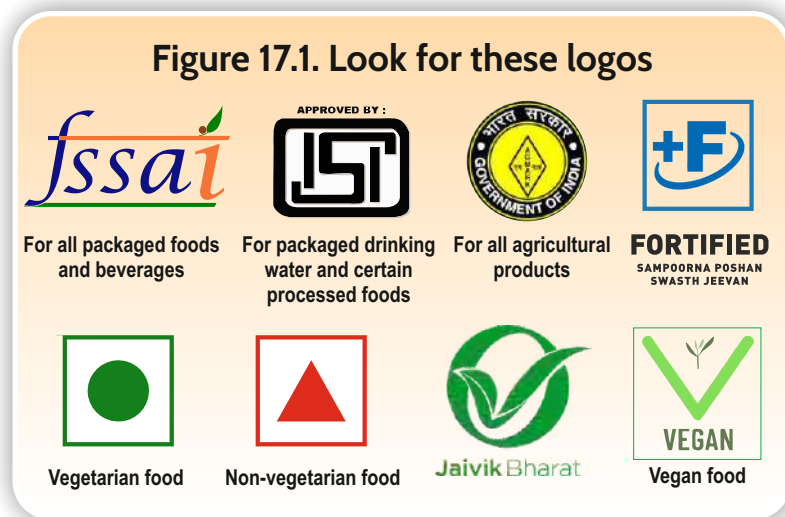
A declaration of nutrient information is mandatory as per the Indian regulation especially: Energy (in Kcal); protein (in grams); carbohydrates (specifying quantity of sugar) and fat (in grams), clearly specifying the quantity of saturated fats and trans fats. The nutrition facts should also display the amount of

any other nutrient the product claims to contain. Always read nutrition facts and ingredients presented on the label and assess the benefits of the specific food items in relation to nutritional requirements.

### What do various terms and symbols used on labels convey?

- FSSAI' logo with license number indicates that the manufacturer is licensed by the regulator.
- A green dot in a green square indicates vegetarian food and a brown triangle in a brown square indicates non-vegetarian [at least one ingredient is from animal source (including egg but not milk)].
- Logo for fortified food: 'Fortified' food means essential nutrients such as vitamins and minerals have been added to the food. Consuming fortified wheat flour, rice, milk, oil, and salt helps to meet the deficit in daily requirement for specific nutrients.

- Vegan logo: In view of the growing popularity of veganism, FSSAI has introduced vegan logo to be displayed on the pack for foods that do not have ingredients, food additives, and processing aids of animal origin (incl. milk, honey etc.). This will help differentiate vegan products from vegetarian and non-vegetarian foods.
- ISI' mark is currently mandatory on the labels of packaged drinking and mineral water and certain processed foods such as infant food, milk and skimmed milk powder. However, this may be done away with soon as all quality symbols on food packs will now be provided by FSSAI alone.
- AGMARK' on agricultural products such as vegetable oil, pulses, cereals, spices, honey, fruits and vegetables indicates quality of the products.



### What information is required to assess the safety and shelf life of a food item?

Always check the 'Date of Manufacture' and 'Use-by' or 'Date of Expiry' for freshness. 'Expiry date' or 'Use-by date' indicates that the product's quality and safety could deteriorate and consumption beyond that date would increase the risk of food poisoning. Be sure to consume foods before the 'Use-by' or 'Expiry' date. Also read the 'Storage Instructions' to know where and how to keep the food product and for how long. Read instructions for use if stated. Make sure you follow these instructions for best results.

Some individuals may be allergic to some specific food items. Avoid food products that include such ingredients. Consuming these even in small quantities can cause severe allergic reactions in some people. Common allergy-causing ingredients include casein in milk, tree nuts, peanuts, eggs, fish, shellfish, soyabean, and proteins in wheat. Those who are concerned can see the Allergen Declaration.

### How is the display of nutrition facts useful?

In the label, under the words 'Nutrition Facts', there is a statement on the 'Serving Size'. This is one of the most important pieces of information on the label because all of the nutrition information shown is based on the referred serving size. The serving size could be described in a few different ways in the label and depends on the food item being referred to. The most common measures are grams, cups, scoops and pieces. Grams tend to be listed most of the time even when the serving size may also be listed in a different way.

Check the net weight of the packet. This is the total amount of product contained in the packet. The Nutrition Facts Label information is generally based on one serving per 100g/100ml, but many packages may contain more than one serving or more than 100g or 100ml. Check how many servings per ml/g is being used against the number of serving unit used for presenting the Nutrition Facts. According to the amount of food item being used, assess calories and other nutrients in the portion being used.

Table 17.1 presents details on the Nutrition Facts that are expected to be stated in the label and factors to be taken into consideration for making healthy food choices.

### What are claims?

Manufacturers also use labels to make incorrect and incomplete claims about their food products. These claims presented on the package can be broadly categorized as follows:

**Nutrition claim:** There is a general misconception that 'Nutrition Facts' and 'Nutrient/Nutrition claims' are the same.



**Table 17.1. Mandatory nutrient information to be provided on the label**

Nutrient information on the label	Importance of choosing the food
Energy	<ul style="list-style-type: none"> <li>• Note calories per serving, presented in 'Kcal', which stands for kilocalories.</li> <li>• Check number of servings. If the label states, two servings for the entire packet and the calorie content is 100 calories per serving, then use of the entire packet would imply consumption of 200 calories.</li> <li>• 'Fat-free' does not mean 'calorie-free'.</li> </ul>
Carbohydrates and sugar	Check for 'energy' coming from carbohydrates and sugars. Pay attention to sugars, especially added sugars, to reduce risk of obesity and NCDs. Select foods that are low in refined carbohydrates.
Fats	Select the food or variant of the foods, that are low in refined carbohydrates and total fat content, especially saturated fats, and those that contain no trans fats. This would help in reducing risk of heart disease.
Sodium	Select foods that are low in sodium content to help reduce the risk of high blood pressure.
Dietary fibre, vitamins and minerals	Check if the vitamins, minerals and fibre in the product are natural or added. It is mandatory to display them under 'Nutrition Facts' in the label. Naturally present vitamins, minerals and fibre have health benefits, but added ones may be chemicals and may not have much value.
Recommended Dietary Allowances (RDAs)	Food labels display nutrient contents as a proportion of the RDAs. i.e. percentage of the nutrients in relation to a 2000 Kcal/day recommendation.

Nutrition claim refers to any statement, which suggests or implies that a food has particular nutritional properties. Claims like 'low calorie', 'high fibre', 'low fat', 'low sodium' is not complete information. These have to be substantiated by providing the actual values or nutritional facts about the product.

**Health claims:** Any representation that states, suggests, or implies that a relationship exists between a food product (or a constituent of the food) and health, is a health claim. These include nutrition claims, which describe the physiological role of the nutrient in growth, development and function of

the body, and other functional claims concerning specific beneficial effects gained upon consumption of the food.

