



FOGSI focus: Healthy **w** **men** for a healthy **nation**





23 essential
vitamins
and minerals
provide everyday
strength

Meets
100% daily
requirement of
Calcium and
Vitamin D



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FROM THE **PRESIDENT'S DESK**



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As of 2023, India has a population of approximately 691.7 million women, representing 48.4% of the total population. The Ministry of Statistics and Programme Implementation (MoSPI) anticipates that this number will rise to 742.7 million by 2036. Promoting preventive and therapeutic services for women and children is a central tenet of the Federation of Obstetric and Gynaecological Societies of India (FOGSI) mission.

This edition of **FOGSI Focus** explores the complex landscape of women's health in India, an urgent and vital issue. Women's health significantly influences the health of future generations, making it a critical area of concern. Malnutrition among women not only affects individual health but also has intergenerational consequences, highlighting the need for targeted interventions to improve women's health and nutrition.

We aim for this publication to act as a call for addressing the persistent health disparities faced by women in India. It provides detailed data on current nutritional deficiencies and outlines the challenges as well as potential solutions for overcoming barriers to adequate nutrition among women across all ages and socio-economic backgrounds.

It is our hope that this book serves as a vital resource for policymakers, healthcare professionals, and all individuals dedicated to advancing women's health in India. We aspire that this work will inspire positive change and enhance understanding of the unique health needs of women across diverse age groups.



FROM THE **DESK OF THE EDITOR-IN-CHIEF**



Dr. Nandita Palshetkar

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A healthy woman is vital to a thriving society, and the nutritional status of women serves as a critical indicator of the overall health and well-being of a community and its healthcare system. This issue of **FOGSI Focus** aims to deepen our understanding of the scope of women's health issues while identifying the associated challenges and potential solutions.

This comprehensive exploration of women's health in India significantly enhances our awareness of this crucial topic. Nutritional inadequacies among women not only affect their well-being but also have cascading effects on their children and families, as evidenced by various economic indicators. Consequently, women's nutrition is influenced by a multitude of complex factors and has far-reaching health and social implications.

The intricacies of women's nutrition are highlighted by the evolving needs throughout different life stages, including adolescence, reproductive years, pregnancy, lactation, perimenopause, and menopause. Each demographic faces unique challenges, necessitating that nutritional solutions be tailored to their specific age-related needs and, in a diverse country like India, to their varying socioeconomic conditions.

What distinguishes this book is its holistic approach. It not only identifies the problems but also provides actionable solutions, paving the way for future progress. The discussions regarding challenges and future directions for women's health in India offer readers a nuanced perspective on collective efforts toward a healthier future for all women.

This book is intended not only for the medical community but also for anyone invested in the well-being of women in India. It serves as a potent reminder of the significant work ahead and the considerable potential for enhancing women's health. The insights within these pages act as a beacon of hope and a call to action that we can no longer overlook.



PREFACE

Women's nutrition in India is a multifaceted issue that spans across different age groups, each with its unique nutritional requirements and challenges. Adolescence marks a crucial period for girls' development, where adequate nutrition is essential for optimal growth and health. However, many adolescent girls in India face nutritional deficiencies due to factors such as poor dietary diversity, lack of access to nutritious food, and cultural practices that prioritize male nutrition over female nutrition. Addressing these challenges requires targeted interventions, including nutrition education, supplementation programs, and ensuring access to nutrient-rich foods like fruits, vegetables, and dairy products.

Women of reproductive age, encompassing those from adolescence to around 49 years old, require specific nutrients to support their reproductive health and overall well-being. Iron and folic acid are particularly important during this stage to prevent anemia and support fetal development during pregnancy. However, many women in India, especially those from marginalized communities, suffer from micronutrient deficiencies due to inadequate diets and limited access to healthcare services. Empowering women with knowledge about proper nutrition, promoting the consumption of micronutrient-rich foods, and implementing supplementation programs can help improve the nutritional status of women of reproductive age and contribute to better maternal and child health outcomes.

During pregnancy and lactation, women's nutritional needs increase significantly to support the growth and development of the fetus and to ensure an adequate supply of nutrients for breastfeeding. Adequate intake of protein, iron, calcium, vitamins, and other essential nutrients is crucial during this period to prevent maternal and infant complications such as low birth weight and stunted growth. However, many pregnant and lactating women in India face barriers to accessing nutritious foods and prenatal care, putting them at risk of malnutrition and related health issues. Therefore, it is imperative for policymakers to prioritize maternal nutrition interventions, including antenatal care programs, supplementation with essential nutrients, and support for breastfeeding mothers to improve the health outcomes of both women and their children. Additionally,

postmenopausal women require special attention to maintain their bone health and overall nutritional status. Adequate intake of calcium, vitamin D, and protein, along with regular physical activity can help mitigate the risk of osteoporosis and other age-related health conditions in this population. Promoting healthy dietary habits and lifestyle choices among postmenopausal women can contribute to their overall well-being and quality-of-life. By addressing the nutritional needs of women across different life stages, India can pave the way for healthier and more empowered women who can contribute to the nation's development.



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Chapter 1

Women's health and nutrition through the lifespan

Women play a central role in the nutritional status of children. Undernutrition in women is a crucial problem that requires the urgent attention of healthcare professionals and policymakers.¹ A number of health conditions are specific to women, or are more common or more serious in women with higher mortality and morbidity rates. In addition, certain conditions may have distinct causes or manifestations in women, or can have different treatment outcomes in women.² In 2017, the Global Burden of Disease Study found that poor diets caused more deaths than did all other risk factors, attributable to a total of 11 million deaths, with 3 million deaths each due to high sodium intake and low intake of whole grains, and 2 million deaths due to low intake of fruits.³

“

“Women's deprivation in terms of nutrition and healthcare rebounds on society in the form of ill-health of their offspring — males and females alike.” — Siddiq Osmani and Amartya Sen⁴

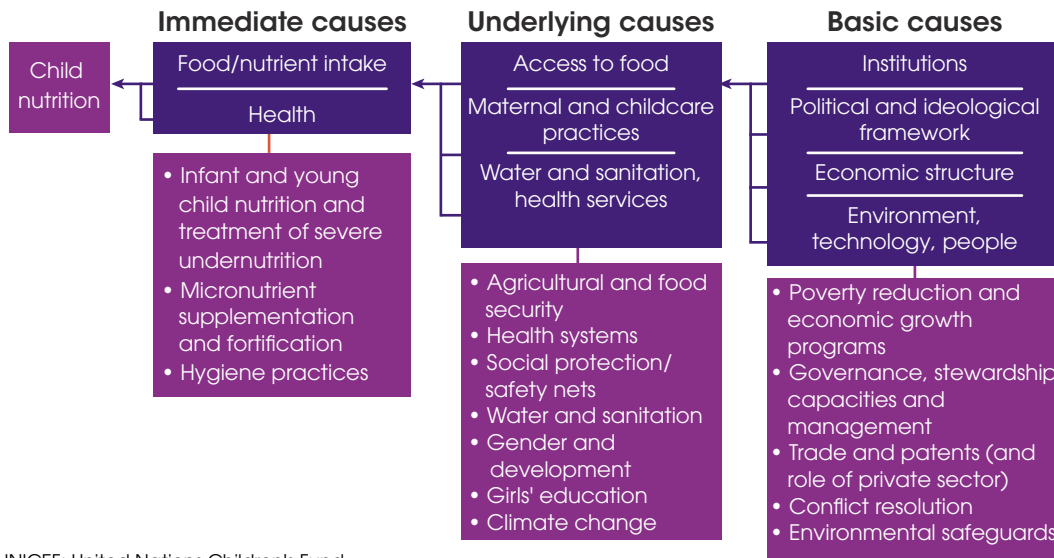
The prevalence rate of undernutrition in women is much higher in rural areas (40.6%) compared to urban regions (25%). The undernutrition rates in women in low wealth index are almost three-fold higher compared to those in highest wealth index. Overnutrition in women is also observed to be an emerging problem in India, with serious implications on adult-onset non-communicable diseases (NCDs).¹ Obesity is a known risk factor for infertility and birth complications, while being underweight is associated with poorer fertility and birth outcomes. The highest risk of infertility is seen in women with body mass index (BMI) <20 kg/m². Obesity is noted in 40–60% of women with polycystic ovary syndrome (PCOS), and PCOS increases the risk of NCDs including metabolic syndrome and cardiovascular diseases.⁵

Undernutrition in women is caused by various direct and indirect factors (Figure 1),⁴ including access to adequate and diversified food, early marriage and conception, domestic violence, and the lack of education, empowerment and decision-making power, etc.¹ In addition, limited availability and high cost of pulses and meat drive a large proportion of the population to consume cereal-based diets, which do not provide all essential macro- and micronutrients. In parallel, the availability of processed foods which are high in fat, sugar, and salt has increased due to affordable prices and aggressive marketing by manufacturers. Thus, expenditure on nutrient-poor foods has displaced the consumption of nutrient-rich foods, leading to micronutrient deficiencies and obesity among adults as well as children.⁶ Health policies in India have been devised to address these issues, but implementation is lacking. The crucial role of women's nutrition on their right to healthy living as well as for reducing undernutrition in children needs to be recognized and accorded a high program priority.¹

Undernutrition is both the cause and effect of poverty. Poor women do not get the right diet, and neither are they aware of the benefits of such a diet. Women's access to basic social infrastructure facilities such as toilet facilities, clean cooking fuel and drinking water are also important variables determining their well-being.⁷



Figure 1. Causes of malnutrition and entry points for intervention as described by UNICEF



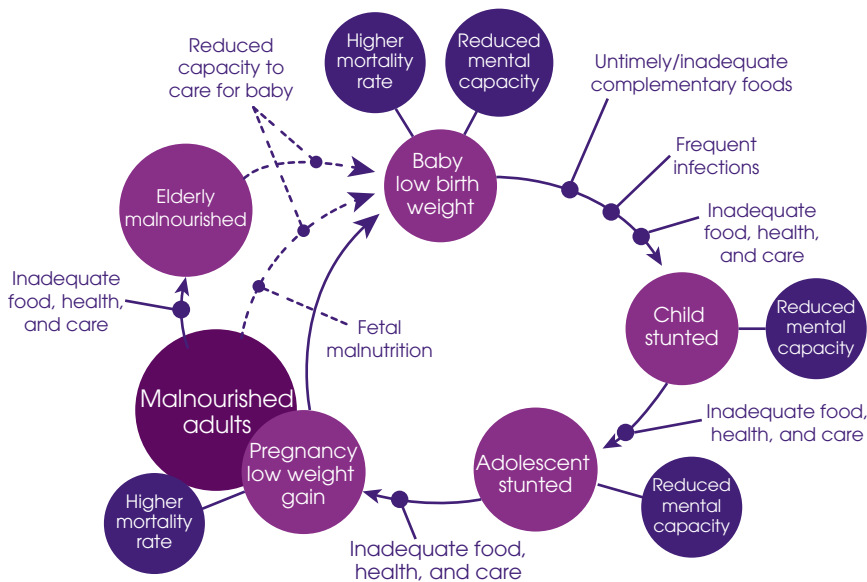
UNICEF: United Nations Children's Fund.

Intergenerational cycle of malnutrition

Babies born with low birth weight grow up to be stunted adolescents and adults. During pregnancy, malnourished women gain less weight, which increases their risk of delivering small infants. Inadequate food intake and care along with increased nutritional needs related to menstruation, pregnancy, and lactation put girls and women at a particularly high risk for malnutrition. Babies born small for gestational age (SGA) run the risk of impaired mental development and inadequate growth, especially when they are not well cared for. In this way, poverty and undernutrition are perpetuated through the life cycle (Figure 2). This phenomenon spans more than two generations through changes in DNA.⁴



Figure 2. Intergenerational cycle of malnutrition



Defining the nutritional needs of Indian women through RDAs

The recommended dietary allowance (RDA) is the average daily dietary intake level that suffices to meet the nutrient requirements of nearly all (97–98%) healthy persons of specific sex, age, or physiological condition.⁸

RDAs are the levels of intake of essential nutrients that, based on scientific knowledge, are judged to be adequate to meet the known nutrient needs of practically all healthy persons. RDAs are intended to reflect the best scientific judgment on nutrient allowances for the maintenance of good health and to serve as the basis for evaluating the adequacy of diets of groups of people.⁹

RDAs should reduce the risk of developing a condition that is associated with the nutrient in question and that has a negative functional outcome. The Estimated Average Requirement (EAR) is the daily intake value that is estimated to meet the requirement, as defined by the specified indicator of adequacy, in half of the apparently healthy individuals in a life stage or gender group.¹⁰

The Indian Council of Medical Research (ICMR)-National Institute of Nutrition (NIN) has defined the RDA and EAR for Indian adults and children based on age and gender. The requirements will be summarized in the subsequent chapters of this book.

Prescribing practices of micronutrient supplementation: Brief findings of the NURTURE (Nutrition Understanding and Research Through the Unique Roles of Experts) survey

A survey was conducted among Indian gynecologists to understand their practices regarding micronutrient supplementation among women of various age groups. The survey covered questions regarding adolescent girls recently attaining menarche, women planning pregnancy, pregnant women, postpartum women, perimenopausal women, postmenopausal women and those with osteoporosis, and covered specific indications including anemia in adolescent girls, women with endometriosis, and women with PCOS. The questions focused on factors that prompt micronutrient supplementation, specific micronutrients for the different age groups and specific conditions.

