ADOLESCENTS, DIETS AND NUTRITION

Growing Well in a Changing World

The CNNS Thematic Reports,
Issue 1, 2019

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Birth to Adolescence

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Contents

Summary

- Investing in the nutrition of the 1.2 billion adolescents (10-19 years aged population) will shape the world's future. A fifth of these adolescents – 253 million – live in India. Ensuring India's adolescents are nourished and growing well is critical to achieving India's demographic dividend.

- Adolescents receive several health and nutrition services in India. These include biannual health check-ups, biannual deworming, Weekly Iron Folic Acid Supplementation (WIFS), counselling for mental and reproductive health conditions. Girls also receive menstrual hygiene services. Longer duration of schooling is critical for preventing early marriage and adolescent pregnancy. In India, education is free and compulsory till age of 14 years. School going adolescents are also entitled to a mid-day meal providing almost a third of energy and protein requirements for 200 school-days in a year in all government schools.

- On 8 October 2019, the Ministry of Health and Family Welfare, Government of India, released the national report of the Comprehensive National Nutrition Survey (CNNS) 2016-18 – birth to adolescence. The CNNS data-set provides unparalleled new insights into all types of macronutrient and micronutrient malnutrition, dietary habits, life skill behaviours, access to services (school, health and nutrition) and physical activity throughout adolescence 10-19 years and for both boys and girls.

- The CNNS survey data comes at an opportune time, two years after the launch of the National Nutrition Mission (*POSHAN Abhiyaan*) which can provide valuable insights to support healthy growth throughout childhood and adolescence. Additionally, focusing on adolescent girls, before they become mothers, is critical to break India's intergenerational cycle of malnutrition. Schools are a cross-sectoral platform to address good nutrition – diets, services and behaviours. CNNS gives important program insights on strengthening nutrition in school premises.

- **Adolescents, Diets and Nutrition: Growing well in a changing world**, is the first CNNS thematic report based on unit-level data analysis. It deep-dives in the CNNS data-set to provide insights in lives of adolescents in India in the 21st century. The analyses provide national and state estimates on adolescents 10-19 years (disaggregated by boys and girls) for levels of malnutrition- both its visible (thin, short and overweight/ obese) and hidden forms (anemia and six micronutrient deficiencies (iron, vitamin B_{12}, folate, vitamin A, vitamin D and zinc)), risks for non-communicable diseases, diets, physical activity patterns, life style and beliefs and access to services (health, social safety net and nutrition) for early adolescents (10 to 14 years) and late adolescents (15 to 19 years). Analytical sample on the basis of which the findings are presented include 35,856 adolescents 10-19 years (and a sub-set of 16,181 for biological samples).

Summary Findings

- **Every second Indian adolescent is either too short or too thin or overweight/obese. Girls are shorter than boys, but boys are thinner than girls. Thinness is highest in 10-12 year olds, with vast in-state variations among 10-14 year olds and 15-19 year olds**

  Every third adolescent girl and every fourth adolescent boy 10-19 years is too short for their age. More boys than girls are thin for

their age in both 10-14 age group (32% boys, 23% girls) and 15-19 age group (26% boys, 14% girls). Highest prevalence of thinness is seen between 10-12 years for both boys and girls. In 10-14 age group, 1 in 2 short girls and 1 in 3 short boys, are also thin. At least, 5% adolescents 10-14 years and 4% adolescents 15-19 years are overweight. In most states of India at least 1 in 5 girls and boys are too short for their age. Thinness in adolescence is a problem of public health concern in most Indian states. Twelve states have overweight/obesity prevalence over 10% in 10-14 years age group itself. Within states, there is variation in prevalence of malnutrition between 10-14 year olds and 15-19 year olds. For example in Bihar 18% girls are short in 15-19 years age group, much higher than 36% in the 10-14 years age group. In Telangana this trend is reverse with few shorter girls 10-14 years (17%) compared to 44% short girls 15-19 years.

- **One in two adolescents suffer from at least two of the six micronutrient deficiencies (iron, folate, vitamin B_{12}, vitamin D, vitamin A and zinc)**

  Of the six micronutrient deficiencies studied, only 14% girls and 21% boys had none of the six micronutrient deficiencies. Over 50% of the girls suffered from two of six micronutrient deficiencies. Out of the six micronutrient deficiencies studied, the most common among adolescent girls is vitamin D deficiency, followed by folate and iron deficiency. Among adolescent boys, the highest burden is of folate deficiency, followed by vitamin B_{12} and zinc deficiency. Punjab is the only state to have high proportions of adolescents affected by five different micronutrient deficiencies (iron, vitamin B_{12}, vitamin D, vitamin A and zinc).

- **Anemia affects 40% adolescent girls and 18% boys. Co-existence of anemia and thinness is higher among girls and 15-19 year olds**

  Anemia affects 32% girls 10-14 years and 48% girls 15-19 years. Among boys 10-19 years, ~20% are anemic. Co-existence of anemia and thinness among girls is twice more than boys in early adolescence (10-14 years) and four times higher in late adolescence (15-19 years). Among girls 10-14 years, anemia is a severe public health problem in eight states (Jharkhand, Tripura, West Bengal, Assam, Chhattisgarh, Gujarat, Telangana and Uttar Pradesh). Among 10-14 year old boys, anemia is a severe public health problem in one state-West Bengal. Among 15-19 year olds, anemia is a severe public health problem in 19 states in girls. There is no state in India where anemia is a severe public health problem among boys 15-19 years.

- **Diabetes and cardiovascular diseases risk and hypertension among adolescents is increasing. At least 1 in 2 adolescents affected by at least one of these risks.**

  1 in 10 adolescent girls and boys 10-14 years and 2 out of 10 adolescents 15-19 years are at risk of diabetes on the basis of HbA1c levels. One in 4 (26%) boys 10-14 years have low good cholesterol (low HDL cholesterol). The proportion of adolescent boys 15-19 years with low HDL cholesterol levels increases to 39% indicating increasing risks in the transition from early to late adolescence in boys. Among girls 10-19 years, 1 in every 4 adolescents have low HDL cholesterol. A small proportion (5%) adolescent boys and girls suffer from hypertension, based on systolic and diastolic blood pressure. Among girls, proportion with hypertension is highest (8%) at 11 years and 18 years. Among boys, highest proportion is noted at 19 years (7%). One in 2 adolescents have at least one of the three non-communicable disease risks (high HbA1c, high diastolic/systolic blood pressure and low HDL cholesterol levels). At least two such risks are seen in 1 in 3 adolescents. None of the states have zero risk for diabetes and heart disease among adolescents 10-14 years of age.

- **Girls suffer more: They have multiple nutritional deprivations and little autonomy**

  More girls suffer from co-existence of shortness and thinness than boys in both

early (10 to 14 years) and late (15 to 19 years) adolescence. Co-existence of anemia and thinness among girls is twice more than boys in early adolescence (10 to 14 years) and four times higher in late adolescence (15 to 19 years). Their situation is exacerbated by the fact that girls have little say in their own life choices around What to buy? Whom to marry? When to marry? There are states like Goa and Mizoram that do exceptionally well on girls' autonomy but they are heavily outnumbered by those which perform poorly.

- **Malnutrition in several forms is higher and/or peaks in early adolescence**

  While there are more than 1 in 5 short adolescents at all ages from 10 to 19 years, prevalence of thinness and obesity peaks in early adolescence (10 to 14 years) for both girls and boys. Thus, reaching adolescents with nutrition services early is imperative. Vitamin A, vitamin D and zinc deficiencies peak in early adolescence (10 to 14 years). Also, risks for non-communicable diseases are established in childhood and adolescence. Thus, within the second decade of life (10 to 19 years), most opportune time to intervene is in early adolescence.

- **Almost all adolescents have "unhealthy" diets**

  Only 2 out of 5 adolescents (~45%) take milk in their daily diet. Only 1 out of 5 adolescents (~20%) take pulses and green leafy vegetables. Less than 1 out of 5 adolescents (<10%) consume fruits daily. Six out of 10 adolescents reported zero consumption of fruits even once a week. Every fourth adolescent reported zero consumption of green leafy vegetables even once a week. At the same time, at least once a week consumption of fried foods was reported by 30% adolescents and sweets by 15%. Consumption of fried foods was reported by 5% adolescents, sweets and aerated drinks by 2% adolescents. Two percent adolescents reported at least thrice a week consumption of junk foods. Adolescent girls and boys who are short, thin, or anemic most often do not eat fruits, egg, fish/chicken, dark green leafy vegetables and pulses. Pulses and dark green leafy vegetable consumption increases around ages 12 to 14 years but these gains are lost in later years. Intake of all avoidable foods peaks at 17 years among boys. States of Delhi and Goa have lowest compliance of fried foods, junk foods, aerated drinks and sweets. Punjab emerges as a state with lowest compliance of adolescents consuming recommended frequencies of nutritive foods (pulses, dark green leafy vegetables, eggs, chicken/fish) and highest levels of micronutrient deficiencies (iron, vitamin B_{12}, vitamin D, vitamin A, zinc).

- **Almost all adolescents fail to meet the daily requirements of physical activity for their age**

  All girls and boys are unable to meet the 60 minutes per day recommended outdoor sports and exercise time. On an average, girls in late adolescence spend only 10 minutes per day on such activities. Boys do relatively better, with exercise time of 40 to 50 minutes per day.

- **Decision making on matters that shape a girl's life course**

  Girls aged 15 to 19 years are least involved in decisions that determine when they will marry (25%) and whom they will marry (36%). More than half have little say on what will be purchased for them or for the family, including foods of choice. Odisha emerges as a state where girls have least autonomy with minimum say in decisions on market purchases, when to marry and whom to marry and Mizoram with the highest.

- **School-based services (noon meal, IFA supplementation, deworming and biannual health checkups) co-coverage is low and variable across states**

  About 20 to 25% of girls and boys do not receive any of the four school based services. Weekly IFA supplementation has the least

penetration with 10% or lower proportion of school going adolescents covered. State with best coverage (Sikkim, Manipur) and worst coverage (Nagaland) for weekly IFA supplementation belong to the same north-eastern region of the country. While receipt of MDM is 67%, WIFS provided on the same platform is low at 11%.

The analysis presented in this report is critical evidence to inform *POSHAN Abhiyaan* for holistic programming for improving nutritional status of adolescent girls and boys, especially through schools. Campaigns on healthy food choices should be centered around promotion of a variety of items in appropriate proportions in the food plate. As the *POSHAN Abhiyaan*, enters its third year, the timing is right to review how the "would be mothers and fathers" be provided the right nutrition to prevent the intergeneration cycle of malnutrition.

Adolescents, Diets and Nutrition: Fast Facts

(All figures are in percentage except for physical activity)

Visible forms of Malnutrition (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Too thin for one's age	23	32	14	26	18	29
Too short for one's age	29	23	30	28	29	25
Overweight/Obese for one's age	5	5	4	4	5	5

Anemia (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Anemic	32	17	48	18	40	18

Hidden Malnutrition (Micronutrient Deficiencies) (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Iron deficiency	24	14	39	8	31	12
Folate deficiency	36	36	32	44	34	39
Vitamin D deficiency	35	16	34	12	35	14
Vitamin B_{12} deficiency	26	30	28	41	27	35
Vitamin A deficiency	19	18	12	13	16	16
Zinc Deficiency	27	36	30	34	28	35
Prevalence of more than one micronutrient deficiency (out of six listed above)						
No deficiency	14	21	14	22	14	21
Any 1 deficiency	35	35	35	36	35	35
Any 2 deficiencies	29	32	31	29	30	30
Any 3 deficiencies	16	10	15	12	15	10
Any 4 deficiencies	5	2	5	2	6	2

Risk of Non-Communicable Diseases (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Low HDL cholesterol (risk of heart disease)	26	26	24	39	25	32
HbA1C (risk of diabetes)	8	7	16	11	8	11
Hypertension	5	5	5	5	5	5

Diet Diversity – were Foods Consumed as per Frequency Recommended in Dietary Guidelines (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Milk and milk products (daily)	45	47	44	47	44	47
Pulses or Beans (daily)	24	22	26	22	25	22
Green leafy vegetables (daily)	19	15	20	17	19	16
Fruits (daily)	9	8	9	8	9	8
Eggs (at least 3 times/week)	10	11	18	21	9	12
Fish/chicken/meat (at least 2 times/week)	17	18	9	14	17	19

Zero Diet Diversity – Food groups not consumed even once in the last week (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Milk and milk products (zero consumption)	42	38	43	35	42	37
Pulses or Beans (zero consumption)	17	14	15	13	16	14
Fruits (zero consumption)	59	58	60	57	60	57
Green leafy vegetables (zero consumption)	26	23	24	21	25	22
Eggs (zero consumption)	67	62	69	62	68	62
Fish/chicken/meat (zero consumption)	66	63	65	61	65	62

Unhealthy Foods – Daily, at least three times a week or zero consumption (not consumed even once in the last week) (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Fried foods (*poori, pakora, vada, samosa, tikki* etc.) (daily consumption)	4	4	4	6	4	6
Fried foods (*poori, pakora, vada, samosa, tikki* etc.) (at least 3 times a week consumption)	12	13	12	18	12	15
Fried foods (*poori, pakora, vada, samosa, tikki* etc.) (zero consumption)	67	62	60	66	66	61
Junk foods (burger, pizza, pasta, instant noodles) (daily consumption)	1	1	1	1	1	1
Junk foods (burger, pizza, pasta, instant noodles) (at least 3 times a week consumption)	3	4	3	5	3	4
Junk foods (burger, pizza, pasta, instant noodles) (zero consumption)	91	88	90	86	91	88
Sweets (Indian sweets, pastries/cakes, doughnuts) (daily consumption)	1	2	2	2	2	2
Sweets (Indian sweets, pastries/cakes, doughnuts) (at least 3 times a week consumption)	5	5	4	7	4	6
Sweets (Indian sweets, pastries/cakes, doughnuts) (zero consumption)	85	84	86	81	86	83
Aerated drinks (daily consumption)	1	1	1	1	1	2
Aerated drinks (at least 3 times a week consumption)	3	4	3	8	3	6
Aerated drinks (at least once a week consumption) (zero consumption)	93	89	93	83	93	86

Physical activity: average hours spent per day

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Outdoor sports/exercise/ PA at school	0	1	0	1	0	1
Screen time	1	1	2	2	1	1
Leisure time physical activity	1	1	3	1	3	1
Travel to school	1	1	1	1	1	1
Sitting time	2	2	2	3	2	1

Access to Nutrition and Health services in Schools (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Consumption of IFA supplements in the last one week	13	11	11	6	12	9
Received mid day meal	67	61	NA	NA	NA	NA
Health camps organised in the last one year	42	37	29	24	37	32
Provision of Albendazole tablet (deworming) in the last 6 months	41	34	23	20	34	29
None of the services	21	25	26	45	22	26
Any one of the services	25	30	NA	NA	NA	NA
Any two of the services	27	24	NA	NA	NA	NA
Any three of the services	22	17	NA	NA	NA	NA
All 4 services	5	4	NA	NA	NA	NA

Decision Making (%)

	10-14 years		15-19 years		10-19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
Duration of study	70	NA	70	NA	70	NA
Going to the market	43	NA	50	NA	47	NA
Whom to marry	25	NA	29	NA	27	NA
When to marry	30	NA	36	NA	32	NA
Currently going to school	85	87	63	37	72	78

NA- Not Applicable

1 Introduction

India is home to 253 million adolescents - 120 million girls and 133 million boys[1]. These are the largest numbers of adolescents in any country, globally[2]. India's economic growth is dependent on its adolescents who are its demographic advantage and hence, it's important that they are nourished and growing well.

The age of adolescence is divided into early and late phases, from 10 to 14 years and 15 to 19 years. Ten to 14 years are critical years for both girls and boys as they achieve their maximum growth spurt. Annual height and weight gains may be as high as 9 cm and 8 to 10 kg, respectively[3,4]. Early adolescence is also an opportune time to catch-up on height and weight deficits suffered in childhood[5]. Girls have added physiological stress due to the onset of menstruation and increased risk of anemia and micronutrient deficiencies. The growth spurt continues into late adolescence (15 to 19 years), especially for boys. In the late adolescence phase, some girls in India do enter pregnancy and with low height, weight and hemoglobin levels, and will not be able to properly support healthy fetal growth or themselves. In a vicious cycle, babies born to adolescent girls are at an increased risk of being born too early or with a low birthweight. Those who conceive later with compromised nutritional status will face similar birth outcomes. Children of malnourished adolescent mothers are more at risk to suffer growth failure during the first 1,000 days (from conception to age two). Without correct nutrition, these children are at risk of growing up physically and cognitively stunted and are at risk of carrying this burden into adolescence and adulthood which fuels the intergenerational cycle of malnutrition.

Many of these individual behaviours are associated with poor nutritional status and increased risk of non-communicable diseases in adulthood, such as lack of physical activity and eating disorders. While national estimates for physical activity were unavailable, global estimates suggest 8 in 10 adolescents were not physically active enough with girls being less active than boys[6]. Similar findings were noted in smaller scale studies from north, north-east and south India[7,8,9].

Body changes are accompanied by rapid increase in cognitive and emotional development and increased inclination to assert own choices and identity formation. The CNNS data-set also provides important insights into self-worth and decision-making choices of adolescents for strengthening this component of adolescent friendly health services.

Schools are a cross-sectoral platform to address good nutrition – diets, services and behaviours. CNNS gives important programme insights on strengthening nutrition in schools, adolescents are entitled to several health and nutrition services through schools such as biannual health check-ups, biannual deworming, weekly iron folic acid supplementation (WIFS), referral for counselling and treatment for reproductive health conditions and hygiene services for girls. Education is free and compulsory till age of 14 years; longer duration of schooling being critical for preventing early marriage and adolescent pregnancy. School-going adolescents are also entitled to a mid-day meal providing almost a third of energy and protein requirements for 200 days a year in all government schools. These services are being provided through government of India's national programs implemented by

Ministry of Health (*Anemia Mukt Bharat, Rashtriya Bal Swasthya Karyakram and Rashtriya Kishore Swasthya Karyakram)* and Ministry of Human Resource Development (mid-day meal scheme and menstrual hygiene and water sanitation and hygiene services)

On 8 October 2019, the Ministry of Health and Family Welfare, Government of India, released the national report of the Comprehensive National Nutrition Survey (CNNS) 2016-18 – birth to adolescence. The CNNS data-set provides unparalleled new insights into all types of macronutrient and micronutrient malnutrition, dietary habits, life skill behaviours, access to services (school, health and nutrition) and physical activity throughout adolescence 10-19 years and for both boys and girls.

The CNNS survey data comes at an opportune time, two years after the launch of the National Nutrition Mission (*POSHAN Abhiyaan*) which can provide valuable insights to support healthy growth throughout childhood and adolescence. Additionally, focusing on adolescent girls, before they become mothers, is critical to break India's intergenerational cycle of malnutrition. The potential of schools as a cross-sectoral platform to address good nutrition – diets, services and behaviours – remains largely untapped even in *POSHAN Abhiyaan*'s first two years. CNNS gives important programme insights on strengthening school-based services.

Adolescents, Diets and Nutrition: Growing well in a changing world, is the first CNNS thematic report of the unit level analysis of the CNNS. It deep-dives in the CNNS unit level data-set into lives of adolescents in India in the 21st century. We analyze and provide national and state estimates on adolescents 10-19 years, levels of malnutrition both its visible and hidden forms, risks for non-communicable diseases, diets, physical activity patterns, life style and beliefs and access to services (health, social safety net and nutrition) for early adolescents (10 to 14 years) and late adolescents (15 to 19 years). The analytical sample included 35,856 adolescents 10-19 years (and a sub-set of 16,181 for biological samples).

The thematic report answers the following questions for girls and boys aged 10 to 14 years and 15 to 19 years, separately. How these answers vary across all states of India is also presented.

1. How many adolescents suffer from visible forms of malnutrition?
2. How many adolescents suffer from anemia and micronutrient deficiencies?
3. How many adolescents are at risks for non-communicable diseases?
4. How many adolescents eat as per recommendation?
5. What foods are most commonly missed in diets of malnourished adolescents?
6. What are the physical activity patterns among adolescents?
7. What are the decision making patterns in adolescents?
8. What is the co-coverage of school-based nutrition services?

This report provides critical evidence to inform *POSHAN Abhiyaan* for holistic programming for improving nutritional status of adolescent girls and boys, especially through schools. As the *POSHAN Abhiyaan* enters its third year, the timing is right to review how the "would be mothers and fathers" be provided the right nutrition to prevent the intergeneration cycle of malnutrition and stregthen the human capital responsible for India's future growth and development.

2 Methods

Adolescents, Diets and Nutrition: Growing well in a changing world is based on unit level analysis of the 10-19 years age-group sub-set of the CNNS data-set which contains information on 0-19 years. Briefly, the CNNS used a multi-stage sampling design to select a representative sample of households and individuals aged 0-19 years across 28 states and 2 union territories. In the CNNS, the total sample for 10 to 14 years aged adolescents was 18,388 with 8,845 girls and 9,543 boys. The total sample for 15 to 19 years aged adolescents was 17,442 with 8,560 girls and 8,882 boys. The sample for biochemical testing was 8,662 in the 10 to 14 years age-group (4,147 girls and 4,515 boys) and 7,520 in the 15 to 19 years age-group (3,818 girls and 3,702 boys). This sample size formed the analytical sample for this report.

Analysis For Malnutrition

First, we present the CNNS estimates on prevalence of different visible and hidden forms of malnutrition. Second, we extrapolate these estimates on the Census, 2011, final population estimates for 10 to 14 years and 15 to 19 years aged girls and boys to determine the burden of different forms of malnutrition. Third, we provide the co-existence of different forms of malnutrition to estimate double and triple burden. Fourth, estimates for each completed age from 10 to 18 years are also presented. Finally, we present the variation in different forms of malnutrition across states of India against public health significance or threshold prevalence at which the prevalence becomes a population-level problem. WHO thresholds of public health issues are used where available. Where thresholds are unavailable 10% or 20% intervals have been considered as per distribution of prevalence.

Visible forms of malnutrition

Measuring lower in height for age (short), weighing less for height (thin) and weighing more for height (overweight/obese) constitute the visible and commonly measurable forms of malnourishment. The weight for height measurement is also referred to as Body Mass Index (BMI). That an adolescent is short, thin or overweight/obese is determined by comparing her/his height and BMI with standards developed for a normal girl or boy of the same age; the standards being the WHO Growth Reference for 5-19 years[10]. How far a girl or boy is from this reference is used to classify short, thin or overweight/obese adolescent.

Hidden forms of malnutrition

Deficiency of vitamins and other essential micronutrients result in malnutrition where in the manifestations are not as obvious with mild or moderate deficits. Thus, these are collectively referred to as hidden forms of malnutrition. In this report we include anemia and six micronutrient deficiencies (iron, vitamin B_{12}, folate, vitamin A, vitamin D and zinc) to present the spectrum of hidden malnutrition. Blood and urine tests are undertaken to determine existence of these forms of malnutrition, comparing an adolescent's whole blood or blood serum or urine levels with WHO standard threshold values. We also present analyses of how many adolescents are facing at least one to all six micronutrient deficiencies to provide data on prevalence of multiple micronutrient deficiencies in an adolescent population.

Measure	Short	Thin	Overweight/obese
Height for age	<-2SD	-	-
BMI for age	-	<-2SD	>+1SD

Deficiency/deficiency disorder	Threshold value
Anemia	Whole blood hemoglobin level 10 to 14 y : <11.5 g/dl (10-11 y), <12 g/dl (12-14y) 15 to 19 y : <12 g/dl (girls), <13 g/dl (boys)
Mild anemia	10 to 14 y : 11 to 11.4 g/dl (10-11 y), 11 to 11.9 g/dl (12-14y) 15 to 19 y : 11 to 11.9 g/dl (girls), 11 to 12.9 g/dl (boys)
Moderate anemia	8 to 10.9 g/dl
Severe anemia	<8 g/dl
Micronutrient Deficiencies	
Iron	Serum ferritin <15 µg/l
Vitamin B_{12}	Serum vitamin B_{12} <203 pg/ml
Folate	Serum erythrocyte folate <151 ng/ml
Vitamin A	Serum retinol concentration <20 µg/dl
Vitamin D	Serum 25(OH)D concentration <12 ng/ml (30 nmol/L)
Zinc	Serum zinc concentration <70 µg/dL (morning fasting) <66 µg/dL (morning non-fasting)

Analysis for risks of non-communicable diseases

First, we present the CNNS estimates on prevalence of different risks of non-communicable diseases. Three risks are included in our analysis- risk for diabetes, risk for cardiovascular diseases and hypertension. Second, we provide the co-existence of different risks among adolescent girls and boys. Third, estimates for risks for non-communicable diseases for each completed age from 10 to 18 years are presented. Finally, we present the state-wide variations against globally endorsed thresholds for increased risks.

Risk of diabetes

Fasting plasma glucose and glycosylated hemoglobin (HbA1c) are diagnostic tests used to screen persons for diabetes[11]. HbA1C indicates plasma glucose levels over eight to 12 weeks.

Diagnostic test	Threshold value
Fasting plasma glucose	>100 mg/dl
HbA1c	>5.6%

Source: Global IDF/ ISPAD guidelines for diabetes in childhood and adolescence. International Diabetes Federation, International Society of Pediatric and Adolescent Diabetes. 2011

Risk of cardiovascular diseases

The early onset of lipid disorders including elevated total or low-density lipoprotein (LDL) cholesterol levels (bad cholesterol), low levels of high-density lipoprotein (HDL) cholesterol (good cholesterol), and high levels of triglycerides (fats) is alarming as these conditions in adolescence are predictive of elevated risk for cardiovascular disease in adulthood[12].

Diagnostic test	Threshold value
Total cholesterol	≥200 mg/dl
High LDL cholesterol	≥130 mg/dl
Low HDL cholesterol	<40 mg/dl
Triglycerides	≥130 mg/dl

Source: National Cholesterol Education Programme, Expert Panel on Cholesterol Levels in Children, 2012

Hypertension

Hypertension in adolescence predicts hypertension in adults and is most commonly associated with obesity[13]. Hypertension is diagnosed by measurement of blood pressure against standard threshold values.

Diagnostic test	Threshold value
Systolic blood pressure	≥140 mmHg
Diastolic blood pressure	≥90 mmHg

Source: National Cholesterol Education Programme, Expert Panel on Cholesterol Levels in Children, 2012

Analysis for eating as per recommendation

As per national guidance adolescent girls and boys in both early and late phases should eat nine types of foods daily (cereals, pulses/beans, milk/milk products, dark green leafy vegetables, other vegetables, roots and tubers, fruits, fats/oils and sugar/jaggery), eggs three time a week and chicken/fish at least two days in a week[4]. Both fats/oils and sugar/jaggery are to be consumed in moderation, that is, in the range of 20 g to 45 g per day[4]. Guidance is to avoid a set of foods including fried foods (*poori, pakora, vada, samosa, tikki,* etc) , junk food (burger, pizza, pasta, instant noodles), sweets (Indian sweets, pastries/cakes, donuts) and aerated drinks completely or to have these rarely.

We calculated the frequency of consumption of each of these foods by each girl and boy and estimated the proportion that complied with the recommendation in the 10 to 14 years and 15 to 19 years age-group. Second, we estimated compliance to food frequency recommendation at each completed age from 10 to 19 years for girls and boys. Third, we estimated the variation in this compliance across states of India and finally we present the lack of compliance to recommendation among adolescents with visible and hidden forms of malnutrition. We did a detailed investigation of compliance to recommended food frequency among those with visible and hidden forms of malnutrition, against a standard for those who did not have these forms of malnutrition. We also compared daily intake of foods to be avoided among those who are overweight/ obese, have risk of diabetes, high LDL cholesterol, low HDL cholesterol, high triglycerides and hypertension, against those who had none of these risks.

Analysis of physical activity

We calculated mean time spent on physical activity every day for girls and boys aged 10 to 14 yeasr and 15 to 19 years. We also calculated mean time spent in each activity by exact ages from 10 to 19 years. Finally, we compare mean time spent on selected activities across states of India against global recommendations presented below.

Under the CNNS, physical activity is divided under five domains - sitting time, travel to school, screen time, leisure time physical activity and outdoor sports/exercise/physical activity at school.

Total time spent on each activity by domain was calculated by adding up the number of hours spent on it from Monday to Sunday by each girl and boy. Mean time spent per day was calculated by dividing the total number of hours spent during the entire week by seven. The observations were compared against recommendations on screen time and physical activity per day for this age group as follows[14]:

Domain	Activities as per the CNNS
Sitting time	Sitting, doing homework, reading, study, tuition, eating, chatting
Travel to school	Travel by walking/cycling, bus/school/auto/metro
Screen time	Watching TV, playing on computer, using smart phones
Leisure time physical activity	Listening/singing music, play indoor games, paying musical instrument, art and craft, painting, drawing, bike riding/scooter, playing with pet, household work (cleaning house, watering plants, washing utensils, washing clothes, pressing clothes, kitchen work)
Outdoor sports/exercise/ physical activity at school	Football, basketball, volleyball, cricket, dancing, hockey, martial arts, rugby/ kabbadi, running/jogging, swimming, cycling, tennis/badminton/squash, dancing, walk for exercise, stretching exercise, yoga, gym, aerobics, skipping

Screen time: <2 hours of screen time per day

Physical activity:

1. At least 60 minutes of moderate- to vigorous-intensity physical activity daily
2. Most of the daily physical activity should be aerobic
3. Vigorous-intensity activities should be incorporated, including those that strengthen muscle and bone (such as running, jumping), at least 3 times per week

Analysis of decision making

In the CNNS questionnaire four questions pertaining to girl's decision making about her life choices were probed. These questions relate to:

1. Duration of schooling
2. Making independent purchases (going to market)
3. Whom to marry, and
4. Age of marriage

We present the proportion of girls 10 to 14 years and 15 to 19 years, who responded positively on these four questions and state-wide variations in these proportions.