**Risk reduction claims:** These are claims relating to the consumption of a food product or food constituent in reducing the risk of developing a specific disease or a health condition. Any such claim made by food companies is supposed to be substantiated with scientific evaluation independently before they are used.

**Other claims:** Claims like 'this food is source of...' or 'has high content of...' referring to particular nutrient(s) are also



subject to certain guidelines, which specify that the numerical specific information pertaining to vitamins and minerals be expressed in metric units and/or as a percentage of the Nutrient Reference Values or per 100g or per 100ml or per serving.

### Can label claims be misleading?

Health claims on packaged food are designed to catch the consumer attention and convince them that product is healthy. Though the Food Safety and Standard Authority of India (FSSAI) has strict norms, the information presented in labels could be misleading. Following are some of the examples.

**'All natural':** A food product can be called 'natural' if it doesn't have added colors, added flavors or artificial substances and goes through minimal processing. This term is often used rather loosely. It is often used by manufacturers to identify one or two natural ingredients in the mix and this can be misleading. Read the label, specifically the ingredients and other information carefully to cross-check the claims. Presented below are some examples of statements on labels that could be misleading.

**'Real fruit or fruit juice':** According to the FSSAI regulation, any food item with even a small amount, for example, fruit juices containing only 10 or less percent of fruit added to a product is allowed to state that the product is made with real fruit pulp or juice. But the product claiming to have real fruit may have added sugar and other additives with only 10 % actual fruit pulp.

**'Made with whole grain':** These words could be misinterpreted. Such a statement does not necessarily imply that the food items are not tertiary or ultra-processed.

**'Organic':** When a food label states 'organic', it may simply mean that it is free of all artificial preservatives, flavors and

colours and that the food ingredients are free from pesticides and chemical fertilizers. If both the above are met, then the label can state 100% organic and have the 'Jaivik Bharat' logo approved by FSSAI.

**'Low fat or Light':** Many low fat or non-fat foods may still have a lot of calories. Often these foods have extra sugar, refined flour or starch thickeners to make them taste better. Many of these ingredients are often used as fat replacers. These ingredients add calories from the added carbohydrates. For low fat, look for information on whether the food item has 0 grams (g) of *trans* fat and whether it is low in saturated fat and cholesterol. Foods that contain 'partially hydrogenated oils' in the ingredients list should not be acceptable. Light/lite versions are also often claimed on products. It may imply that the fat/oil used is more easily absorbed than others. However, it does not mean that it is low in calories since 1 gm of ANY fat/oil will give 9 calories.

**'No cholesterol or Heart friendly':** No plant-based oil contains cholesterol. However, all oils are 100% fat and therefore should be consumed in moderate quantities.

**'Good source of protein, vitamin D' or other nutrients':** A good source means that a single serving of that food has 10% to 19% of the amount of that nutrient. While this information is useful, read about the quantity of these nutrients with reference to daily nutrient recommended.

**'Sugar free':** People often associate sugar-free foods with lower calories and perceive these to be beneficial for diabetics and weight watchers. Sugar-free foods may be loaded with fats, refined cereals (white flour, starch) and even hidden sugars (maltitol, fructose, corn syrup, molasses). These would imply high glycaemic index and high calories in the food item.



## POINTS TO REGISTER

- Nutrition and health claims are regulated by FSSAI.
- Always read food label information to know about content of foods inside a pack.
- Food label should display the name of the food, brand name, list of the ingredients, date of manufacture, use-by/expiration dates, allergen declaration, etc.
- The ingredients are presented in a descending order, with the food item that has been used in highest quantity stated as the first item.
- The nutrient content declaration is usually printed on the back of the pack. This nutrient content provides nutrients per 100gm/100ml or serve size to help the consumer make informed choices.
- Now percent RDA per nutrient for every serving of food is also mandatory on the label.
- Although nutrition and health claims are regulated by FSSAI, consumers are advised to exercise caution by cross-checking the claims with ingredients and nutrition information on the label.

## Suggested measuring katori/cups and spoons



\* Refer General consideration for measuring food items

## General considerations for measuring food items

Due to substantial variances in home measures such as measuring cups, spoons, or katoris, it is difficult to collect accurate information regarding food intake or measurements. Many of these measures rely on subjective, categorical size assessments (small, medium and large). For scientific purposes of determining portion sizes, a set of standardized measuring utensils are used to measure food portions. In order to offer the most precise measurements, we employ several of these metrics and also provide their volume so that you may perform the most precise measurements possible.

Dietary diversity is essential for good health, various pulses and cereals, fruits and vegetables are utilized, in our diets. However not all varieties are consumed by everyone. The family may select items that are acceptable to them and select suitable alternatives, if required. For instance, some legumes, such as rajma, require a longer cooking time, making it impractical to cook only a few seeds for the infant/young child. Whenever the family prepares these foods, they should ensure that the child receives the recommended quantity.

We have employed tablespoons and teaspoons in order to standardize most of the measurements (these are similar in most households). Katoris (small bowls) are used to measure items that require a somewhat larger quantity. We utilized a big katori (360ml), a medium katori (200ml), and two small katoris (155ml and 115ml). The **115ml katori is highlighted (Bold)** to distinguish it from the 155ml katori.

Please Note:

To provide approximate weight for a food group we chose one of the food items in that group. You may use the same weight for other items in the same group if the actual item is not presented here.

Ragi is taken for 'any other millet'

Rice is taken for 'cereals'

Lentil is taken for 'pulses'

Guava is taken for 'fruits'

Ivy gourd is taken for 'vegetables'

- For all the green leafy vegetables, stalks, stems and roots are removed. Only leaves are weighed. The leaves were placed neither too tight nor too loose in the bowl during measurement.
- For sapota, skin as well as seeds are removed. Edible parts are weighed (chopped and peeled) for all the fruits.
- A difference of 5g in weight is not very apparent in the katori (eg. 155 ml & 150ml look almost similar in a 155ml katori).
- Fruits and vegetables of small/medium size were chosen for weight estimation (banana, oranges, etc). The same for eggs as well.
- Volumes of the standard cups used in descending order. C1=1500mL, C2=1100mL, C3=900mL, C4=700ml, C5=470ml, C6=360ml, C7=200ml, C8=155ml, C9=115ml, C10=95ml, C11=70ml, C12=25ml.
- Only 4 cups i.e., C6, C7, C8, C9 were used here as these are most commonly used in households.
- Diet and kitchen scale (Seca Culina 852) was used to measure all the weights.