As of May 31st, 2024, a total of 484 doctors had completed the survey. Data analysis revealed:

- **Rates of obesity are alarming:** 49.8% of doctors responded that over 25% of the patients are obese.
- **Awareness of dietary requirements is lacking:** Two-thirds of doctors (67.6%) responded that less than 25% of the patients are aware of dietary requirements for their age.
- **Common deficiencies in women:** ~82% of doctors responded that iron, calcium and vitamin D deficiencies are commonly encountered among women.
- **Micronutrient requirements:**
 - ▶ ~83% of doctors responded that all vitamins and minerals are required by adolescent girls.
 - ▶ 77% of doctors responded that calcium and vitamin D are essential for breastfeeding women.

- ▶ Omega 3 fatty acids and DHA were considered essential for breastfeeding women by 15.9% of doctors, while iron and folic acid were considered essential for breastfeeding women by 18.6% of doctors.
- **Impact of micronutrient deficiencies:**
 - ▶ 78.7% of doctors responded that vitamin D is a crucial micronutrient associated with PCOS.
 - ▶ ~54% of doctors responded that vitamin D deficiency is associated with infertility, while ~25% of doctors responded that zinc deficiency is associated with infertility.

Scope of FOGSI Focus

In this issue of *FOGSI Focus*, women's health and nutrition across the lifespan will be discussed. Nutritional requirements across age groups varies, i.e., from adolescents to women of reproductive age, pregnant and lactating women, and menopausal/postmenopausal women. Each of these age groups has been covered in a separate chapter of this book.

Summary

Undernutrition in women requires the urgent attention of healthcare professionals and policymakers. A number of health conditions are specific to women, or are more common or more serious in women with higher mortality and morbidity rates. Apart from the inadequate diet or inappropriate consumption of foods, socioeconomic status plays a role in nutrition and health. Undernutrition is both the cause and effect of poverty. Poverty and undernutrition are perpetuated through the life cycle. This phenomenon spans more than two generations, through DNA alterations.

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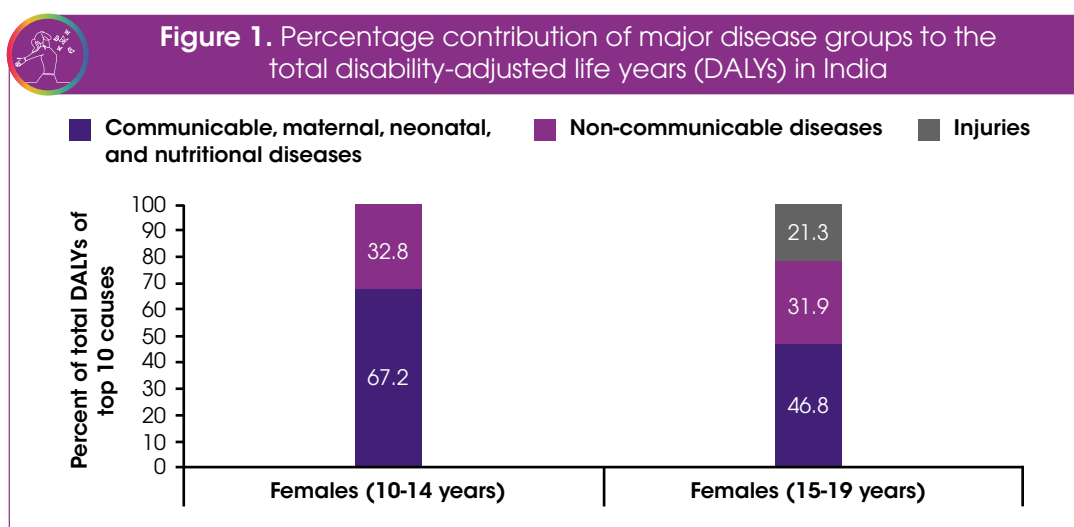
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Chapter 2

Economic impact of nutritional deficiencies amongst women in India

An estimated 6.75 million and 9.25 million disability-adjusted life-years (DALYs) were attributed to females in the 10–14 years and 15–19 years age groups, 39.1% and 44.2% of it accounted for by years of life lost (YLLs), respectively. In the 10–14 years, five out of the top 10 causes of DALYs were communicable, maternal, neonatal, and nutritional diseases (CMNNDs) contributing 67.2% of the total DALYs and the remaining were non-communicable diseases (NCDs) contributing 32.8% of the total DALYs (Figure 1). The pattern in the top 10 causes of DALYs and YLLs in 15–19 years was different than the 10–14 years age group, as injuries contributed to 21.3% and 45.3% of the total respective DALYs and YLLs.¹



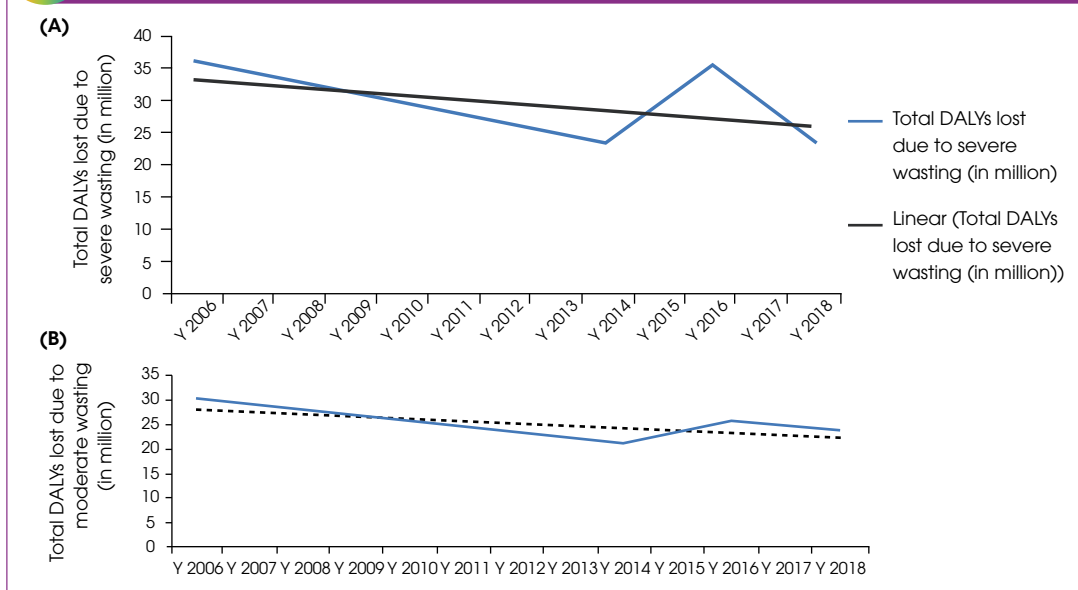
DALYs: Disability-adjusted life-years.

Maternal nutrition affects infant health as well. Childhood wasting and stunting are a cause of concern in India. If a child had his first episode of severe wasting at the age of 2.3 years and survives, the total disabled life lived by the child due to severe wasting was 67.4 years, without adjusting for discounting and disability weight for severe wasting. Using the standard YLDs formula given above, YLDs due to severe wasting for the child who survived, after adjusting for discounting (0.03) and disability weight for severe wasting (0.128) was calculated as 3.702 years. Figure 2A describes the DALYs lost due to severe wasting and Figure 2B describes DALYs lost due to wasting-induced stunting in India. Figure 3 describes the estimated annual economic loss with respect to gross domestic product (GDP) due to malnutrition in India.

Communicable, maternal, neonatal, and nutritional diseases (CMNNDs) contribute to 67.2% of the total DALYs among women in India.¹



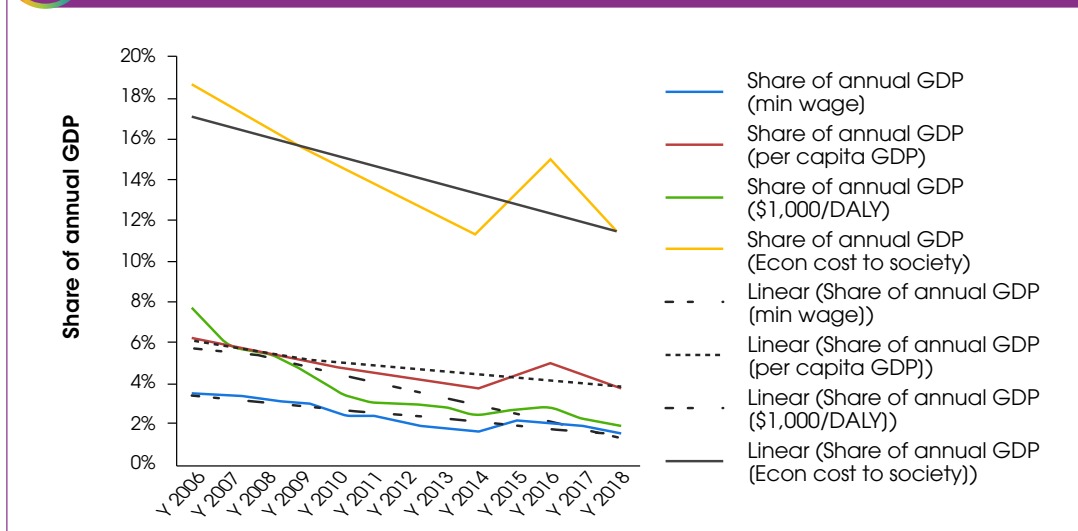
Figure 2. DALYs lost due to (A) Severe wasting (B) Wasting-induced stunting



DALYs: Disability-adjusted life-years; Y: Year.



Figure 3. Estimated economic loss with respect to annual GDP



DALYs: Disability-adjusted life-years; Econ: Economic; GDP: Gross domestic product; min: Minimum; Y: Year.

Summary

Economic burden of disease in India is largely due to communicable, maternal, neonatal, and nutritional diseases (CMNNDs). Furthermore, maternal nutrition has a major impact on the nutrition and health of the infant. It is, thus, necessary to address women's nutrition to build a healthy society and reduce the health and economic burden of disease.

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Chapter 3 Adolescent health

During adolescence, rapid growth and development, along with biological and psychological changes occur. These changes are affected by socio-cultural factors. Early adolescence, from the age of 10 to 14 years, is marked by pubertal changes, while late adolescence, from 15 to 19 years, is characterized by sexual maturation and development of adult roles and responsibilities. Adolescents, therefore, have nutritional requirements that overlap with those of children and adults. A compounding factor in low- and middle-income countries is the burden of overweight and obesity as well as undernutrition within the same population.¹

Dietary behaviors established in adolescence may contribute to nutrition-related problems that have consequences for long-term health.² The World Health Organization (WHO) estimates that roughly 70% of premature deaths among adults can be linked to behavior that was initiated during adolescence. Malnutrition weakens the ability to survive childbirth, increases susceptibility to infections, and depletes resources required for recovering from illnesses.³

One of the crucial issues associated with obesity is early menarche. Globally, the age of menarche has advanced over the past decades. In India, the mean menarcheal age has declined from 16.50 years to 12.43 years over the last 40 years.⁴ This could be attributed to the change in lifestyle, habits, and diet, which has led to increasing prevalence of obesity.⁵ A study in India demonstrated a significant shift towards early onset of puberty by six months (12.46 years vs. 12.06 years, $p < 0.05$) and early progression from stage 2 to 5 was observed in overweight/obese girls.⁶

Burden of malnutrition in adolescents

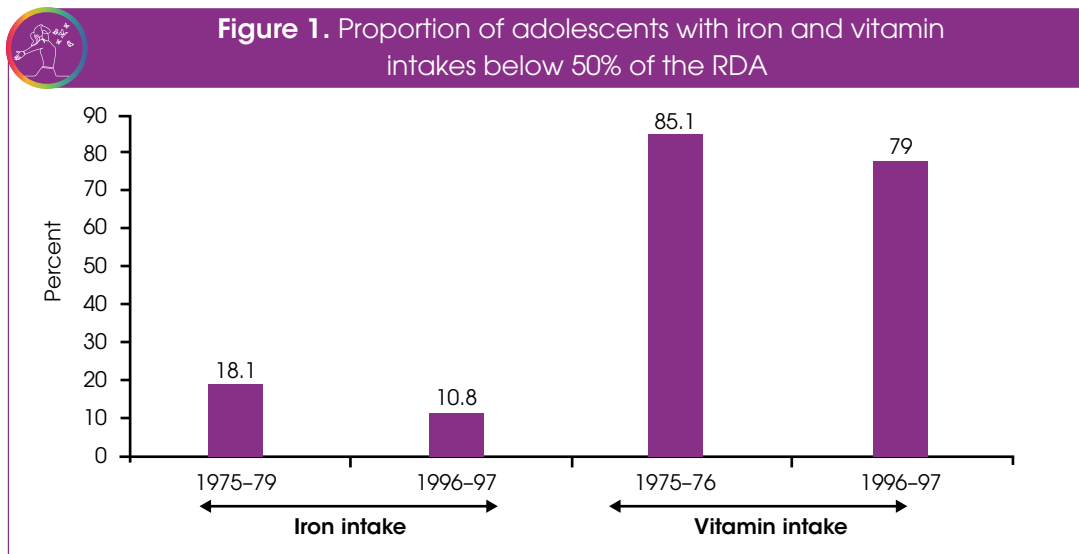
The National Family Health Survey (NFHS) reported that the prevalence of short-statured women of reproductive age-group (<145 cm) was 12.7% in NFHS-4. The prevalence of stunting is 34.4% (95% confidence interval (CI) 34.2–34.7%) in girls. A significant increase in stunting from NFHS-3 to NFHS-4 for girls, in urban/rural populations, and within the wealth quintiles ($p < 0.001$) was observed. The prevalence of thin was 46.8% and 42% in NFHS-3 and NFHS-4, respectively. Overweight has been reported for 2.4% of girls in the NFHS-3, which increased to 4.2% in NFHS-4. There was a clear socioeconomic gradient as there were higher thinness and stunting in rural areas. Therefore, the problem of stunting in this age group is much bigger than thinness and there is a trend indicating an increase in overweight.¹

In a cross-sectional survey of adolescent girls in India, girls of the middle and upper socioeconomic strata were about 35 times more likely to be obese (odds ratio (OR) 35.12) and 12 times more likely to be overweight (OR 12.46) as compared to those in lower income groups. The girls in the

Poor nutrition can manifest as failure in achieving maturation with a stunted linear growth. This perpetuates the cycle of poverty and intergenerational undernutrition. In addition, the risk of non-communicable diseases (NCDs) increases.¹

mid- and late-adolescent age group were less susceptible to being underweight for age (OR 0.28). The probability of overweight and obesity were about 3 times (OR 3.13) and 10 times (OR 9.66) higher among adolescent girls residing in urban areas as compared to rural areas.⁷

Multiple micronutrient deficiencies have been reported in adolescent girls in India. A recent study reported that only 19.1% of girls had adequate levels of all micronutrients tested (iron, vitamin B12, zinc, copper, selenium, and iodine). It was noted that 24.1% and 11.8% of girls had two or three micronutrient deficiencies, respectively. Vitamin B12 deficiency was higher in obese adolescent girls compared to those who had normal body weight (60.53% vs. 36.46%). Thus, evidence indicates a double burden of malnutrition among adolescent girls, from undernutrition to overweight, but with failing micronutrient levels.⁸ A study reported the proportion of adolescents with iron and vitamin intakes below 50% of the recommended dietary allowance (RDA) (Figure 1).⁹



RDA: Recommended dietary allowance.