Analysis of school-based health and nutrition services access

Schools are mandated to provide at least four health, food security and nutrition services under the *Anemia Mukt Bharat, Rashtriya Bal Swasthya Karyakram, Rashtriya Kishore Swasthya Karyakram* and mid-day meal scheme. The services are – 1) weekly IFA supplementation, 2) bi-annual deworming, 3) bi-annual health check-ups with counselling and referral and 4) mid-day hot cooked meal.

We present the proportion of school-going adolescent girls and boys receiving these services for 10 to 14 years and 15 to 19 years age-group. We then present the state-wide variations in receipt of these services. Finally, we assess what proportion of girls and boys receive a combination of services.

3 Findings

3.1 How many adolescents suffer from visible forms of malnutrition?

Key messages

- Every third adolescent girl and every fourth adolescent boy 10-19 years is too short for their age.
- More boys than girls are thin for their age in both 10-14 years age-group (32% boys, 23% girls) and 15-19 years age-group (26% boys, 14% girls). Highest prevalence of thinness is seen between 10-12 years for both boys and girls.
- In 10-14 years age-group, one in two short girls and one in three short boys, are also thin.
- 5% adolescents 10-14 years and 4% adolescents 15-19 years are overweight.
- In most states of India at least 1 in 5 girls and boys are too short for their age. Thinness in adolescence is a problem of public health concern in most Indian states. Twelve states have overweight/obesity prevalence over 10% in 10-14 years age-group itself. Within states, there is variation in prevalence of malnutrition between 10-14-year olds and 15-19 year olds. For example, in Bihar 18% girls are short in 15-19-years age-group, this increases to 36% in 10-14 years age-group. In Telangana, this trend is reverse with fewer short girls 10-14 years (17%) compared to 44% shorter girls 15-19 years.

Being short is an indication of chronic or long-term undernutrition while thinness and overweight/obesity are indicative of acute or short-term malnutrition. Adolescent girls who are short are more likely to have low birth weight, small for gestational age and preterm babies. Girls who are thin and whose condition remains unchecked before pregnancy are likely to have similar birth outcomes. Those entering pregnancy with obesity, face complications throughout pregnancy like hypertension and gestational diabetes as well as in labor due to large sized fetus.

Short

Early adolescence (10 to 14 years)

More than **1 in 4 girls (29%)**

Nearly **1 in 4 boys (23%)**

Late adolescence (15 to 19 years)

1 in 3 girls and boys (30%) and **(28%)**, respectively) are short

Thin

Early adolescence (10 to 14 years)

Nearly **1 in 4 girls (23%)** are thin

1 in 3 boys (32%) boys are thin

Thinness is **more prevalent among boys** than girls

Late adolescence (15 to 19 years)

More than **1 in 10 girls** are thin **(14%)**

More than **1 in 4 boys** are thin **(26%)**

Prevalence of **thinness in boys** is nearly **double** that among girls in the age-group of **15 to 19** years

Overweight/obese

Early adolescence (10 to 14 years)

1 in 20 (5%) girls and boys are overweight/obese

Late adolescence (15 to 19 years)

1 in 25 (4%) girls and boys are overweight/obese

Figure 1: Prevalence of visible forms of malnutrition in adolescents aged 10 to 14 years (%)

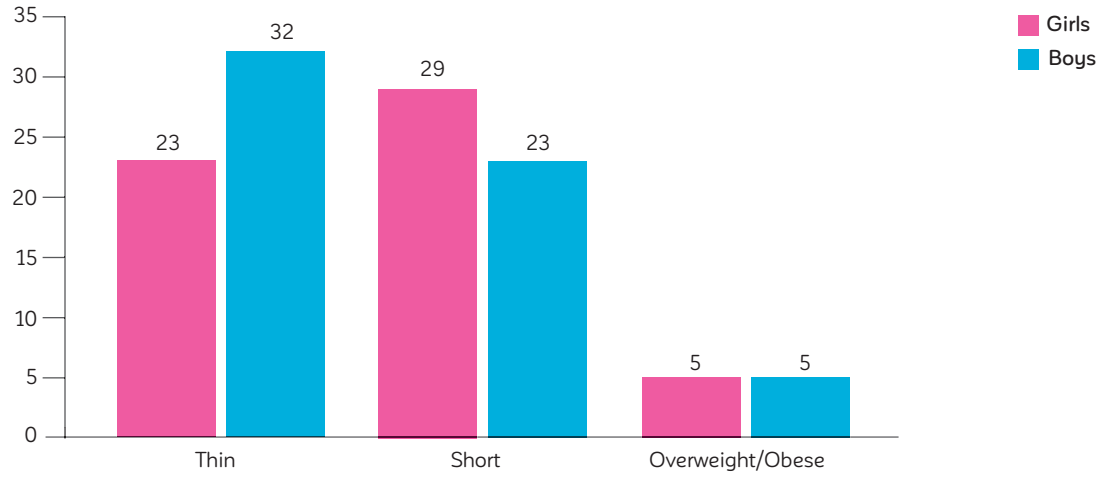
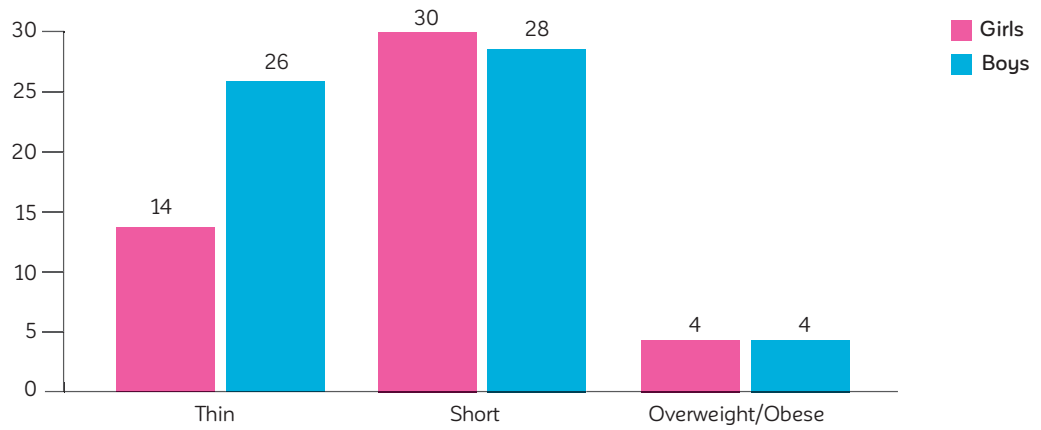


Figure 2: Prevalence of visible forms of malnutrition in adolescents aged 15 to 19 years (%)



Age-group	Short	Thin	Overweight/obese
Girls			
10 to 14 y	18 million (29%)	14.5 million (23%)	3 million (5%)
15 to 19 y	17 million (30%)	8 million (14%)	2 million (4%)
10 to 19 y	35 million (29%)	22.5 million (18%)	5 million (5%)
Boys			
10 to 14 y	16 million (23%)	24 million (32%)	3.5 million (5%)
15 to 19 y	18 million (28%)	17 million (26%)	2.5 million (4%)
10 to 19 y	34 million (25%)	41 million (29%)	6 million (5%)

Numbers in millions are approximate figures based on data from Census 2011.

3.1.1. Co-existence of visible forms of malnutrition

Short and thin

Early adolescence (10 to 14 years)

1 in 2 short girls are also thin **(50%)**

1 in 3 short boys are also thin **(32%)**

Late adolescence (15 to 19 years)

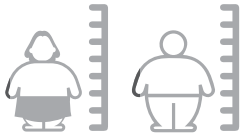
1 in 3 short girls are also thin **(31%)**

1 in 10 short boys are also thin **(12%)**

Short and overweight/obese

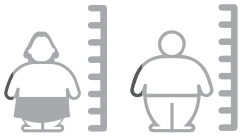
Early adolescence (10 to 14 years)

(2%) and **(3%)** of **short girls** and **boys** are also **overweight/obese**



Late adolescence (15 to 19 years)

(3%) and **(4%)** of **short girls** and **boys** are also **overweight/obese**



Age-group	Neither short, nor thin nor overweight/obese	Affected by one condition (short or thin or overweight/ obese)	Affected by two conditions Short and thin or Short and overweight/obese
Girls			
10 to 14 y	34 million (54%)	23 million (36%)	6 million (10%)
15 to 19 y	31 million (56%)	22 million (39%)	3 million (5%)
10 to 19 y	66 million (55%)	46 million (38%)	8 million (7%)
Boys			
10 to 14 y	36 million (52%)	25 million (36%)	8 million (12%)
15 to 19 y	32 million (51%)	25 million (40%)	6 million (10%)
10 to 19 y	68 million (51%)	51 million (38%)	15 million (11%)

Numbers in millions are approximate figures based on data from Census 2011.

3.1.2. Peak ages for different forms of visible malnutrition

Short

Among girls, from 10 to 18 years of age, there is not much variation in prevalence. Among boys, highest proportion of short adolescents is at 17 and 18 years (34%).

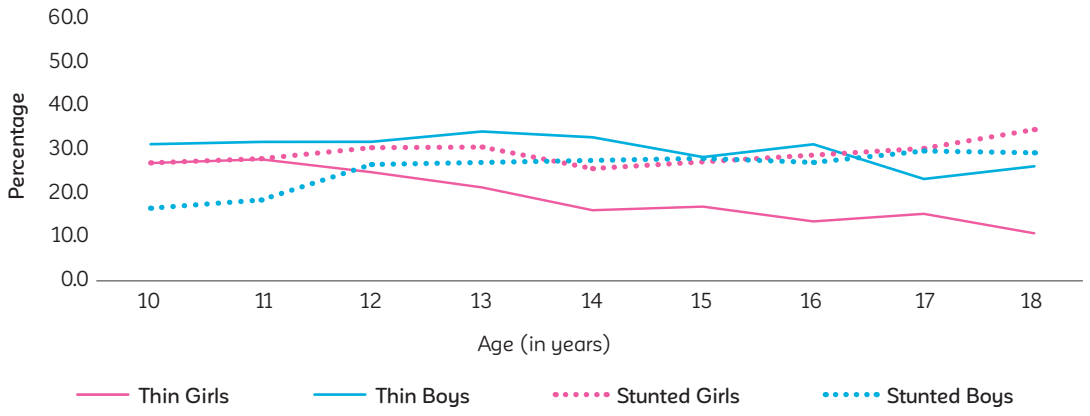
Thin

Among girls, highest prevalence of thinness is noted at age 11 years (27%). It declines steadily thereafter with a slight increase at 18 years of age. Among boys, prevalence of thinness plateaus from 10 to 12 years and increases marginally to reach highest level at 13 years (34%). From 15 to 18 years, prevalence of thinness rises.

Overweight/obese

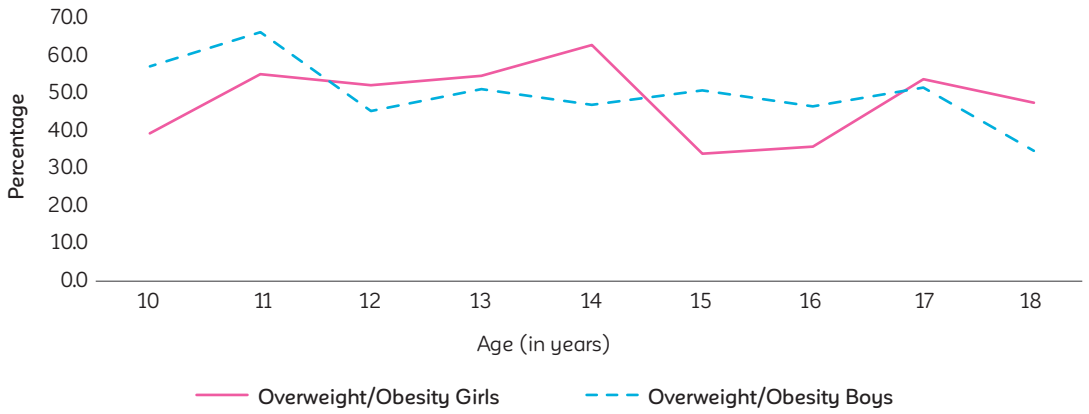
Due to the overall low prevalence of overweight and obesity, there is not much variation in prevalence among both girls and boys. Among girls, prevalence of overweight/obesity peaks at 14 years (6%) and among boys at 11 years (7%).

Figure 3: Prevalence of Thinness and Stunting in Adolescents aged 10-18 years (%)



Thinness is defined as BMI-for-age<-2SD and Stunting as Height-for-age <-2SD below the WHO Growth Reference for 5-19 years

Figure 4: Prevalence of Overweight/Obesity in Adolescents aged 10-18 years (%)



Overweight and obesity are defined as BMI-for-age > +1SD and >+2SD above the WHO Growth Reference for 5-19 years

3.1.3. State variations in visible forms of malnutrition

Short

Early adolescence (10 to 14 years)

Among girls, shortness varies from 11% (Kerala) to 43% (Assam) in early adolescence. In late adolescence it varies from 9% (Tripura) to 52% (Meghalaya). In Jharkhand and Meghalaya, shortness is high while in Goa it is low in both age-groups. From early to late adolescence, Telangana transitions from a better performing state to one with high prevalence of shortness, while the trend reverses in Bihar. Among boys, shortness varies from 13% (Haryana) to 45% (Meghalaya) in early adolescence. In late adolescence it varies from 14% (Uttar Pradesh) to 65% (Nagaland). In Meghalaya and Nagaland, shortness is high, while in Goa it is low in both age-groups. From early to late adolescence, Haryana transitions from a better performing state to one with high prevalence of shortness.

Thin

Among girls, thinness is a public health problem (BAZ <-2SD is ≥20%) in half the states in early adolescence but drops to five states in late adolescence (Madhya Pradesh (21%), Himachal Pradesh (22%), Telangana (22%), Gujarat (22%) and Goa (23%)). Among boys, thinness is a public health problem in 22 states in early adolescence and in 17 states in late adolescence.

Overweight/obese

Among girls, more than 1 in 10 girls are overweight/obese in one-third states of India (Goa 20%, Tamil Nadu 17%, Delhi 17%, Arunachal Pradesh and Nagaland 13%, Tripura, Himachal Pradesh and Jammu Kashmir 12%, Mizoram and Odisha 11%) in early adolescence but this drops to three states (Sikkim 13%, Karnataka 11% and Arunachal Pradesh 11%) in late adolescence. Among boys more than 1 in 10 are overweight/obese in one-third states of India (Goa 17%, Tamil Nadu 17%, Arunachal Pradesh 15%, Delhi and Nagaland 13%, Andhra Pradesh, Kerala, Manipur and Tripura 11%) in early adolescence but in late adolescence it drops down to just 2 states (Kerala and Punjab).

Table 1: Nutritional Status of Adolescents aged 10-14 years, CNNS 2016-18 (%)

States	Adolescent Girls			Adolescent Boys		
	Thin	Short	Overweight/ Obese	Thin	Short	Overweight/ Obese
India	**22.9**	**27.8**	**5.3**	**31.8**	**23.2**	**5.3**
Andhra Pradesh	20.7	24.1	11.0	24.0	21.6	8.0
Arunachal Pradesh	6.5	25.8	14.6	12.0	19.9	12.5
Assam	21.1	42.9	7.6	27.1	34.1	4.2
Bihar	16.1	36.4	1.3	30.0	28.7	1.9
Chhattisgarh	13.9	22.6	3.9	28.8	24.2	5.2
Delhi	26.1	22.6	13.4	21.3	15.3	17.4
Goa	16.4	13.7	19.9	20.3	13.6	17.3
Gujarat	26.3	30.6	9.7	37.5	21.1	7.3
Haryana	23.1	17.1	3.1	22.5	13.1	6.1
Himachal Pradesh	38.4	24.4	3.8	30.1	19.4	12.0
Jammu & Kashmir	16.6	18.6	8.1	19.1	14.2	12.2
Jharkhand	28.2	39.2	2.0	37.1	20.6	2.3
Karnataka	25.0	28.5	6.4	35.0	25.4	6.8
Kerala	20.0	11.0	11.4	20.7	16.7	8.8
Madhya Pradesh	29.7	33.5	1.6	40.9	24.5	1.5
Maharashtra	23.2	27.7	4.9	33.0	29.2	10.0
Manipur	6.3	20.3	10.8	6.9	26.0	10.2
Meghalaya	6.3	37.4	5.0	6.2	45.4	4.2
Mizoram	7.3	29.4	9.4	9.1	30.7	10.7
Nagaland	11.8	41.3	13.4	14.6	41.3	12.9
Odisha	19.9	30.6	7.7	22.8	23.4	11.3
Punjab	19.0	18.7	6.9	21.4	16.5	12.3
Rajasthan	29.8	20.8	4.7	36.6	17.6	2.8
Sikkim	10.3	19.2	10.6	14.6	19.1	9.6
Tamil Nadu	16.2	17.1	16.5	28.4	17.1	16.7
Telangana	23.4	16.6	5.8	33.2	18.7	5.6
Tripura	18.1	34.8	11.2	22.6	36.6	12.2
Uttar Pradesh	22.3	28.9	3.3	32.2	22.5	0.8
Uttarakhand	18.1	28.9	6.0	21.9	16.1	6.2
West Bengal	27.3	18.3	8.1	35.2	26.4	9.1

Thin:	< 20%	20–39.9%	> 40%	
Short:	< 10%	10–20%	20–30%	> 30%
Overweight /Obese:	< 5%	5–9%	9–14%	> 14%

Table 2: Nutritional Status of Adolescents aged 15-19 years, CNNS 2016-18 (%)

States	Adolescent Girls			Adolescent Boys		
	Thin	Short	Overweight/ Obese	Thin	Short	Overweight/ Obese
India	**14.2**	**30.2**	**4.1**	**26.3**	**28.3**	**4.4**
Andhra Pradesh	9.4	30.7	9.9	21.7	27.2	7.1
Arunachal Pradesh	1.9	39.3	10.8	9.4	41.5	5.6
Assam	9.1	30.0	2.6	17.2	56.1	1.2
Bihar	17.3	35.0	2.3	29.5	27.0	2.7
Chhattisgarh	11.0	29.3	3.7	18.7	28.6	4.1
Delhi	14.1	30.7	6.7	22.8	17.2	9.7
Goa	22.7	22.0	9.3	28.8	20.6	9.2
Gujarat	22.3	29.2	6.2	33.3	21.2	8.9
Haryana	13.4	17.9	3.9	21.9	17.0	4.5
Himachal Pradesh	21.7	22.4	2.2	32.7	13.6	3.6
Jammu & Kashmir	4.6	17.7	9.3	11.0	24.4	4.4
Jharkhand	17.2	46.7	1.4	26.6	32.8	1.8
Karnataka	15.5	27.8	10.7	32.4	29.6	6.1
Kerala	9.5	14.7	9.2	30.1	14.9	10.0
Madhya Pradesh	21.2	26.5	1.7	34.5	37.1	1.9
Maharashtra	12.1	27.0	6.0	26.2	40.3	6.3
Manipur	4.2	23.5	7.1	6.7	40.0	5.7
Meghalaya	1.1	52.0	4.3	12.1	50.5	0.2
Mizoram	2.9	22.5	6.5	5.3	32.9	3.9
Nagaland	2.7	20.3	4.1	8.3	64.9	3.6
Odisha	11.8	29.3	4.9	17.4	27.8	6.3
Punjab	17.3	8.7	6.3	13.0	19.7	10.1
Rajasthan	15.2	16.7	1.5	32.9	15.9	2.2
Sikkim	1.0	25.9	13.2	14.2	33.9	2.1
Tamil Nadu	13.4	19.9	9.4	26.0	22.4	6.2
Telangana	21.8	29.7	7.0	35.5	18.7	4.8
Tripura	10.5	36.7	6.0	12.8	52.1	7.6
Uttar Pradesh	10.9	34.9	2.7	23.7	26.5	1.7
Uttarakhand	8.1	19.8	4.4	10.2	19.0	3.7
West Bengal	11.9	43.8	3.6	24.9	33.8	9.2

Thin:	< 20%	20–39.9%	> 40%	
Short:	< 10%	10–20%	20–30%	> 30%
Overweight /Obese:	< 5%	5–9%	9–14%	> 14%

3.2 How many adolescents suffer from anemia and micronutrient deficiencies?

Key messages

- Anemia and iron deficiency is one-fold higher in girls compared to boys.
  - Anemia affects 32% girls 10-14 years and 48% girls 15-19 years. Among boys 10-19 years, ~20% are anemic.
  - Iron deficiency affects 24% girls 10-14 years and 39% girls 15-19 years. ~10% boys 10-19 years are iron deficient.
- Every third adolescent girl is B_{12} or folate deficient. More boys 15-19 years compared to girls 15-19 years are deficient in B_{12}, (41% boys, 28% girls) and folate (44% boys, 32% girls).
- Every fifth adolescent 10-14-years and every tenth adolescent 15-19 years is Vitamin A deficient.
- There is three-fold higher vitamin D deficiency in girls compared to boys (every third girl and every tenth boy affected). Vitamin D deficiency is higher in early adolescence (10 to 14 years) among both girls and boys.
- At least one in three adolescents are deficient in zinc.
- Out of the six micronutrient deficiencies studied, the most common form of hidden malnutrition among adolescent girls is vitamin D deficiency, followed by folate and iron deficiency. Among adolescent boys, the highest burden is of folate deficiency, followed by vitamin B_{12} and zinc deficiency. Double burden of anemia and thinness among girls is twice more than boys in early adolescence (10 to 14 years) and four times higher in late adolescence (15 to 19 years).
- Punjab is the only state to have high proportions of adolescents affected by five different micronutrient deficiencies (iron, vitamin B_{12}, vitamin D, vitamin A and zinc).
- Of the six micronutrient deficiencies studied, only 14% girls and 21% boys had no micronutrient deficiency and over 50% of them suffered from at least two deficiencies.

Anemia

Anemia is caused by inadequate bioavailability of micronutrients (iron, folate, and vitamin B_{12}); parasitic infections such as malaria and helminthic infestation of hookworms and other parasitic worms and flukes; genetic hemoglobinopathies such as thalassemia and sickle cell disease; chronic infection and inflammation; and chronic disease conditions such as renal failure[15,16,17]. Anemia results in fatigue, poor productivity and predisposition to infections. Girls who enter pregnancy with anemia are at increased risk of hemorrhaging during labor; babies may be low birth weight or premature. A prevalence of ≥40% is considered a severe public health problem, 20 to 39.9% a moderate public health problem, 5 to 19.9% a mild public health problem and less than 5% as not a public health problem[18].

Early adolescence (10 to 14 years)

1 in 3 girls (32%) and nearly **1 in 5 boys (17%)** are **anemic** (mild or moderate or severe). Of those that are anemic (either sex), **40%** anemia is of **moderate to severe** form

Late adolescence (15 to 19 years)

1 in 2 girls (48%) and **1 in 5 boys (18%)** are **anemic** (mild or moderate or severe). Of those girls who are anemic, nearly **50%** have anemia of **moderate or severe** in nature. However, in boys who are anemic, **90%** anemia is **mild in nature**

Iron deficiency

Iron deficiency is the most common nutritional deficiency and most common cause of nutritional anemia world-wide. Even in absence of anemia, iron deficiency has negative impact on motor and cognitive development[14].

Early adolescence (10 to 14 years)

1 in 4 girls (24%) girls and **1 in 10 boys (14%)** suffer from **iron deficiency**

Late adolescence (15 to 19 years)

2 in 5 girls (39%) girls and less than **1 in 10 boys (8%)** have **iron deficiency**

Vitamin B_{12} deficiency

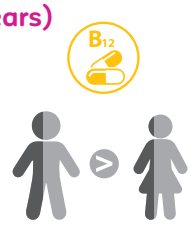
Vitamin B_{12} deficiency is associated with anemia, impaired nerve function and poor cognitive function[19].

Early adolescence (10 to 14 years)

Nearly every third adolescent **10-14 years** (**26%** girls and **30%** boys) has **vitamin B_{12} deficiency**

Late adolescence (15 to 19 years)

More boys **15-19 years** compared to girls have **vitamin B_{12} deficiency** (**41%** boys, **28%** girls)



Folate deficiency

Folate deficiency is also associated with anemia as well as increased cardiovascular risks[15].

Early adolescence (10 to 14 years)

Every third girl and boy **10-14 years** has **folate deficiency**

Late adolescence (15 to 19 years)

1 in 3 girls (32%) girls and **2 in 5 boys (44%)** boys have **folate deficiency**

Age-group	Anemia	Iron deficiency	Vitamin B_{12} deficiency	Folate deficiency
Girls				
10 to 14 y	20 million (32%)	14.5 million (24%)	16 million (26%)	23 million (36%)
15 to 19 y	27 million (48%)	22 million (39%)	16 million (28%)	18 million (32%)
10 to 19 y	47 million (40%)	35 million (31%)	22 million (27%)	42 million (34%)
Boys				
10 to 14 y	11.5 million (17%)	9.5 million (14%)	21 million (30%)	25 million (36%)
15 to 19 y	11.5 million (18%)	5 million (8%)	26 million (41%)	28 million (44%)
10 to 19 y	23 million (18%)	14.5 million (12%)	47 million (35%)	56 million (39%)

Numbers in millions are approximate figures based on data from Census 2011.

Vitamin A

In addition to impaired vision, vitamin A deficiency is associated with impaired bone growth, delayed sexual maturation and increased predisposition to infections[20]. A prevalence of ≥20% is a severe public health problem, 10 to 19.9% a moderate public health problem, 2 to 9.9% a mild public health problem and less than 2% not a public health problem[21].

Early adolescence (10 to 14 years)

Nearly **1 in 5 girls and boys** (**19%** and **18%**, respectively) have **vitamin A deficiency**

Late adolescence (15 to 19 years)

Slightly over **1 in 10 girls and boys** (**12%** and **13%**, respectively) have **vitamin A deficiency**

Vitamin D

Vitamin D is essential for bone mineralization and attaining full height potential. Deficiency may result in stunting and increased risk of osteoporosis in adulthood[22].

Early adolescence (10 to 14 years)

1 in 3 girls (35%) girls have **vitamin D deficiency**

Almost **1 in 5 boys (16%)** have **vitamin D deficiency**

Late adolescence (15 to 19 years)

1 in 3 girls (34%) have **vitamin D deficiency**

1 in 10 boys (12%) have **vitamin D deficiency**

Prevalence of vitamin D deficiency among girls is almost thrice than that in boys in the age-group of **15 to 19 years**

Zinc

Among adolescents zinc deficiency may delay sexual maturation. It also has a role in bone growth; deficiency may limit attainment of full height potential[23].

Early adolescence (10 to 14 years)

More than **1 in 4 girls (27%)** have **zinc deficiency**

More than **1 in 3 boys (36%)** have **zinc deficiency**

Late adolescence (15 to 19 years)

1 in 3 girls and boys (30% and **34%**, respectively) **have zinc deficiency**

Age-group	Vitamin A	Vitamin D	Zinc
Girls			
10 to 14 y	12 million (19%)	22 million (35%)	17 million (27%)
15 to 19 y	7 million (12%)	19 million (34%)	17 million (30%)
10 to 19 y	19 million (16%)	41 million (35%)	34 million (28%)
Boys			
10 to 14 y	12 million (18%)	11 million (16%)	25 million (36%)
15 to 19 y	8 million (13%)	8 million (12%)	22 million (34%)
10 to 19 y	20 million (16%)	19 million (14%)	47 million (35%)

Numbers in millions are approximate figures based on data from Census 2011.