## Raw food item measures using household utensils

## Diet chart for 6 to 8 months old infants

Meals	Items	Quantity (g)	Quantity (in katori, teaspoons, etc.)
Mid-morning (10–11AM)	Rice	10	2 teaspoons
	Redgram dal	5	1 teaspoon
	Spinach	20	3/4 of a medium (200ml) katori
	Oil/ghee	5	1 teaspoon
Afternoon (1PM)	Banana or steamed and mashed apple	40	1/4 of a small (115 ml) katori
Evening (4–5 PM)	Wheat	10	3 teaspoons of wheat flour
	Rajmah	5	1 teaspoon - 8 beans/seeds
	Amaranth	20	1 full medium (200ml) katori
	Oil/ghee	5	1 teaspoon

## Diet chart for 6 to 8 months old infants

Day	Mid-morning			Afternoon			Evening		
	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity
Sunday	Rice	10	2 teaspoon	Steamed and mashed apple	50	About 1/2 of small (150ml) katori	Wheat	10	3 teaspoons of wheat flour
	Redgram dal	5	1 teaspoon				Chana	5	1 teaspoon
	Spinach	20	3/4 of medium (200ml) katori				Egg	20	1/2 egg
	Oil/ghee	5	1 teaspoon				Bottle gourd	25	Half a <b>small</b> (115ml) <b>katori</b>
Monday	Ragi	10	3 teaspoons (flour)	Orange	50	1/2 orange without peel	Oil/ghee	5	1 teaspoon
	Cowpea	5	1 teaspoon				Rice	10	2 teaspoon
	Egg	20	1/2 egg				Redgram dal	5	1 teaspoon
	Fenugreek	20	3/4 of medium (200ml) katori				Beans	25	1/4 of medium (200ml) katori
	Oil/ghee	5	1 teaspoon				Oil/ghee	5	1 teaspoon
Tuesday	Wheat	10	3 teaspoons of wheat flour	Mashed papaya	50	Half of a <b>small</b> (115ml) <b>katori</b>	Bajra	10	2 teaspoons
	Chana	5	1 teaspoon				Green gram dal	5	1 teaspoon (whole)
	Colocasia leaves	20	1/2 a big (360ml) katori				Ridge gourd	25	About 1/2 of small (150ml) katori
	Oil/ghee	5	1 teaspoon				Oil/ghee	5	1 teaspoon



### Diet chart for 6 to 8 months old infants (contd..)

Day	Mid-morning			Afternoon			Evening		
	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity
Wednesday	Bajra	10	2 teaspoons	Mashed mango	50	1/2 a <b>small (115ml) katori</b>	Rice	10	2 teaspoon
	Chana dal	5	1 teaspoon				Lentil	5	1 teaspoon
	Egg	20	1/2 egg				Beans	25	1/4 of medium (200ml) katori
	Bachali	20	1/2 a big (360ml) katori				Oil/ghee	5	1 teaspoon
	Oil/ghee	5	1 teaspoon						
Thursday	Rice flakes	10	4 teaspoons	Mashed chikoo	50	2 medium size or 1/2 a <b>small (115ml) katori</b>	Maize	10	
	Blackgram dal	5	1 teaspoon				Kidney beans	5	1 teaspoon or 8 beans/seeds
	Mint leaves	20	3/4 of a big (360ml) katori				Egg	20	1/2 egg
	Oil/ghee	5	1 teaspoon				Ivy gourd	25	1/4 of medium (200ml) katori
							Oil/ghee	5	1 teaspoon
Friday	Wheat	10	3 teaspoons of wheat flour	Water melon	50	3/4 of a <b>small (115ml) katori (without rind)</b>	Rice	10	2 teaspoon
	Rajmah	5	1 teaspoon or 8 beans/seeds				Black gram dal	5	
	Egg	20	1/2 egg				Beans	25	1/4 of medium (200ml) katori
	Amaranth	20	1 full medium (200ml) katori				Oil/ghee	5	1 teaspoon
	Oil/ghee	5	1 teaspoon						
Saturday	Ragi	10	3 teaspoons (flour)	Mashed banana	50	1 small size banana without peel	Wheat	10	3 teaspoons of wheat flour
	Cowpea	5	1 teaspoon				Channa dal	5	
	Fenugreek	20	3/4 of a medium (200ml) katori				Egg	20	1/2 egg
	Oil/ghee	5	1 teaspoon				Bottle gourd	25	
							Oil/ghee	5	1 teaspoon

### Diet chart for 9 to 12 months old infants

Day	Mid-morning			Afternoon			Evening		
	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity
SUNDAY	Rice	10	2 teaspoon	Cereals/ nutricereals	15	3 teaspoons	Wheat	10	3 teaspoons of wheat flour
	Redgram dal	5	1 teaspoon	Any dal	10	2 teaspoons	Channa dal	5	1 teaspoon
	Spinach	20	3/4 of a medium (200ml) katori	Groundnut	5	1 teaspoon or 11 pieces	Meat	20	1 full tablespoon
	Groundnut	5	1 teaspoon or 11 nuts	Fruits	20	1/4 of a small (150ml) katori	Bottle gourd	25	Half cup of a <b>small (115ml) katori</b>
	Oil/ghee	5	1 teaspoon				Oil/ghee	5	1 teaspoon
	Fruits	20	1/4 of a small (150ml) katori				Fruits	20	1/4 of a small (150ml) katori
MONDAY	Ragi	10	3 teaspoons (flour)	Cereals/ nutricereals	15	3 teaspoons	Rice	10	2 teaspoon
	Cowpea	5	1 teaspoon	Any dal	10	2 teaspoons	Redgram dal	5	1 teaspoon
	Egg	20	1/2 egg	Groundnut	5	1 teaspoon	Beans	25	1/4 of a medium (200ml) katori
	Methi	20	3/4 of a medium (200ml) katori	Fruits	20	1/4 of a small (150ml) katori	Oil/ghee	5	1 teaspoon
	Sesame seed	5	2 teaspoons				Fruits	20	1/4 of a small (150ml) katori
	Oil/ghee	5	1 teaspoon						
TUESDAY	Fruits	20	1/4 of a small (150ml) katori						
	Wheat	10	3 teaspoons of wheat flour	Cereals/ nutricereals	15	3 teaspoons	Bajra	10	2 teaspoons
	Channa dal	5	1 teaspoon	Any dal	10	2 teaspoons	Greengram dal	5	1 teaspoon
	Colocasia leaves	20	1/2 of a big (360ml) katori	Groundnut	5	1 teaspoon	Fish	20	1 full tablespoon
	Cashew nuts	5	1 teaspoon or 3 pieces	Fruits	20	1/4 of a small (150ml) katori	Ridge gourd	25	Little less than 1/2 of a small (150ml) katori
	Oil/ghee	5	1 teaspoon				Oil/ghee	5	1 teaspoon
WEDNESDAY	Fruits	20	1/4 of a small (150ml) katori				Fruits	20	1/4 of a small (150ml) katori
	Bajra	10	2 teaspoons	Cereals/ nutricereals	15	3 teaspoons	rice	10	2 teaspoon
	Channa dal	5	1 teaspoon	Any dal	10	2 teaspoons	Lentil	5	1 teaspoon
	Fish	20	1 full tablespoon	Cashew nuts	5	1 teaspoon or 3 pieces	Beans	25	1/4 of medium (200ml) katori
	Bachali	20	1/2 of a big (360ml) katori	Fruits	20	1/4 of a small (150ml) katori	Oil/ghee	5	1 teaspoon
	Walnuts	5	2 teaspoons level				Fruits	20	1/4 of a small (150ml) katori
Oil/ghee	5	1 teaspoon							
Fruits	20	1/4 of a small (150ml) katori							