Adolescents with nutritional deficiencies are likely to face short physique, cognitive impairment, mental functioning, and reduced immunity whereas overweight and obese adolescents often experience low self-esteem, distorted body image and are at higher risk for developing non-communicable diseases (NCDs) including mental disorders. Adolescent girls are more susceptible to infections, face difficulties in recovering from illnesses and surviving childbirth in future or more likely to deliver low birth weight babies.¹⁰

Multiple micronutrient deficiencies have been reported in adolescent girls in India.^{9,10}

Nutritional requirements of adolescent girls

The changes in height, weight and body composition during adolescence are described in Table 1.³ The Indian Council of Medical Research (ICMR)-National Institute of Nutrition (NIN) guidelines for the recommended dietary allowance (RDA), estimated average requirement (EAR), and nutrient intake are described in Tables 2 to 6.^{11,12}





Table 1. Changes in height, weight, and body composition for adolescent girls

Parameter	Change	Factors affecting change in parameter
Height	15–20% of adult height is gained during adolescence. Growth spurt starts later in boys than girls and has a higher peak velocity than in girls.	Linear growth can be slowed or delayed in adolescence if diet is severely restricted in energy or energy expenditure is increased.
Weight	25–50% of final adult ideal weight is gained during adolescence.	
Body composition	Approximately 45% of skeletal mass is added during adolescence. By the age of 20 years, 90% of total bone mass is gained. Growing boys gain proportionately more muscle mass than fat, and more lean body mass as compared to girls.	Females with delayed puberty fail to gain bone mass at a normal rate and show lower mineral density as adults. Nutrition is one of the environmental factors that determines onset of puberty.



Table 2. ICMR-NIN guideline for RDA for adolescent girls

Age	Body wt	Protein	Dietary Fiber*	Cal cium	Magne sium	Iron	Zinc	Iodine	Thia mine	Ribo flavin	Niacin	Vit B6	Folate	Vit B12	Vit C	Vit A	Vit D
	(kg)	(g/kg/d)	(g/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(µg/d)	(mg/d)	(µg/d)	(IU/d)
10-12 y	36.4	0.90	30	850	250	28	8.5	100	1.4	1.9	14	1.9	225	2.2	50	790	600
13-15 y	49.6	0.87	36	1,000	340	30	12.8	140	1.6	2.2	16	2.2	245	2.2	65	890	600
16-18 y	55.7	0.83	38	1,050	380	32	14.2	140	1.7	2.3	17	2.3	270	2.2	70	860	600

d: Day; ICMR: Indian Council of Medical Research; NIN: National Institute of Nutrition; RDA: Recommended dietary allowance; Vit: Vitamin; Wt: Weight; y: Years



Table 3. ICMR-NIN guideline for EAR for adolescent girls

Age	Body wt	Energy (**)	Protein	Cal cium	Magne sium	Iron	Zinc	Iodine	Thia mine	Ribo flavin	Niacin	Vit B6	Folate	Vit B12	Vit C	Vit A	Vit D
	(kg)	(Kcal/kg/d)	(g/kg/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(µg/d)	(mg/d)	(µg/d)	(IU/d)
10-12 y	36.4	57	0.73	650	207	16	7.1	70	1.2	1.6	12	1.6	186	2	44	370	400
13-15 y	49.6	49	0.70	800	282	17	10.7	100	1.3	1.9	13	1.8	204	2	55	420	400
16-18 y	55.7	45	0.67	850	317	18	11.8	100	1.4	1.9	14	1.9	223	2	57	400	400

d: Day; EAR: Estimated average requirement; ICMR: Indian Council of Medical Research; NIN: National Institute of Nutrition; Vit: Vitamin; Wt: Weight; y: Years.



Table 4. Suggested food groups for a balanced diet to meet the EAR of different nutrients

Age	Body wt (kg)	Cereals/ Millets (g) **	^A Pulses and Beans (g)	GLV (g)	Vege tables (g)	Roots and tubers (g)	Fruits (g)	Nuts (g)	Milk/ Curd (mL)	Fats and oils (g)	Energy (Kcal) obtained from these food groups	Crude protein (g) Obtained from these food groups
10-12 y	36.4	250	85	100	200	100	100	30	400	30	-2,060	70
13-15 y	49.6	300	100	100	200	100	100	30	400	40	-2,410	81
16-18 y	55.7	315	105	100	200	100	100	30	400	40	-2,490	85

EAR: Estimated average requirement; GLV: Green leafy vegetable; y: Years.



Table 5. Key vitamins in different food groups per 100 g 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) (µg)	Vitamin A (Retinol) (µg)	Vitamin D (D2) (µg)
Cereals	238.46	84.6	2,138.5	162.31	15.86	0	2.01	6.88
Millets	355.56	155.6	2,177.8	113.33	24.17	0	1.02	6.10
Pulses	400.00	158.8	2,123.5	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 and 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	3,210.0	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 and poultry	81.82	109.1	2,772.7	220.00	5.59	0	1.93	0
Fish and 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	1,066.7	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



Table 6. Key minerals in different food groups per 100 g weight

Foods	Calcium (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)
Cereals	18.1	69.1	2.73	1.71
Millets	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 and 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 and poultry	18.7	11.7	1.49	1.82
Fish and sea foods	323.1	4.4	2.16	0.20

Contd.



Foods	Calcium (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)
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	1,962.6	1.8	12.08	0.04
Cooking oil/fats	0	0	0	0
Table sugar	0	0	0	0

Healthy eating habits for adolescents

- Good eating habits should be inculcated at a young age, and this should form a part and parcel of a healthy lifestyle.²

Teenagers should be taught about the five healthy food groups, i.e., grains, proteins, vegetables, fruits, and dairy products:²

- Whole grains with low glycemic index give longer-lasting energy and satiety.
- Key dairy products (milk, cheese, and yogurt) are good sources of calcium and protein.
- Eating fruits and vegetables is important as they provide energy, vitamins, antioxidants as well as fiber and water.
- Protein-rich foods are important for growth and muscle development during puberty.
- Animal sources: Lean meat, fish, chicken, and eggs
- Vegetable sources: Beans, lentils, chickpeas, tofu, and nuts

Certain foods should be restricted or avoided:

- Adolescents should avoid salty/fatty/sugary foods, and low-fiber foods as such foods can lead to overweight, obesity, and type 2 diabetes mellitus.²
- Excessive consumption of sugary drinks can cause tooth decay and replace consumption of healthier drinks such as milk and fruit juice.^{2,9}

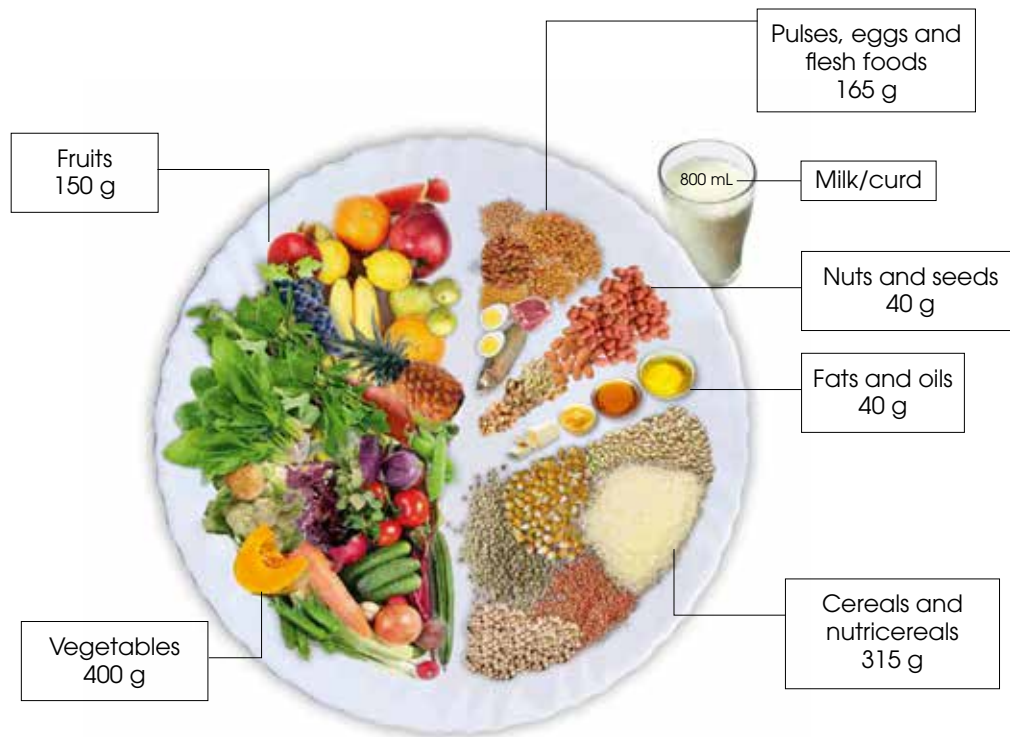
Nutritional requirements of growing adolescent girls require them to eat three regular meals a day with some snacks in between:²

- Skipping meals will lead to the deficiency of vitamins, minerals, and carbohydrates, which in turn leads to a lack of energy and difficulty in concentration.
- Adolescent girls need iron-rich food to compensate for monthly blood loss. Foods like meat, fish, green leafy vegetables, pulses, lentils, nuts, and seeds are good sources of iron.

- The suggested diet for girls and boys aged 16-18 years is depicted in Figure 2 (as recommended by ICMR-NIN, 2024).¹²



Figure 2. Suggested diet for physically active girls (weight ~56 kg; energy 2,490 kcal) aged 16–18 years



Need for micronutrient supplementation during adolescence

There is an increased demand for thiamine, riboflavin, and niacin for the release of energy from carbohydrates. The increased rate of growth and sexual maturation increases the demand for folic acid and vitamin B12. The rapid rate of skeletal growth demands for more vitamin D. Vitamins A, C, and E are needed in increased amounts for new cell growth. The vitamin needs of adolescents are also associated with the degree of maturity rather than chronological age because of demands of growth.⁹ Table 7 describes the benefits of micronutrient supplementation among adolescents.^{9,13-15}





Table 7. Outcomes of vitamin supplementation among adolescent Indians

Age and number of participants	Micronutrient formulation	Duration of supplementation	Outcomes
6–16 years; n=869 ¹²	Micronutrient-fortified beverage	14 months	Significant increase in mean increments of height and weight z-scores (–0.04 and 0.02, respectively for supplement vs. –0.14 and –0.09 for placebo) Velocity of weight was significantly higher (3.56 vs. 3.00; p<0.01) with supplementation Rate of change in height was 5.0 cm vs. national average of 4.7 cm Rate of change in weight was 3.5 vs. national average of 2.6 kg
Adolescent women; n=39 ¹³	Vitamin B12 2 µg/day, either alone (n=19) or with multiple micronutrients (n=20)	11 months	Vitamin B12 group: Plasma vitamin B12 levels increased Prevalence of anemia reduced from 79% to 59%
10–16 year-old girls; n=180 ¹⁴	Food supplement containing zinc- and micronutrient-rich foods (n=60); Ayurvedic zinc tablets (n=60); Control group (no supplementation; n=60)	10 weeks	Food supplement: Plasma zinc, β-carotene, and vitamin C levels increased Zinc supplement: Plasma zinc and retinol increased
Adolescents aged 10–19 years; girls: n=117; boys: n=127 ¹⁵	Weekly iron and folic acid (100 mg elemental iron and 500 µg folic acid) Distribution of albendazole tablets for de-worming bi-annually	52 weeks	Prevalence of anemia reduced from 79.5% to 58% among girls Mean increase in hemoglobin in girls: 1.3 g/dL

Need for deworming of adolescents

National deworming day aims to deworm all children up to the age of 19 years through the platform of schools. Adolescents up to the age of 19 years are given albendazole 400 mg.¹⁶