Figure 5: Prevalence of Anaemia and Micronutrient Deficiencies among Adolescents aged 10-14 years (%)

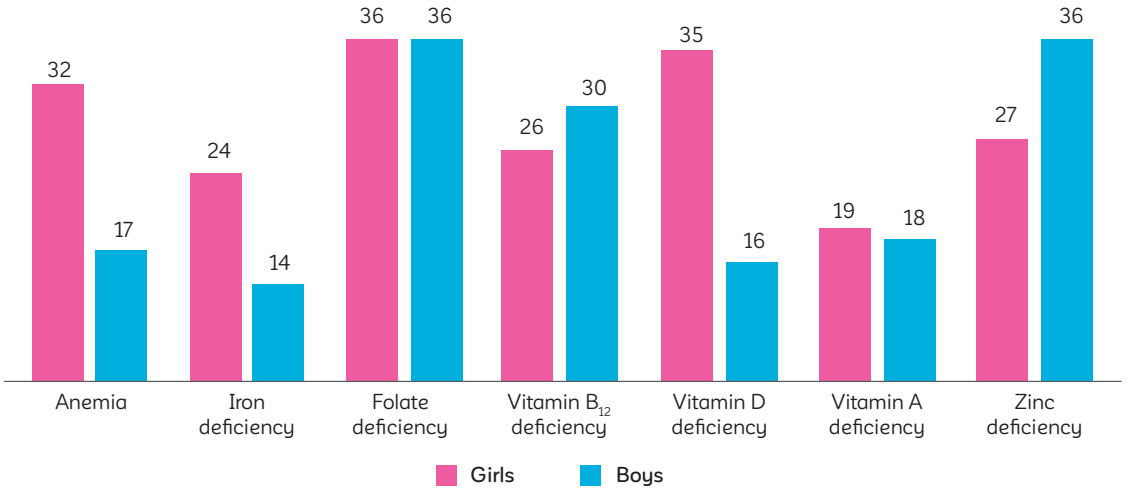
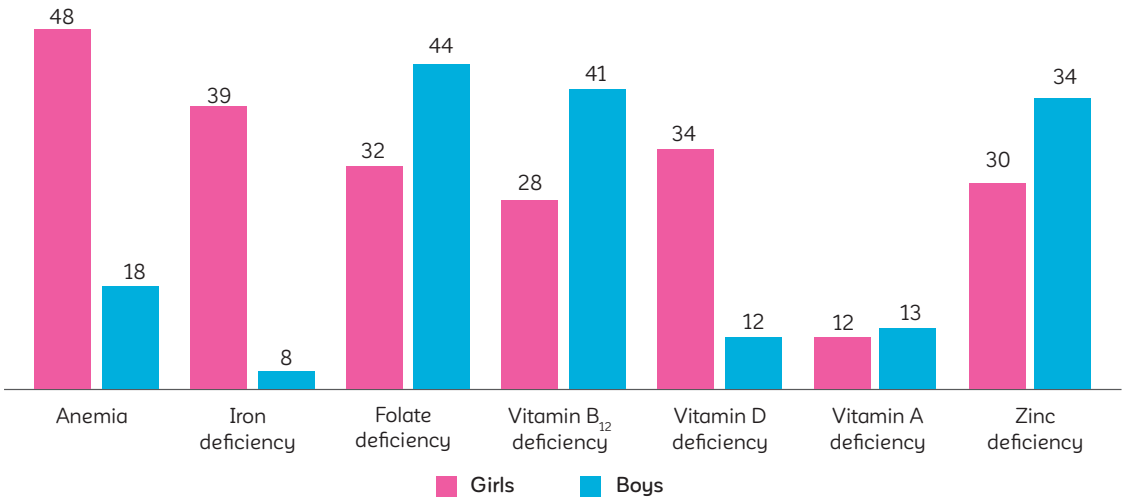


Figure 6: Prevalence of Anemia and Micronutrient Deficiencies among Adolescents aged 15-19 years (%)



3.2.1. Co-existence of visible and hidden forms of malnutrition

Anemic and short

Early adolescence (10 to 14 years)

1 in 3 anemic girls are short

More than **1 in 4 anemic boys (28%) are short**

Late adolescence (15 to 19 years)

1 in 3 anemic girls (35%) and **boys (34%) are short**

Anemic and thin

Early adolescence (10 to 14 years)

Almost **2 in 5 anemic girls (38%) are thin**

1 in 5 anemic boys (19%) are thin

Late adolescence (15 to 19 years)

More than **2 in 5 anemic girls (44%) are thin**

More than **1 in 10 anemic boys (14%) are thin**

Anemic and iron, vitamin B_{12} or folate deficient

Early adolescence (10 to 14 years)

1 in 4 anemic girls have **iron (26%) or folate (25%) deficiency**, **1 in 3 anemic girls (32%)** have **vitamin B_{12} deficiency**

2 in 5 anemic boys (42%) have **iron deficiency**. Over **1 in 4** have **vitamin B_{12} deficiency (26%) or folate deficiency (30%)**

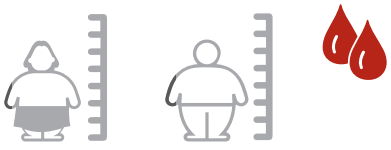
Late adolescence (15 to 19 years)

1 in 5 anemic girls (22%) have **iron deficiency**. **2 in 5** have **vitamin B_{12} (37%) or folate deficiency (40%)**

Half the anemic boys (54%) have **iron deficiency**. **Over 1 in 4 boys** have **vitamin B_{12} (26%)** or **folate deficiency (29%)**

Anemic and overweight/obese

Early adolescence (10 to 14 years)



4% and **5%** of anemic **girls and boys** are **overweight/obese**

Late adolescence (15 to 19 years)

2% and **4%** of anemic **girls and boys** are **overweight/obese**

Micronutrient deficiencies (N)	0	≥1	≥2	≥3	≥4	≥5	6
Girls							
10 to 14 y	14%	86%	51%	22%	6%	1%	0%
15 to 19 y	14%	86%	51%	21%	6%	1%	0%
10 to 19 y	14%	86%	51%	21%	6%	1%	0%
Boys							
10 to 14 y	21%	79%	44%	12%	2%	0%	0%
15 to 19 y	22%	78%	42%	14%	2%	0%	0%
10 to 19 y	21%	79%	43%	13%	2%	0%	0%

Multiple micronutrient deficiencies have been estimated based on respective cut-offs for each micronutrient (iron, folate, vitamin B_{12}, vitamin A, vitamin D and zinc); excluding cases of high inflammation (C-reactive protein level > 5mg/L)

Numbers in millions are approximate figures based on data from Census 2011.

Of the six micronutrient deficiencies studied, among both 10 to 14 years and 15 to 19 years aged adolescents, only 14% girls and 21% boys had no micronutrient deficiency. Over half the girls have at least two types of micronutrient deficiencies and a fifth of the girls have at least three types of micronutrient deficiencies.

3.2.2. Peak ages for different forms of hidden malnutrition

Anemia

Among girls, prevalence of anemia peaks at 16 years (49%) and persists at that level for another year. There is a marginal decline in prevalence thereafter. Among boys, prevalence peaks at 15 years (30%) after a sharp rise in levels at 14 years. Prevalence falls rapidly after 16 years of age.

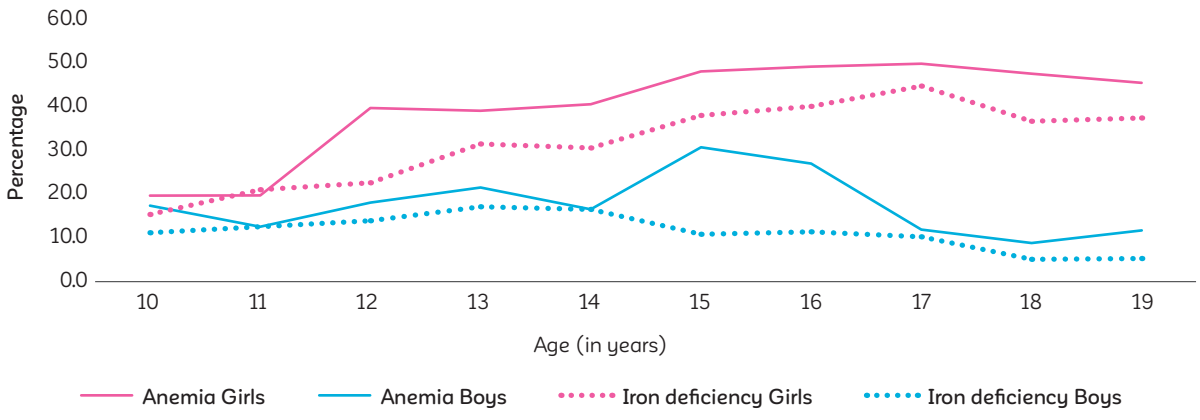
Iron deficiency

Among girls, iron deficiency anemia peaks at 17 years (44%) after a steady increase from 10 years of age. Among boys the trend is different from girls as prevalence of iron deficiency increases marginally to reach peak at 13 years (17%), after which it declines consistently.

Vitamin B_{12} deficiency

Among girls, vitamin B_{12} deficiency peaks at 16 years of age (35%). It falls sharply at 17 years (10% points) but increases marginally after that.

Figure 7: Prevalence of Anemia and Iron Deficiency in Adolescents aged 10-19 years (%)



Anemia

Adolescent Girls: Hemoglobin levels <11.5 g/dl for 10–11 years, <12.0 g/dl for 12–14 years and <12.0 g/dl for 15–19 years

Adolescent Boys: Hemoglobin levels <11.5 g/dl for 10–11 years, <12.0 g/dl for 12–14 years and <13.0 g/dl for 15–19 years

Iron Deficiency: Serum ferritin levels <15 µg/l; excluding cases with C-reactive protein >5 mg/L

Among boys, prevalence peaks at 15 years (44%) after increasing steadily from 10 years of age.

Folate deficiency

Among girls, folate deficiency peaks at 13 years (43%) but declines consistently thereafter. Among boys, it peaks later at 17 years (50%).

Vitamin A deficiency

Among girls, vitamin A deficiency peaks at 12 years (22%). In boys, it peaks earlier at 11 years (22%).

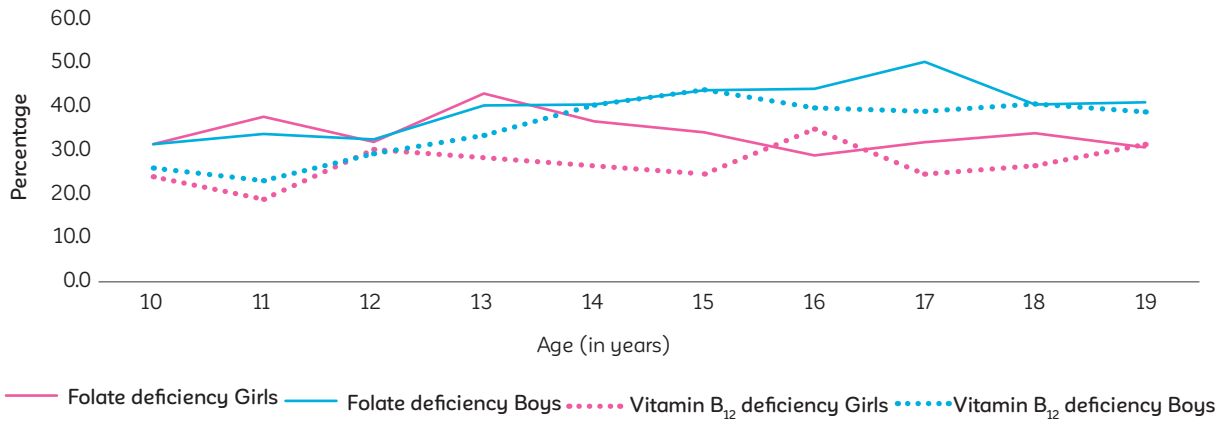
Vitamin D deficiency

Among girls, vitamin D deficiency peaks at 13 years (41%) and remains around this level for two consecutive years. Among boys, vitamin D deficiency is highest at age of 10 years (19%) after which it declines almost consistently.

Zinc deficiency

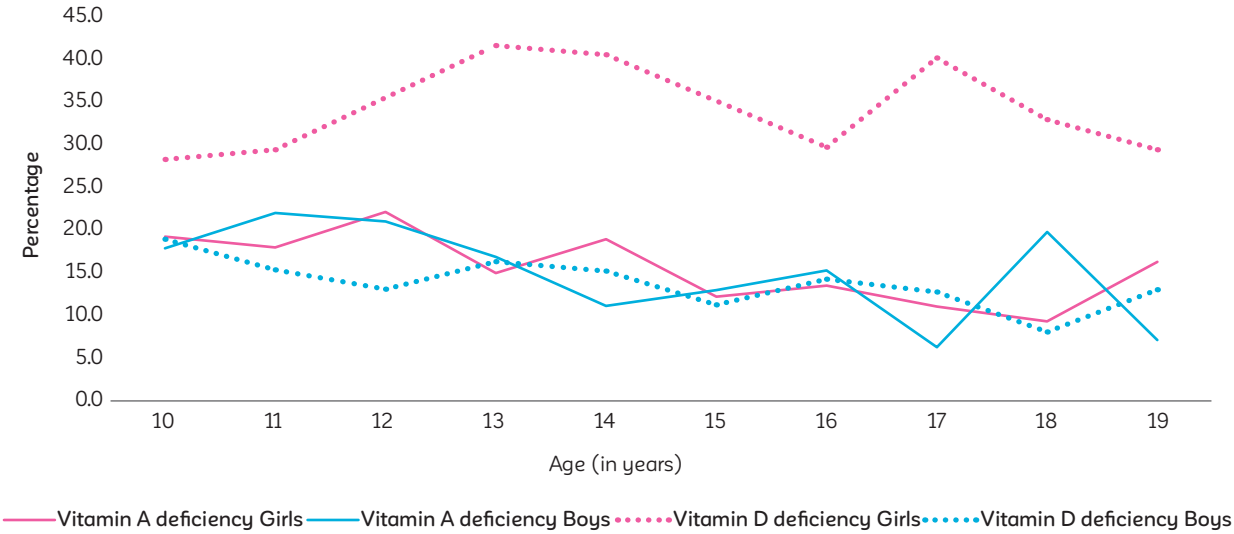
Among girls, zinc deficiency is highest at 19 years (34%), following a steady increase since age of 10 years. Among boys, zinc deficiency peaks at 11 years (40%).

Figure 8: Prevalence of Folate and Vitamin B_{12} Deficiency in Adolescents aged 10-19 years (%)



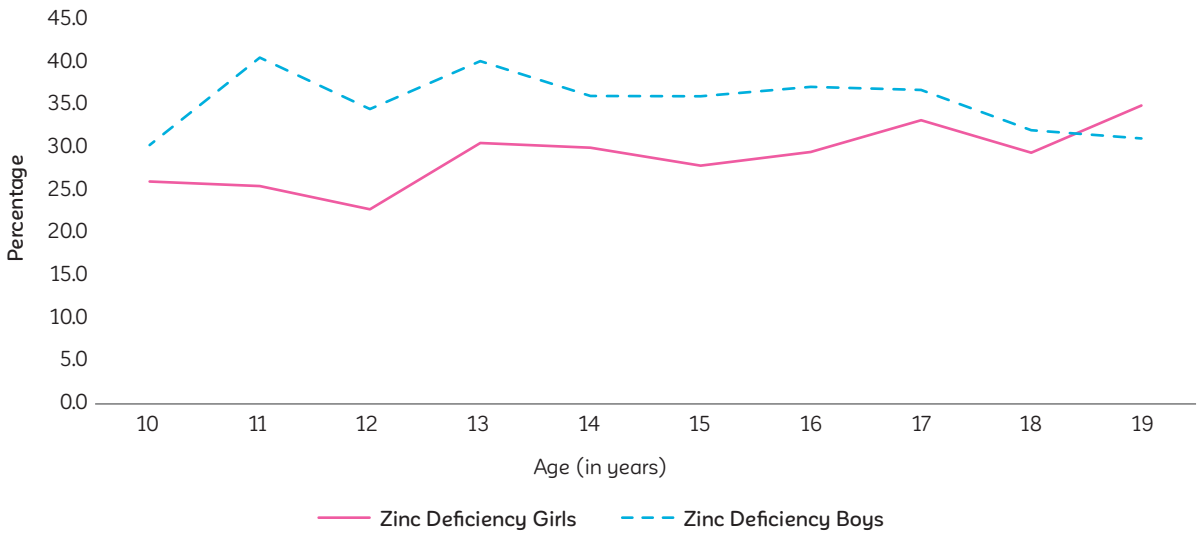
Folate deficiency: Serum erythrocyte folate < 151 ng/ml **Vitamin B_{12} deficiency:** Serum vitamin B_{12} < 203 pg/ml

Figure 9: Prevalence of Vitamin A and Vitamin D Deficiency in Adolescents aged 10-19 years (%)



Vitamin A deficiency: Serum retinol concentration <20 µg/dL; excluding cases with C-reactive protein >5mg/L
Vitamin D deficiency: Serum 25(OH)D concentration <12ng/mL (30 nmol/L)

Figure 10: Prevalence of Zinc Deficiency in Adolescents aged 10-19 years (%)



Zinc Deficiency: Serum zinc concentration < 70 µg/dl (morning fasting) and <66 µg/dl (morning non-fasting) in non-pregnant females and < 74 µg/dl (morning fasting) and < 70 µg/dl (morning non-fasting) in males.

3.2.3 State variations in prevalence of hidden malnutrition

Anemia

Among girls, anemia is a severe public health problem (prevalence ≥ 40%) in five states in early adolescence and worsens to 19 states in late adolescence. At the same time states with mild to no public health concern for anemia reduces from fourteen states in early adolescence to nine states in late adolescence. Among boys, anemia is a moderate public health problem in ten states in early adolescence and eleven states in late adolescence. Nagaland was the only state with zero prevalence of anemia for boys in late adolescence.

Iron deficiency

Among girls, iron deficiency ranges from 6% (Jharkhand) to 53% (Maharashtra) in late adolescence and from 5% (Nagaland) to 69% (Goa) in late adolescence. In Jharkhand and Mizoram, prevalence of iron deficiency is low in both age-groups while in Punjab it is high in both age-groups. Among boys, it ranges from 0 (Nagaland) to 56% (Punjab) in early adolescence and from 0 (Mizoram, Nagaland, Uttarakhand) to 28% (Uttar Pradesh) in late adolescence.

Vitamin B_{12} deficiency

Among girls, vitamin B_{12} deficiency ranges from 1% (West Bengal) to 47% (Rajasthan) in early adolescence and from 0 (West Bengal) to 55% (Odisha) in late adolescence. In Chhattisgarh and Punjab, prevalence is high in both age-groups while in Manipur, Nagaland and West Bengal it is low in both. Among boys, prevalence ranges from <1% (Nagaland) to 51% (Uttar Pradesh) in early adolescence and from 5% (Telangana, West Bengal) to 61% (Chhattisgarh). As among girls, prevalence is high in both early and late adolescence in Chhattisgarh, Punjab, and low in Nagaland, West Bengal.

Folate deficiency

Among girls, folate deficiency varies from 0 (West Bengal) to 89% (Andhra Pradesh) in early

Table 3: Prevalence of Anaemia in Adolescents, CNNS 2016-19 (%)

States	10-14 years		15-19 years	
	Girls	Boys	Girls	Boys
India	**32.1**	**17.1**	**47.5**	**18.1**
Andhra Pradesh	28.0	9.8	39.4	13.3
Arunachal Pradesh	22.3	20.5	48.2	17.8
Assam	35.2	24.9	53.4	39.1
Bihar	23.0	20.4	46.0	16.4
Chhattisgarh	42.1	21.0	41.4	21.0
Delhi	32.0	12.5	56.5	18.8
Goa	14.2	5.8	32.1	6.2
Gujarat	44.2	21.6	47.8	20.6
Haryana	29.6	23.2	54.2	20.5
Himachal Pradesh	12.1	4.4	28.0	21.1
Jammu & Kashmir	15.6	6.7	31.9	5.6
Jharkhand	50.2	17.6	53.7	15.0
Karnataka	16.5	4.8	34.9	12.7
Kerala	6.4	2.9	21.4	5.2
Madhya Pradesh	23.3	12.1	34.1	19.8
Maharashtra	27.6	21.2	47.5	20.3
Manipur	8.1	7.3	14.9	12.5
Meghalaya	32.1	23.8	60.1	20.5
Mizoram	16.0	13.0	35.7	9.0
Nagaland	9.0	15.5	6.0	0.0
Odisha	31.1	18.2	50.2	17.5
Punjab	24.1	16.5	46.9	13.7
Rajasthan	31.1	6.0	50.3	17.1
Sikkim	30.7	17.8	45.5	10.5
Tamil Nadu	11.4	9.2	40.2	5.3
Telangana	37.8	16.7	55.2	20.3
Tripura	41.3	25.7	67.1	33.0
Uttar Pradesh	39.9	17.9	49.2	16.9
Uttarakhand	17.0	7.0	23.7	15.9
West Bengal	56.0	31.2	67.6	28.0

< 5% 5–19.9% 20–39.9% ≥ 40%

Table 4: Micronutrient Deficiencies in Adolescents aged 10-14 years, CNNS 2015-16 (%)

States	Girls (10-14 years)						Boys (10-14 years)					
	Iron deficiency	Vitamin B_{12} Deficiency	Folate deficiency	Vitamin A deficiency	Vitamin D Deficiency	Zinc Deficiency	Iron deficiency	Vitamin B_{12} Deficiency	Folate deficiency	Vitamin A deficiency	Vitamin D Deficiency	Zinc Deficiency
India	**24.1**	**25.6**	**36.1**	**18.7**	**35.0**	**26.6**	**14.0**	**30.4**	**35.6**	**17.8**	**15.6**	**36.0**
Andhra Pradesh	15.9	20.1	89.3	12.4	22.0	22.2	5.7	15.4	1.9	17.0	11.2	18.2
Arunachal Pradesh	23.2	7.0	50.0	13.0	35.2	23.6	3.7	10.2	37.0	15.2	16.5	35.1
Assam	10.5	10.2	73.9	9.9	15.1	34.0	2.5	5.0	6.5	5.1	2.5	33.0
Bihar	9.8	16.9	14.4	25.7	55.4	15.3	9.8	27.3	17.2	7.1	19.8	29.5
Chhattisgarh	35.3	40.9	71.1	42.1	37.0	19.6	22.0	41.6	18.6	10.8	10.9	37.0
Delhi	21.0	21.9	0.6	15.1	60.0	42.8	8.7	25.3	55.7	0.0	28.3	43.1
Goa	17.6	11.7	44.5	1.8	26.0	24.9	5.2	14.2	4.2	24.2	18.6	33.5
Gujarat	42.9	40.0	58.3	7.7	46.7	37.7	31.4	37.7	62.8	23.5	33.2	66.0
Haryana	34.7	22.3	37.2	7.4	64.2	22.8	24.7	33.1	77.4	9.0	42.3	25.4
Himachal Pradesh	10.7	22.5	9.2	2.6	33.4	51.0	7.3	31.6	4.1	23.4	9.8	63.9
Jammu & Kashmir	30.7	14.5	9.5	6.0	69.4	33.0	25.7	32.9	8.8	26.6	23.9	45.3
Jharkhand	5.7	18.9	19.5	43.5	32.6	38.7	6.8	20.8	23.4	22.3	22.5	67.0
Karnataka	36.6	32.8	72.2	15.4	26.8	35.0	26.3	32.6	64.6	21.8	4.3	46.3
Kerala	27.4	3.3	48.5	14.9	42.0	18.8	13.6	1.6	0.0	9.1	15.4	13.8

Iron, Zinc, Vitamin B_{12}: < 10% | 10–20% | 20–30% | > 30%

Folate: < 20% | 20–40% | 40–60% | > 60%

Vitamin D: < 10% | 10–30% | 30–40% | > 40%

Vitamin A: < 2% | 2–9.9% | 10–19.9% | > 20%

(Continued)

(Continued)

States	Girls (10-14 years)						Boys (10-14 years)					
	Iron deficiency	Vitamin B_{12} Deficiency	Folate deficiency	Vitamin A deficiency	Vitamin D Deficiency	Zinc Deficiency	Iron deficiency	Vitamin B_{12} Deficiency	Folate deficiency	Vitamin A deficiency	Vitamin D Deficiency	Zinc Deficiency
Madhya Pradesh	11.9	37.6	68.6	16.7	37.2	21.9	23.0	37.4	50.6	12.4	16.8	23.9
Maharashtra	53.4	26.6	75.6	7.4	33.1	24.7	17.0	30.0	71.4	17.6	13.6	24.2
Manipur	12.4	5.4	7.0	10.6	75.3	47.2	4.4	9.3	6.7	18.3	48.9	64.3
Meghalaya	24.6	8.2	78.3	15.9	13.1	51.8	2.8	11.4	59.0	3.7	2.3	44.0
Mizoram	11.8	8.4	21.1	19.5	24.4	2.8	4.4	13.3	23.5	43.7	4.2	1.0
Nagaland	20.4	4.9	73.6	3.6	15.2	0.0	0.0	0.6	93.2	14.8	5.8	3.5
Odisha	25.9	11.4	65.2	24.4	25.6	43.0	7.5	11.4	0.0	7.7	13.5	39.1
Punjab	50.0	46.9	16.3	26.9	80.7	54.2	45.6	44.4	1.1	23.3	63.5	56.4
Rajasthan	37.6	47.4	48.8	0.0	38.8	30.5	15.6	45.6	35.5	4.7	18.8	10.6
Sikkim	22.0	7.5	2.2	4.3	26.5	32.0	11.3	14.9	58.9	19.3	13.1	41.0
Tamil Nadu	37.0	12.5	74.8	7.7	11.0	30.7	16.6	10.9	68.7	10.4	3.9	44.6
Telangana	33.1	25.2	58.6	26.9	10.9	23.7	13.9	30.7	80.5	22.2	4.3	29.1
Tripura	20.6	3.4	5.5	13.1	43.0	33.9	3.3	7.9	65.8	5.8	20.3	42.1
Uttar Pradesh	14.8	39.5	3.8	24.9	32.1	18.7	9.9	50.8	43.9	14.5	8.6	35.0
Uttarakhand	27.5	16.2	22.2	22.5	74.7	32.1	14.9	24.3	59.7	3.1	58.9	41.5
West Bengal	25.8	1.1	0.0	4.4	30.9	25.8	6.8	5.5	53.7	21.7	14.3	29.8

Iron, Zinc, Vitamin B_{12}: < 10% | 10–20% | 20–30% | > 30%

Folate: < 20% | 20–40% | 40–60% | > 60%

Vitamin D: < 10% | 10–30% | 30–40% | > 40%

Vitamin A: < 2% | 2–9.9% | 10–19.9% | > 20%

Table 5: Micronutrient Deficiencies in Adolescents aged 15-19 years, CNNS 2015-16 (%)

States	Girls (15-19 years)						Boys (15-19 years)					
	Iron deficiency	Vitamin B_{12} Deficiency	Folate deficiency	Vitamin A deficiency	Vitamin D Deficiency	Zinc Deficiency	Iron deficiency	Vitamin B_{12} Deficiency	Folate deficiency	Vitamin A deficiency	Vitamin D Deficiency	Zinc Deficiency
India	**39.0**	**28.1**	**32.0**	**12.2**	**33.6**	**30.2**	**8.5**	**40.5**	**43.7**	**13.0**	**11.6**	**34.2**
Andhra Pradesh	37.7	13.6	81.3	16.3	20.1	19.3	4.8	30.7	81.1	2.7	12.6	20.6
Arunachal Pradesh	40.7	5.4	36.8	9.6	27.0	13.5	7.9	29.1	52.7	1.9	9.5	7.8
Assam	40.6	8.3	66.4	14.3	9.1	27.2	4.0	16.1	80.5	15.2	1.8	40.0
Bihar	21.6	25.6	8.8	16.9	48.5	25.3	5.1	29.6	16.4	17.4	10.8	24.5
Chhattisgarh	51.4	49.2	62.9	22.4	25.7	44.0	14.1	58.1	76.4	11.9	9.8	46.0
Delhi	41.2	33.7	3.8	13.6	68.1	47.8	3.8	42.5	8.0	4.3	35.8	37.1
Goa	32.8	12.2	51.9	7.9	30.0	24.0	0.0	17.1	59.2	0.8	13.4	21.6
Gujarat	47.4	50.4	55.2	25.7	39.4	55.8	20.5	60.7	65.2	11.7	24.6	59.1
Haryana	42.6	38.5	24.7	12.5	76.7	10.5	17.1	42.7	33.7	3.7	38.3	17.9
Himachal Pradesh	41.8	33.0	0.5	4.5	16.4	44.7	27.9	46.9	5.3	1.0	5.1	48.2
Jammu & Kashmir	42.2	22.8	3.1	9.7	80.5	33.9	18.8	34.9	3.8	3.6	24.6	42.0
Jharkhand	26.6	17.5	23.7	26.9	43.9	27.7	2.8	33.5	30.7	27.3	21.7	57.8
Karnataka	40.6	54.7	71.9	1.6	24.0	48.2	17.8	59.9	71.4	9.9	6.9	56.7
Kerala	48.7	0.0	53.3	17.1	44.6	23.3	4.2	5.4	68.1	4.5	22.5	11.4

Iron, Zinc, Vitamin B_{12}:	< 10%	10–20%	20–30%	> 30%
Folate:	< 20%	20–40%	40–60%	> 60%
Vitamin D:	< 10%	10–30%	30–40%	> 40%
Vitamin A:	< 2%	2–9.9%	10–19.9%	> 20%

(Continued)

States	Girls (15-19 years)						Boys (15-19 years)					
	Iron deficiency	Vitamin B_{12} Deficiency	Folate deficiency	Vitamin A deficiency	Vitamin D Deficiency	Zinc Deficiency	Iron deficiency	Vitamin B_{12} Deficiency	Folate deficiency	Vitamin A deficiency	Vitamin D Deficiency	Zinc Deficiency
Madhya Pradesh	48.9	36.7	64.5	19.5	29.1	9.5	6.2	56.8	84.8	6.2	13.3	23.3
Maharashtra	51.5	30.0	60.9	10.4	30.5	24.5	13.7	58.3	79.7	4.6	15.9	27.6
Manipur	27.6	11.1	3.5	11.4	72.3	49.7	4.2	20.0	10.1	9.8	40.3	49.2
Meghalaya	31.1	3.5	52.5	1.3	7.0	30.9	2.9	14.3	53.2	2.0	6.4	63.4
Mizoram	23.4	3.5	25.8	7.9	21.4	15.4	0.0	16.3	19.2	16.4	3.9	10.9
Nagaland	5.5	2.2	88.4	5.6	7.7	9.9	0.0	5.6	96.4	0.0	7.4	1.9
Odisha	39.8	20.5	73.4	13.0	25.6	43.4	5.8	18.6	72.0	17.1	6.1	44.8
Punjab	65.0	45.9	23.9	9.4	75.6	41.8	16.5	49.1	15.7	6.1	52.5	55.8
Rajasthan	69.2	45.4	46.3	6.3	29.4	18.4	20.0	50.9	60.6	0.0	15.2	33.5
Sikkim	39.6	15.6	0.0	6.5	23.2	39.1	10.0	27.1	0.7	0.0	11.3	33.9
Tamil Nadu	44.1	18.2	67.9	6.2	11.0	58.3	4.4	33.3	80.0	38.6	0.7	33.0
Telangana	40.0	23.2	72.5	17.4	17.4	30.1	16.7	37.6	71.1	12.9	2.9	29.4
Tripura	19.1	10.4	3.4	20.3	39.6	43.0	3.9	16.6	5.5	19.4	15.4	37.9
Uttar Pradesh	35.3	30.8	4.9	11.9	31.2	21.5	4.1	49.7	8.8	13.8	2.8	32.3
Uttarakhand	34.9	24.6	21.0	12.3	77.1	26.6	6.5	43.0	28.9	6.8	46.3	17.8
West Bengal	32.9	2.5	0.1	1.5	28.9	29.7	2.7	5.4	0.0	4.4	4.4	19.9

Iron, Zinc, Vitamin B_{12}: < 10% | 10–20% | 20–30% | > 30%

Folate: < 20% | 20–40% | 40–60% | > 60%

Vitamin D: < 10% | 10–30% | 30–40% | > 40%

Vitamin A: < 2% | 2–9.9% | 10–19.9% | > 20%

adolescence and from 0 (Gujarat, Telangana, Uttar Pradesh) to 88% (Nagaland) in later years. In Delhi from almost no cases of folate deficiency in early adolescent, almost every girl (81%) is affected in late adolescence. Among boys, the prevalence ranges from 0 (Kerala, Odisha) to 93% (Nagaland) in early adolescence and from 0 (Telangana) to 96% (Nagaland).