### Diet chart for 9 to 12 months old infants (contd..)

Day	Mid-morning			Afternoon			Evening		
	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity
THURSDAY	Rice flakes	10	4 teaspoons	Cereals/ nutricereals	15	3 teaspoons	Maize	10	2 teaspoons
	Blackgram dal	5	1 teaspoon	Any dal	10	2 teaspoons	Kidney beans	5	1 teaspoon or 8 beans/seeds
	Mint leaves	20	3/4 of a big (360ml) katori	Almonds	5	1 teaspoon or 3 pieces	Egg	20	1/2 egg
	Sesame seeds	5	2 teaspoons	Fruits	20	1/4 of a small (150ml) katori	Ivy gourd	25	1/4 of medium (200ml) katori
	Oil/ghee	5	1 teaspoon				Oil/ghee	5	1 teaspoon
	Fruits	20	1/4 of a small (150ml) katori				Fruits	20	1/4 of a small (150ml) katori
FRIDAY	Wheat	10	3 teaspoons of wheat flour	Cereals/ nutricereals	15	3 teaspoons	Rice	10	2 teaspoons
	Rajma	5	1 teaspoon or 8 beans/seeds	Any dal	10	2 teaspoons	Blackgram dal	5	1 teaspoon
	Amaranth	20	1 full medium (200ml) katori	Coconut	5	1 teaspoons	Fish	20	1 tablespoon
	Pista	5	1 teaspoon	Fruits	20	1/4 of a small (150ml) katori	Beans	25	1/4 of a medium (200ml) katori
	Oil/ghee	5	1 teaspoon				Oil/ghee	5	1 teaspoon
	Fruits	20	1/4 of a small (150ml) katori				Fruits	20	1/4 of a small (150ml) katori
SATUR DAY	Ragi	10	3 teaspoons (flour)	Cereals/ nutricereals	15	3 teaspoons	Wheat	10	3 teaspoons of wheat flour
	Cowpea	5	1 teaspoon	Any dal	10	2 teaspoons	Chana dal	5	1 teaspoon
	Fenugreek	20	3/4 of medium (200ml) katori	Groundnut	5	1 teaspoon	Chicken	20	1 full tablespoon
	Sesame seeds	5	2 teaspoons	Fruits	20	1/4 of a small (150ml) katori	Bottle gourd	25	Half of a <b>small (115 ml) katori</b>
	Oil/ghee	5	1 teaspoon				Oil/ghee	5	1 teaspoon
	Fruits	20	1/4 of a small (150ml) katori				Fruits	20	1/4 of a small (150ml) katori

### Diet chart for 1–3 years old children

All days	Item	Raw weight (g)	Quantity
Early Morning	Milk	150ml	One and half small steel glass
Evening	Milk	150ml	One and half a small steel glass
	Nuts	10	1 tablespoon

Day	Breakfast			Lunch			Dinner		
	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity
SUNDAY	Bajra	40	1/2 of a small (115ml) katori	Wheat	40	3/4 of a small (115ml) katori (flour)	Rice	40	4 tablespoons or 1/4 of a small (150ml) katori
	Redgram	15	1 tablespoon	Chana	15	1 tablespoon	Greengram	10	2 teaspoons
	Spinach	25	1/2 of a big (360ml) katori	Egg	20	1/2 egg	Ridge gourd	30	1/2 of a small (150ml) katori
	Tomato	35	1/2 of a small (150ml) katori	Bottle gourd	35	1/2 of a small (150ml) katori	Oil/ghee	6	1 teaspoon
	Oil/ghee	7	One and half teaspoon	Methi	25	1 full medium (200ml) katori	Fruits	25	1/4 of medium (200ml) katori
	Fruits	25	1/4 of a medium (200ml) katori	Oil/ghee	7	One and a half teaspoon			
	Ragi	40	1/2 of a small (150ml) katori (Flour)	Fruits	25	1/4 of a medium (200ml) katori			
MONDAY	Cowpea	15	1 & 1/2 tablespoon	Rice	40	4 tablespoons or 1/4 of small (150ml) katori	Rice	40	4 tablespoons or 1/4 of a small (150ml) katori
	Chicken	25	1/4 of a small (115ml) katori	Redgram dal	15	1 tablespoon	Redgram	10	2 teaspoons
	Methi	25	1 Full medium (200ml) katori	Beans	35	1/2 of a small (150ml) katori	Beans	30	1/2 of a small (150ml) katori
	Tomato	35	1/2 of a small (150ml) katori	Bachali	25	3/4 of a big (360ml) katori	Oil/ghee	6	1 teaspoon
	Oil/ghee	7	One and half teaspoon	Oil/ghee	7	One and a half teaspoon	Fruits	25	1/4 of a medium (200ml) katori
	Fruits	25	1/4 of a medium (200ml) katori	Fruits	25	1/4 of a medium (200ml) katori			
TUESDAY	Wheat	40	3/4 of a small (115ml) katori (flour)	Bajra	40	1/2 of a small (115ml) katori	Wheat	40	3/4 of a small (115ml) katori (flour)
	Chana	15	1 tablespoon	Greengram dal	15	1 tablespoon	Chana	10	2 teaspoons
	Mutton	25	1/4 a medium (200ml) katori	Ridgegourd	35	Little more than 1/2 of a small (150ml) katori	Egg	20	1/2 egg
	Colocasia leaves	25	3/4 of a big (360ml) katori	Spinach	25	1/2 of a big (360ml) katori	Gourd	35	1/2 of a small (150ml) katori
	Tomato	35	1/2 of a small (150ml) katori	Oil/ghee	7	One and a half teaspoon	Oil/ghee	6	1 teaspoon
	Oil/ghee	7	One and half teaspoon	Fruits	25	1/4 of a medium (200ml) katori	Fruits	25	1/4 of a medium (200ml) katori
	Fruits	25	1/4 a medium (200ml) katori						