Summary

With the increasing prevalence of hidden malnutrition among Indian children, adolescence can be the second opportunity to catch up growth and cover the deficits suffered during childhood and to meet the demands of physical and cognitive growth and development, provide adequate stores of energy for illnesses and pregnancy, and prevent adult onset of nutrition-related diseases. Adolescents should be recognized as a priority target group as an integral part of health promotion and optimal nutrition through balanced diet and nutrient supplementation should be promoted in conjunction with healthy eating habits and physical activity.¹²

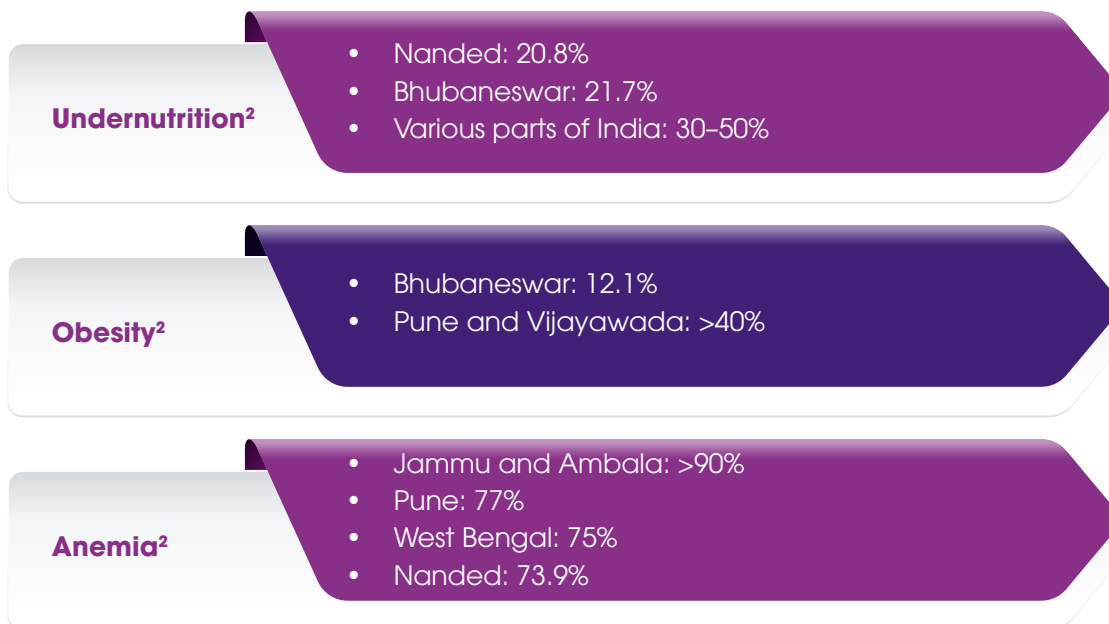
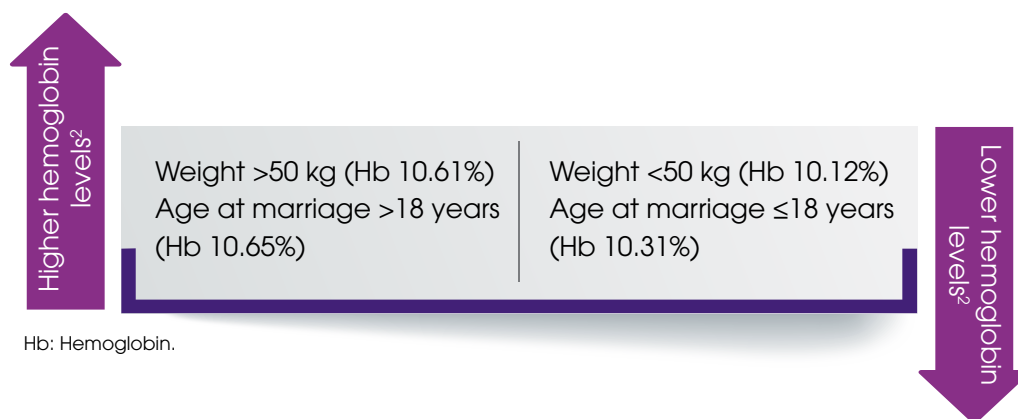
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Chapter 4 Women of reproductive age

In India, women of reproductive age (WRA) constitute 55% of the female population and one-fourth of the total population. Energy and protein shortages with micronutrient deficiencies of public health importance in the diet are widely prevalent among this group.¹ India is one of the countries with a very high prevalence of anemia in the world. As per National Family Health Survey-5 (NFHS-5), 57.2% of non-pregnant women in the WRA group are anemic.²



Dietary intakes of WRA are often inadequate

A cross-sectional survey in India reported that only 57% of WRA who were newly married met 70% of the recommended energy requirements and consumed less than three-fourths of the recommended intakes of energy, iron, calcium, folic acid, protein, and zinc in one day. On the contrary, the consumption of fat was 140% of the recommended intake (Table 1). Mean body mass index (BMI) and waist-hip ratio (WHR) of WRA were 20.9 kg/m² and 0.85, respectively.¹



Table 1. Median intake and percent adequacy of energy and various nutrients for newly-married women

Nutrients	Median intake	Adequacy (%)
Energy	1,404.4 kcal	73.9
Protein	37.8 g	68.7
Fat	27.4 g	140
Calcium	294.5 mg	49.1
Iron	11.0 mg	52.3
Vitamin C	35.7 mg	90
Zinc	5.3 mg	53
Folic acid	101.9 µg	51

Nutrient intakes of women vary depending on socioeconomic class and other factors:¹

Women of socially backward classes¹

- Median intakes of energy and most of the nutrients except fats were lower compared to the general class

Women of upper SEC¹

- Higher consumption of almost all the nutrients compared to lower SEC

Women residing in urban slums¹

- Significantly lower intake of all nutrients compared to counterparts in rural areas

Women registered at Anganwadi centers¹

- Higher consumption of proteins, fats, iron, folic acid, and calcium compared to those not registered

SEC: Socioeconomic class.

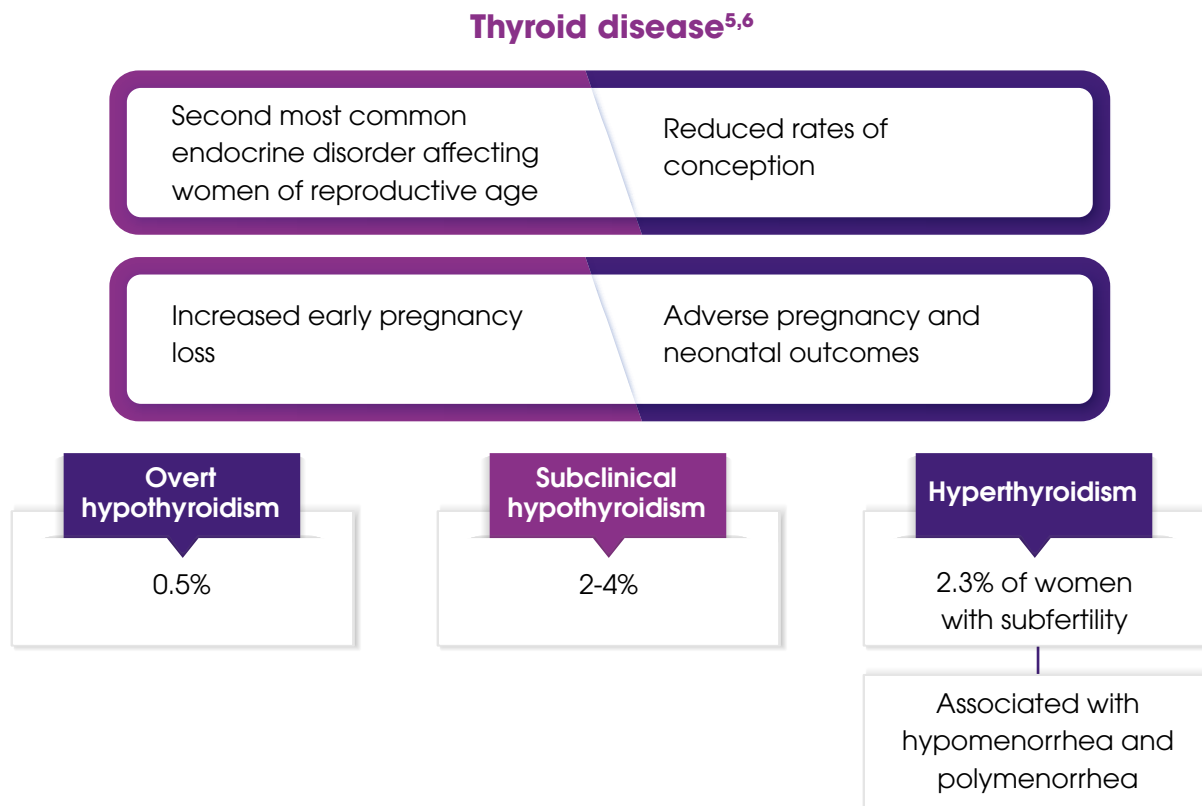


It is alarming that concurrent micronutrient deficiencies are prevalent in WRA. A study among rural and tribal women found that 40% of these women had two concurrent deficiencies, and 10% had concurrent deficiency of three or more micronutrients. Concurrent prevalence of zinc deficiency and anemia was the highest (34%) and was significantly higher among tribal women than rural women.³

Diseases of WRA linked to poor nutrition: Polycystic ovary syndrome, thyroid disease, and obesity

Polycystic ovary syndrome (PCOS) is a condition with a range of reproductive and metabolic features that affects 4–18% of reproductive-age women, depending on the diagnostic criteria used. PCOS typically involves hormonal imbalances, insulin resistance, and metabolic abnormalities, which significantly increase the risk of infertility, type 2 diabetes mellitus (T2DM), and cardiovascular disease (CVD) and reduce quality-of-life. About 90–95% of anovulatory women seeking treatment for infertility have PCOS, and many women are diagnosed with PCOS only when they seek treatment for infertility. Women with PCOS who become pregnant are at higher risk than those without PCOS of developing gestational diabetes mellitus or suffering a first-trimester spontaneous abortion.⁴

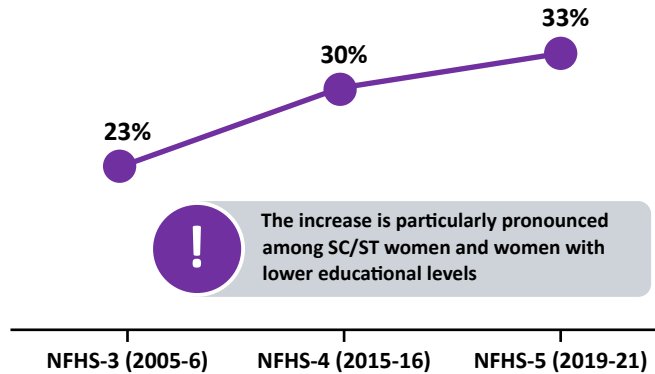
Thyroid disease among WRA can have various consequences:^{5,6}



Data from the NFHS indicates that there is an increase in the prevalence of obesity in WRA in urban India (Figure 1).⁷

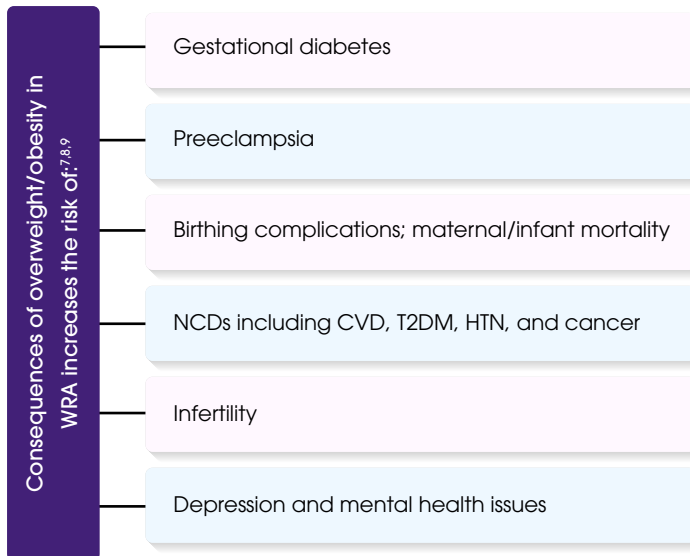


Figure 1. Increase in the prevalence of obesity among women of reproductive age, as per NFHS data



NFHS: National Family Health Survey; SC/ST: Scheduled castes/scheduled tribes.