Vitamin A deficiency

Among girls, prevalence ranges from 0 (Rajasthan) to 43% (Jharkhand) in early adolescence and from 1% (Meghalaya, Telangana) to 27% (Jharkhand) in late adolescence. It is a public health problem (prevalence ≥20%) in nine states in early and four states in late adolescence. Among boys it ranges from 0 (Delhi) to 44% (Mizoram) in early adolescence and from 0 (Goa, Gujarat, Nagaland) and 39% (Maharashtra) in later years. It is a severe public health problem in 10 states which drops to two states (Jharkhand and Tamil Nadu) in late adolescence.

Vitamin D deficiency

Among girls vitamin D deficiency varies from 11% (Telangana) to 81% (Punjab) in early adolescence and from 7% (Meghalaya) to 80% (Bihar) in late adolescence. In Manipur, prevalence of vitamin D deficiency is high in both age groups. Among boys, it varies from 2% (Meghalaya) to 64% (Punjab) in early adolescence and from 1% (Maharashtra) to 53% (Tripura) in late adolescence. As among girls, vitamin D deficiency prevalence is high in both age-groups among boys.

Zinc deficiency

Among girls, zinc deficiency varies from 0 (Nagaland) to 54% (Punjab) in early adolescence, and from 9% (Arunachal Pradesh) to 58% (Maharashtra) in late adolescence. Prevalence is high in both age groups in the states of Manipur and Odisha. Among boys, prevalence ranges from 1% (Mizoram) to 67% (Jharkhand) in early and 2% (Nagaland) to 63% (Meghalaya) in late adolescence. Prevalence is high in both age-groups in the state of Jharkhand.

3.3 Risks for non-communicable diseases

Key messages

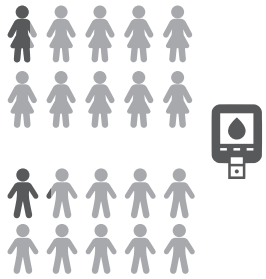
- 1 in 10 adolescent girls and boys 10-14 years and 2 out of 10 adolescents 15-19 years are at risk of diabetes on the basis of HbA1c levels.
- 26% boys 10-14 years have low good cholesterol which is indicative of low physical activity in addition to imbalanced diet. The proportion of adolescent boys 15-19 years with low HDL levels increases to 39% in 15-19 age-group. Among girls 10-19 years, 1 in every 4 adolescents have low HDL cholesterol levels. Thus, physical inactiveness is higher in boys compared to girls in 15-19-years age-group.
- 5% adolescent girls and boys suffer from hypertension, based on systolic and diastolic blood pressure. Among girls, proportion with hypertension is highest (8%) at 11 years and 18 years. Among boys highest proportion is noted at 19 years (7%).
- One in 2 adolescents have at least one of the three non-communicable disease risk (high HbA1C, high systolic/systolic blood pressure and low HDL levels). At least two such risks are seen in 1 in 3 adolescents 10-14 years. Pattern and proportion affected by risk of the three non-communicable diseases in 15-19 years age-group is similar to 10-14 years.
- None of the states have zero risk for diabetes and heart disease among 10-14 years aged adolescents.

Risk of diabetes

Pre-diabetes is a condition resulting from lack of physical activity and being overweight/obese. A high carbohydrate diet also contributes to the risk. Pre-diabetes often leads to type 2 diabetes.

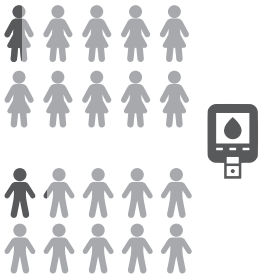
Early adolescence (10 to 14 years)

1 in 10 adolescent girls and boys **10-14 years** are at risk of diabetes on the basis of fasting **HbA1c levels** (**8% girls**, **12% boys**)



Late adolescence (15 to 19 years)

1 out of 10 adolescents **15-19 years** are at risk of diabetes on the basis of fasting **HbA1c levels** (**11% boys** and **7% girls**)



Risk of cardiovascular disease

Cardiovascular diseases include a range of conditions that affect the heart, which could be congenital or lifestyle related. Conditions related to lifestyle factors are more common and are a result of "unhealthy" diets, smoking, stress, excessive alcohol and caffeine intake. Diabetes and high blood pressure also contributes to increased risk of cardiovascular diseases. The early onset of lipid disorders including elevated total or LDL cholesterol levels (bad cholesterol), low levels of HDL cholesterol (good cholesterol),

and high levels of triglycerides (fats) is alarming as these conditions in adolescence are predictive of elevated risk for cardiovascular disease in adulthood.

Early adolescence (10 to 14 years)

1 in 4 (26%) of **girls** and **boys 10-14 years** have low HDL cholesterol (occurs largely due to low physical activity).

High triglycerides in adolescents **10-14** years is seen in more girls than boys **(20% girls, 13% boys)**. This may be largely contributed by high consumption of high calorie junk foods, fried foods, sweets and/or aerated drinks rich in fats and refined carbohydrates.

Late adolescence (15 to 19 years)

1 in 4 girls (24%) 1 in 3 boys (39%) and **15-19 years** have low HDL cholesterol

High triglycerides in adolescents **15-19 years** is seen in **16% girls** and **boys**

Hypertension

High blood pressure or hypertension is also most commonly lifestyle related. Smoking, alcohol consumption, high salt in diets, lack of physical activity and stress are contributing factors.

Adolescence (10 to 19 years)

5% adolescent **girls and boys** suffer from hypertension, based on **systolic and diastolic blood pressure**.

Burden in numbers

	Risk of diabetes (HbA1c)	Risk of cardiovascular diseases			Hypertension
		High LDL	Low HDL	High Triglycerides	
Girls					
10-14 y	5 million (8%)	3 million (4%)	16 million (24%)	13 million (20%)	3 million (5%)
15-19 y	10 million (8%)	2 million (4%)	13 million (25%)	9 million (16%)	3 million (5%)
10-19 y	10 million (8%)	5 million (4%)	30 million (25%)	22 million (18%)	6 million (5%)
Boys					
10-14 y	8 million (12%)	3 million (4%)	18 million (26%)	9 million (13%)	3 million (5%)
15-19 y	7 million (11%)	2 million (3%)	25 million (39%)	10 million (16%)	3 million (5%)
10-19 y	15 million (11%)	5 million (3%)	43 million (32%)	19 million (14%)	7 million (5%)

Numbers in millions are approximate figures based on data from Census 2011.

Figure 11: Prevalence of Risk Factors for Non-communicable Diseases among Adolescents aged 10-14 years (%)

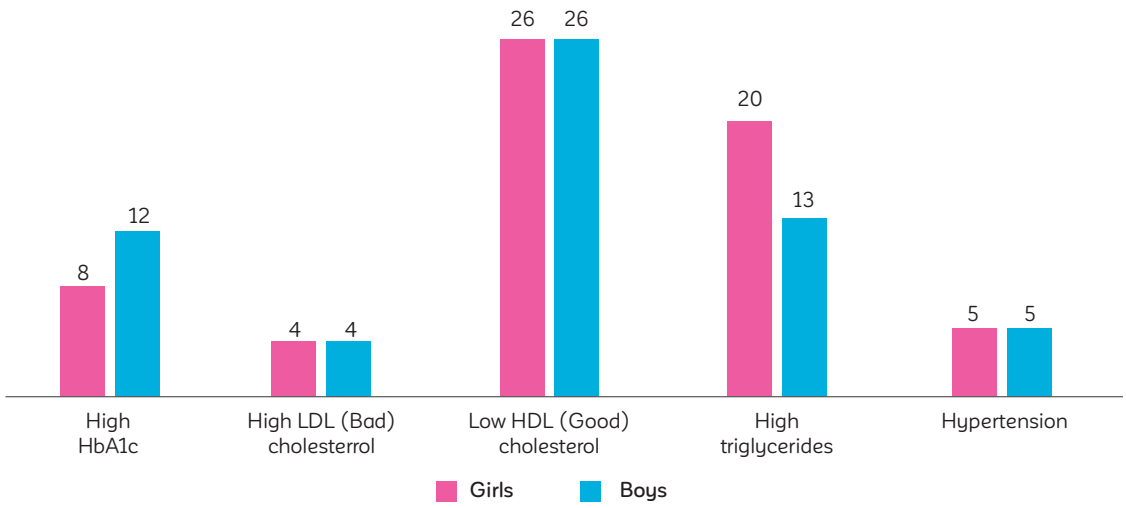
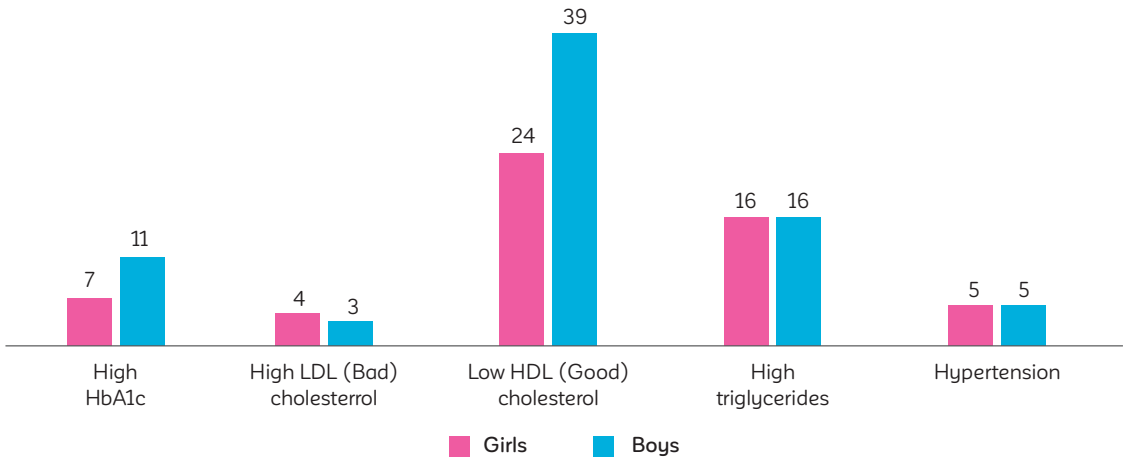


Figure 12: Prevalence of Risk Factors for Non-communicable diseases among Adolescents aged 15-19 years (%)



3.3.1. Co-existence of three non-communicable disease risks – diabetes, hypertension and cardiovascular diseases.

Early adolescence (10 to 14 years)

1 in 2 adolescents have at least one of the three non-communicable disease risks.

At least two such risks are seen in **1 in 3** adolescents **10-14 years**

Late adolescence (15 to 19 years)

Pattern and proportion affected by three non-communicable disease risks in **15-19 year** age group is similar to **10-14 years**

Risks of three non-communicable diseases	10 to 14 years		15 to 19 years		10 to 19 years	
	Girls	Boys	Girls	Boys	Girls	Boys
None	45%	44%	46%	36%	45%	40%
One risk	32%	38%	32%	39%	32%	39%
Two risk	17%	12%	18%	17%	18%	14%
Three risks	5%	5%	4%	7%	4%	6%

High HbA1C, high fasting plasma glucose, high systolic/systolic blood pressure, overweight/obesity, high total cholesterol, high LDL cholesterol, high trigycerides and low HDL cholesterol levels

High HbA1C is indicative of risk of diabetes. High systolic/systolic blood pressure is indicative of hypertension and high total cholesterol, high LDL cholesterol, high trigycerides, low HDL cholesterol levels is indicative of risk for cardiovascular diseases.

3.3.2. Peak ages for different risks of non-communicable disease

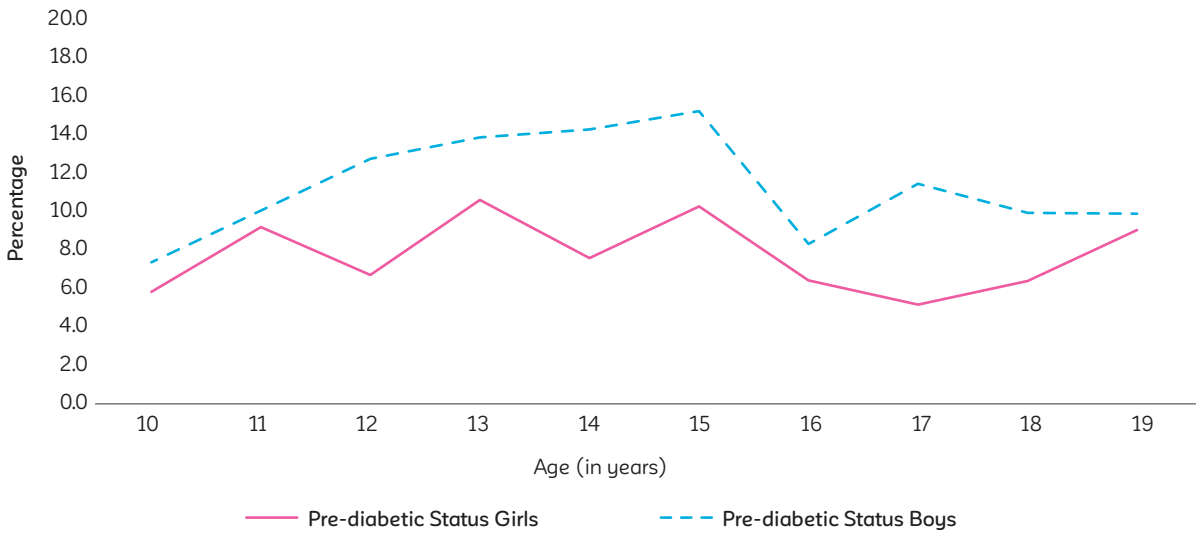
Risk of diabetes

The prevalence of high HbA1c peaks at 13 years for both girls (11%) and boys (14%).

Risk of cardiovascular diseases

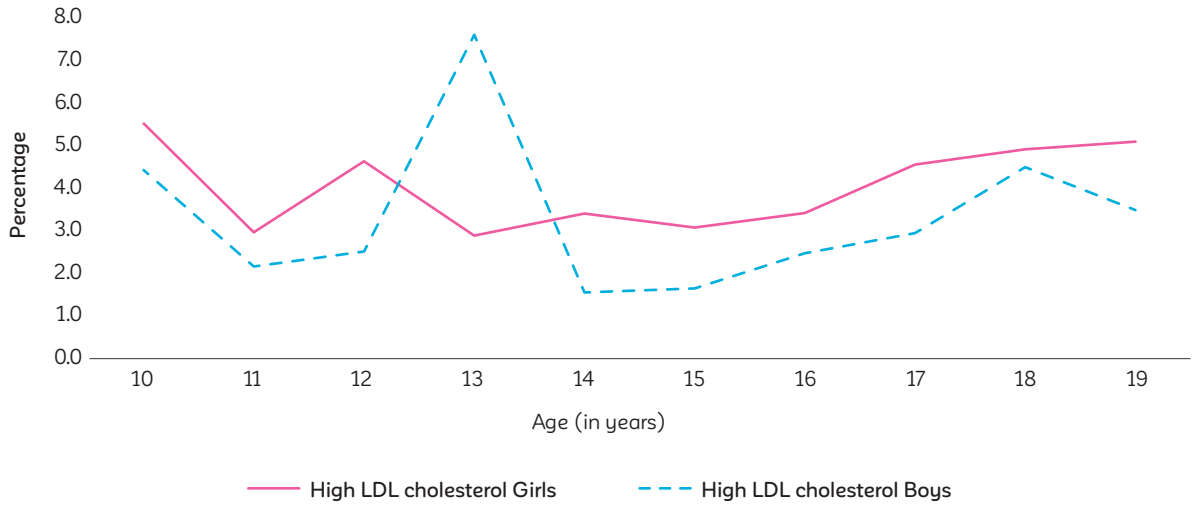
At the age of 10 years the proportion of both girls and boys with low levels of "good" cholesterol is lowest in the range to 18% to 20%. Among girls it peaks at 14 years (32%) and among boys at 16 years (43%). Among girls prevalence lowers with age but among boys it persists at high levels attained at 16 years. Proportion with high

Figure 13: Prevalence of Risk Factors for Diabetes in Adolescents aged 10-19 years (%)



Pre-diabetic Status: Glycosylated Haemoglobin (HbA1c) level >5.6% &≤6.4%

Figure 14: Prevalence of High "Bad" Cholesterol in Adolescents aged 10-19 years (%)



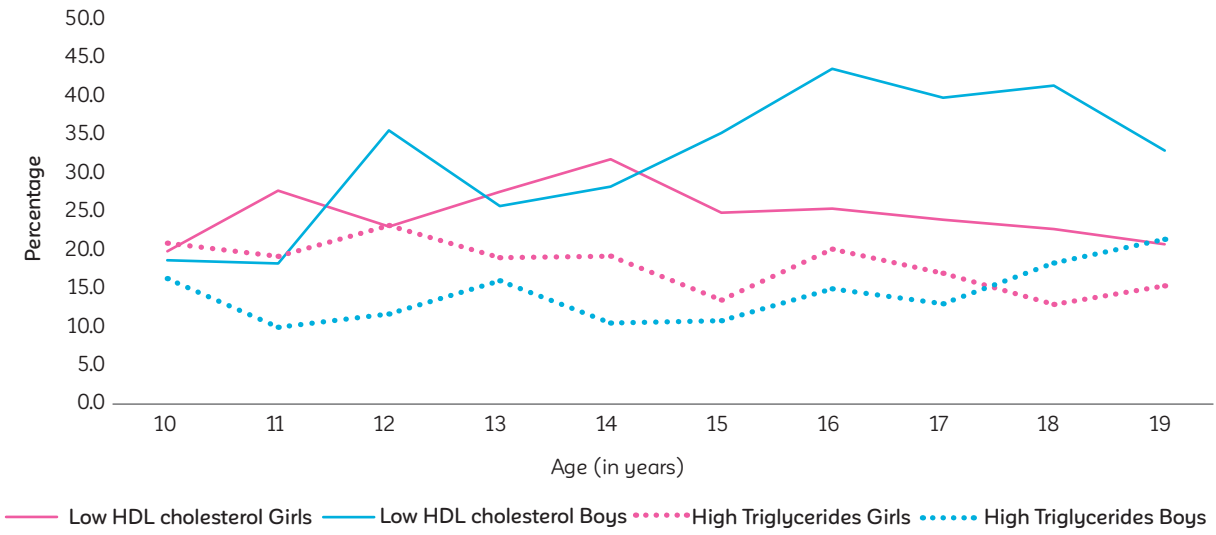
High LDL or "Bad" cholesterol ≥130 mg/dl

triglycerides is highest at 12 years (23%) among girls and 18 years among boys (18%). Other risks for cardiovascular disease have overall low prevalence and little variation across ages 10 to 19 years.

Hypertension

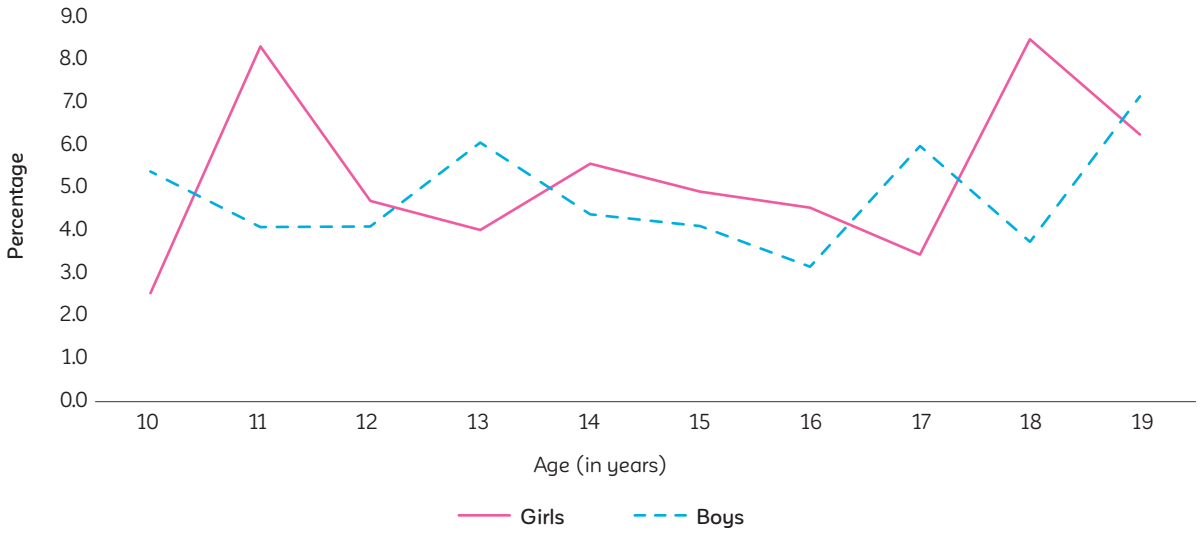
Among girls, proportion with hypertension is highest (8%) at 11 years and 18 years. Among boy highest proportion is noted at 19 years (7%).

Figure 15: Prevalence of Low "Good" Cholesterol and High Triglycerides in Adolescents aged 10-19 years (%)



Low HDL or "Good" cholesterol < 40 mg/dl
High Triglycerides ≥ 130 mg/dl

Figure 16: Prevalence of Hypertension in Adolescents aged 10-19 years (%)



Hypertension
- systolic blood pressure level ≥ 140 mmHg, or
- diastolic blood pressure level ≥ 90 mmHg

3.3.3. State variations in prevalence of risks for non-communicable diseases

Risk of diabetes

Early adolescence (10 to 14 years)

Among girls, risk of diabetes based on elevated HbA1c levels, ranges from 1% (Sikkim) to 28% (Goa) in early adolescence and from 0% (Assam, Nagaland) to 17% in Haryana in late adolescence. Among boys, it ranges from <1% (Nagaland) to 34% (Goa) in early adolescence and from 1% (Bihar) to 24% (Haryana) in late adolescence. Thus, risks for diabetes are higher in Goa and Haryana for both girls and boys.

Among boys, the highest prevalence is 13% in both early and late adolescence (Uttar Pradesh and Goa, respectively).

Risk of cardiovascular diseases

Among girls, those with low levels of "good" cholesterol range from 9% (Mizoram) to 53% (Meghalaya) in early adolescence and from 0% (Mizoram, Nagaland, Telangana) to 29% (Goa) in late adolescence. Among boys it ranges from 3% (Nagaland) to 50% (Meghalaya) in early adolescence and from 8% (Nagaland) to 65% (Delhi). Nagaland does best on low risk of cardiovascular risk based on this indicators, while Chhattisgarh, Delhi and Meghalaya have very high proportion of adolescents with low levels of "good" cholesterol.

Hypertension

Among girls, there are no cases of hypertension in five states- Haryana, Jharkhand, Kerala, Punjab and Uttarakhand in early adolescence and in six states- Haryana, Himachal Pradesh, Nagaland, Telangana, Punjab and West Bengal in late adolescents. The highest prevalence of hypertension is in Tamil Nadu (10%) in early adolescence and 13% (Odisha) in late adolescence.

Among boys, 1 in 10 are hypertensive in Delhi and Tamil Nadu, in early adolescence and same proportion in Uttar Pradesh in late adolescence.