### Diet chart for 1–3 years old children (contd..)

Day	Breakfast			Lunch			Dinner		
	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity	Item	Raw weight (g)	Quantity
WEDNESDAY	Jowar	40	1/2 of a small (115 ml) katori	Rice	40	4 tablespoons or 1/4 of a small (150ml) katori	Rice	40	4 tablespoons or 1/4 of a small (150ml) katori
	Chana	15	1 tablespoon	Lentil	15	1 tablespoon	Lentil	10	2 teaspoons
	Fish	25	1/4 of a small (115ml) katori	Beans	35	1/2 of a small (150ml) katori	Beans	30	1/2 of a small (150ml) katori
	Bachali	25	3/4 of a big (360ml) katori	Methi	25	1 full medium (200ml) katori	Oil/ghee	6	1 teaspoon
	Tomato	35	1/2 of a small (150ml) katori	Oil/ghee	7	One and a half teaspoon	Fruits	25	1/4 of a 1 full medium (200ml) katori
	Oil/ghee	7	One and half teaspoon	Fruits	25	1/4 of a medium (200ml) katori			
	Fruits	25	1/4 of a medium (200ml) katori						
THURSDAY	Rice flakes	40	one a small (115ml) katori	Maize	40	4 tablespoons or 1/4 of a small (150ml) katori	Maize	40	4 tablespoons or 1/4 of a small (150ml) katori
	Black gram dal	15	1 tablespoon	Kidney beans	15	2 tablespoons	Kidney beans	10	2 teaspoons
	Fish	25	1/4 of a small (115ml) katori	Egg	20	1/2 egg	Ivy gourd (Kovai)	30	1/2 of a small (150ml) katori
	Methi leaves	25	1 Full medium (200ml) katori	Ivy gourd	35	1/2 of a small (150ml) katori	Oil/ghee	6	1 teaspoon
	Tomato	35	1/2 of a small (150ml) katori	Spinach	25	1/2 of a big (360ml) katori	Fruits	25	1/4 of a 1 full medium (200ml) katori
	Oil/ghee	7	One and half teaspoon	Oil/ghee	7	One and a half teaspoon			
	Fruits	25	1/4 of a medium (200ml) katori	Fruits	25	1/4 of a medium (200ml) katori			
FRIDAY	Wheat	40	3/4 of a small (115ml) katori (flour)	Rice	40	4 tablespoons or 1/4 of a small (150ml) katori	Rice	40	4 tablespoons or 1/4 of a small (150ml) katori
	Rajmah	15	2 tablespoon	Blackgram dal	15	1 tablespoon	Blackgram	10	2 teaspoons
	Chicken	25	1/2 of a small (150ml) katori	Beans	35	1/2 of a small (150ml) katori	Ridge gourd	30	1/2 of a small (150ml) katori
	Amaranth	25	1 and 1/4 of a medium (200ml) katori	Bachali	25	3/4 of a big (360ml) katori	Oil/ghee	6	1 teaspoon
	Tomato	35	1/2 of a small (150ml) katori	Oil/ghee	7	One and a half teaspoon	Fruits	25	1/4 of a medium (200ml) katori
	Oil/ghee	7	One and half teaspoon	Fruits	25	1/4 of a medium (200ml) katori			
	Fruits	25	1/4 of a medium (200ml) katori						
SATURDAY	Ragi	40	1/2 of a small (150ml) katori (flour)	Wheat	40	3/4 of a small (115ml) katori (flour)	Wheat	40	3/4 of a small (115ml) katori (flour)
	Cowpea	15	1 & 1/2 tablespoon	Chana	15	1 tablespoon	Chana	10	2 teaspoons
	Fish	25	1/4 of a small (115ml) katori	Egg	20	1/2 egg	Carrot (peeled)	30	1/4 of a small (150ml) katori
	Methi	25	1 Full medium (200ml) katori	Bottle gourd	35	1/2 of a small (150ml) katori	Oil/ghee	6	1 teaspoon
	Tomato	35	1/2 of a small (150ml) katori	Drumstick leaves	25	1 full big (360ml) katori	Fruits	25	1/4 of a medium (200ml) katori



**Suggested diet for normally nourished physically active children aged 4 to 6 yrs**

Meal/item	Raw weight (g)	Quantity
<b>Breakfast</b>		
Soaked and boiled bajra	50	3/4 of a small (115ml) katori
Any other millet	50	1/2 of a small (150ml) katori (ragi)
Boiled rajma/black beans,	20	1/4 of a small (115ml) katori
Lobia/chick pea	20	1/4 of a small (115ml) katori
Vegetable chutney	50	1/2 of a medium (200ml) katori
Nuts	5	1 teaspoon or 4 pieces (cashew)
<b>Lunch</b>		
Cereals (preferably whole grain)	60	1/2 of a small (150ml) katori
Pulses	20	4 teaspoons
Meat	20	1 full tablespoon
Vegetables	50	1/2 of a medium (200ml) katori
Green leafy Vegetables	50	2 full medium (200ml) katori
Curd	75ml	¾ of a small steel glass
Oil	10	1 tablespoon
Nuts	10	2 teaspoons or 8 pieces (cashew nuts)
Fruits	50	1/2 of a medium (200ml) katori
<b>Evening</b>		
Milk	100ml	One small steel glass
<b>Dinner</b>		
Cereals	50	1/2 of a small (115ml) katori
Pulses	20	4 teaspoons
Vegetables	50	1/2 of a medium (200ml) katori
Oil	10	1 tablespoon
Curd	75ml	¾ of a small steel glass
Fruits	25	1/4 of a medium (200ml) katori

**Suggested diet for normally nourished physically active children aged 7 to 9 yrs**

Meal/item	Raw weight (g)	Quantity
<b>Breakfast</b>		
Soaked and boiled bajra	50	3/4 of a small (115ml) katori
any other millet	50	1/2 of a small (150ml) katori (ragi)
Boiled rajma/black beans,	20	1/4 of a small (115ml) katori
Lobia/chick pea	20	1/4 of a small (115ml) katori
Green leafy Vegetables	50	2 full medium (200ml) katoris
Vegetable chutney	50	1/2 of a medium (200ml) katori
Nuts	10	2 teaspoons or 8 pieces (cashew nuts)
<b>Lunch</b>		
Cereals (preferably whole grain)	90	3/4 of a small (150ml) katori
Pulses	25	1/4 of a small (115 ml) katori
Vegetables	100	One full medium (200ml) katori
Green leafy Vegetables	50	2 full a medium (200ml) katoris
Curd	100ml	One small steel glass
Oil	15	One and a half table spoon
Nuts	10	2 teaspoons or 8 pieces (cashew nuts)
Fruits	50	1/2 of a medium (200ml) katori
<b>Evening</b>		
Milk	100ml	One small steel glass
<b>Dinner</b>		
Cereals	60	1/2 of a small (150ml) katori
Pulses	20	4 teaspoons
Vegetables	100	One full medium (200ml) katori
Oil	10	One tablespoon
Curd	100ml	One full small steel glass
Fruits	50	1/2 of a medium (200ml) katori

### Suggested diet for normally nourished sedentary men

Meal/Item	Raw weight (g)	Quantity
<b>Breakfast</b>		
Soaked and boiled bajra	90	3/4 of a medium (200ml) katori
Any other millet	90	One full small (115ml) katori
Boiled rajma/black beans	35	1/2 of a small (115ml) katori
Cowpea/chickpea	35	1/2 of a small (115ml) katori
Green leafy Vegetables	50	2 full medium (200ml) katoris
Vegetables	50	1/2 of a medium (200ml) katori
Nuts	20	4 teaspoons or 16 pieces (cashew nuts)
<b>Lunch</b>		
Cereals (preferably whole grain)	100	One full small (115ml) katori
Pulses	30	1/4 of a small (115ml) katori
Vegetables	150	One and a half medium (200ml) katoris
Green leafy vegetables	50	2 full medium (200ml) katoris
Oil	20	4 teaspoons or 16 pieces (cashewnuts)
Nuts	20	2 tablespoons
curd	150ml	One and a half small steel glass
Fruits	50	1/2 of medium (200ml) katori
<b>Evening</b>		
Milk	50ml	Half of a small steel glass
<b>Dinner</b>		
Cereals	80	1/2 of a medium (200ml) katori
Pulses	25	1/4 a small (115ml) katori
Vegetables	100	One full medium (200ml) katori
Oil	10	One tablespoon
Curd	100ml	One small steel glass
Fruits	50	1/2 of a medium (200ml) katori