In addition, ~50% of women aged 40–49 years exhibited overweight/obesity, while this was observed in <10% of women aged 15–19 years. Overall, older women (adjusted odds ratio (aOR) 5.98), those from the richest quintile (aOR 4.23), those living in south India (aOR 1.77), and those having diabetes (aOR 1.92) were more likely to be overweight/obese.⁷



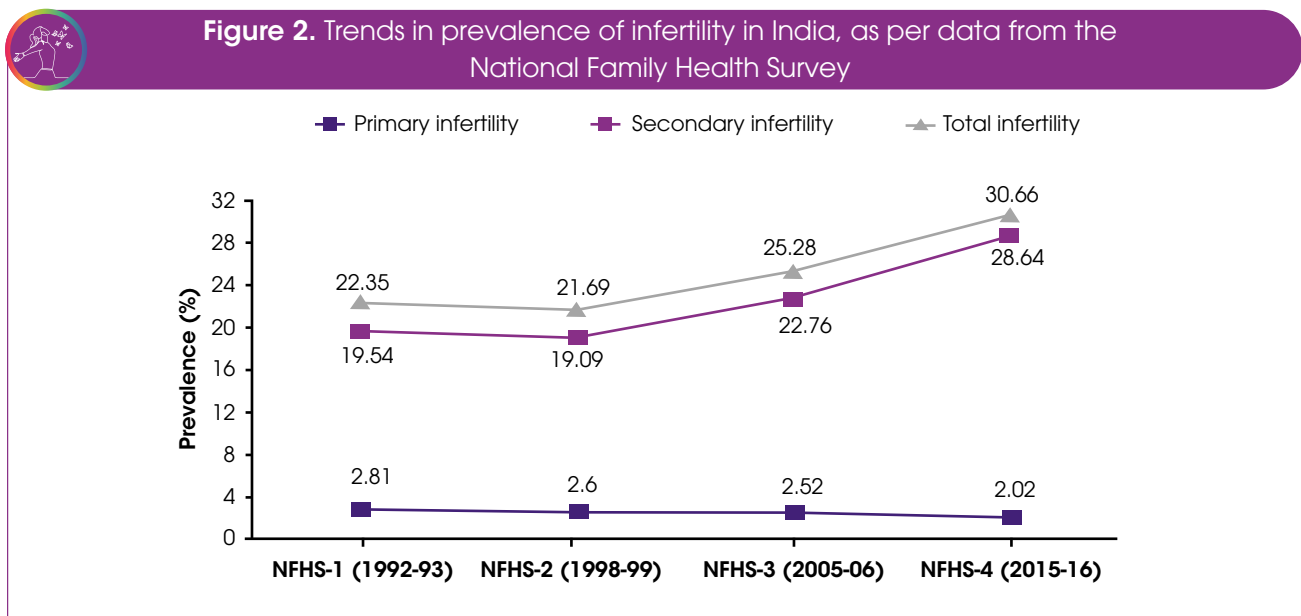
CVD: Cardiovascular disease; HTN: Hypertension; NCD: Non-communicable disease; T2DM: Type 2 diabetes mellitus; WRA: Women of reproductive age.



Infertility is increasing among Indian women

The estimates of the Census of India show that infertility in India has increased from 13% in 1981 to 16% in 2001 among ever-married women. The primary causes of infertility among women are menstrual disorders, diseases like obesity, thyroid diseases, diabetes, uterine factor, fallopian tubes, ovulation dysfunction, and cervical factor. Primary infertility is the inability to bear any children, either due to the inability to conceive or the inability to carry a pregnancy to a live birth; while secondary infertility is the inability to bear a child after having an earlier birth. Analysis of data from NFHS revealed that primary infertility declined steadily from 1992 to 2015, whereas secondary infertility increased during this time, with a resultant increase in overall infertility (Figure 2).⁹

Infertility in India has increased from 13% in 1981 to 16% in 2001 among ever-married women.⁹



NFHS: National Family Health Survey.

Among the lifestyle factors and disease associated with infertility, the risk of primary and secondary infertility was higher among women who consumed alcohol (odds ratio (OR) 1.116 and OR 1.522, respectively), those who smoked (OR 1.104 and OR 1.968, respectively), were obese (OR 1.114 and OR 3.162, respectively), had thyroid disease (OR 1.412 and OR 2.338, respectively), and had diabetes (OR 1.233 and OR 4.258, respectively).⁹

Nutritional requirements of women of reproductive age

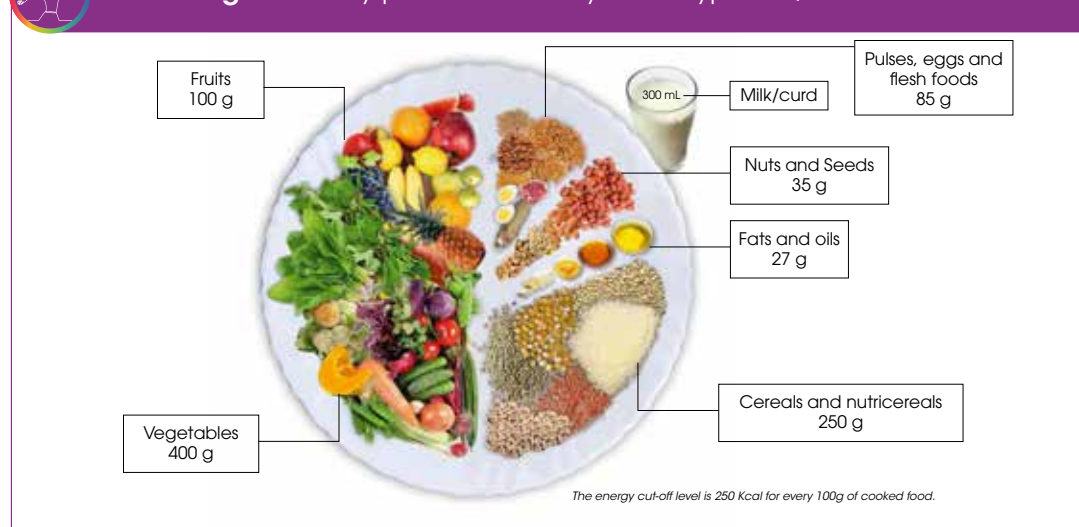
The Indian Council of Medical Research (ICMR)-National Institute of Nutrition (NIN) guidelines for the recommended dietary allowance (RDA) for women are described in Table 2.¹⁰ The suggested diet for adults requiring 2,000 kcal per day is described in Figure 3.¹¹

Table 2. ICMR-NIN guideline for RDA of nutrients for women

Category of work	Body wt	Protein	Dietary Fiber*	Cal cium	Magne sium	Iron	Zinc	Iod ine	Thia mine	Ribo flavin	Nia cin	Vit B6	Fola te	Vit B12	Vit C	Vit A	Vit D
	(kg)	(g/kg/d)	(g/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(µg/d)	(mg/d)	(µg/d)	(IU/d)
Sedentary	55	0.83	25	1,000	370	29	13.2	140	1.4	1.9	11	1.9	220	2.2	65	840	600
Moderate			30						1.7	2.4	14	1.9					
Heavy			40						2.2	3.1	18	2.4					

d: Day; ICMR: Indian Council of Medical Research; NIN: National Institute of Nutrition; RDA: Recommended dietary allowance; Vit: Vitamin; Wt: Weight.

Figure 3. "My plate for the day" for a typical 2,000 kcal diet



National and international policies for women's health

National policies

- **The Prime Minister's Overarching Scheme for Holistic Nourishment (POSHAN) Abhiyaan** is a multi-ministerial effort to address malnutrition by strengthening and converging actions to support nutrition. It supports several nutrition initiatives and policies to address micronutrient deficiencies. It aims to reduce the prevalence of anemia among women and adolescent girls in the age group of 15–49 years, with a target of 9% reduction.¹²
- **Universal Implementation of the National Food Security Act, 2013 (NFSA):** NFSA 2013 has been implemented in all 36 States and Union Territories (UTs), benefiting 80.72 crore persons in the country by providing them access to highly subsidized food grains at Rs. 1/2/3 per kg for coarse grains/wheat/rice, respectively.¹²

- **Rashtriya Kishor Swasthya Karyakram** focuses on sexual reproductive health, nutrition, injuries and violence, non-communicable diseases, mental health and substance misuse.¹²
- **Mission Parivar Vikas** aims to increase access to contraceptives and family planning services.¹²
- **The Intensified National Iron Plus Initiative** provides prophylactic iron and folic acid supplementation to six target age groups: children 6–59 months, adolescent girls (15–19 years), adolescent boys (15–19 years), pregnant women and lactating mothers, and WRA.¹³

FOGSI guidelines

- In pregnant women with established mild-to-moderate anemia with a period of gestation less than 30–32 weeks, and those who respond to a trial of oral iron, the treatment should continue with 100 mg elemental iron twice-daily and 500 µg of folic acid with an assessment for the rise in hemoglobin.¹⁴
 - ▶ A repeat hemoglobin test is recommended after 4 weeks of oral iron. After achieving the normalization of hemoglobin, a prophylactic daily iron supplementation (60–100 mg of iron and 500 µg of folic acid) is recommended for at least 6 months during pregnancy and should be continued in postpartum for another 6 months.¹⁴
- Parenteral iron could be an alternative to oral iron in patients who are unable to tolerate oral iron and are non-compliant or need rapid restoration of iron stores.¹⁴
 - ▶ Parenteral iron may be used from the second trimester and during the postpartum period.¹⁴

World Health Organization (WHO) guidance¹⁵

- As per the WHO, intermittent iron and folic acid supplementation is recommended as a public health intervention in menstruating women living in settings where anemia is highly prevalent, to improve their hemoglobin concentrations and iron status and reduce the risk of anemia.
- Intermittent supplementation, though not eliminating side effects, reduces their frequency and possibly their severity compared to daily supplementation.
- Intermittent iron supplementation is the provision of iron supplements once, twice, or three times a week on non-consecutive days.
- The rationale behind the intervention is that there is a limit to the iron absorption capacity of the intestine.
- Intermittent dosing may be as effective as daily supplementation because similar amounts of iron would reach the blood and tissues under both strategies.
- Intermittent supplementation has been shown to improve iron status more than no supplementation and, in many cases, it is as effective at improving iron status as daily supplementation.
- A suggested scheme for intermittent iron and folic acid supplementation in menstruating women is presented in Table 3.



Table 3. Suggested scheme for intermittent iron and folic acid supplementation in menstruating women¹⁵

Supplement composition	Iron: 60 mg of elemental iron; folic acid: 2,800 µg (2.8 mg)
Frequency	One supplement per week
Duration and time interval between periods of supplementation	3 months of supplementation followed by 3 months of no supplementation after which the provision of supplements should restart If feasible, intermittent supplements could be given throughout the school or calendar year
Target group	All menstruating adolescent girls and adult women
Settings	Populations where the prevalence of anemia among non-pregnant women of reproductive age is 20% or higher
*60 mg of elemental iron equals 300 mg of ferrous sulfate heptahydrate, 180 mg of ferrous fumarate or 500 mg of ferrous gluconate.	

Summary

The nutritional requirements of women of reproductive age are often not met through diet alone. This can lead to a number of conditions that impact not only reproductive health but can have long-term consequences as well. In addition, nutritional inadequacies and imbalances during this time will impact the health of offspring as well, thus perpetuating the intergenerational cycle of malnutrition. It is, thus, imperative to address nutritional deficiencies in this crucial subgroup.

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Chapter 5 Pregnancy, lactation and nutrition

Suboptimal dietary intake is a critical cause of poor maternal nutrition, with several adverse consequences both for mothers and for their children, thus making it a crucial public health issue. Maternal malnutrition is associated with increased risk of maternal morbidity, preterm deliveries, and small-for-gestational-age babies. Multiple supply- and demand-side factors influence maternal diets in India. Factors that influence maternal diet include food unavailability, economic constraints, low exposure to nutrition services and counseling, food restrictions and taboos during pregnancy, family influence, gender norms, and gaps in maternal knowledge.¹

Nutritional status of pregnant and lactating women in India

Analysis of data from a survey carried out by the National Nutrition Monitoring Bureau (NNMB) revealed that the median intake of energy was 1,736 kcal, compared to the estimated average requirement (EAR) of 2010 kcal, and the median intake of protein was 45 g, compared to the EAR of 54 g for sedentary pregnant women. About 50% of pregnant women had inadequate intakes of energy (Table 1).¹



Table 1. Median intake and percent adequacy of energy and various nutrients for newly-married women

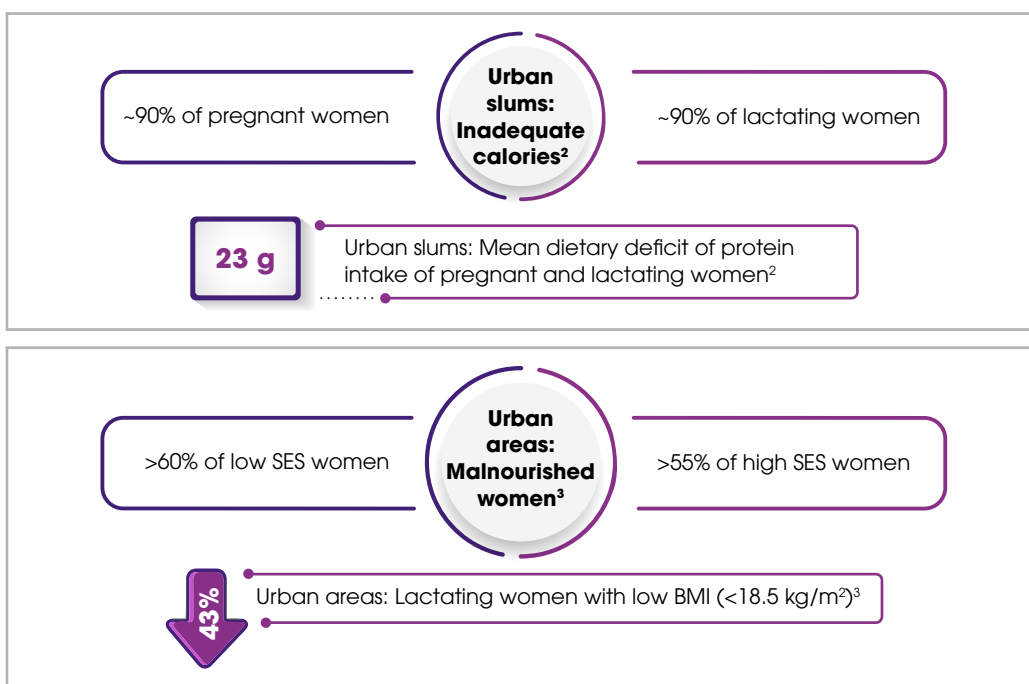
Nutrients	Median intake	Adequacy (%)
Energy	1,773 kcal	86.3
Protein	48.6 g	64.3
Fat	28.1 g	80.4
Calcium	418 mg	23.9
Iron	13.7 mg	22.0
Vitamin C	43 mg	49.4
Vitamin B1	1.3 mg	83.9
Vitamin B2	0.8 mg	47.5
Vitamin B3	13.8 mg	86.6
Folic acid	129 µg	28.0

The National Family Health Survey (NFHS) data revealed no improvement in dietary intakes among pregnant women between 2006 and 2016, except for dairy, which increased marginally over time (8 percentage points (pp)). Consumption of pulses and vegetables reduced over time (6 and 16 pp, respectively).¹

There is substantial subnational variation across states in consumption of pulses, dairy, and green vegetables (ranging from 3% to 80%).¹

A low proportion of pregnant women consumed animal-source foods in most states in 2015–2016 (<30%), with the exception of Kerala, where 65% of women consumed meat or fish. Similarly, low consumption of fruits was observed in most states.¹

Poor dietary habits of pregnant and lactating women in urban areas:^{2,3}



BMI: Body mass index; SES: Socioeconomic status.