Table 6: Prevalence of Risk Factors for Non-Communicable Diseases in Adolescents aged 10-14 years (%)

States	Girls (10-14 years)					Boys (10-14 years)				
	High HbA1c	High LDL Cholesterol	Low HDL Cholesterol	High Triglycerides	Hypertensive	High HbA1c	High LDL Cholesterol	Low HDL Cholesterol	High Triglycerides	Hypertensive
India	**7.9**	**4.1**	**26.0**	**20.3**	**5.0**	**11.7**	**3.8**	**25.6**	**12.9**	**4.8**
Andhra Pradesh	9.6	1.2	15.0	19.6	7.1	19.4	4.0	18.0	9.6	5.3
Arunachal Pradesh	8.1	3.0	40.9	22.9	2.0	11.8	0.0	34.8	9.4	3.7
Assam	10.8	1.3	24.4	41.8	4.4	13.1	0.0	22.6	18.0	6.3
Bihar	2.3	0.0	36.8	19.8	5.3	6.9	0.0	33.1	10.4	1.8
Chhattisgarh	16.5	0.7	41.2	14.0	5.1	10.6	0.4	46.6	6.7	5.5
Delhi	3.1	3.1	31.1	29.6	9.5	14.1	1.0	31.4	16.0	9.8
Goa	28.4	17.7	17.3	14.2	4.6	33.9	5.5	17.4	9.3	5.5
Gujarat	25.3	5.6	26.2	17.8	2.2	21.0	8.0	27.0	18.7	4.0
Haryana	27.3	0.0	10.7	7.9	0.0	29.1	2.4	10.2	8.9	0.0
Himachal Pradesh	2.4	6.4	31.6	32.9	5.1	10.4	7.4	11.6	14.4	3.8
Jammu & Kashmir	7.5	1.7	11.2	23.1	2.0	10.8	0.9	16.9	20.2	0.0
Jharkhand	14.7	3.7	25.3	26.2	0.0	15.4	0.0	32.6	7.6	0.0
Karnataka	5.6	3.8	28.4	16.1	2.9	19.6	8.6	28.7	15.0	5.3
Kerala	3.7	18.6	24.6	10.1	0.0	4.5	13.4	14.4	4.3	0.0
Madhya Pradesh	13.6	1.5	17.8	19.9	6.7	19.0	1.7	32.3	5.4	2.3
Maharashtra	5.4	1.6	24.8	11.8	5.4	10.9	2.5	13.6	8.5	5.7

HbA1c: < 5% | 5–10.9% | 11–20.9% | > 21%

HDL Cholesterol, Triglycerides: < 10% | 10–20.9% | 21–30.9% | > 31%

LDL Cholesterol, Hypertension: < 2% | 2–4.9% | 5–7.9% | > 8%

NA- Not Applicable

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States	Girls (10-14 years)					Boys (10-14 years)				
	High HbA1c	High LDL Cholesterol	Low HDL Cholesterol	High Triglycerides	Hypertensive	High HbA1c	High LDL Cholesterol	Low HDL Cholesterol	High Triglycerides	Hypertensive
Manipur	16.3	9.1	24.1	41.6	4.3	19.1	4.8	26.7	34.6	9.5
Meghalaya	3.8	0.3	52.9	27.5	2.7	17.2	0.0	50.3	15.5	4.4
Mizoram	3.1	0.9	9.0	37.1	NA	14.8	1.3	17.9	19.5	NA
Nagaland	3.5	0.0	19.2	39.5	3.7	0.7	0.0	2.5	18.1	0.6
Odisha	8.6	3.7	31.5	10.9	6.0	15.2	2.4	16.8	6.0	7.6
Punjab	8.1	2.3	14.3	10.0	0.0	19.3	2.4	7.9	8.3	0.0
Rajasthan	11.2	4.8	14.1	6.7	1.1	15.0	2.0	14.5	5.3	1.0
Sikkim	1.3	11.2	13.5	41.2	0.8	5.0	13.5	8.6	40.9	0.5
Tamil Nadu	7.7	16.2	19.9	15.2	9.8	7.2	21.0	7.9	11.2	6.0
Telangana	15.5	2.6	19.6	17.6	8.3	13.5	3.1	15.7	6.7	5.8
Tripura	10.6	0.0	26.9	36.3	1.5	16.2	4.4	13.9	28.5	5.1
Uttar Pradesh	2.5	1.4	33.8	19.8	6.4	4.5	1.9	40.3	12.8	12.7
Uttarakhand	7.3	1.0	16.5	21.9	0.0	9.7	2.1	18.7	14.7	6.3
West Bengal	3.6	13.6	16.6	43.7	1.4	7.7	7.1	5.8	38.3	0.8

HbA1c: < 5% | 5–10.9% | 11–20.9% | > 21%

HDL Cholesterol, Triglycerides: < 10% | 10–20.9% | 21–30.9% | > 31%

LDL Cholesterol, Hypertension: < 2% | 2–4.9% | 5–7.9% | > 8%

NA- Not Applicable

Table 6: Prevalence of Risk Factors for Non-Communicable Diseases in Adolescents aged 15-19 years (%)

States	Girls (15-19 years)					Boys (15-19 years)				
	High HbA1c	High LDL Cholesterol	Low HDL Cholesterol	High Triglycerides	Hypertensive	High HbA1c	High LDL Cholesterol	Low HDL Cholesterol	High Triglycerides	Hypertensive
India	**7.4**	**4.3**	**23.8**	**15.8**	**5.0**	**10.9**	**3.0**	**38.6**	**15.5**	**4.6**
Andhra Pradesh	12.4	4.1	7.1	10.9	2.3	11.5	3.2	24.7	20.5	4.9
Arunachal Pradesh	4.5	1.4	37.7	19.6	6.0	6.0	1.0	47.6	15.8	2.7
Assam	0.0	1.5	15.0	23.6	0.2	23.6	0.3	35.7	44.7	7.4
Bihar	2.6	0.7	30.3	15.1	8.3	1.4	1.1	48.4	11.9	6.7
Chhattisgarh	12.4	1.7	43.1	9.7	1.9	13.9	1.8	56.5	2.4	4.9
Delhi	3.2	2.1	30.6	11.2	9.4	7.5	1.2	64.5	8.5	11.3
Goa	16.4	28.6	5.2	13.0	1.3	19.7	10.3	27.0	15.0	12.8
Gujarat	11.6	1.8	18.1	12.5	5.1	19.1	8.7	30.2	19.6	7.8
Haryana	17.0	4.6	10.9	5.4	0.0	24.0	3.5	18.2	23.9	0.0
Himachal Pradesh	2.0	6.6	29.9	14.8	0.0	6.0	3.2	35.5	18.9	2.2
Jammu & Kashmir	9.2	2.1	12.3	13.1	3.7	5.2	4.1	26.4	25.0	2.6
Jharkhand	8.8	1.8	14.8	27.2	3.2	10.1	0.0	16.3	14.6	0.0
Karnataka	16.6	2.6	41.1	9.3	1.9	22.3	1.9	55.4	9.5	2.2
Kerala	13.5	19.7	11.3	5.0	1.8	6.6	5.1	36.4	13.1	0.8
Madhya Pradesh	1.8	2.9	15.0	13.8	10.4	15.8	0.6	38.5	4.2	12.7
Maharashtra	10.1	6.2	23.0	2.1	3.2	8.0	1.3	36.1	3.6	1.7

HbA1c: < 5% | 5–10.9% | 11–20.9% | > 21%

HDL Cholesterol, Triglycerides: < 10% | 10–20.9% | 21–30.9% | > 31%

LDL Cholesterol, Hypertension: < 2% | 2–4.9% | 5–7.9% | > 8%

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States	Girls (15-19 years)					Boys (15-19 years)				
	High HbA1c	High LDL Cholesterol	Low HDL Cholesterol	High Triglycerides	Hypertensive	High HbA1c	High LDL Cholesterol	Low HDL Cholesterol	High Triglycerides	Hypertensive
Manipur	7.3	11.6	21.6	36.8	7.8	16.9	17.6	26.9	39.4	12.1
Meghalaya	7.8	2.2	34.8	19.2	7.8	1.9	0.0	60.6	19.0	11.8
Mizoram	6.8	0.0	31.0	35.4	4.4	6.2	0.8	20.3	19.6	0.0
Nagaland	0.0	0.0	8.8	41.4	0.0	4.6	0.0	7.9	12.7	4.9
Odisha	15.5	4.4	22.8	9.9	13.3	11.1	7.7	35.5	9.9	4.7
Punjab	11.0	5.2	6.8	7.3	0.0	17.0	3.2	18.5	13.9	0.6
Rajasthan	8.5	2.8	22.6	10.3	1.7	15.8	1.0	23.2	8.6	6.0
Sikkim	0.1	11.1	2.8	35.9	2.0	4.1	18.4	14.9	40.7	3.1
Tamil Nadu	11.2	16.3	16.0	7.3	5.6	7.7	3.2	36.7	9.7	1.4
Telangana	9.9	0.0	19.5	5.8	0.0	21.6	0.7	46.3	19.1	6.9
Tripura	1.8	11.3	18.6	30.2	0.5	19.4	6.6	29.7	21.4	9.4
Uttar Pradesh	5.7	1.2	32.5	17.5	11.0	5.5	1.7	53.9	13.7	3.6
Uttarakhand	7.0	1.8	16.9	18.8	6.2	4.0	7.0	31.5	22.5	2.5
West Bengal	4.5	18.0	10.4	43.8	0.0	9.5	11.0	14.6	44.5	0.4

HbA1c: < 5% | 5–10.9% | 11–20.9% | > 21%

HDL Cholesterol, Triglycerides: < 10% | 10–20.9% | 21–30.9% | > 31%

LDL Cholesterol, Hypertension: < 2% | 2–4.9% | 5–7.9% | > 8%

3.4 Adolescents diets – are they healthy or unhealthy?

Key messages

- Six out of 10 adolescents reported no consumption of fruits in the past week. Every fourth adolescent reported no consumption of green leafy vegetables in the past week.
- Foods most commonly missed from the food plate of an adolescent are fish/chicken, eggs, fruits and dark green leafy vegetables.
- At least once a week consumption of fried foods was reported by 30% adolescents and sweets by 15%.
- Daily consumption of fried foods and junk foods was reported by 5% and 1% adolescents, respectively.
- Dark green leafy vegetables and pulses consumption increases around ages 12 to 14 years but these gains are lost in later years. Intake of all unhealthy foods peaks at 17 years among boys.
- Adolescent girls and boys who are short, thin, or anemic most often do not eat fish/chicken, eggs, fruits, dark green leafy vegetables and pulses. Milk is not consumed more often by those short than those thin or anemic.
- In states like Delhi and Goa high proportion of adolescents are consuming fried and junk food. These two states also have more overweight/obese adolescents in addition to Tamil Nadu and higher prevalence of risks for non-communicable diseases. Punjab emerges as a state with lowest compliance of adolescents consuming recommended frequencies of nutritive foods (chicken/fish, eggs, dark green leafy vegetables and pulses) and highest levels of micronutrient deficiencies (iron, vitamin B_{12}, vitamin D, vitamin A, zinc).

Foods to be consumed daily

The food plate of an adolescent should have at least eleven food groups of which nine food groups require to be consumed daily in the diet, in recommended quantity. These nine food items include – 1. cereals, 2. milk or curd, 3. pulses or beans, 4. dark green leafy vegetables, 5. other vegetables, 6. roots and tubers, 7. fruits, 8. fats and oils and 9. sugar/jaggery.

Early adolescence (10 to 14 years)

4 out of 5 adolescents **(~85%)** eat cereals daily

2 out of 5 adolescents **(~45%)** take milk in their daily diet. However, another **2 out of 5** adolescents did not consume milk even once during the past week

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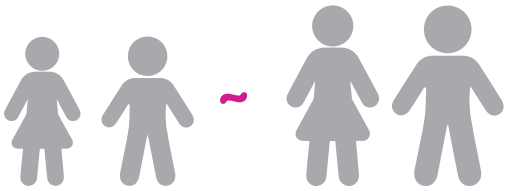
3 out of 5 adolescents **(~70%)** have daily intake of food rich in fats/ oils and sugar/jaggery

Less than **1 out of 5** adolescents **(<10%)** consume fruits daily and as high as **3 out of 5** adolescents **(~70%)** did not consume fruits even once during the past week.

1 out of 5 adolescents **(~20%)** take pulses and green leafy vegetables. However, another **1 out of 5** adolescents did not consume pulses even once in the past week and **2 out of 5** adolescents did not consume any green leafy vegetables even once during the past week

Late adolescence (15 to 19 years)



The pattern established for food items to be consumed daily across late adolescence is the same as in early adolescent phase. Excepting that more **15-19** years (**~20%** eat eggs thrice a week compared to **~10%** in **10-14** age group). This indicates that the food frequency pattern is established in early phases.

Foods to be consumed at least two days a week

The food plate of an adolescent needs to have heme iron-rich foods like chicken/fish at least twice a week and egg at least thrice a week.

Early adolescence (10 to 14 years)

1 out of 5 adolescents **(~20%)** take fish/chicken at least two days a week

Less than **1 out of 5** adolescents **(10%)** have eggs thrice a week

3 out of 5 adolescents did not consume fish/egg/chicken even once during the past week

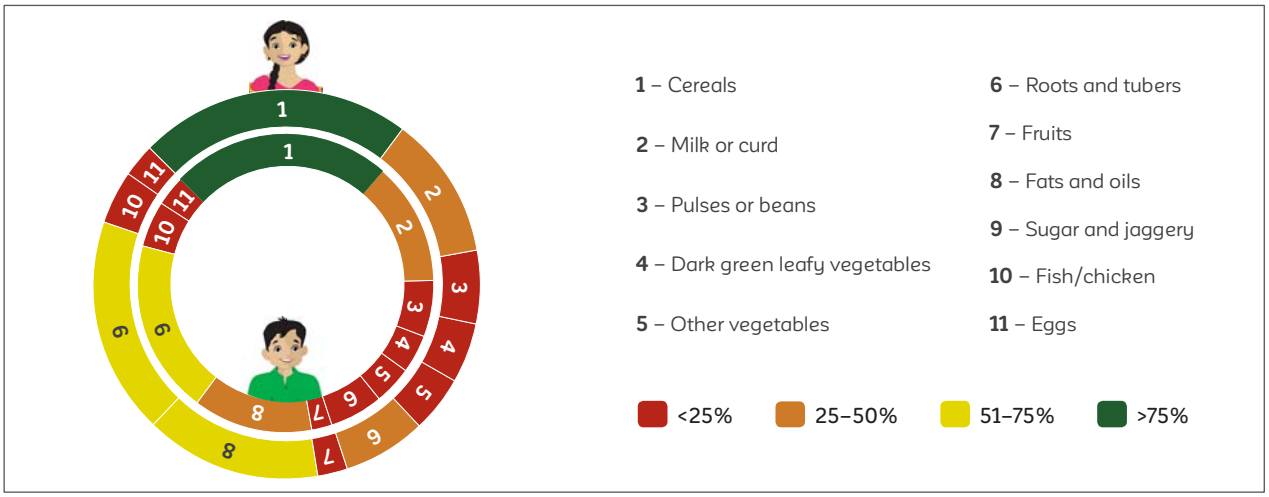
Late adolescence (15 to 19 years)

Less than **1 out of 5** adolescents **(~10%)** take fish/ chicken at least two days a week

1 out of 5 adolescents **(~20%)** have eggs at least thrice a week

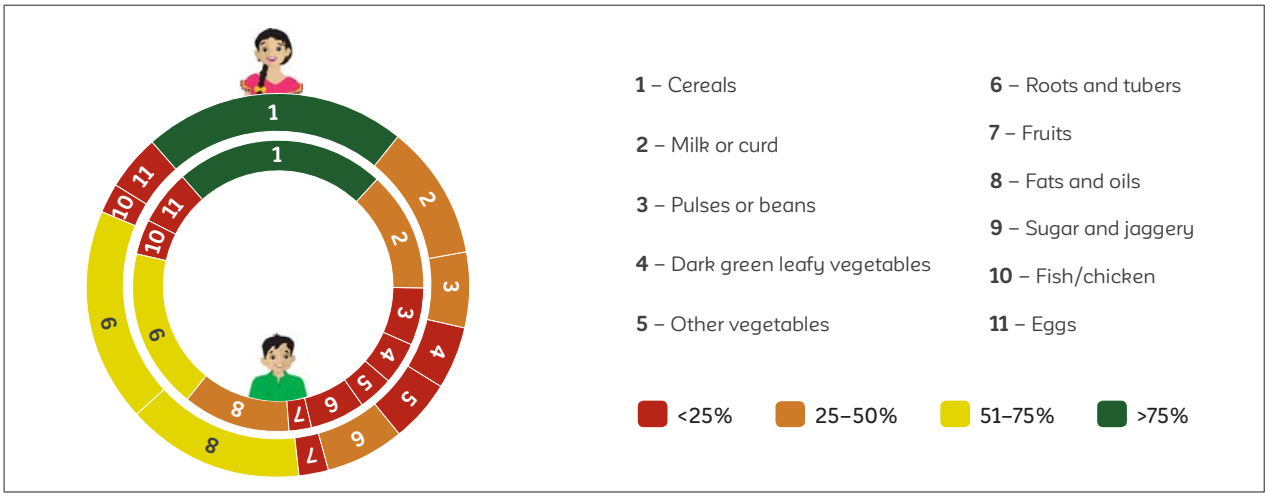
3 out of 5 adolescents did not consume fish/egg/chicken even once during the past week

Consumption of food groups by 10-14 year old girls and boys, by percentage, CNNS 2016-18 (India)



The India donut graph for 15-19 year old adolescents as well, in the same manner as above.

Consumption of food groups by 15-19 year old girls and boys, by percentage, CNNS 2016-18 (India)



The India donut graph for 15-19 year old adolescents as well, in the same manner as above.

Foods to be avoided

The food plate of an adolescent should not include or include rarely – junk foods, fried foods, sweets and aerated drinks.

Early adolescence (10 to 14 years)

Junk foods

2% adolescents ate junk food 3 times a week

1% adolescents ate junk food daily

Sweets

2% adolescents ate sweets 3 times a week

2% adolescents ate sweets daily

Aerated drinks

2% consumed aerated drinks 3 times a week

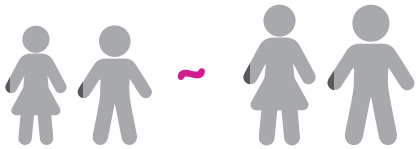
1% consumed aerated drinks daily

Fried foods

1 out of 20 adolescents **(5%)** ate fried food 3 times a week

1 out of 25 adolescents **(4%)** ate fried food daily

Late adolescence (15 to 19 years)



Intake of junk foods, sweets and aerated drinks was similar to adolescents **10-14** years. Daily and 3 times a week consumption of junk foods were slightly higher than **10-14** years at **5%** and **6%**, respectively.

3.4.1 Age wise compliance to eating as per recommended frequency

Foods to be consumed daily

Girls are most compliant to daily milk/milk product intake at 13 years and 17 years.

Pulses/beans intake daily is highest at 14 years.

Daily intake of green leafy vegetables also peaks at 14 years.

Daily fruit intake is high at 13 years and 17 years.

Boys are most compliant to daily milk/milk product intake at 17 years.

Pulses/beans intake daily is highest at 12 years.

Daily intake of green leafy vegetables also peaks at 11 years and again at 19 years.

Daily fruit intake is overall low, but highest at 19 years.

Figure 17: Daily Consumption of foods by Adolescent Girls aged 10-19 years (%)

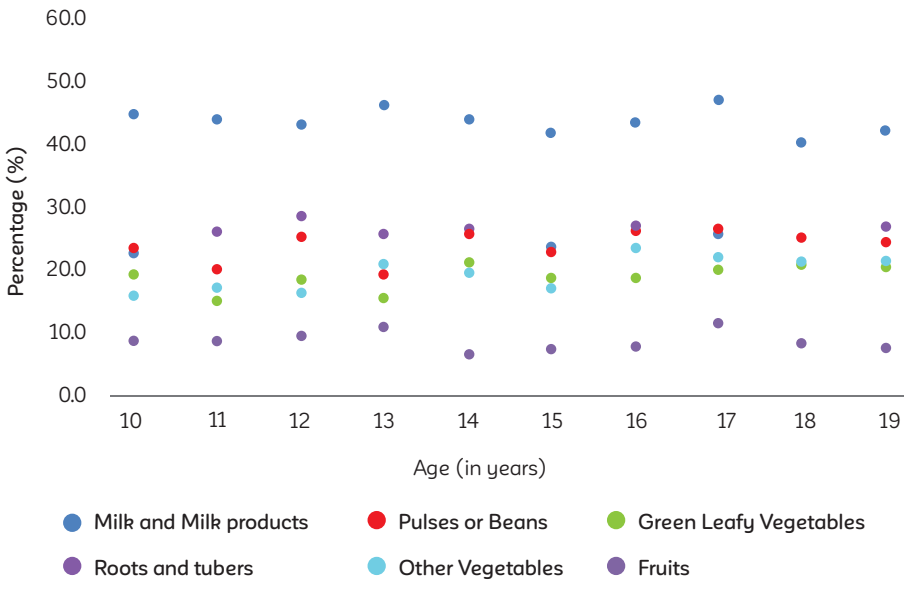
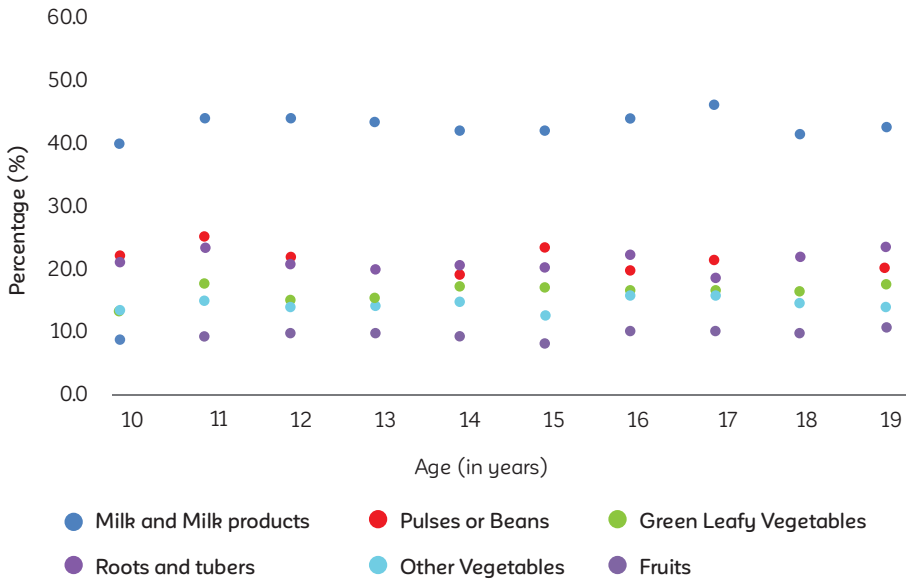


Figure 18: Daily Consumption of foods by Adolescent Boys aged 10-19 years (%)



Foods to be consumed at least two days a week

Highest proportion of girls consume fish/chicken at least two days per week at 17 years of age.

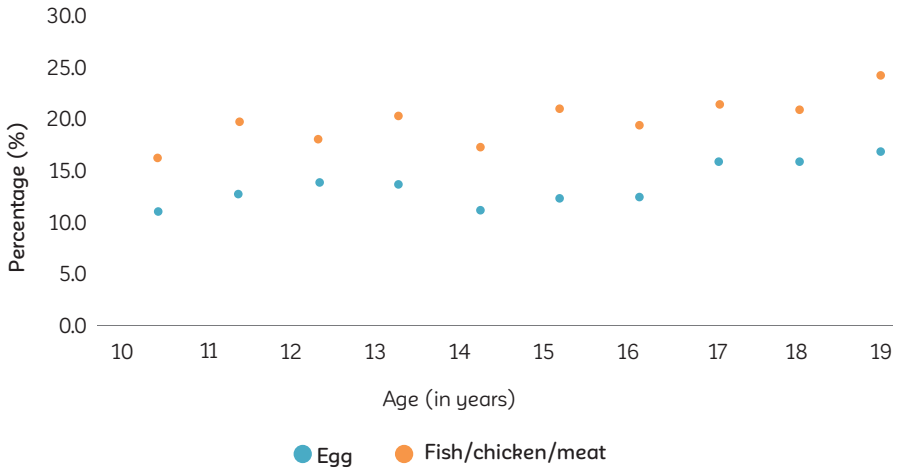
Highest proportion of boys consume fish/chicken at least two days per week at 19 years of age.

Highest proportion of girls consume eggs at least three days per week at 11 years and 17 years.

Among boys, proportion consuming eggs at least three days per week is above 15% at and after 17 years and peaks at 19 years.

Figure 19: Consumption of eggs and fish/chicken/meat as per recommendation by Adolescent Girls aged 10-19 years (%)

Figure 20: Consumption of eggs and fish/chicken/meat as per recommendation by Adolescent Boys aged 10-19 years (%)



Foods to be avoided

Among girls, consumption of all avoidable food fluctuates throughout adolescence with different peak consumption ages for the four foods we investigated. Fried food intake three times per week peaks at 15 years while daily at 17 years though it is close to peak value at 15 years too. Junk food intake three times a week is marginally higher at 17 years of age compared with other ages. Daily sweet intake increase steadily among girls with increasing age and peaks at 16 years and daily intake of aerated drinks peaks at 19 years of age.

Among boys, there is a very distinct pattern of increasing consumption in late adolescence compared with early adolescence for all avoidable foods. When daily intake is considered fried foods intake peaks at 15 years, junk foods at 17 years, sweets at 16 years and aerated drinks at 18 years.

Figure 21: Foods to be Avoided: Daily Consumption by Adolescent Girls aged 10-19 years (%)

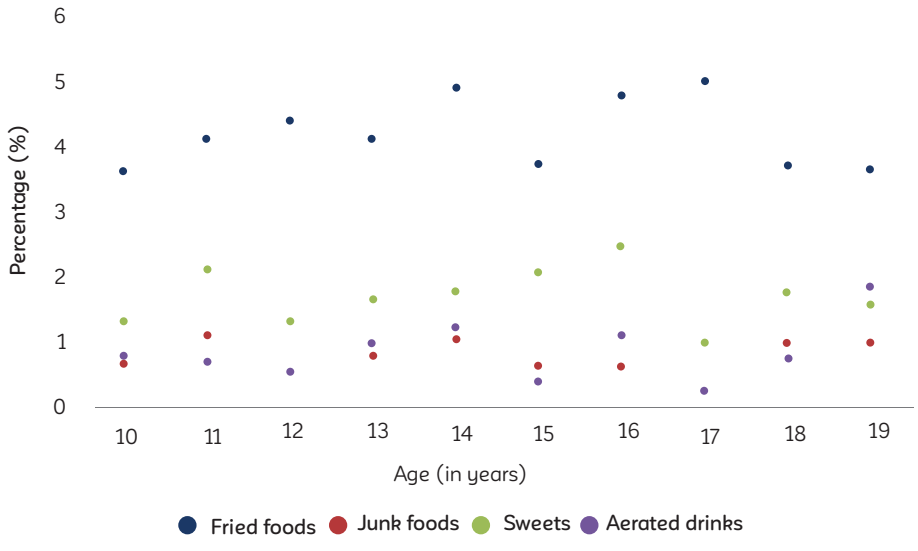


Figure 22: Foods to be Avoided: Daily Consumption by Adolescent Boys aged 10-19 years (%)

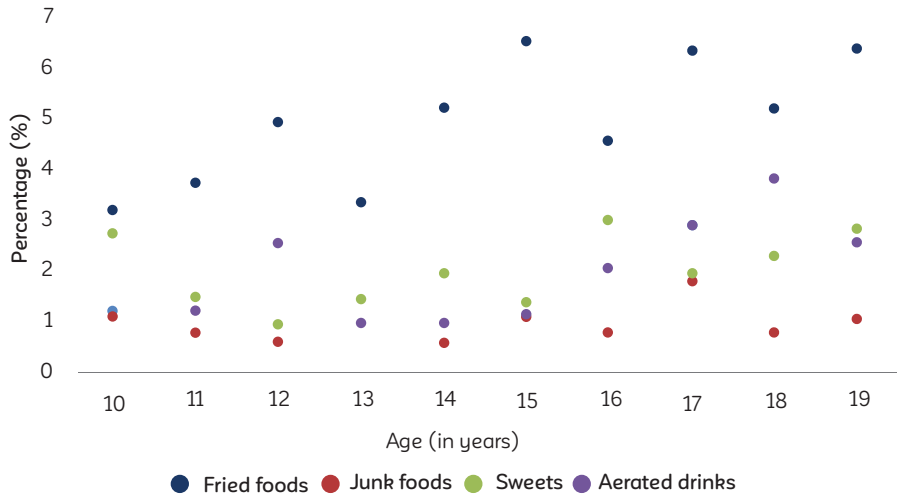


Figure 23: Foods to be Avoided: Consumption (3 times/week) by Adolescent Girls aged 10-19 years (%)

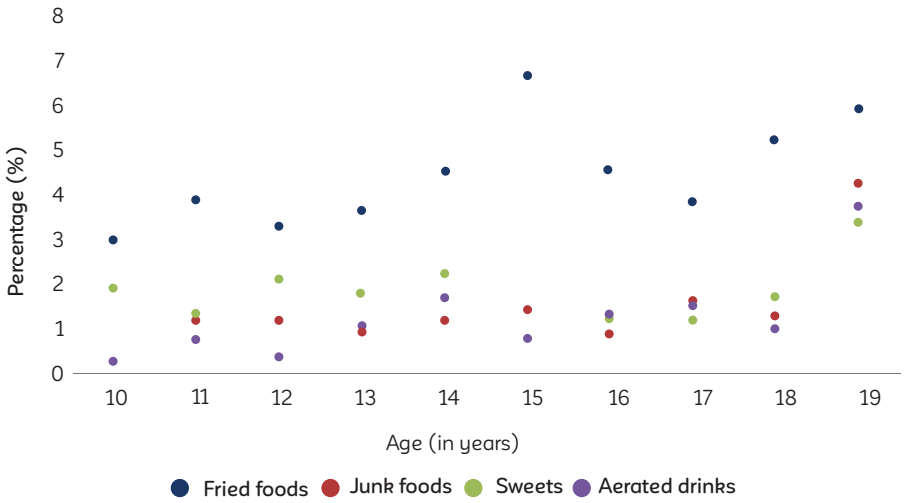
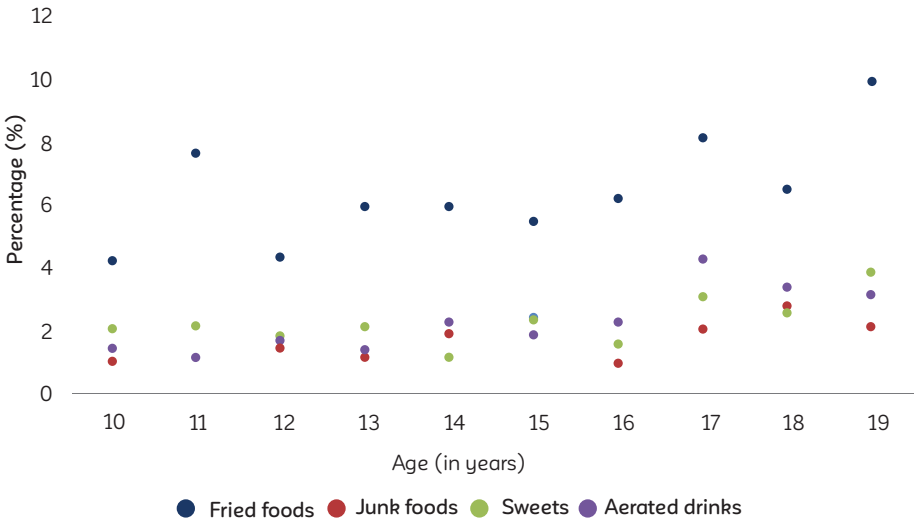


Figure 24: Foods to be Avoided: Consumption (3 times/week) by Adolescent Boys aged 10-19 years (%)



3.4.2 Variation in compliance to eating as per recommended frequency across states

Foods to be consumed daily

Early adolescence (10 to 14 years)

Cereals

Among girls, more than 75% consume cereals daily across 22 to 24 states in 10 to 14 and 15 to 19 years age-groups. In five states- Goa, Karnataka, Maharashtra, Mizoram and Sikkim, daily cereal consumption is a concern with levels ranging from 6% to 33%.

Observations were similar among boys with daily cereal consumption almost universal in most states, exceptions being Goa, Karnataka, Maharashtra, Mizoram and Sikkim.