### Suggested diet for normally nourished sedentary women\*

Meal/Item	Raw weight (g)	Quantity
<b>Breakfast</b>		
Soaked and boiled bajra	60	1 full small (115ml) katori
Any other millet	60	3/4 of a small (115ml) katori (ragi)
Boiled rajma/black beans	30	1/4 of a small (150ml) katori
Cowpea/chickpea	30	1/4 of a small (150ml) katori
Green leafy Vegetables	50	2 full medium (200ml) katoris
Vegetables	100	1 full medium (200ml) katori
Nuts	20	4 teaspoons or 16 pieces (cashew nuts)
<b>Lunch</b>		
Cereals (preferably whole grain)	80	1/2 of a medium (200ml) katori
Pulses	20	4 teaspoons
Vegetables	150	One and a half medium (200ml) katori
Green leafy vegetables	50	2 full medium (200ml) katoris
Oil	10	1 tablespoon
Nuts	20	4 teaspoons or 16 pieces (cashew nuts)
Cooking oil	15	One and a half tablespoon
curd	150ml	One and a half small steel glass
Fruits	50	1/2 of a medium (200ml) katori
<b>Evening</b>		
Milk	50ml	Half small steel glass
<b>Dinner</b>		
Cereals	60	1/2 of a small (150ml) katori
Pulses	15	1 tablespoon
Vegetables	50	1/2 a medium (200ml) katori
Oil	5	1 teaspoon
Curd	100ml	One small steel glass
Fruits	50	1/2 of a medium (200ml) katori

\* Non-pregnant and non-lactating

**Suggested diet for normally nourished elderly men (>60yrs)**

Meal/item	Raw weight g	Quantity
<b>Breakfast</b>		
Soaked and boiled bajra	50	3/4 of a <b>small</b> (115ml) katori
Any other millet	50	1/2 of a small (150ml) katori (ragi)
Boiled rajma/black beans	20	1/4 of a <b>small</b> (115ml) katori
Cowpea/chick pea	20	1/4 of a <b>small</b> (115ml) katori
Green leafy Vegetables	50	2 full medium (200ml) katoris
Vegetables	100	1 full medium (200ml) katori
Nuts	10	2 teaspoons or 8 pieces (cashew nuts)
Milk	100ml	One small steel glass
<b>Lunch</b>		
Cereals (preferably whole grain)	80	1/2 of a medium (200ml) katori
Pulses	40	1/2 of a small (150ml) katori
Vegetables	100	1 full medium (200ml) katori
Green leafy vegetables	50	2 full medium (200ml) katori
Oil	10	One tablespoon
Nuts	20	4 teaspoons or 16 pieces (cashew nuts)
Curd	100ml	One small steel glass
Fruits	50	1/2 of a medium (200ml) katori
<b>Evening</b>		
Milk	100ml	One small steel glass
<b>Dinner</b>		
Cereals	50	1/2 of a <b>small</b> (115ml) katori
Pulses	20	4 teaspoons
Vegetables	100	1 full medium (200ml) katori
Oil	10	One tablespoon
Curd	100ml	One small steel glass
Fruits	100	1 full medium (200ml) katori

**Suggested diet for normally nourished elderly women (>60yrs)**

Meal/item	Raw weight g	Quantity
<b>Breakfast</b>		
Soaked and boiled bajra	40	1/2 of a small (150ml) katori
Any other millet	40	1/2 of a <b>small</b> (115ml) katori (Ragi)
Boiled rajma/black beans	20	1/4 of a <b>small</b> (115ml) katori
Cowpea /chick pea	20	1/4 of a <b>small</b> (115ml) katori
Green leafy Vegetables	50	2 full medium (200ml) katori
Vegetables	100	1 full medium (200ml) katori
Nuts	10	2 teaspoons or 8 pieces (cashewnuts)
Milk	100ml	One small steel glass
<b>Lunch</b>		
Cereals (preferably whole grain)	60	1/2 of a small (150ml) katori
Pulses	30	1/4 of a small (115ml) katori
Vegetables	100	1 full medium (200ml) katori
Green leafy vegetables	50	2 full medium (200ml) katoris
Oil	20	2 tablespoons
Nuts	20	4 teaspoons or 16 pieces (cashewnuts)
Curd	100ml	One small steel glass
Fruits	50	1/2 of a medium (200ml) katori
<b>Evening</b>		
Milk	100ml	One small steel glass
<b>Dinner</b>		
Cereals	40	1/4 of a medium (200ml) katori
Pulses	20	4 teaspoons
Vegetables	100	1 full medium (200ml) katori
Oil	5	One teaspoon
Curd	100ml	One small steel glass
Fruits	100	1 full medium (200ml) katori

### Diet chart for normal sedentary pregnant women

Meal/Item	Raw weight g	Quantity
<b>Early morning</b>		
Milk	150ml (already given)	One and a half small steel glass
<b>Breakfast</b>		
Millets (Nutricereals)	65	3/4 a small (115ml) katori (ragi)
Vegetables	75	3/4 of a medium (200ml) katori
Pulses	20	4 teaspoons
Nuts	20	4 teaspoons or 16 pieces (cashew nuts)
<b>Lunch</b>		
Rice	100	3/4 a small (115 ml) katori
Phulka	100	100g of wheat flour (already given)
Pulses	30	1/4 of a small (115 ml) katori
Vegetable curry with roots	1.25 cup	
Oil	15	One and a half teaspoon
GLV curry	75	
Curd	200ml	Two small steel glass
Fruits	100	One full medium (200ml) katori
<b>Evening</b>		
Nuts	20	4 teaspoons or 16 pieces (cashew nuts)
Milk	50ml	Half small steel glass
<b>Dinner</b>		
Rice	75	1/2 of a medium (200ml) katori
Phulka	75	75 grams wheat flour (already given)
Red gram	30	1/2 cup (already given)
Green leafy vegetable curry	75	1/2 cup (already given)
Vegetable curry with roots	1.25 cup	1.25 cup (already given)
Oil	5	One teaspoon
Fruits	50	1/2 of a medium (200ml) katori

## Measuring of raw food items





## Measuring of raw food items



### Estimation of glycemic carbohydrates from commonly consumed foods (g/100g DM)

Food sample	Glycemic carbohydrates (g/100g DM)
Rice	79.22 ± 0.67
Wheat flour	63.26 ± 0.23
Barley	64.99 ± 0.21
Red gram dhal	51.90 ± 1.03
Green gram dhal	51.24 ± 1.72
Bengal gram whole	52.33 ± 1.29
Masoor dhal	52.52 ± 0.83
Chana dhal	56.22 ± 0.62
Wheat + chana (60:40)	49.94 ± 1.27
Wheat + chana + barley (40:30:30)	46.89 ± 0.22
Mixed dhal	40.09 ± 1.56

Each value is the average of triplicate determinations ±, one SD

Source: S. Devindra et al., (2017). Estimation of glycemic carbohydrate and glycemic index/load of commonly consumed cereals, legumes and mixture of cereals and legumes. *Int. J. Diab. Dev. Coun.* 37(4):426–431.