Analysis of dietary diversity in India revealed that 56.5% of lactating women have a minimum diversified diet (MDD, comprising foods of 5 different food groups). The prevalence of lactating women with MDD was higher among households with higher income than those in the lower income group (73.1% vs. 50.7%). Food groups such as fruits, meat, poultry, fish, nuts, and seeds were among the rare food items in daily diet. Lactating women (in early phase) who received health and nutrition counseling services are more likely (odds ratio (OR) 2.37) to consume a diversified diet.⁴

A community-based cross-sectional study in India reported the prevalence of micronutrient deficiencies in pregnant women to be 42.4% for ferritin, 41.7% for vitamin B12, 11.5% for zinc, <1% for copper, <1% for selenium, and 14.4% for iodine. Multiple micronutrient deficiency along with anemia was reported among 19.4% of pregnant women. Vitamin B12 reported a positive correlation with zinc (r=0.212) and ferritin (r=0.195), whereas zinc and selenium (r=0.253) showed a positive correlation. Selenium had a highly significant correlation with copper (r=0.386).⁵




Impact of maternal nutrition on neonatal outcomes

Low birth weight (LBW) is highly prevalent in rural India. As a chronic undernutrition problem, poor birth outcomes are closely related to various nutritional factors, more prominently the poor maternal anthropometry at conception. A study in rural India demonstrated that mothers were young (21.46 ± 2.09 years), thin (46.46 ± 6.1 kg), short (153.39 ± 5.79 cm), and poorly nourished (19.74 ± 2.41 kg/m²). Mean birth weight was low ($2,655 \pm 507$ g), and the prevalence of LBW and stunting at birth was highest among mothers in the lower tertile of each of the anthropometric indicators. Stunting was significantly higher for mothers in lower tertile compared to higher tertile of weight (44.6 vs. 64.6%) and was also true for head circumference (43.7 vs. 60.6%).⁶

Nutritional requirements for pregnant women and lactating/postpartum women

Indian Council of Medical Research-National Institute of Nutrition guidelines

The Indian Council of Medical Research (ICMR)-National Institute of Nutrition (NIN) guidelines for the recommended dietary allowance (RDA) for women of reproductive age are described in Table 2.⁷

 **Table 2.** ICMR-NIN guideline for RDA for pregnant and lactating women⁷

Category of work	Body wt (kg)	Protein (g/kg/d)	Dietary Fiber* (g/d)	Calcium (mg/d)	Magnesium (mg/d)	Iron (mg/d)	Zinc (mg/d)	Iodine (µg/d)	Thiamine (mg/d)	Riboflavin (mg/d)	Niacin (mg/d)	Vit B6 (mg/d)	Folate (µg/d)	Vit B12 (µg/d)	Vit C (mg/d)	Vit A (µg/d)	Vit D (IU/d)
Pregnant woman	55+10	10.33 (2 nd trimester) 22.83 (3 rd trimester)	-	1,000	440	27	14.5	220	2.0	2.7	13	2.3	570	2.45	80	900	600
Lactation																	
0-6 m		17.83	-	1,200	400	23	14.1	280	2.1	3.0	16	2.16	330	3.2	115	950	600
7-12 m		13.83								2.9		2.07					

d: Day; ICMR: Indian Council of Medical Research; m: Months; NIN: National Institute of Nutrition; RDA: recommended dietary allowance; Vit: Vitamin; Wt: Weight.

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 8 g of protein is required daily during the second trimester, and an additional 18 g of protein is required daily during the third trimester. The additional calories and micronutrients required should be obtained from micronutrient-dense foods. The micronutrients required in higher quantities include iron, folic acid, calcium, vitamin D, vitamin A, vitamin B12, and polyunsaturated fatty acids. Table 3 describes the dietary requirements during pregnancy.⁸

Lactating women require an additional 600 calories of energy and 13.6 g of protein in the daily diet. In the next 6 months, an additional 520 calories of energy and 10.6 g of protein are required daily.⁸

Overall, 45% of energy requirements can be met through cereals and millets, while consumption of pulses contributes to protein intake, as well as intake of fiber and micronutrients. Good quality protein is derived from a combination of cereals and pulses (3:1), and animal foods including milk, fish, and meat.⁸



Table 3. Intake of various food groups during pregnancy according to ICMR-NIN

Food group	Quantity
Cereals and millets	240 g
Pulses	80 g
Nuts and seeds	40 g
Cooking oils and fats	20 mL
Vegetables, roots, and tubers	300 g
Green leafy vegetables	150 g
Fruits	150 g
Fish, lean meat	80 g/day or 250–300 g/week
Dairy	400 mL

ICMR: Indian Council of Medical Research; NIN: National Institute of Nutrition.

World Health Organization (WHO)⁹

- Daily oral iron and folic acid supplementation is recommended as part of antenatal care to reduce the risk of low birth weight, maternal anemia and iron deficiency.
- The WHO recommends **intermittent use of iron and folic acid supplements** by non-anemic pregnant women to prevent anemia and improve gestational outcomes.
- In malaria-endemic areas, **iron and folic acid supplementation** programs should be implemented in conjunction with measures to prevent, diagnose and treat malaria during pregnancy.
- In areas where there is a severe public health problem related to vitamin A deficiency, **vitamin A supplementation** during pregnancy is recommended for the prevention of night blindness.
- Supplementation of pregnant women with 1.5 to 2.0 grams of **elemental calcium** per day is recommended in areas where dietary calcium intake is low and for women at high risk of developing hypertensive disorders during pregnancy.
- Table 4 describes the supplementation recommended by the WHO.





Table 4. World Health Organization (WHO)-recommended supplementation of micronutrients during pregnancy

Micronutrient	Dose	Frequency	Duration
Iron	30–60 mg elemental iron	One supplement daily	Throughout pregnancy
	120 mg elemental iron	One supplement once per week	
Folate	400 µg (0.4 mg)	One supplement daily	Throughout pregnancy
	2,800 µg (2.8 mg)	One supplement once per week	
Vitamin A	Up to 10,000 IU	Daily	A minimum of 12 weeks during pregnancy until delivery
	Up to 25,000 IU	Weekly	
Calcium	1,500 mg	Three tablets (500 mg each) three times per day with meals	Throughout pregnancy
Iodine	250 µg	Daily	

Foods fortified with micronutrients may not meet fully the needs of certain nutritionally vulnerable subgroups such as pregnant and lactating women. For this reason, United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) have developed the daily multiple micronutrient formula shown in Table 5 to meet the reference nutrient intake (RNI) of these vulnerable groups.



Table 5. Composition of multiple micronutrient supplements for pregnant and lactating women, designed to provide the daily recommended intake of each nutrient

Micronutrient	Content
Vitamin A (µg)	800.0
Vitamin D (µg)	5.0
Vitamin E (mg)	15.0
Vitamin C (mg)	55.0
Thiamine (vitamin B1) (mg)	1.4
Riboflavin (vitamin B2) (mg)	1.4
Niacin (vitamin B3) (mg)	18.0
Vitamin B6 (mg)	1.9
Vitamin B12 (µg)	2.6
Folic acid (µg)	600.0
Iron (mg)	27.0
Zinc (mg)	10.0
Copper (mg)	1.15
Selenium (µg)	30.0
Iodine (µg)	250.0

Royal Australian College of General Practitioners (RACGP) guidance¹⁰

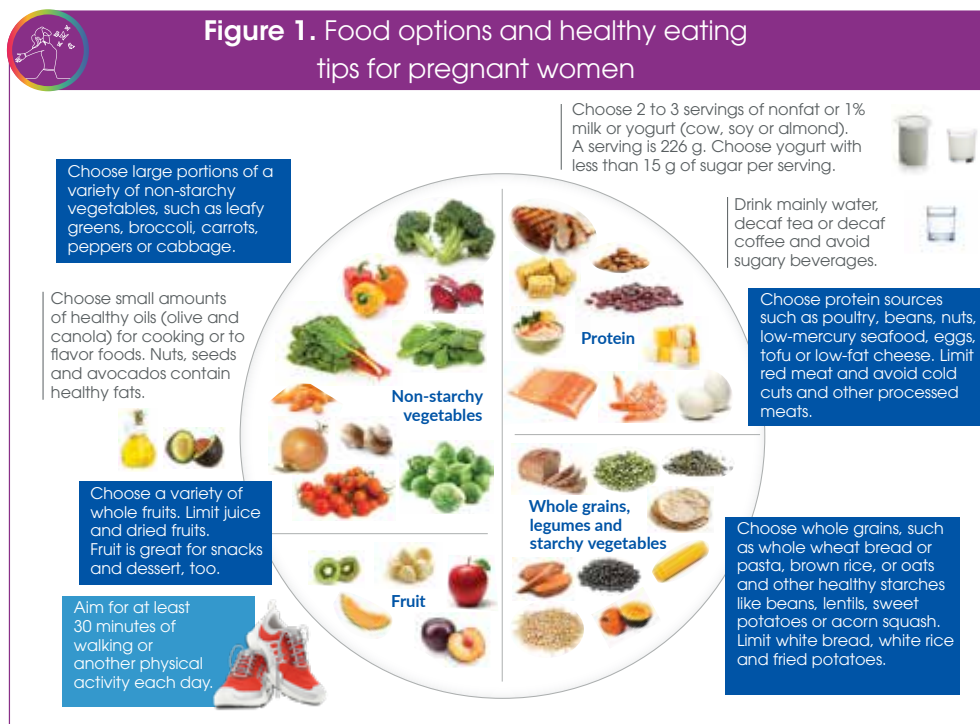
- Women whose babies are exclusively breastfed require approximately 2,000 kJ each day beyond what is recommended for those not breastfeeding, as well as 150 µg/day iodine supplementation.
- Nutrients such as protein, vitamin B12 and vitamin D are also important in supporting healthy function and infant growth through breast milk.
- Table 6 describes the recommended nutrient intake for lactating women.

Nutrient	Requirement if breastfeeding (per day)
Protein	Age 14–18 years (RDI) : 63 g (1.11 g/kg) Age 19–50 years (RDI): 67 g) 1.10 g/kg)
Calcium	Age 14–18 years (RDI) : 1,300 mg Age 19–50 years (RDI): 1,000 mg
Iodine	All age (RDI): 270 µg/day
Vitamin B12	All ages (RDI): 2.8 µg/day
Vitamin D	All ages (RDI): 5.0 µg/day
Water (from fluid)	Age 15–18 years (AI): 2.3 L fluids Age 19–50 years (AI): 2.6 L fluids

AI: Adequate intake; RACGP: Royal Australian College of General Practitioners; RDI: Recommended dietary intake.

Nutrition guide for pregnant women

“My Pregnancy Plate” (Figure 1) shows healthy food options at a glance, as well as healthy eating tips.¹¹



National and international policies for health and nutrition of pregnant and lactating women

Policies of the Government of India

- The biggest pan-India Maternity Benefit Program, the **Pradhan Mantri Matru Vandana Yojana (PMMVY)** for pregnant and lactating women was announced on 31st December 2016 and made effective from 1st January 2017. Under this program, the eligible beneficiaries receive cash incentive of Rs. 6,000/- as per approved norms during pregnancy and after institutional delivery.¹²
- Extension of maternity leave to 26 weeks (~6 months) of age.¹²
- **Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA)** provides pregnant women a fixed day, free of cost assured and quality antenatal checkup by a specialist/medical officer on the 9th day of every month. Further, Extended PMSMA strategy was launched to ensure quality antenatal care to pregnant women, especially to high-risk pregnancy (HRP) women and individual HRP tracking till a safe delivery is achieved.¹³
- **Anaemia Mukh Bharat (AMB)** strategy to reduce the prevalence of anemia in children (6–59 months), children (5–9 years), adolescent girls and boys (10–19 years), pregnant and lactating women and in women of reproductive age group (15–49 years) in program mode through life cycle approach through Iron Folic Acid (IFA) supplementation across life stages.¹³
- **National Guidelines for Deworming in Pregnancy:** Considering the potential benefits and high infestation load from the public health perspective, deworming is recommended routinely during pregnancy for all pregnant women in soil transmissible helminthes (STH)-endemic areas (prevalence >20%). The aim of deworming is to reduce the incidence of anemia in pregnancy, and to reduce maternal morbidity and mortality. Albendazole is the recommended drug of choice for deworming. Deworming should be done after the 1st trimester of pregnancy (preferably during the 2nd trimester). A single dose of 400 mg of albendazole is recommended.¹⁴

Micronutrient supplementation in pregnant and lactating women

A number of studies have evaluated the impact of micronutrient supplementation in pregnant and lactating women. These are summarized in Table 7.^{15–18}



Table 7. Outcomes of vitamin supplementation among pregnant and lactating women

Subject group, number of subjects	Micronutrient formulation	Duration of intervention	Outcomes
Lactating mothers (n=816) ¹⁵	Food supplement in the form of a snack to be consumed daily that provided 600 kcal with 25–30% of energy from fats and 13% of energy from proteins (<i>versus</i> a control group)	6 months	Mothers in the intervention group had: <ul style="list-style-type: none"> • Higher rate of exclusive breastfeeding at 5 months (45.1% vs. 34.5%; RR 1.31) • Higher BMI at the end of 6 months (mean difference 0.37; p=0.009) • Higher hemoglobin concentration (11.99±1.16 vs. 11.62±1.38 g/dL; p<0.001) • Lower rate of anemia (39.6% vs. 55.6%; p=0.002)
Pregnant women at 24–32 weeks gestation (n=200) ¹⁶	Multi-micronutrient supplement containing 29 vitamins and minerals once-daily (<i>versus</i> placebo)	From enrollment until delivery (median duration 58 days)	In the micronutrient group: <ul style="list-style-type: none"> • The proportion of LBW infants decreased by 70% • The proportion of SGA infants decreased by 55%
Pregnant women at <14 weeks of gestation ¹⁷	Vitamin B12 50 mcg (<i>versus</i> placebo)	From enrolment till 6 weeks postpartum	No impact on infant cognitive outcomes
Pregnant women ¹⁸	60 mg iron-folic acid	6 months	Reduced mortality, preterm births and increased birth weight of infants
Pregnant women ≥18 years ¹⁹	Vitamin B12 50 mcg	From enrolment till 6 weeks postpartum	Vitamin B12 status measurements in maternal plasma and breast milk improved

BMI: Body mass index; LBW: low birth weight; RR: Risk ratio; SGA: Small for gestational age.