Milk/milk products

Among girls, in Haryana, Punjab, Rajasthan and Tamil Nadu, over 75% girls have milk/ milk products daily. However, in 8 to 10 states daily consumption of milk/milk products daily is low (ranging from less than 10% to 25%). In Arunachal Pradesh, Assam, Chhattisgarh, Manipur, Meghalaya, Mizoram, Odisha and Tripura daily milk/milk product consumption is low in both age groups. Among boys, daily consumption of milk is higher than 50% in 11 states; highest being in Delhi (91%). However, in 10 states less than 25% have milk every day.

Pulses/beans

In Himachal Pradesh and Odisha daily consumption of pulses is high among both girls and boys and in both age-groups. Among girls, lowest daily consumption of pulses is in Manipur (2%, early adolescence) and Punjab (3%, late adolescence); among boys it's in Manipur (2%, early adolescence) and Jammu and Kashmir (4%, late adolescence).

Dark green leafy vegetables

Among girls, daily green leafy vegetables consumption ranges from 1 to 2% (Telangana) to ~50% (Odisha) in both early adolescence and late adolescence. Among boys, it ranges from 2% (Kerala) to ~50% (Odisha) in early adolescence; in late adolescence lowest consumption is in Telangana (<1%) and highest in Odisha (45%).

Fruits

Fruit intake is very low in most states. The highest compliance to daily fruit intake among girls and boys is in Delhi in the range of 28% to 34%.

Proportion of adolescents consuming fats/oils and sugars are high in most states of India. Exceptions are - Arunachal Pradesh, Manipur and Sikkim where fat consumption is less than 20% among both girls and boys and in both age groups.

Foods to be consumed at least three days a week

Among girls, egg consumption at least three days a week, ranges from <1% (Haryana) to 45% (Tamil Nadu) in early adolescence and from <1% (Punjab) to 82% (Goa) in late adolescence.

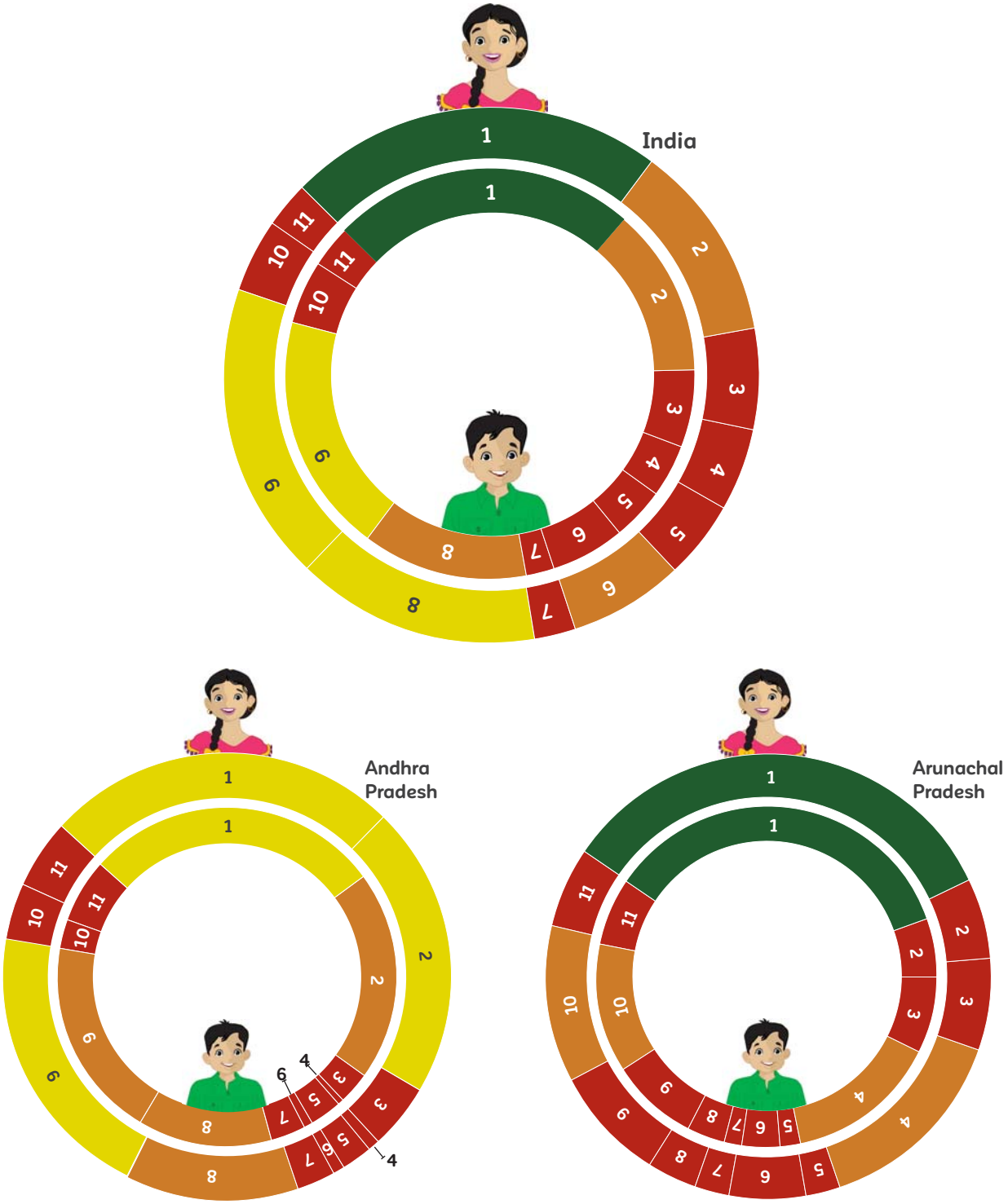
Among boys, compliance to egg consumption ranges from <1% (Himachal Pradesh) to Tamil Nadu (45%) early adolescence and from <1% (Himachal Pradesh) to Goa (77%). In Haryana, Himachal Pradesh, Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh consumption of eggs as per recommendation is less than 10% among both girls and boys.

Foods to be consumed at least two days a week

Among girls, in Goa and Kerala more than 70% girls have fish/chicken at least two days per week in early adolescence but there are nine states with less than 10% compliance. In late adolescence, compliance is lower and ranges from 1% (Himachal Pradesh) to 33% (Mizoram).

Among boys compliance to fish/chicken consumption ranges from <1% (Himachal Pradesh) to 74% (Goa) in early adolescence and much lower, from 2% (Himachal Pradesh) to 38% (Tamil Nadu) in late adolescence.

Percentage of adolescent girls and boys with consumption as per ICMR-NIN recommendation



1 – Cereals **2** – Milk or curd **3** – Pulses or beans **4** – Dark green leafy vegetables **5** – Other vegetables

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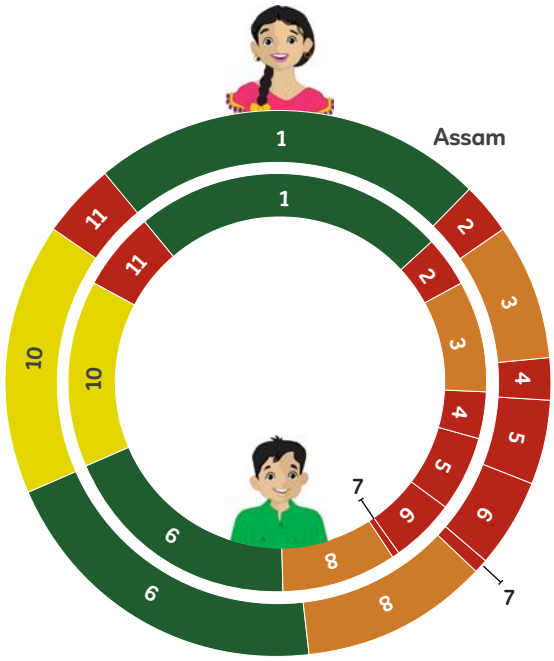
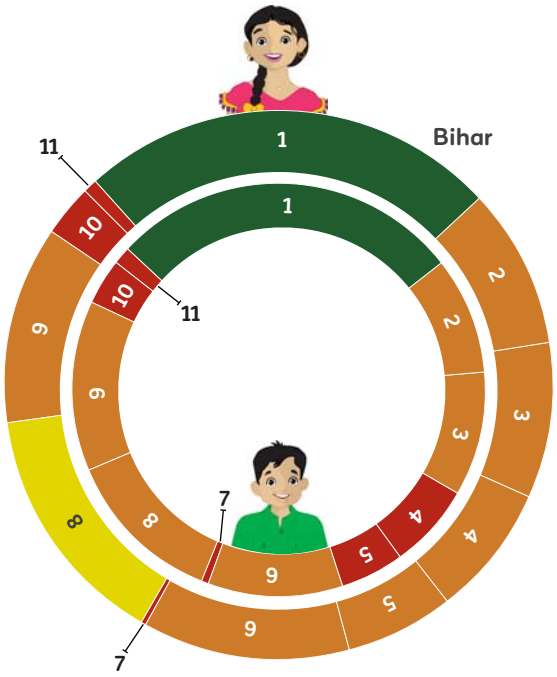
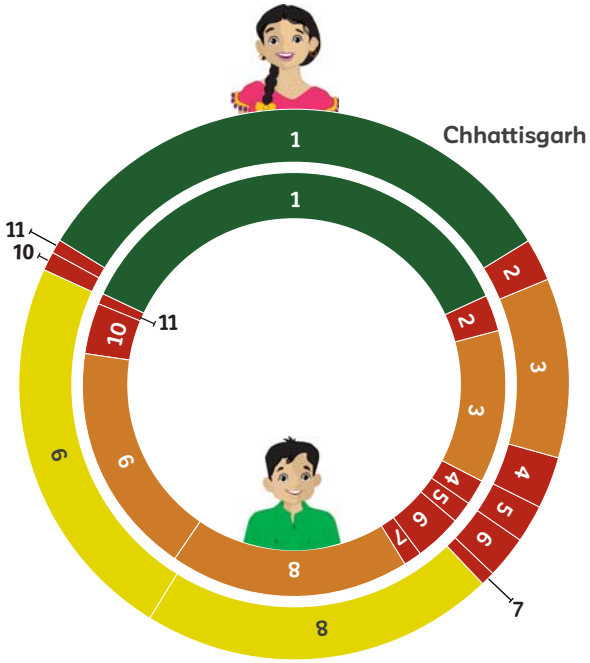
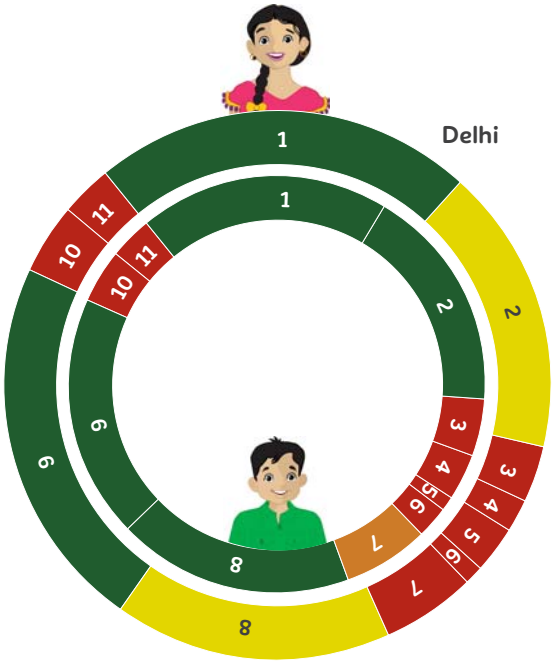
<25% 25–50% 51–75% >75%









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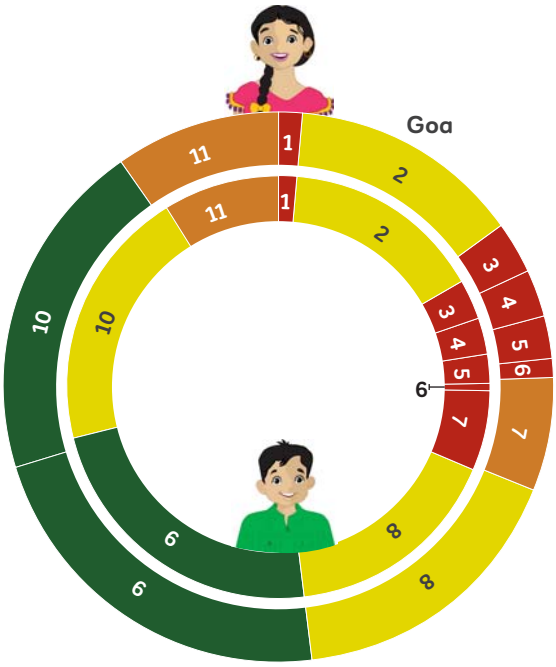

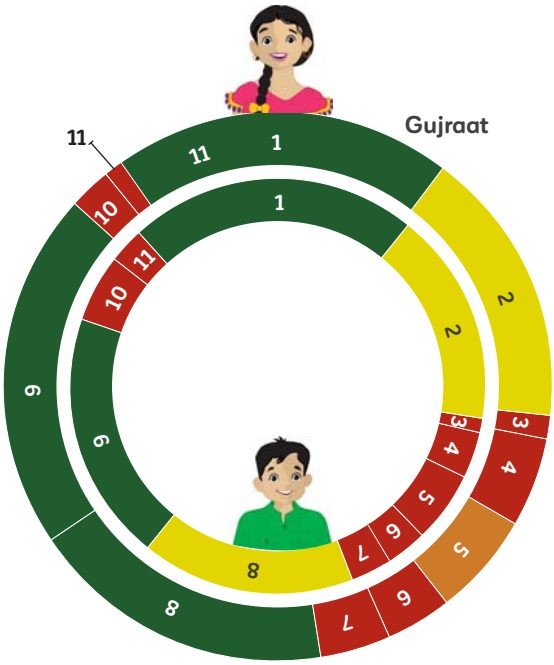

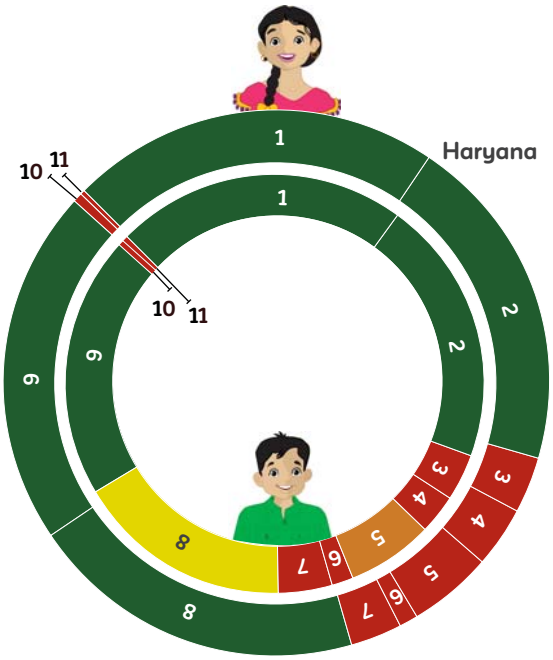

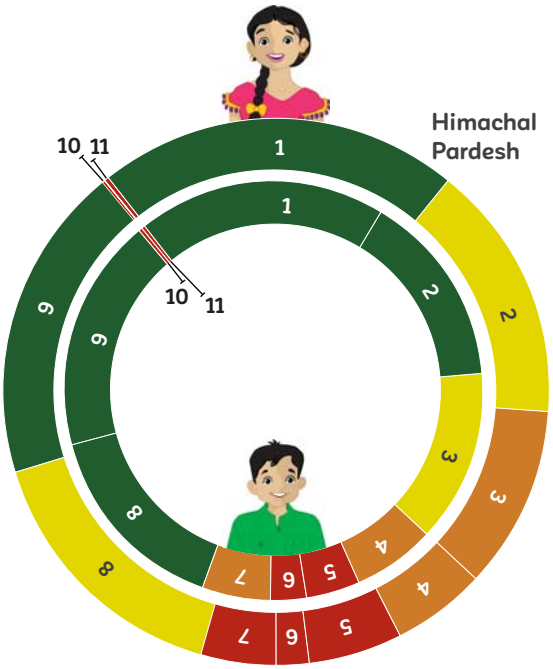

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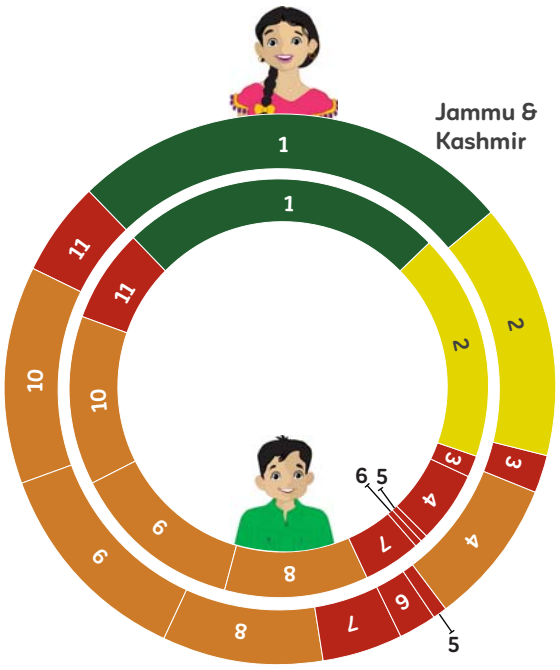

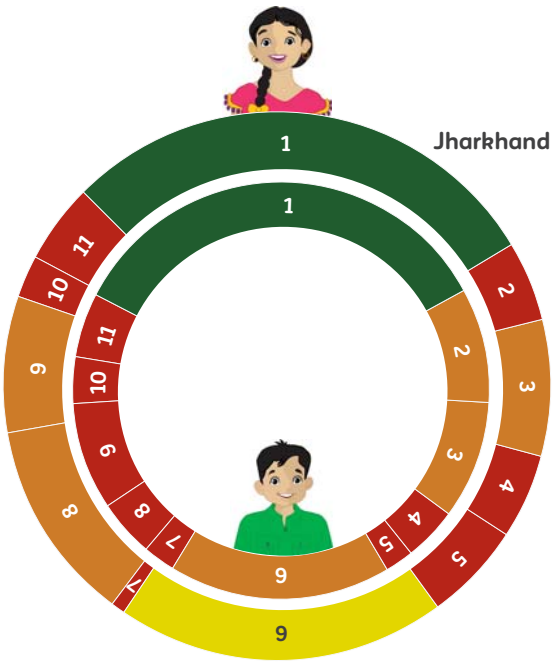

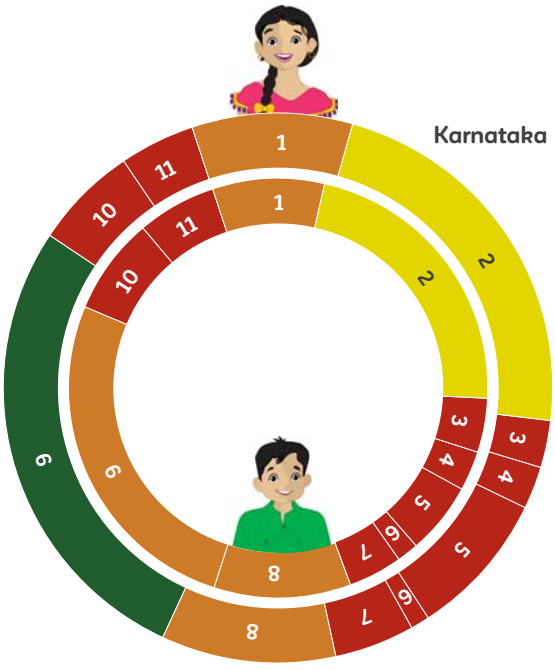

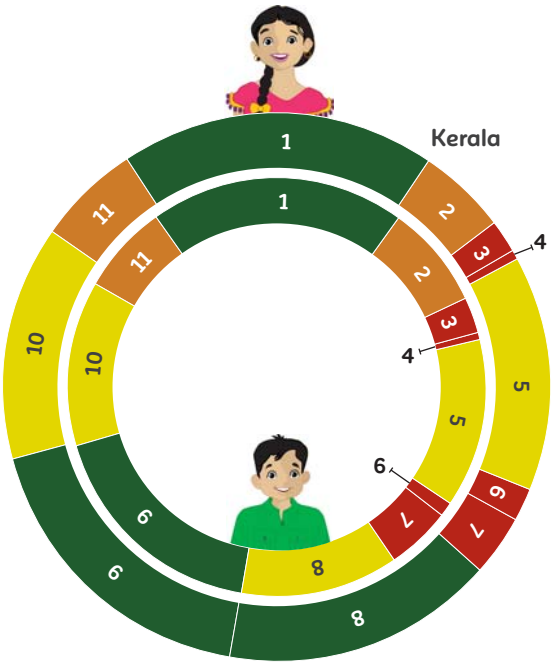

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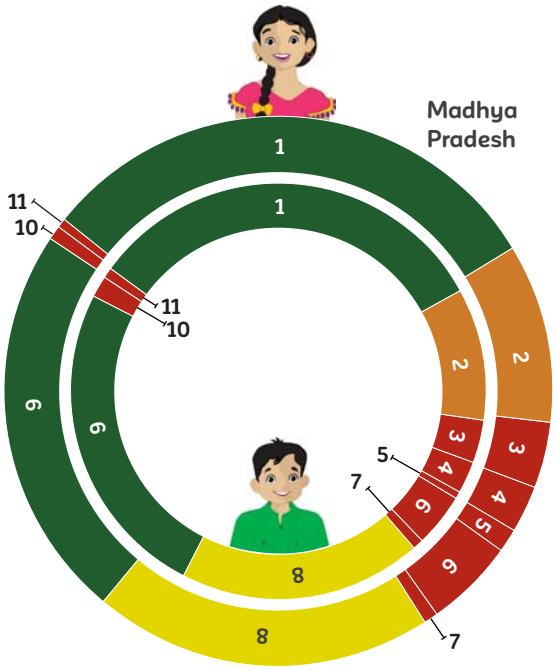

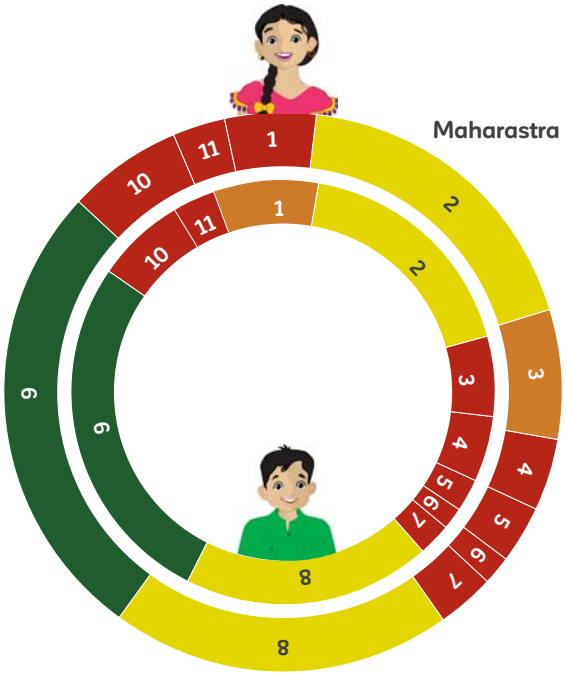

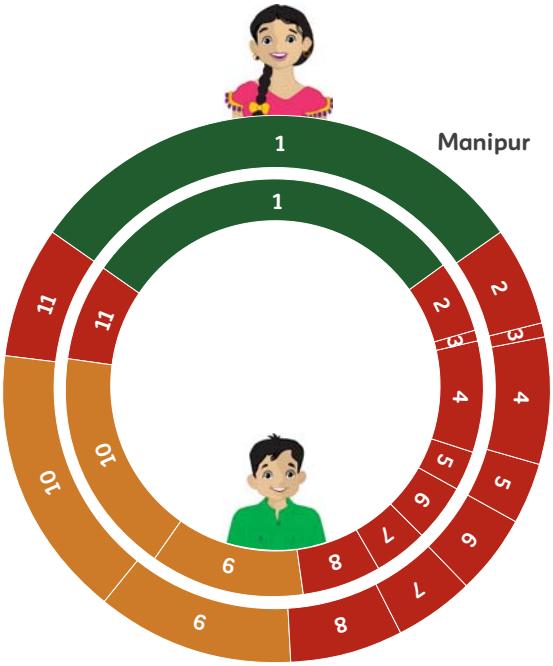

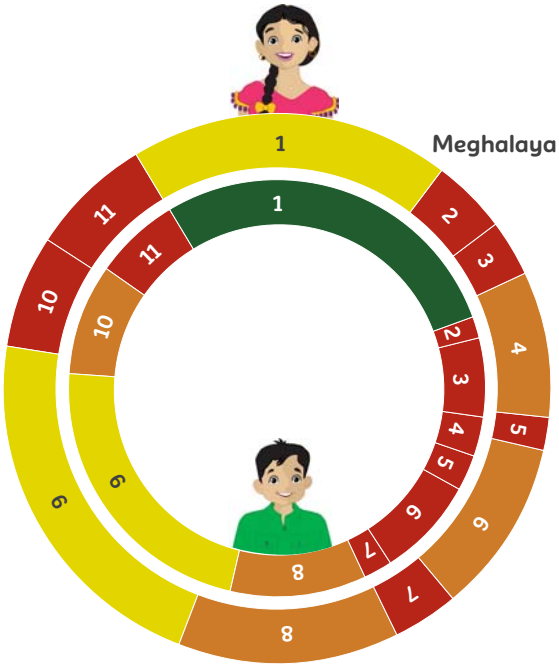

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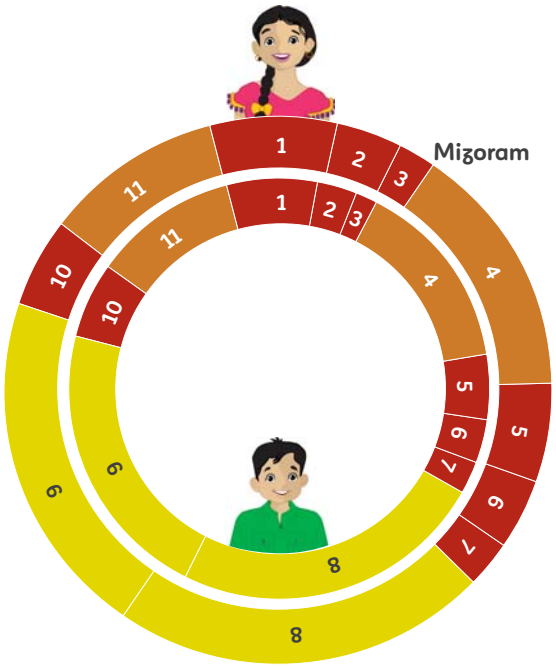