### Glycemic carbohydrates content of commonly consumed Indian breakfast foods (g/100 g)

Food sample	Glycemic carbohydrates (g/100g DM)	Food sample	Glycemic carbohydrates (g/100g DM)
Idly sambar	58.98 ± 0.0	MLA Dosa	70.13 ± 0.5
MLA Upmapesarattu	66.26 ± 2.7	Bisibelebhath	56.99 ± 0.2
Onion ravadosa	70.95 ± 0.5	Open veg paneerdosa	66.34 ± 0.9
Open dosa	70.33 ± 5.7	Tomato bhath	61.49 ± 2.0
Paneer dosa	68.69 ± 0.6	Lemon rice	70.36 ± 0.1
Pesarattu	65.75 ± 0.1	Chapati	66.12 ± 2.2
Ravapaneerdosa	65.17 ± 3.1	Tomato rice	71.35 ± 0.2
Set dosa	69.93 ± 0.2	Vegetable biryani	71.84 ± 3.1
Vegetable dosa	69.56 ± 2.9	Curd rice	70.96 ± 0.7
Vadasambar	49.63 ± 1.5	Parota	63.50 ± 1.3
Onion dosa	69.96 ± 0.3	Mysore bonda	70.38 ± 0.1
Plain dosa	70.75 ± 0.3		

Each value is the average of triplicate determinations ±, one SD

Source: S. Devindra et al., (2017). Estimation of glycemic carbohydrate and glycemic index/load of commonly consumed cereals, legumes and mixture of cereals and legumes. *Int. J. Diab. Dev. Coun.* 37(4):426–431.

### Glycemic index and glycemic load of different food samples

Name of foods	Glycemic index (GI)	Glycemic load (GL)
Rice	78.23 d ± 4.24	49.38 d ± 2.67
Wheat chapatti	65.66 b ± 4.22	32.83 b ± 2.11
Red gram	43.01 a ± 4.93	21.50 a ± 2.46
Green gram	42.45 a ± 4.05	21.22 a ± 2.02
Bengal gram	37.95 ac ± 5.73	18.97 ac ± 2.86
Masoor dhal	42.15 a ± 3.26	21.07 a ± 1.63
Mixed dhal	43.64 a ± 6.98	21.82 a ± 3.49
Wheat +chana dhal	32.37 c ± 9.10	16.18 ce ± 5.30
Wheat + chana dhal +barley	39.27 ac ± 5.20	19.63 ae ± 6.33

Values are mean and ±SD of three separate determinations. Values in the same row with different letters are significantly different ( $P < 0.05$ )

Source: S. Devindra et al., (2017). Estimation of glycemic carbohydrate and glycemic index/load of commonly consumed cereals, legumes and mixture of cereals and legumes. *Int. J. Diab. Dev. Coun.* 37(4):426–431.

### Glycemic index and glycemic load of commonly consumed breakfast foods of India

Name of the breakfast foods	Glycemic index (GI)	Glycemic load (GL)
Idly sambar	68.69 ± 5.8	34.34 ± 7.1
MLA Upma pesArattu	72.85 ± 5.8	36.42 ± 6.7
Onion rava dosa	66.43 ± 5.7	33.21 ± 5.3
Open dosa	77.33 ± 5.7	39.34 ± 3.5
Paneer dosa	71.47 ± 4.3	35.73 ± 3.7
Pesarattu	60.69 ± 5.7	33.70 ± 9.5
Rava paneer dosa	71.94 ± 6.2	35.97 ± 5.2
Set dosa	65.97 ± 5.7	32.98 ± 6.5
Vegetable dosa	63.97 ± 5.7	31.98 ± 7.4
Vada sambar	36.89 ± 5.7	18.44 ± 7.7
Onion dosa	79.69 ± 5.9	39.84 ± 4.8
Plain dosa	79.39 ± 6.8	39.69 ± 2.7
MLA dosa	71.17 ± 6.6	35.58 ± 5.4
Bisibelebhath	74.64 ± 5.8	32.59 ± 5.6
Open veg paneer dosa	70.98 ± 6.4	35.49 ± 6.8
Tomato bhath	68.57 ± 5.8	36.54 ± 7.3
Lemon rice	79.30 ± 5.9	39.65 ± 3.9
Chapati	62.43 ± 6.1	28.37 ± 5.3
Tomato rice	68.89 ± 6.2	34.44 ± 7.3
Vegetable biryani	74.53 ± 6.1	37.26 ± 7.3
Curd rice	64.94 ± 5.6	32.47 ± 7.5
Parota	62.48 ± 5.6	31.24 ± 6.3
Mysore bonda	61.41 ± 5.6	30.70 ± 5.7

Each value is the average of ten participant's determinations ±, one SD

Source: Devindra S, et al (2022). Glycemic carbohydrates, glycemic index, and glycemic load of commonly consumed South Indian breakfast foods. *Journal of Food Science and Technology*. 59, 3619–3626. Doi.org/10.1007/s13197-022-05368-6

## Various foods categorized under different food groups

### Cereals & millets

Nutrient composition for cereals is mean of maize, dry, rice, parboiled, handpounded, rice, parboiled, milled, rice, raw( brown) handpounded, rice, raw, milled, rice, flakes, rice, puffed, wheat, whole, wheat, flour atta, wheat, flour(refined), wheat, semolina, wheat, vermicelli, wheat, bulgar.

Nutrient composition for millets is mean of bajra, barley, Italian millet (foxtail millet), jowar, panivaragu, ragi, samai, sanwa millet, varagu.

Nutrient composition for pulses is mean of bengal gram, whole, bengal gram, dhal, bengal gram, roasted, black gram, dhal, cowpea, field bean, dry, green gram, whole, green gram, dhal, horse gram, whole, khesari, dhal, lentil moth beans, peas, dry, peas, roasted, rajmah, red gram, dhal, soyabean.