Guidelines by the Maternal Health Division, Ministry of Health and Family Welfare

Oral swallowable calcium tablets to be taken twice-a-day (total 1 g calcium/day) starting from 14 weeks of pregnancy up to six months post-partum.²⁰

Summary

Nutrition is an essential component which has a very important role in the outcome of pregnancy. The health of women and mothers is directly related to their status in society. The nutrient supply during pregnancy to the fetus is a vital process that can affect the birth weight and development of the infant. During this physiological stage of life, a woman needs the best foods available within the family. If a mother is malnourished, the quantity of breast milk produced is very limited. Therefore, adequate nutrition is very much required for the well-being of mother and child. A multipronged and concerted effort from various stakeholders is required to achieve adequate nutrition for pregnant and lactating women so as to benefit the health of both mother and child.



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Chapter 6 Menopause and perimenopause

The menopause, defined as the permanent cessation of menstruation resulting from the loss of ovarian follicular activity, marks the end of natural female reproductive life. It is preceded by a period of menstrual cycle irregularity, the menopausal transition, which usually begins in the mid-40s.¹ During this period there is loss of follicular activity of ovaries which is accompanied by change in hormonal levels leading to drop in the levels of estrogen and progesterone.²

The World Health Organization (WHO) has defined post-menopausal women as those women who have stopped menstrual bleeding one year ago or stopped having periods as a result of medical or surgical intervention (hysterectomy/ oophorectomy) or both. With increasing life expectancy, women spend one-third of life in this phase.³

Postmenopausal women are at increased risk of developing certain chronic diseases like heart disease, hypertension, diabetes, sleep apnea, cancer, osteoarthritis, and mental health problems.²

Nutritional status of menopausal and postmenopausal women in India

A study in India reported that 12% of postmenopausal women were underweight, 46% were normal, 36% were overweight, and 6% were obese. The mean nutrient intake of most of the nutrients was lower than what is recommended for their age group. However, the mean total energy intake of the population was 5.78% higher than the recommended value, likely due to a higher intake of fat and carbohydrate-rich food (Table 1).²

Nutrient	Mean Intake	RDA for sedentary women	% of excess of deficiency
Energy (kcal/day)	1988.63±584.63	1880	5.78+
Protein (g/day)	47.15±19.21	55	14.27-
Fat (g/day)	42.67±9.80	20	113.35+
Calcium (mg/day)	479.36±183	600	20.11-
Phosphorus (mg/day)	519.68±165.45	800	35.04-
Iron (mg/day)	17.03±8.34	21	19.90-

RDA: Recommended dietary allowance.

Postmenopausal status is associated with higher prevalence of obesity:⁴

42.1%

Post-menopausal women in India who are obese

82.1%

Post-menopausal women in India who have high waist-to-hip ratio

77.1%

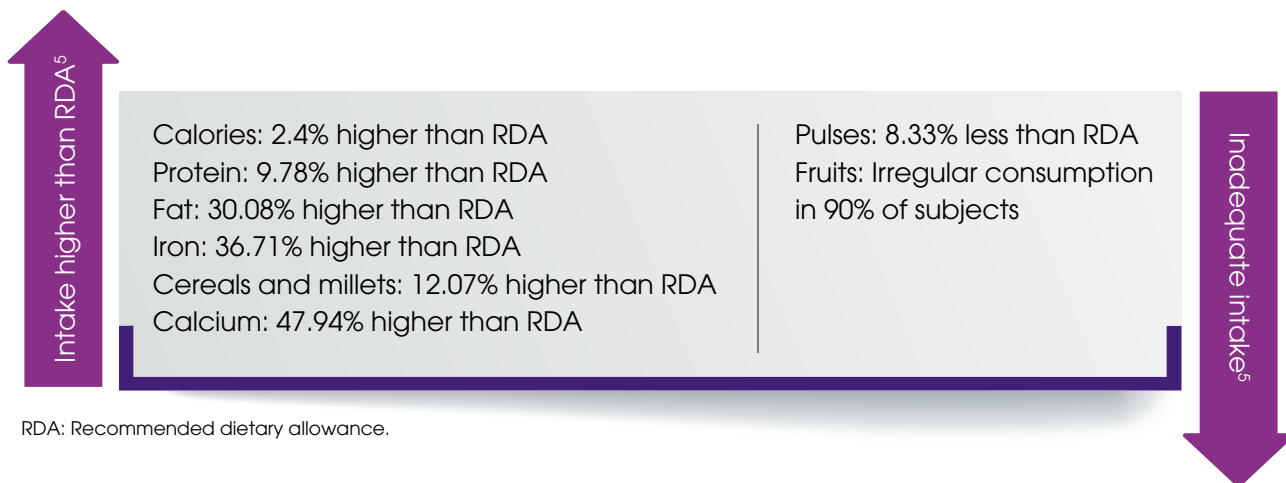
Post-menopausal women in India who have high waist circumference

50.9%

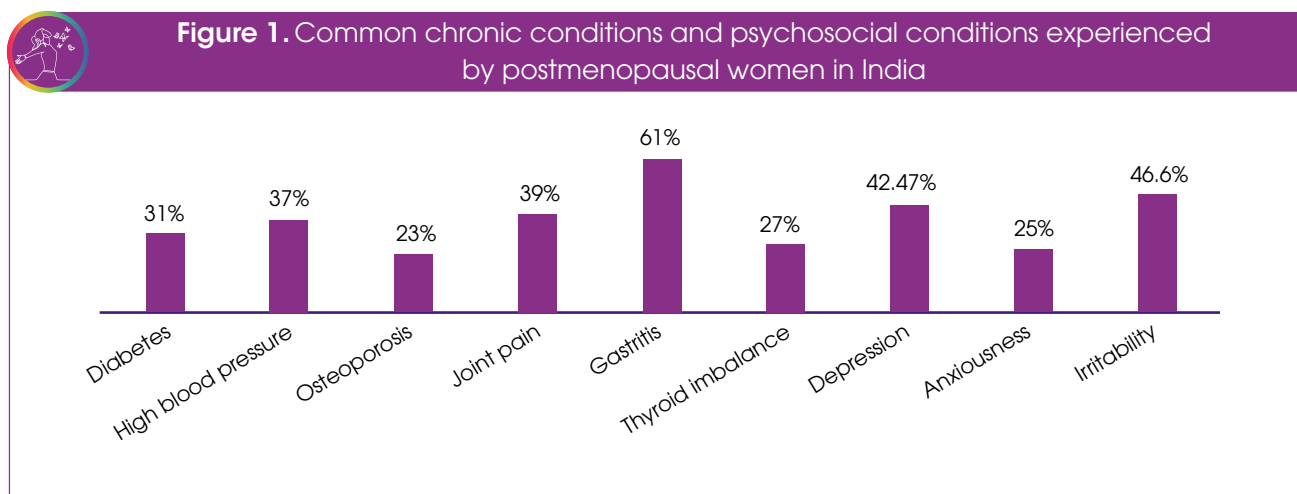
Post-menopausal women leading sedentary lifestyle and were obese



An analysis of 100 perimenopausal and postmenopausal women:⁵



Postmenopausal women can develop a number of chronic conditions and psychosocial symptoms (Figure 1).⁵⁻⁷

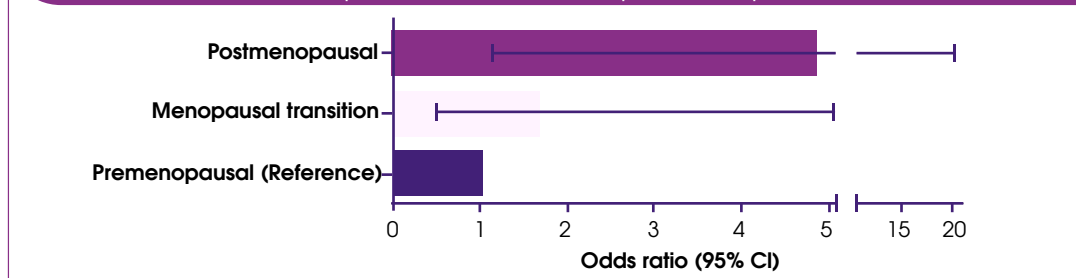


Central obesity in menopausal women is a risk factor for subclinical CVD

Figure 2 describes the odds ratio for central adiposity in menopausal and postmenopausal women. The presence of central obesity is associated with decreased heart rate variability, which is a marker of subclinical CVD. Lean body mass (LBM) loss during the menopausal transition averages 0.5% (a mean annual absolute decrease of 0.2 kg), and fat mass increases by 1.7% per year (mean annual absolute increase of 0.45 kg). Body composition changes in this population are associated with increased risk of coronary heart disease. Postmenopausal women have two to three times higher prevalence of metabolic syndrome, compared to premenopausal women of similar age.⁸



Figure 2. Adjusted odds ratios (with 95% confidence intervals) for central adiposity, defined as waist circumference ≥ 88 cm, in women in the menopausal transition and postmenopausal women



CI: Confidence interval.

Dietary approaches and physical activity requirements of menopausal and postmenopausal women

It has been suggested that a sedentary lifestyle rather than menopause is associated with a two-fold increased risk of overweight/obesity. Therefore, exercise along with calorie restriction should be recommended in all those postmenopausal women with excess weight, for reductions in metabolic and cardiovascular risk. Aging increases dietary protein requirements because skeletal muscles reduce their capacity of activating protein synthesis in response to anabolic stimuli, possibly due to insulin resistance. In fact, observational studies have indicated that higher protein intake is associated with higher lean body mass (LBM) in postmenopausal women.⁸

Key dietary requirements of menopausal women:⁹

Body composition	<ul style="list-style-type: none"> • Use body composition analysis tools to assess nutritional status • Keep the weight in healthy range with adequate nutrient intakes • Manage overweight, obesity: Reduce current energy by 500–700 kcal/day • Regular physical activity
Dietary recommendations	<ul style="list-style-type: none"> • Protein: 0.8–1–1.2 g/kg/day • Calcium, vitamin D, vitamin C, vitamin B • N-3 LCPUFA, omega-3 fatty acids • Fruits and vegetables provide vitamins, minerals, fiber, and other plant nutrients, such as antioxidants, to help protect the heart <ul style="list-style-type: none"> ▶ Vegetables: 300–400 g/day, 3–4 portions/day ▶ Fruits: 100–200 g, 1–2 portions/day • Legumes: Beans, peas, lentils, chickpeas, soy; at least once-a-week • Low-fat dairy products, 500 mL milk: Calcium • Red meat: Moderate consumption of 350–500 g per week (boiled/steamed/ fried) • Deep-sea fish: 100–120 g/occasion; at least two servings per week • 30 g unsalted nuts, oily seeds per day • 30–45 g/day dietary fiber: Whole grain, fiber-rich cereals
Foods and lifestyle habits which should not be preferred	<ul style="list-style-type: none"> • Simple, fast-acting sugars • Smoking • Sugary and alcoholic beverages • Sedentary lifestyle • Salt (max. 5 g/day) • Saturated fat: Not to exceed 10% of the total energy intake



Nutritional habits are essential because they concern all women, can be modified, and impact both longevity and quality-of-life:⁸

Low energy diet	Prevents metabolic alterations	
Protein intake of 1.2 g/kg body weight	32% lower risk of frailty	Better physical function
Low glycemic index diet	Decreases fat mass in overweight/obese women	
Low fat diet	Improves LDL cholesterol levels	
Low carbohydrate diet	Improves triglyceride and HDL cholesterol levels	
Mediterranean diet	Decreases BP and CVD risk	Reduces the rate of BMD loss
Ca, Se, Mg, Vitamin D, vitamin K, beta-carotene	Better BMD in postmenopausal women	

BMD: Bone mineral density; BP: Blood pressure; CVD: Cardiovascular disease; HDL: High-density lipoprotein; LDL: Low-density lipoprotein.