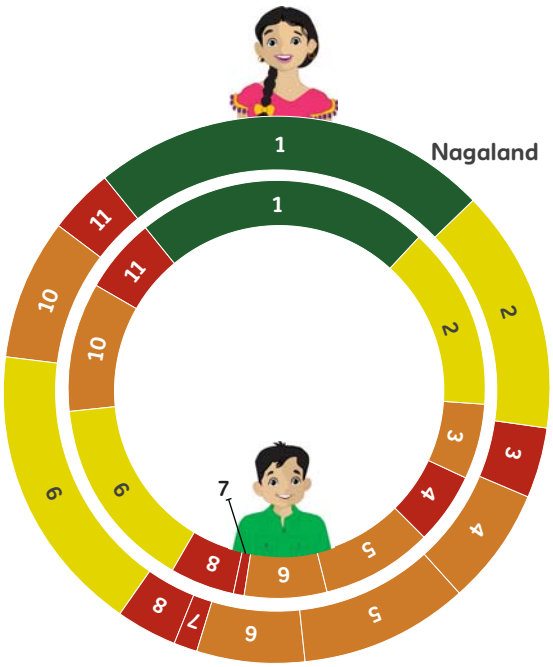

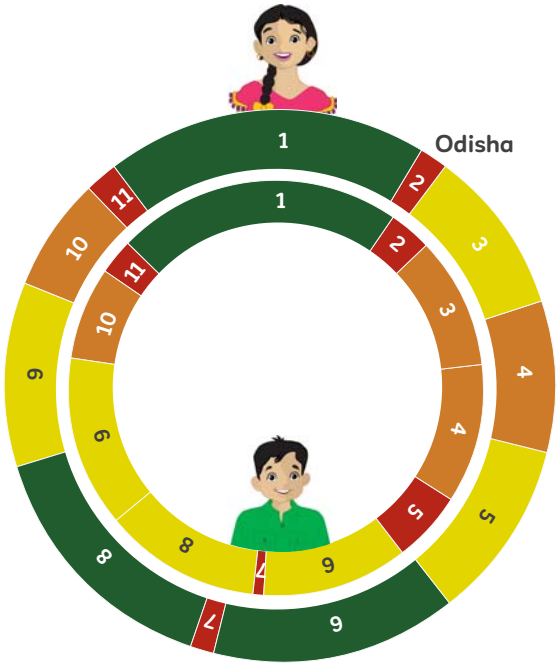

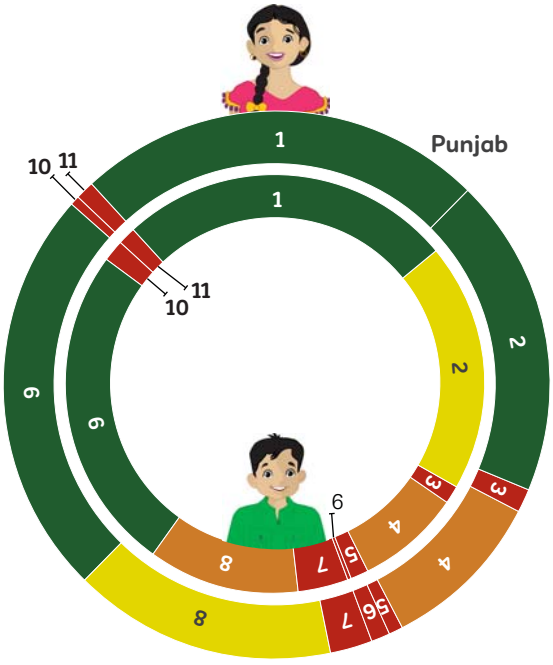

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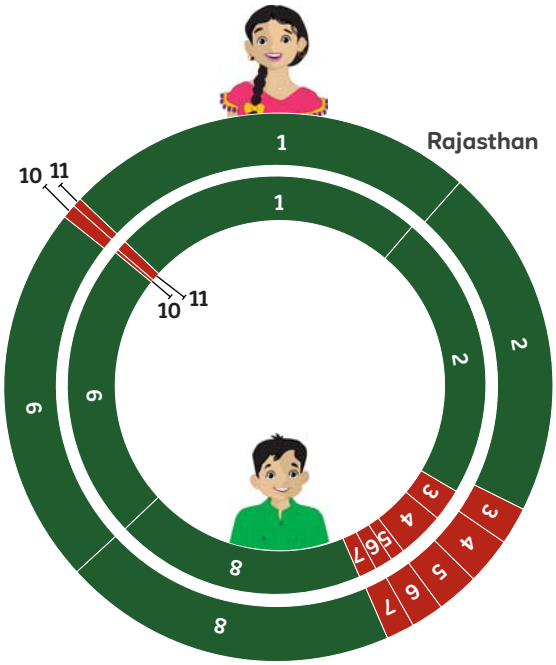

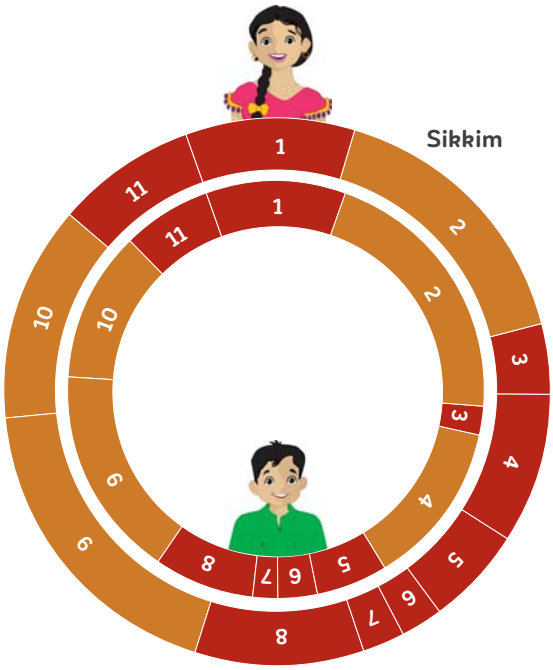

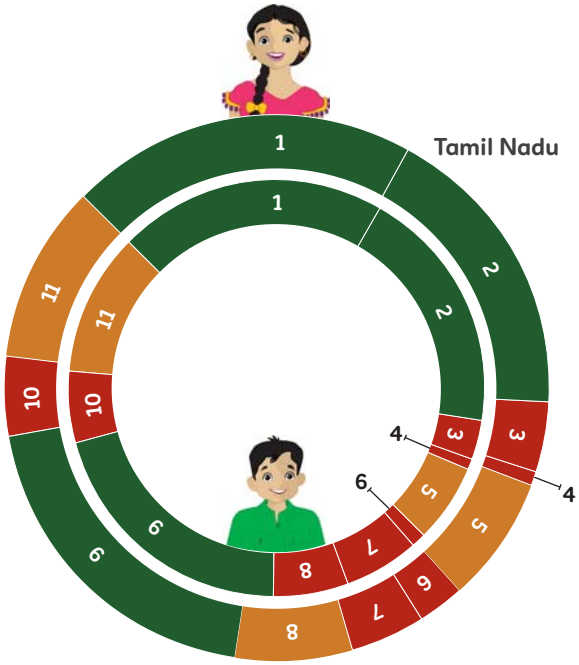

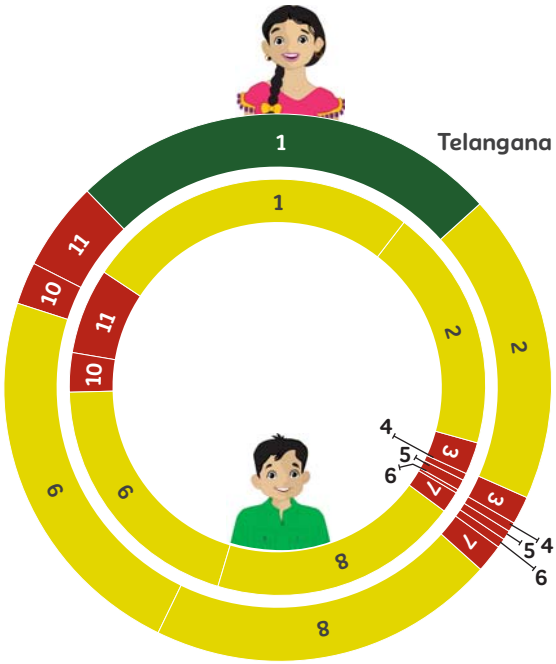

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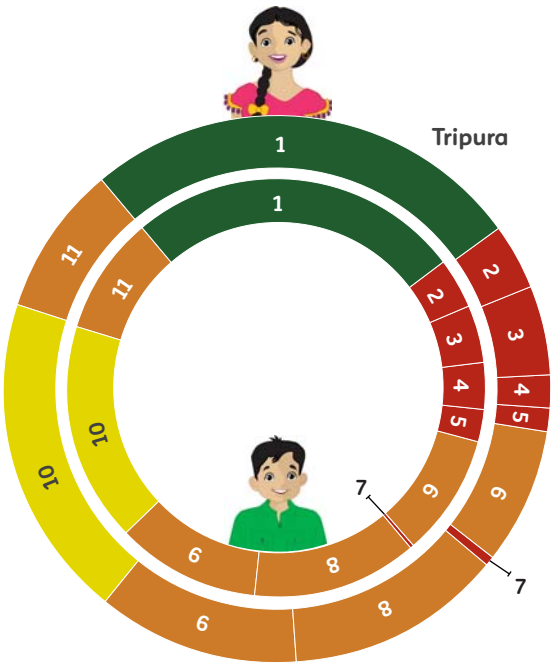

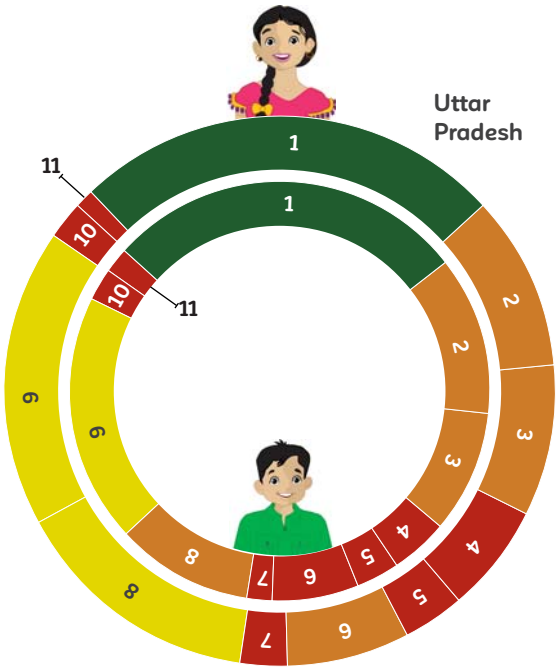

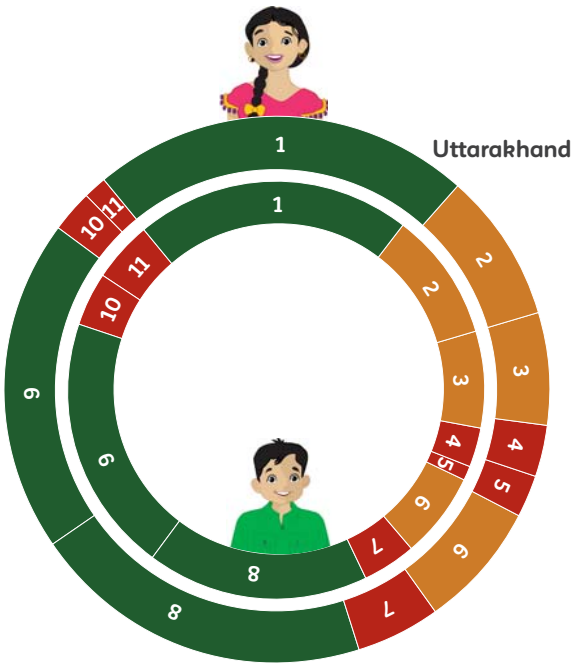

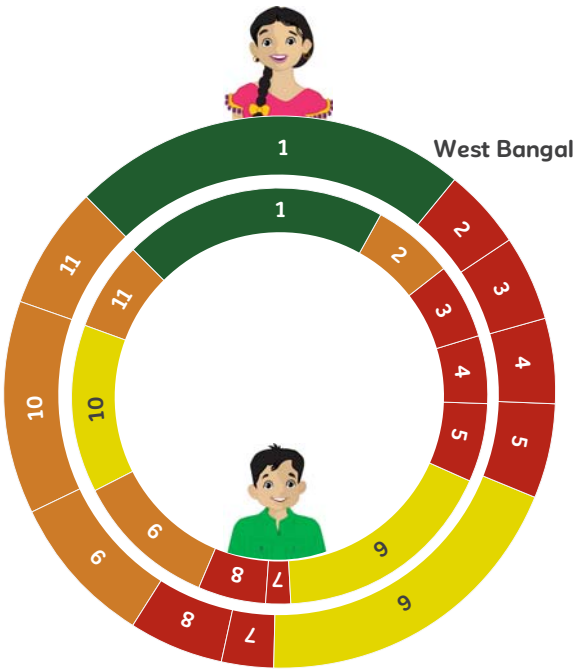

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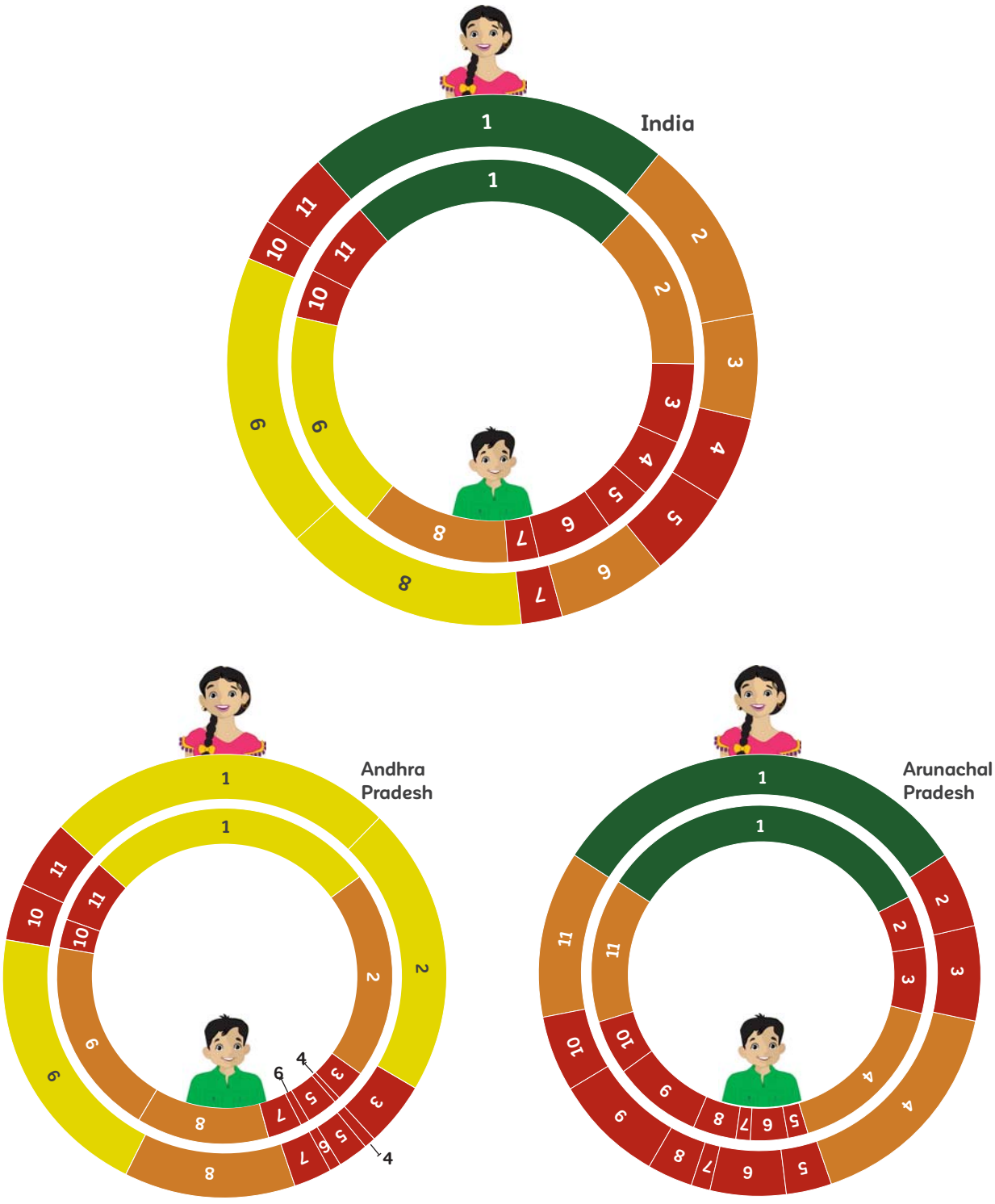
Percentage of adolescent girls and boys with consumption as per ICMR-NIN recommendation



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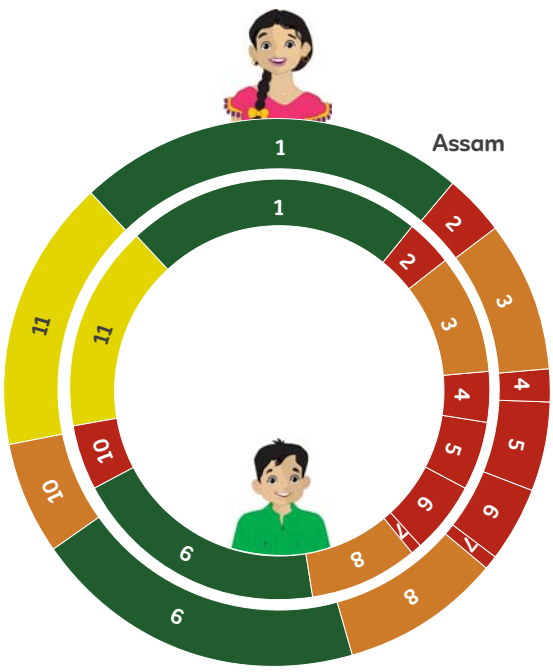
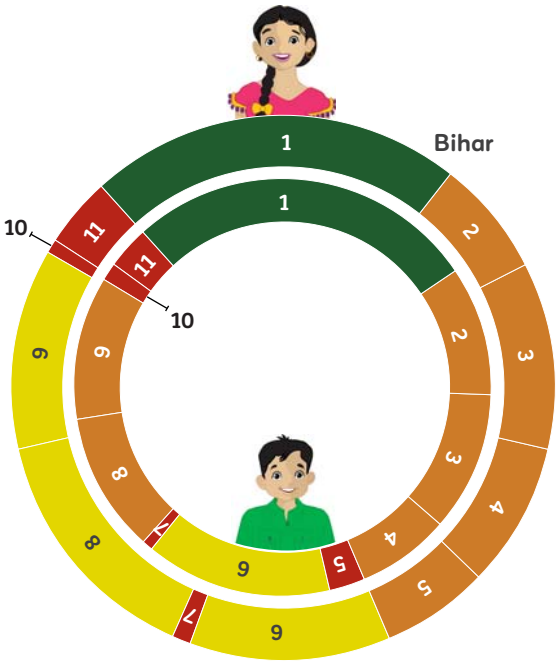
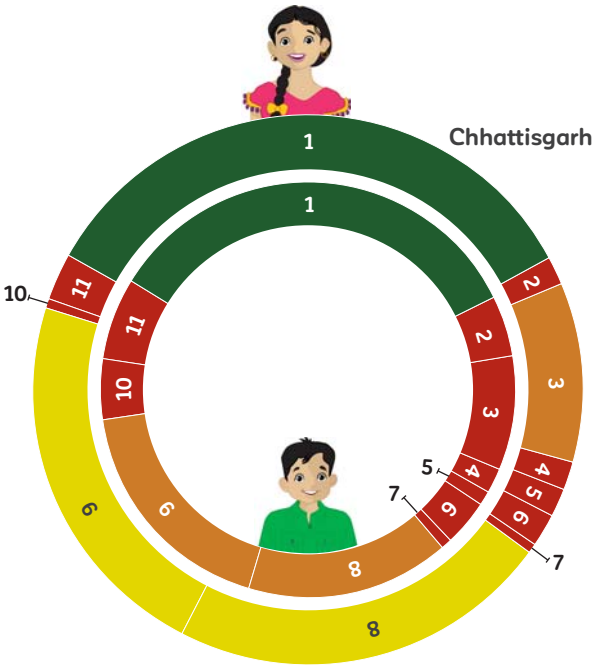
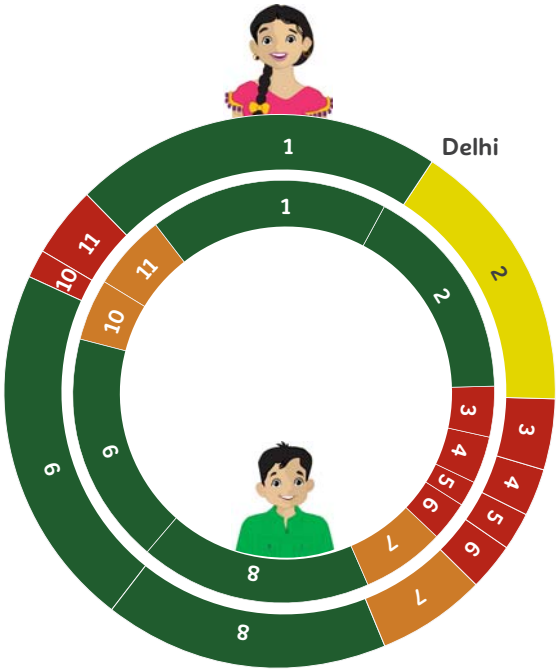




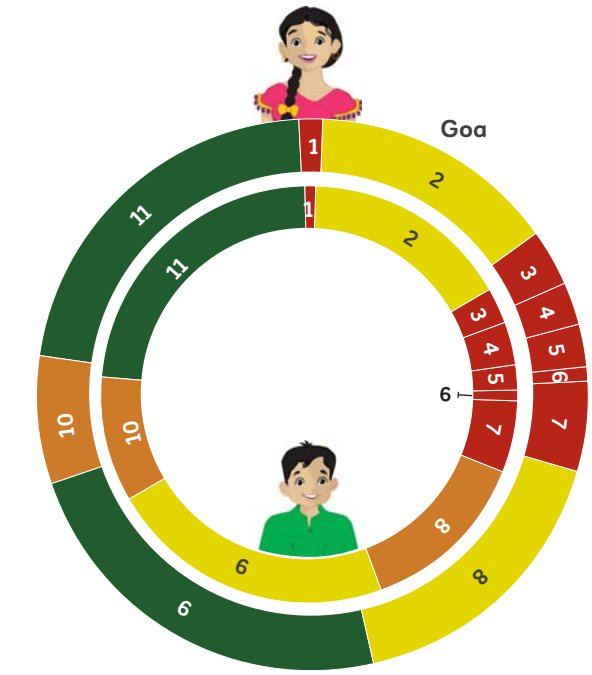


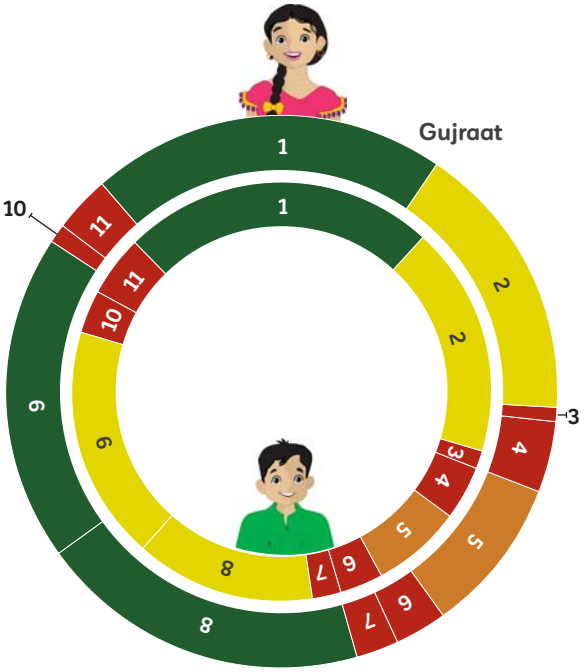


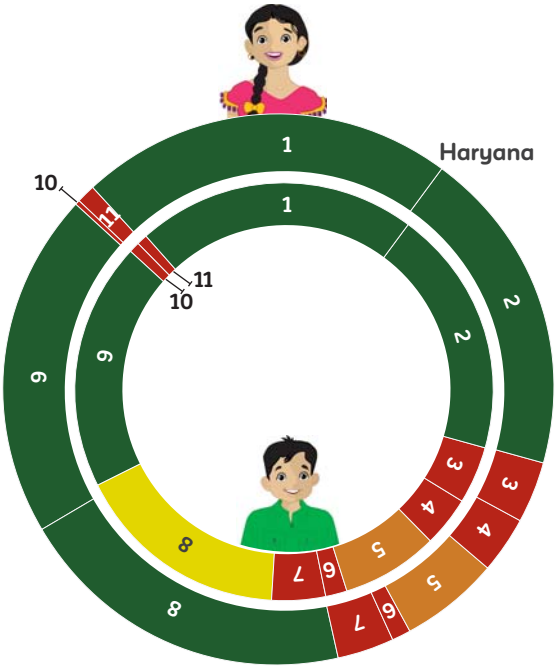
1 – Cereals **2** – Milk or curd **3** – Pulses or beans **4** – Dark green leafy vegetables **5** – Other vegetables

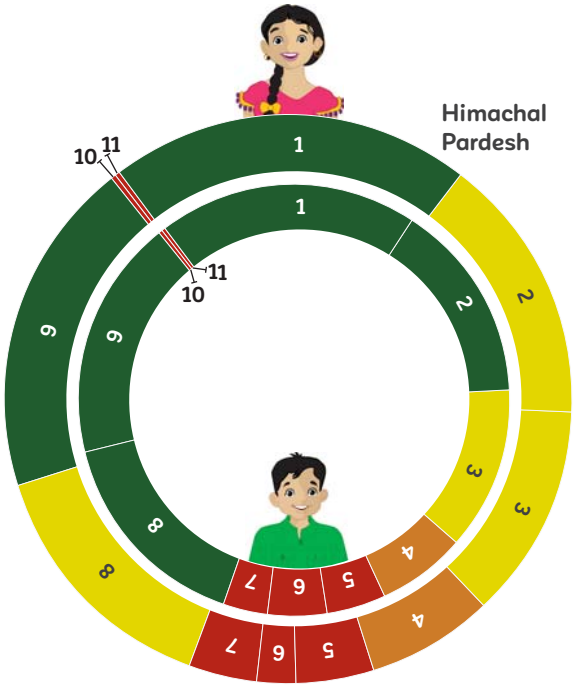
6 – Roots and tubers **7** – Fruits **8** – Fats and oils **9** – Sugar and jaggery **10** – Fish/chicken **11** – Eggs

<25% 25–50% 51–75% >75%









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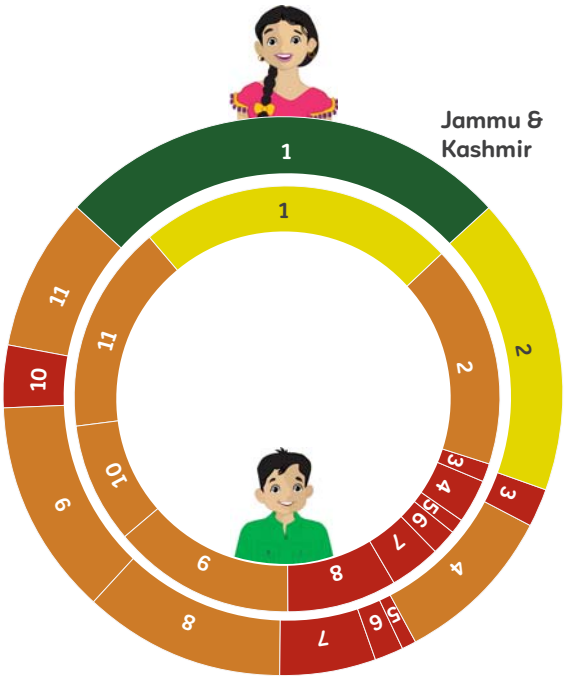

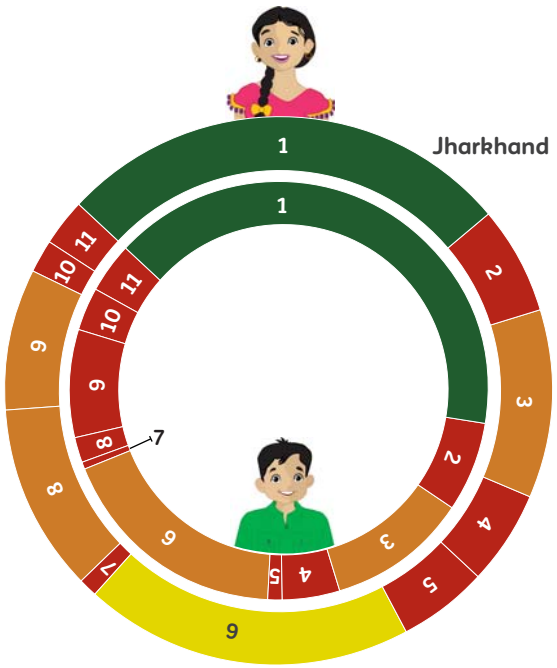

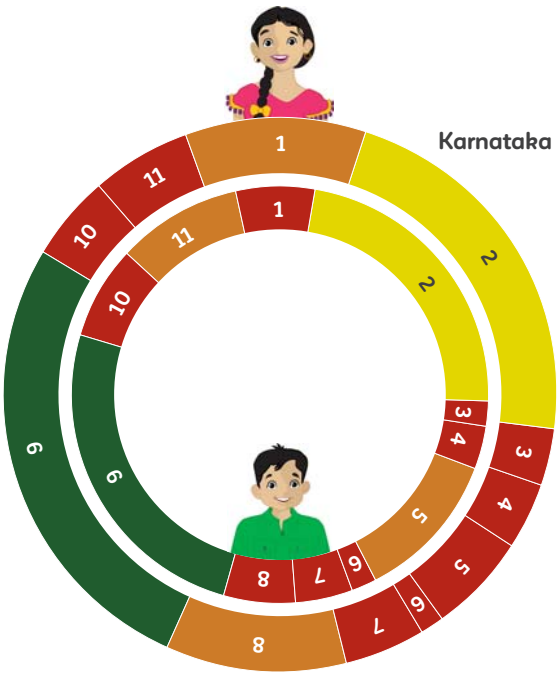

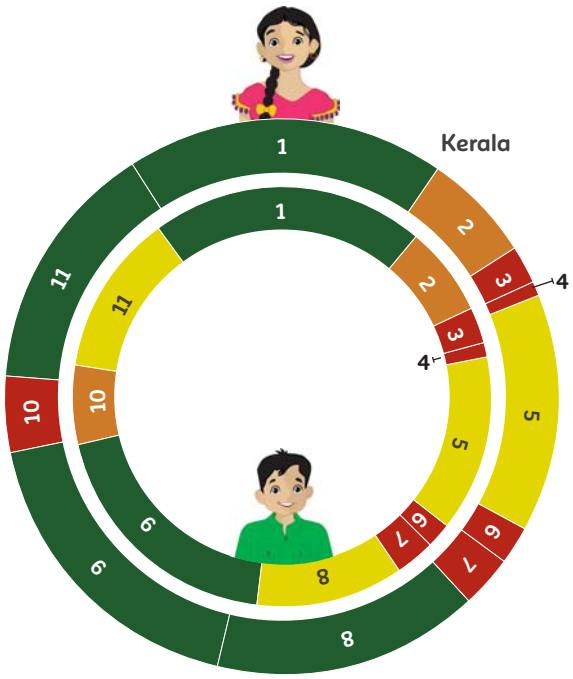

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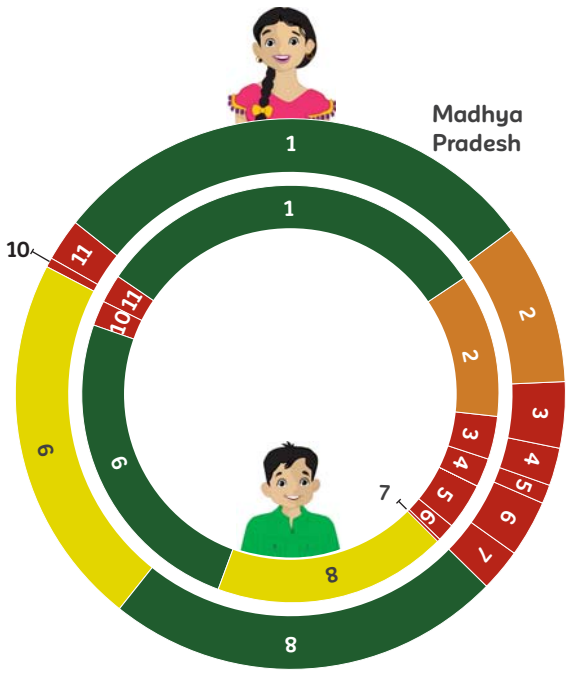