### Green leafy vegetables

Nutrient composition for GLV is mean of agathi , amaranth caudatus, amaranth, tender gangeticus, amaranth, stem gangeticus, amaranth, paniculatus, amaranth, polygonoides, amaranth, spinosus, amaranth species (chakravarthikeerai), amaranth species (koyakeerai), amaranth tristis, amaranth, viridis, ambat chuka, bathua leaves, beet greens, bengal gram leaves, betel leaves, bottle gourd leaves, broad bean leaves, brussels sprouts, cabbage, carrot leaves, cauliflower leaves, celery leaves, celery stalk, chekkur manis, colocasia leaves (black variety), colocasia leaves (green variety), coriander leaves, cow pea leaves, curry leaves, drumstick leaves, fenugreek leaves, fetid cassia, fresh, garden cress, garden sorrel (sepals), gogu, ipomoea stems, ipomoea leaves, knol-khol greens, kuppameni, lettuce, lettuce tree leaves, mature, lettuce tree leaves, tender, menathakkali leaves, mayalu, mint, modakanthan keerai, mukarrate keerai, mustard leaves, neeringi, parsley, paruppu keerai, ponnanganni, pumpkin leaves, radish leaves, table radish leaves, rape leaves, rape leaves, safflower leaves, shepu, spinach, spinach stalks, susni sag, tamarind leaves, tender, turnip greens.

### Vegetables

Nutrient composition for vegetables is mean of ash guard, beans, scarlet tender, bitter gourd, bitter gourd, small, bottle gourd, brinjal, broad beans, cauliflower, cho-cho-marrow, cluster beans, colocasia stem, cow pea pods, cucumber, double beans, drum stick, drumstick flowers, field beans, tender, figs, red (ficus cunia), french beans, ghosala, giant chillies (capsicum), jack, tender, jack, fruit seed, kankoda, karonda fresh, kheksa, kovai, knol-khol, ladies fingers,

lakuch, raw, leeks, mango green, onion stalks, papaya green, parwar, pink beans, plantain flower, plantain, green, plantain, stem, pumpkin, pumpkin flowers, ridge gourd, snake gourd, sword beans, tinda, tender, tomatoto, green, vegetable marrow.

### Roots and tubers

Nutrient composition for roots and tubers is mean of banana rhizome, beet root, carrot, colocasia, khamalu, mango ginger, onion, big, onion, small, potato, radish, pink, radish rat-tailed, radhish, round red, radish, round white, sweet potato, tapioca, tapioca, chips, dried, urnip, yam, elephant, yam, ordinary, yam, wild.

### Fruits

Nutrient composition for fruits is mean of amla, apple, apricot, fresh, avocado pear, bael fruit, banana ripe, banyan tree figs, cashew fruit, cherries, red, currants, black, figs (ficus carcia), grapes, blue variety, grapes, pale green variety, grape fruit, marsh's seedless, grape fruit, triumph, guava, country, guava, hill, harfarowrie, jack fruit, jamb, safed, jambu fruit, korukkapalli, lakuch, lemon, lemon sweet, lichi, lichies, bastard, lime, lime, sweet, malta, lime, sweet, musambi, loquat, mango ripe, mangosteen, melon, musk, melon, water, mulberry, orange, palmyra fruit ripe (mesocarp), palmyra fruit, tender, papaya, ripe, passion fruit, peaches, pears, persimmon, phalsa, pine apple, plum, pomegranate, prunes, pummelo, quince, raspberry, rose apple, sapota, custard apple (seethaphal), strawberry, tomato ripe, tree tomato, wood apple, zizyphus.

### Nuts

Nutrient composition for nuts is mean of almond, arecanut, avocado pear (nut), cashewnut, chilgoza, coconut, dry, coconut, fresh garden cress seeds, gingelly seeds, groundnut, groundnut, roasted, linseed, mustard seeds, niger seeds, pistachionut, piyal seeds, safflower seeds, sunflower seeds, walnut, water melon seeds (kernal), arisithippili, asafoetida, cardamom, chillies, dry, chillies, green, cloves, dry, cloves, green, coriander, cumin seeds, fenugreek seeds, garlic, dry, ginger, fresh, lime peel, mace, mango powder, nutmeg, nutmeg rind, omum, pepper, dry, pepper, green, peppali, poppy seeds, tamarind pulp, turmeric.

### Poultry, meat & sea foods

Nutrient composition for fish sea foods is mean of fish sea foods, air, anchovy, bacha, bam, baspata machli, bata, small varieties, beley, bhanger, fresh, bhangan bata, bhukti fresh, bhola, big jawed jumper,

boal, blue mussel, cat fish, chela, chital crab muscle, crab small, folui, ghol, goggler, herring, Indian, herring ox-eyed, hilsa, horse ,mackerel, Indian whiting, jew fish (kora), jew fish (pallikora), kalabasu,

Katla, khorsula, khoyra fresh, koi, koocha machli, lata, lobster, mackerel, magur, mahasole, mrigal, mullet, mussel, fresh water, oil sardine, pabda, parsey fresh, pomfrets, black, pomfrets, white, prawn, puti, ravas, ray, ribbon fish fresh, rohu, sardine, sarputi, shark, seer, silver belly, singhala, singhi, sole, sole (malahar), surmai fresh, tartoor, tengra fresh, tunny, white bait.

Nutrient composition for dry fish is mean of bhagon dried, bhekti dried, bombay duck, dried, chela dried, chingri small dried, chingri goda, dried, khoyra dried, mandeli, dried, mutijella, dried, parsey dried, ribbon fish dried, shrimp (small, dried), surmai dried, tapra (dried), tapsi (dried), tengra dried.

Nutrient composition for meat & chicken is mean of beef muscle, buffalo meat, duck, finch, fowl, goat meat (lean), grey quail, mutton, muscle, pigeon, pork, muscle, ruff and reeve.

### **Milk & milk products**

Nutrient composition for milk is mean of milk ass's, milk buffalo's, milk cow's, milk goat's, curds (cow's milk), butter milk, skimmed milk, liquid.

Nutrient composition for milk products is mean of channa, cow's milk, channa, buffalo's, cheese, khoa (whole buffalo milk), khoa (skimmed buffalo milk), khoa (whole cow milk), skimmed milk powder (cow's milk), whole milk powder (cow's milk).



## ICMR-NIN, Dietary Guidelines for Indians Expert Committee Members-2024

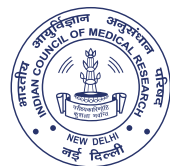


### Sitting (R-L)

Dr. K. V. Radhakrishna, Dr. K. Damayanti, Dr. Hemalatha R-Chairperson, Dr. Kamala Krishnaswamy, Dr. B. Sesikeran, Dr. GNV. Brahmam, Dr. K. Madhavan Nair

### Standing (R-L)

Dr. N. Arlappa, Dr. Ahmed Ibrahim, Dr. SubbaRao M Gavaravarapu, Dr. P. Uday Kumar-Member Secretary, Dr. V. Sudershan Rao, Dr. D. Raghunatha Rao, Dr. Bharathi Kulkarni



**icmr** | **NIN**  
INDIAN COUNCIL OF MEDICAL RESEARCH | NATIONAL INSTITUTE OF NUTRITION

## ICMR-NATIONAL INSTITUTE OF NUTRITION

Indian Council of Medical Research

Ministry of Health and Family Welfare, Government of India

Tarnaka, Hyderabad - 500 007, Telangana. INDIA.

Website: [www.nin.res.in](http://www.nin.res.in)