The role of micronutrients in menopause

With aging, the rate of hydroxylation of vitamin D precursors in the body decreases, so the importance of exogenous vitamin D intake increases with age. Clinical studies have proven that osteoporosis treatments only achieve their effectiveness with adequate vitamin D supplementation (more than 1,000 IU per day). Without vitamin D supplementation, the fracture risk reduction effect of osteoporosis therapies can decrease by up to 30%. In addition to insufficient vitamin D status, the factor inhibiting calcium absorption and utilization is a diet rich in protein, dietary fiber, and phytates. Supplements should only be used if a calcium deficiency can be diagnosed. The recommended daily calcium intake (recommended dietary allowance (RDA)) for menopausal women (from the age of 51) is 1,000–1,200 mg. The calcium intake recommended by the European Food Safety Authority (EFSA) is 950 mg over the age of 25.⁹

The calcium requirements can be covered by a balanced diet. In the case of a diagnosed deficiency, the appropriate intake can be ensured primarily by modifying the diet. Routine calcium supplementation is not recommended due to its cardiovascular risks.⁹

Vitamin C is necessary for bone formation due to its role in collagen formation. Its absorption is about 80% if the daily intake is 100 mg/day. The RDA for vitamin C is 100 mg/day, which can be provided through diet. B vitamins also play an important role in menopause. They play a fundamental role in the processing of carbohydrates and the functioning of the nervous system. Adequate B vitamin intake significantly reduces the serum homocysteine level and, in parallel, the risk of stroke. High homocysteine levels have also been associated with osteoporosis and increased risk of bone fractures.⁹

About 75% of women report troublesome symptoms during menopause, but the severity and frequency of symptoms are very inconsistent. An appropriate micronutrient intake may help to ease some of the symptoms.^{10,11}

- The balanced and appropriate multivitamin and mineral supplements containing vitamins (vitamin A, riboflavin, pantothenic acid, pyridoxine, folic acid, vitamin E) and minerals (chromium, copper, magnesium, selenium, silicon, zinc) are essential for the prevention or correction of disorders accompanying menopause like aging of skin and its accessory structures, decreased bone metabolism, decreased immune function and increased risk of degenerative pathology, in particular cardiovascular system.¹⁰
- Antioxidants like vitamin C acutely improve the endothelial function in postmenopausal women with established estrogen deficiency.¹⁰
- Postmenopausal women have increased plasma homocysteine levels. Folic acid, vitamin B6 and vitamin B12 are associated with a significant reduction in plasma concentrations of homocysteine.¹⁰
- The potential role of micronutrients and phytochemicals in controlling menopausal symptoms is of increased interest. Vitamin and phytoestrogens (e.g., black cohosh, soy) may be beneficial.¹¹
- Soy, other beans, clover, and alfalfa contain isoflavone precursors, which are converted to genistein, daidzein, and equol by intestinal bacteria. Flax seeds, other seeds, legumes, whole grains, and some fruits and vegetables contain lignan precursors that can be converted to enterolactone and enterodiol by intestinal bacteria. Phytoestrogens can have estrogenic activity and may act as potential dietary modulators of endocrine function.¹¹

Summary

Postmenopausal women have a complex physiology which is a culmination of endocrine changes as well as aging, and therefore, maintenance of health at this stage is of prime importance. A healthy lifestyle, the core of which is a healthy diet and appropriate micronutrient supplementation, is the foundation of good health and well-being for this subgroup of women. It is important to acknowledge the fact that health habits during this mid-life period can pave the way for a healthier old age. Nutrition among postmenopausal women, thus, needs to be addressed on a larger scale.

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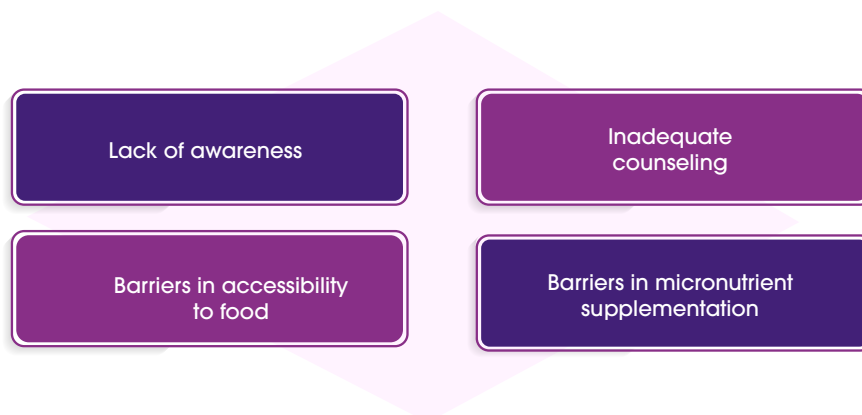


Chapter 7

Challenges in addressing women's health issues in India

The health of women is linked to their status in society. The demographic consequences of women have formed expressions in various forms, such as female infanticide, higher death rates, lower sex ratio, low literacy levels and lower levels of employment of women in the non-agricultural sector compared to men. Generally, at the household level, cultural norms, practices and socio-economic factors determine the extent of nutritional status among women.¹ Considerable progress has been made over the last quarter century in dealing with the reproductive health issues of women, which is a matter of celebration. Despite this, women continue to be the “weaker” sex in terms of their status in society and access to healthcare beyond care during pregnancy, which limits even greater improvements in their health outcomes.²

Challenges in women's healthcare in India



Challenge 1: Lack of awareness of healthy dietary habit

- Awareness of nutrition and nutrition-associated diseases is lacking in India.³
- A study of over 1,000 adolescent girls in India reported that ~80% of adolescent girls were unaware of iron-deficiency anemia, ~70% were not aware of the hemoglobin test, 68% did not know about malnutrition, and 44% did not know the benefits of using sanitary napkins. In addition, uptake of nutritional and health services was limited. The study found a statistically significant association of age, the number of family members, knowledge, and the use of a toilet with low-BMI.³
- Another study among literate and illiterate women reported that 60% of illiterate respondents did not know whether nutritional needs are the same throughout life, whereas 76% of literate respondents knew that nutritional needs vary throughout life. However, 90% of illiterate and 72% of literate respondents had the same food intake as other members of the family.⁴

- Traditional/cultural beliefs and taboos also impact the intake of food. Beliefs like “casting an evil eye” or “the color of the baby” have an influence on the food given to an antenatal mother.⁵
 - ▶ Taboos during pregnancy include avoidance of certain fruits (banana, papaya, jackfruit, coconut), vegetables (brinjal, leafy vegetables), meat, fish, and eggs to prevent miscarriage and fetal malformations and promote easy delivery.⁵
 - ▶ Taboos during the lactation period include avoidance of small fish, foods with multiple seeds, other "cold" foods, and fluid restriction in some areas.⁵
- The widespread display of food commercials in electronic, print, and social media was viewed as a potential barrier to nutrition promotion. The content of food advertising worldwide is primarily limited to nutrient-poor foods including, confectionery, salty snacks, and sugar-sweetened beverages. Commercials promoting healthy foods are rarely advertised.⁶

Awareness camps should be organized to educate women regarding the varied nutritional needs throughout life.

Camps can be targeted to address the challenge of specific subgroups, and can be conducted at schools and colleges for adolescents, at PHCs for women of reproductive age, pregnant women, and lactating women, and at clinics and hospitals for postmenopausal women.

PHCs: Primary health centers.



Addressing the challenge

Care should be taken to reach out to women who are illiterate or uneducated by providing knowledge that can be understood easily.

All commercial advertisements promoting foods that exceed FDA recommendations with high salt/sugar/fats should be banned.

Challenge 2: Accessibility to nutritious food

- The primary barriers preventing daily consumption of food from all food groups include affordability, availability, and food habits.⁵
- A study among households with pregnant women in India revealed that a nutritious diet was unaffordable for 75% of households due to current income levels, consumption patterns, and food prices. Household income and dietary preferences, rather than food availability, were the key barriers to obtaining a nutritious diet.⁵
- Overall, it is estimated that 63–76% of the rural poor could not afford the recommended diet in 2011.⁵
- While Take Home Ration (THR) schemes have been implemented, the awareness of women regarding the quantity they are entitled to is lacking.⁷



Addressing the challenge

Strategies to improve food availability include kitchen gardens, homestead production, women's cooperatives, and nutrition-sensitive agriculture interventions.⁵



Food systems approach (from Farm to Fork) needs to be strengthened to ensure affordability, availability, accessibility, food security, sustainability, and resilience in production and promotion of diverse nutrient-rich foods and safe diets for pregnant women.⁵

Improving ICDS services requires effective monitoring and supervision. Information about various entitlements under the ICDS program should be made part of routine ANC and PNC counseling under the Department of Health. The THR program could improve the nutrition status of economically disadvantaged tribal populations.⁷

ANC: Antenatal care; ICDS: Integrated Child Development Services; PNC: Postnatal care.

Challenge 3: Counseling regarding nutrition in various settings

- Nutrition counseling during pregnancy is not explicitly included in the antenatal care (ANC) package. The dietary intake and weight gain also remains a low priority.⁸
- While there is knowledge of nutritional recommendations, structural opportunity barriers (financial strain, lack of food availability and accessibility) prevented behavioral change in adopting a healthy diet.⁹
- Schools have been identified as powerful platforms for supporting physical and psychological well-being as well as social and academic development in young people. However, there is a lack of a government mandate regarding school food policy, which is thus a potential barrier to school-based nutrition promotion. There is limited involvement of key stakeholders in the implementation of healthy school food policies.⁶

Addressing the challenge

Measures should be taken to implement nutrition counseling as a core part of ANC. This can be carried forward to the postpartum period, thus allowing for nutrition counseling of mothers and their infants.

ASHA workers and Female health Workers should be trained to provide counseling to women of diverse social, cultural, and economic backgrounds, and should be able to address taboos regarding food choices during various periods of life.

Implementation of a structured nutrition system which provides healthy meal options to schoolchildren in forms that appeal to children is of prime importance. KOLs including pediatricians, nutritionists, and policymakers should come together to formulate a meal plan for schools.

Parents and teachers should be educated regarding the importance of a healthy diet for children, and they should encourage the intake of healthy food at school.

ANC: Antenatal care; ASHA: Accredited Social Health Activist; KOL: Key opinion leader.

Challenge 4: Barriers in supplementation for iron-deficiency anemia

- Daily supplementation with iron and folic acid for three months has been the standard approach for preventing and treating iron-deficiency anemia (IDA) among women.¹⁰
- Despite its proven efficacy, supply and distribution of daily supplements can be costly and logistically complicated.¹⁰
- Lack of supply of affordable supplements may limit the success of many supplementation programs. Another challenge is the occurrence of mild side effects, such as darkened stools, gastrointestinal pain, diarrhea, constipation and vomiting.¹⁰
- Provision of only folic acid supplement in the pre-conception period have been included for the first time in a program in India. Effective implementation and scaling up interventions remains the primary challenge.⁸

Addressing the challenge

1

The challenge of the private sector is to disseminate knowledge on proposed interventions, create demand for services and market products and services.⁸

2

Social marketing of IFA tablets as well as low-cost nutrient dense supplement for promoting minimum weight gain of mothers are interventions which could be spearheaded by the private sector.⁸

IFA: Iron-folic acid.

Summary

The challenges of awareness, accessibility, and counseling require a multipronged approach from all stakeholders, including policymakers and doctors. Considering the non-homogeneous population with varying social conditioning and economic status, it is necessary to tailor solutions based on the needs of the population. Policies can be formulated and implemented at the district-level, and scaled up for similar populations based on the success of the approach.

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Chapter 8 Women's health: Way forward

The outlook of women's health in India is poised at a critical juncture, with both challenges and opportunities on the horizon. While significant progress has been made in recent years, particularly in areas such as maternal and reproductive health, disparities persist, especially in rural and marginalized communities. Factors such as limited access to healthcare facilities, cultural norms, and socioeconomic barriers continue to impact women's health. A holistic approach to women's health that addresses both physical and mental well-being is the need of the hour.

Policymakers must prioritize nutritional policies and comprehensive healthcare services that cater to the diverse needs of women across the country. This includes implementing awareness campaigns, promoting regular screenings and check-ups, and integrating nutrition into the primary healthcare systems. Collaboration between government agencies, healthcare providers, non-governmental organizations (NGOs), and community leaders is essential to address the multifaceted challenges facing women's health in India. By adopting a proactive and inclusive approach, policymakers can pave the way for a future where every woman in India has equal access to quality healthcare and the opportunity to lead a healthy and fulfilling life.

A multi-sector approach is required for maintaining a focus on equity and ensuring that the most disadvantaged are reached through the involvement of sectors beyond health and Integrated Child Development Services (ICDS). Platforms of self-help or microcredit groups, livelihood programs, agriculture groups, seed bank groups, public distribution systems etc., should be used to reach women who are missed out by health or ICDS systems. Investing in strategies of linking nutrition interventions with such non-traditional program platforms shall be systematically explored in high-priority districts. States should be encouraged to be accountable for achieving specified nutrition outcomes and policy reform within specified time frames while having the flexibility to decide which strategic options are best suited to achieve the same. Inter-state sharing and learning should also be encouraged, and sharing and adaptation of best practices should be promoted. The matrix of strategy choices will enable states to design and evolve their Annual Nutrition Implementation Plans, building on best practices and based on evidence of what works well.

To ensure a brighter future for women's health in India, policymakers must prioritize gender-sensitive nutrition and healthcare policies and interventions. There is a need for a concerted effort to address social determinants of health, such as poverty and education, which disproportionately affect women. Empowering women through education and economic opportunities can enhance their health outcomes and contribute to overall societal development.



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strength

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Calcium and
Vitamin D



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