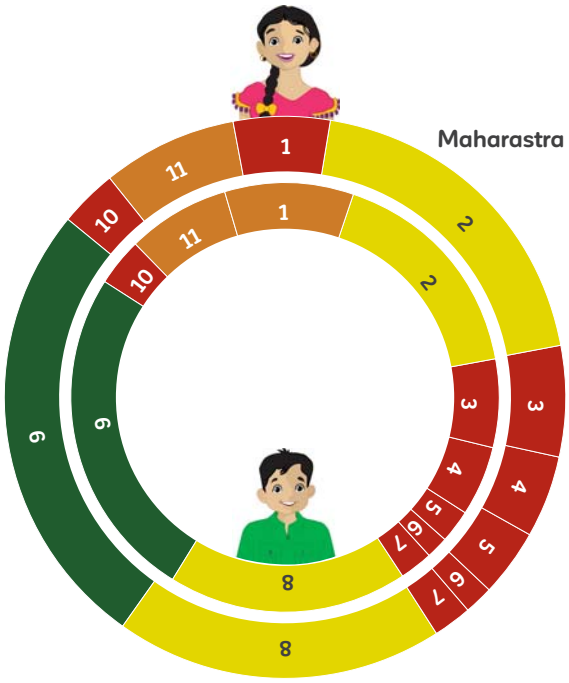

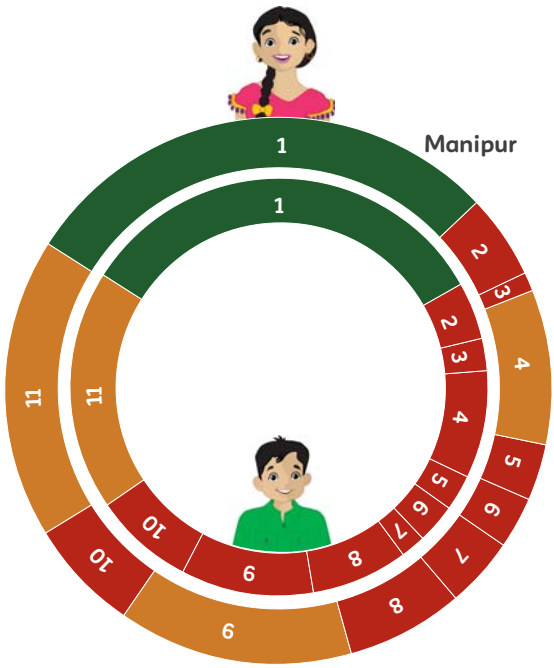

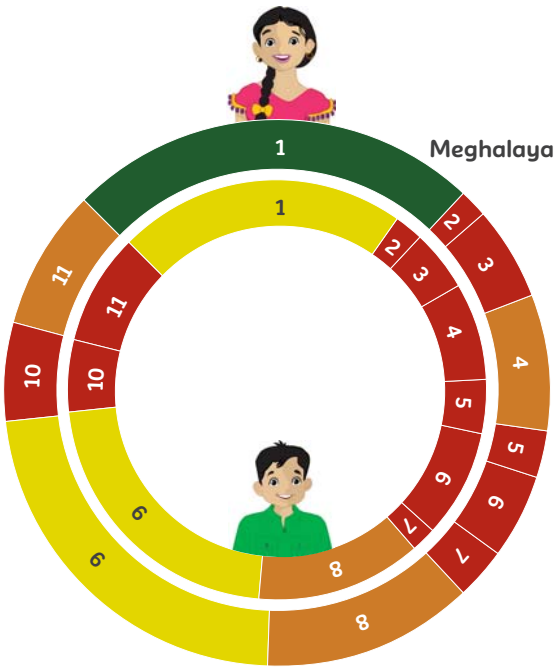

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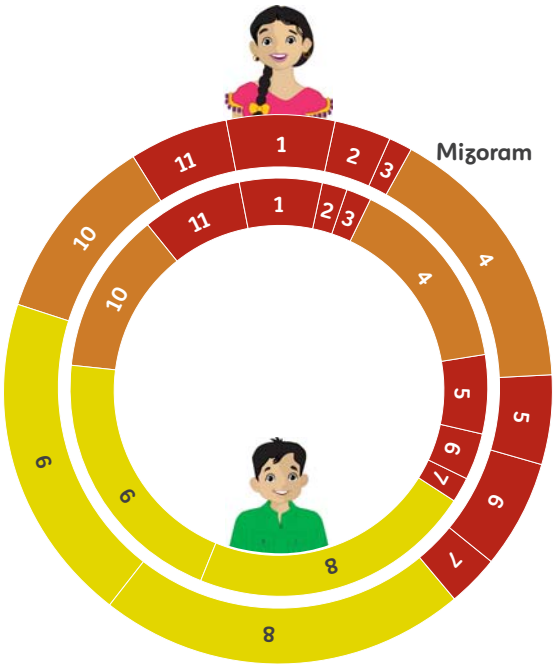

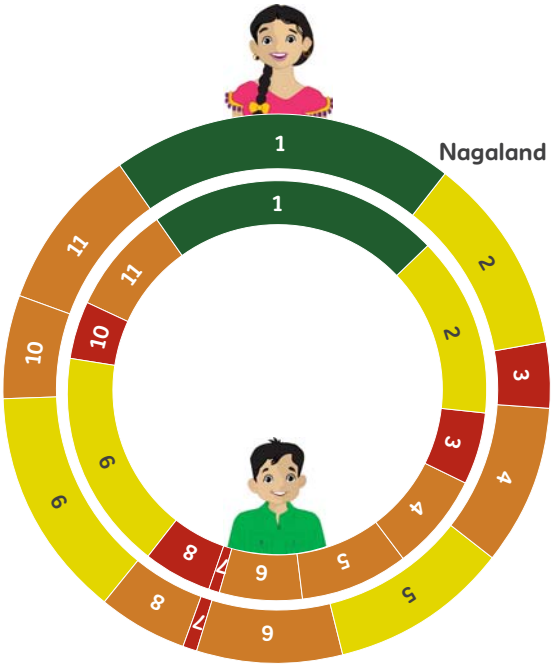

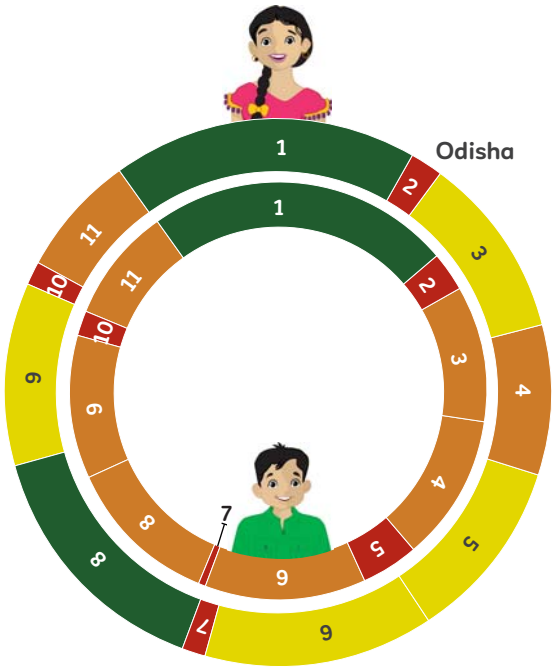

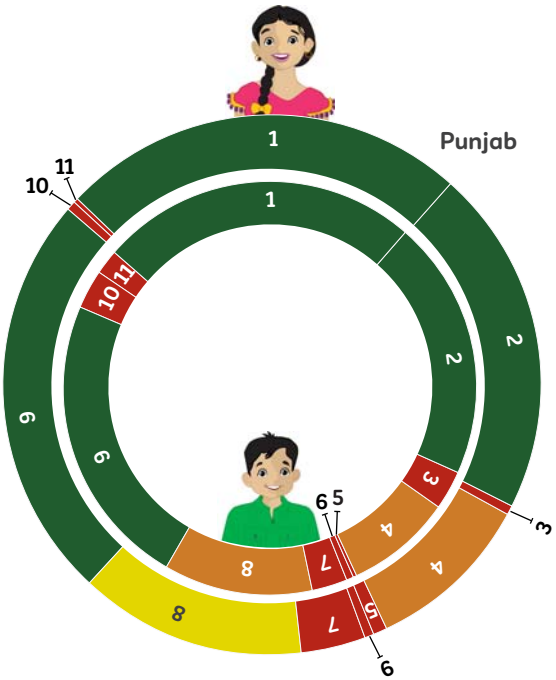

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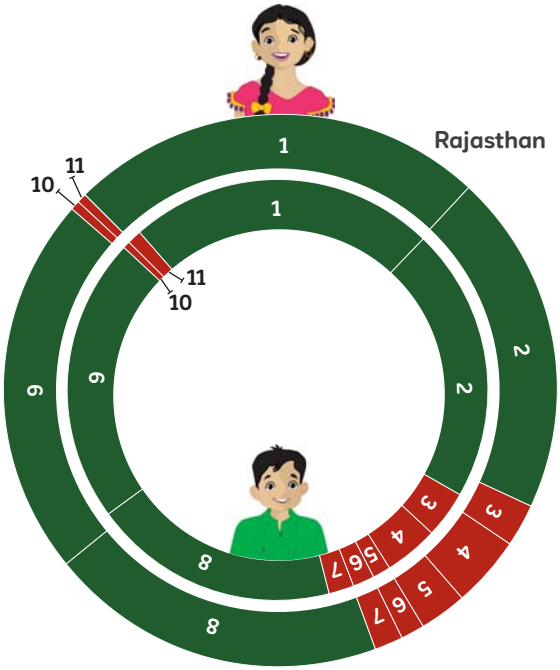

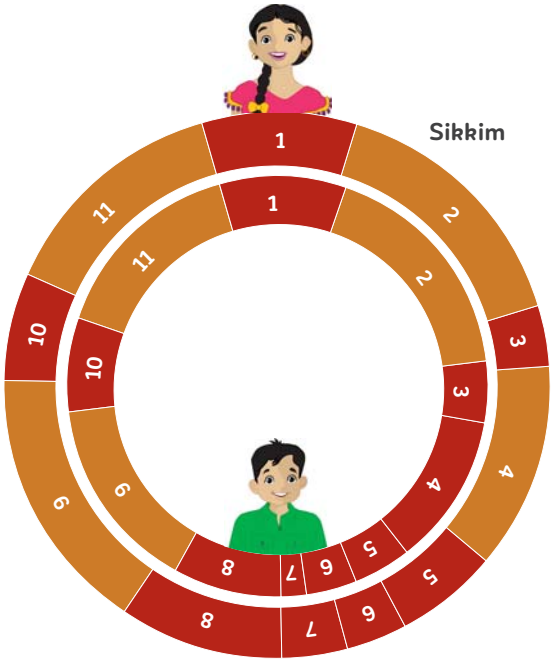

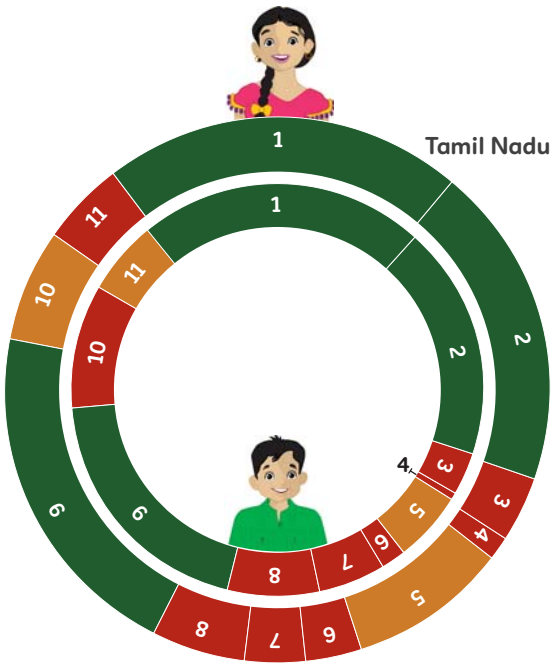

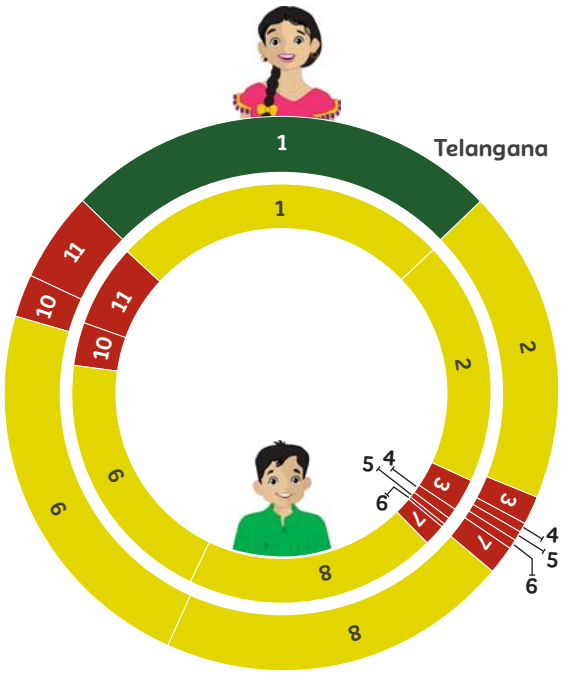

1 – Cereals **2** – Milk or curd **3** – Pulses or beans **4** – Dark green leafy vegetables **5** – Other vegetables

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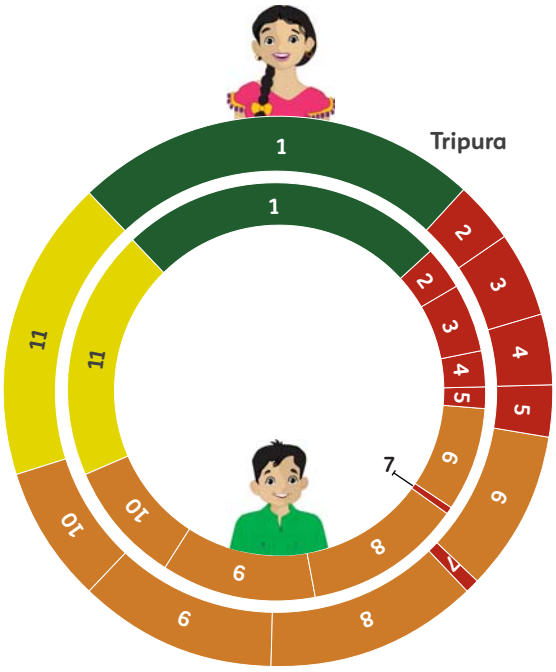

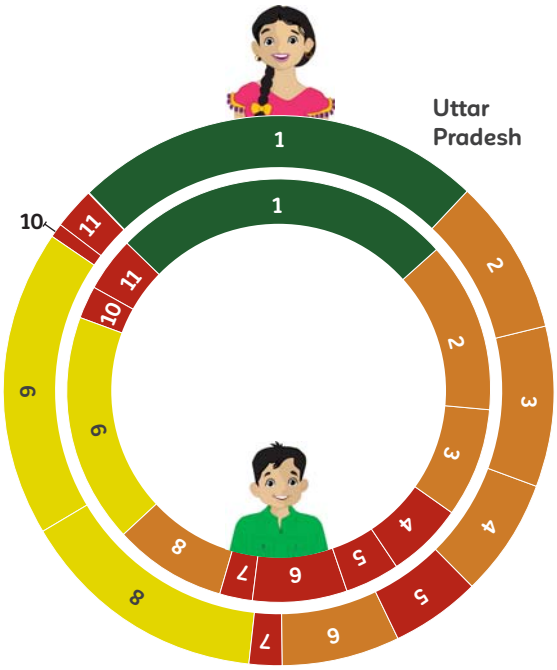

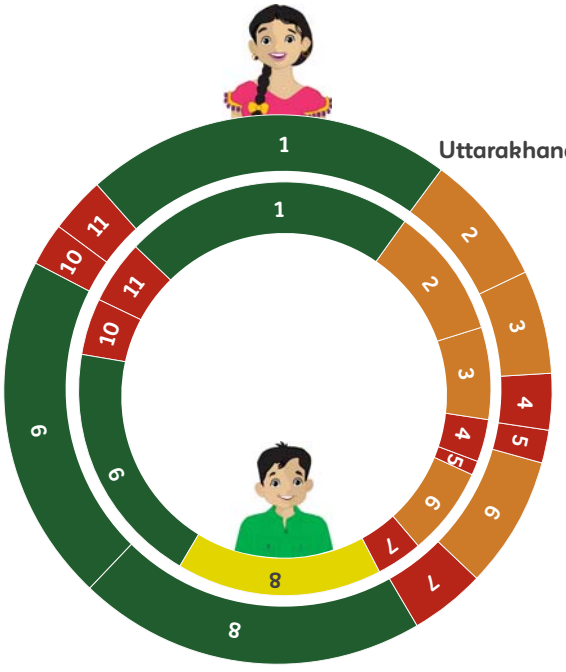

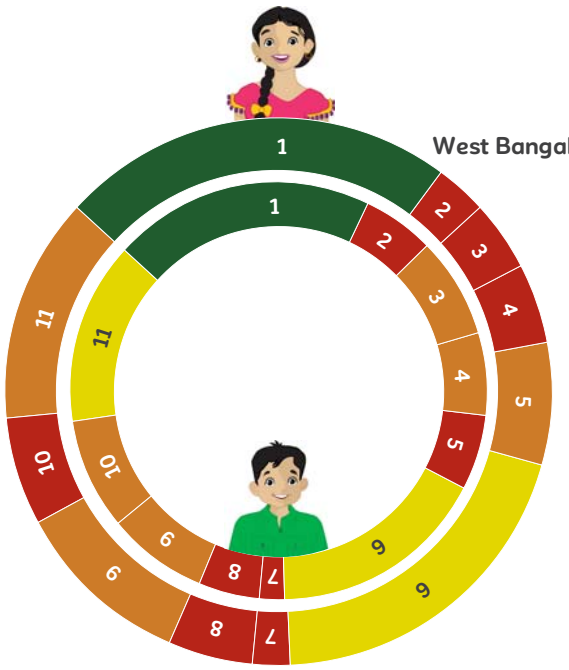

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Table 7: Consumption of food groups by 10-14 year old Girls, CNNS 2016-18 (%)

States	Percentage of adolescent girls with consumption as per ICMR-NIN recommendation										
	All 7 days/week									At least 2 days/week	At least 3 days/week
	Cereals	Milk or Curd	Pulses or Beans	Dark green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Fats and Oils	Sugar and Jaggery	Fish/Chicken	Eggs
India	**87.3**	**45.3**	**23.6**	**18.6**	**18.3**	**26.6**	**9.1**	**56.6**	**69.1**	**16.6**	**9.9**
North											
Delhi	97.9	72.2	15.2	8.1	11.6	5.3	23.4	71.2	94.7	18.5	12.6
Haryana	99.4	90.6	15.0	17.1	22.4	4.5	14.3	90.2	96.1	2.3	0.4
Himachal Pradesh	100.0	71.1	49.9	25.9	24.9	9.7	21.0	72.6	87.2	0.4	0.8
Jammu & Kashmir	94.9	53.7	8.5	30.7	3.2	8.2	17.0	34.4	44.5	46.4	19.5
Punjab	99.1	76.2	6.5	39.4	2.9	4.1	11.1	63.3	97.4	2.6	4.0
Rajasthan	98.6	83.8	9.1	11.3	9.5	8.5	5.8	79.3	91.1	3.3	1.4
Uttarakhand	99.1	38.3	29.5	13.9	10.3	32.8	21.8	89.0	85.8	11.3	5.7
Central											
Chhattisgarh	92.4	7.1	30.3	8.8	6.2	6.9	2.5	59.2	65.1	3.1	2.3
Madhya Pradesh	99.8	33.8	13.2	8.9	4.8	16.7	2.5	65.7	75.5	2.3	1.6
Uttar Pradesh	97.8	40.2	33.6	24.7	14.5	27.4	10.4	56.7	67.8	9.2	3.3
East											
Bihar	99.2	34.7	36.6	31.6	25.6	48.4	2.0	57.1	46.7	12.1	3.1
Jharkhand	99.6	16.7	27.5	17.6	19.4	67.3	3.1	41.3	27.0	9.0	15.7
Odisha	100.0	8.5	51.7	47.2	54.6	76.8	7.1	79.3	56.5	35.1	9.5
West Bengal	87.3	17.4	18.2	19.0	20.4	71.1	11.0	20.5	33.0	46.5	26.1

< 25% 25–50% 51–75% > 75%

(Continued)

(Continued)

States	Percentage of adolescent girls with consumption as per ICMR-NIN recommendation										
	All 7 days/week									At least 2 days/week	At least 3 days/week
	Cereals	Milk or Curd	Pulses or Beans	Dark green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Fats and Oils	Sugar and Jaggery	Fish/Chicken	Eggs
North-East											
Arunachal Pradesh	84.6	14.9	16.7	35.9	6.9	14.1	6.1	9.0	21.1	28.6	14.3
Assam	99.5	13.5	34.2	11.0	21.7	22.2	3.1	47.8	86.8	67.9	18.6
Manipur	77.5	15.2	1.9	19.2	8.8	12.5	11.4	17.3	29.4	41.2	19.1
Meghalaya	62.2	14.5	10.2	28.1	6.4	33.6	12.1	43.0	70.1	22.8	22.6
Mizoram	20.8	10.7	6.1	41.4	15.7	12.0	7.6	60.6	56.5	14.8	28.4
Nagaland	99.4	60.8	17.1	29.6	41.4	27.0	5.8	14.8	72.6	34.7	15.6
Sikkim	20.1	31.7	8.2	17.6	11.2	5.3	4.8	19.7	36.4	25.1	15.8
Tripura	93.3	14.3	18.5	6.6	5.7	28.3	1.5	46.3	42.0	68.3	31.2
West											
Goa	6.0	52.4	11.5	10.5	10.1	3.6	25.4	66.0	85.0	76.7	36.9
Gujarat	90.1	73.9	6.0	22.9	27.2	18.1	18.4	80.4	94.7	11.4	4.2
Maharashtra	18.4	63.8	25.5	14.7	10.7	6.3	11.3	68.5	92.3	23.0	10.1
South											
Andhra Pradesh	70.1	57.4	12.4	2.5	6.1	1.8	7.9	33.5	55.2	11.4	13.3
Karnataka	27.2	65.0	8.0	7.5	24.2	3.8	13.5	28.9	79.2	17.8	12.3
Kerala	98.7	26.6	11.2	2.3	73.4	10.2	19.2	84.2	94.7	72.1	31.7
Tamil Nadu	89.0	76.6	17.2	4.5	32.3	11.3	18.8	30.0	85.7	20.0	44.5
Telangana	82.7	59.6	5.6	1.8	1.9	1.4	5.0	67.0	73.6	8.2	16.3

< 25% 25–50% 51–75% > 75%

Table 8: Consumption of food groups by 10-14 year old Boys, CNNS 2016-18 (%)

States	Percentage of adolescent boys with consumption of food groups as per ICMR-NIN recommendations										
	All 7 days/week									At least 2 days/week	At least 3 days/week
	Cereals	Milk or Curd	Pulses or Beans	Dark green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Fats and Oils	Sugar and Jaggery	Fish/Chicken	Eggs
India	**86.3**	**46.7**	**22.2**	**15.4**	**14.0**	**21.5**	**8.0**	**46.3**	**67.7**	**17.7**	**11.4**
North											
Delhi	100.0	89.6	22.7	17.2	6.4	12.4	34.0	93.0	97.3	21.2	16.0
Haryana	100.0	90.5	15.9	13.0	29.5	8.1	17.7	74.4	88.9	1.7	1.4
Himachal Pradesh	99.5	77.1	68.6	33.6	20.3	14.4	27.0	79.8	93.0	0.8	0.8
Jammu & Kashmir	81.9	57.4	5.0	18.9	1.6	2.1	14.4	36.1	43.9	42.3	23.1
Punjab	99.4	73.9	5.7	30.5	4.9	1.9	14.0	45.3	96.4	6.5	5.2
Rajasthan	98.6	90.7	10.0	14.1	4.8	5.9	5.3	78.3	93.6	1.8	2.6
Uttarakhand	97.7	45.4	34.7	13.2	5.6	29.9	18.8	78.2	90.7	19.5	20.3
Central											
Chhattisgarh	94.3	7.5	30.0	5.1	4.0	10.0	3.3	47.8	46.3	9.9	1.9
Madhya Pradesh	99.5	31.5	10.6	7.5	1.6	12.7	2.5	58.7	77.4	5.1	2.2
Uttar Pradesh	94.1	41.5	31.4	15.3	11.6	22.3	5.9	35.9	64.5	8.5	6.3
East											
Bihar	99.4	32.7	34.8	24.2	18.3	38.2	1.8	45.1	47.1	13.6	4.3
Jharkhand	98.2	25.4	25.7	12.2	6.7	48.4	7.3	12.9	23.6	9.7	14.2
Odisha	99.4	15.7	45.8	48.8	24.5	51.2	3.8	54.2	59.8	31.7	12.2
West Bengal	80.8	25.3	22.7	21.8	23.5	69.2	6.9	21.1	43.4	51.8	26.4

< 25% 25–50% 51–75% > 75%

(Continued)

(Continued)

States	Percentage of adolescent boys with consumption of food groups as per ICMR-NIN recommendations										
	All 7 days/week									At least 2 days/week	At least 3 days/week
	Cereals	Milk or Curd	Pulses or Beans	Dark green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Fats and Oils	Sugar and Jaggery	Fish/Chicken	Eggs
North-East											
Arunachal Pradesh	89.0	14.2	18.8	36.3	5.0	9.2	4.1	9.0	21.2	31.6	15.6
Assam	97.9	15.6	35.4	14.5	23.0	20.3	2.4	35.7	77.4	58.1	23.9
Manipur	81.0	14.4	2.1	22.9	8.4	11.5	11.5	16.0	31.4	47.0	19.4
Meghalaya	86.1	5.3	18.6	9.7	8.6	24.0	6.7	32.0	69.2	26.8	19.6
Mizoram	18.6	8.4	3.7	39.4	12.8	9.0	6.7	63.5	56.5	15.7	28.8
Nagaland	99.8	61.7	25.3	24.0	37.4	28.2	3.8	21.1	66.1	42.9	24.9
Sikkim	24.9	47.3	5.3	29.4	12.3	7.1	4.5	17.3	37.7	26.5	15.5
Tripura	94.1	13.4	16.8	12.7	9.4	33.4	1.0	46.9	39.6	61.8	32.4
West											
Goa	5.4	56.9	10.9	10.9	7.9	2.0	22.9	61.6	84.6	74.0	32.3
Gujarat	93.8	70.0	4.1	14.5	24.1	13.3	13.3	68.2	81.2	22.6	10.4
Maharashtra	25.5	58.6	20.6	15.8	8.6	5.0	8.3	62.2	89.1	24.9	9.5
South											
Andhra Pradesh	68.8	47.9	7.1	1.8	7.4	1.9	8.0	30.9	45.8	6.8	14.5
Karnataka	26.5	67.4	13.0	8.8	17.1	4.8	13.1	31.9	80.5	22.5	18.3
Kerala	97.7	39.8	14.5	1.6	65.2	5.8	24.2	59.9	87.8	63.2	33.8
Tamil Nadu	87.7	80.1	13.0	2.6	26.0	4.9	24.3	24.0	85.9	23.9	45.3
Telangana	74.4	53.9	7.0	2.2	2.0	0.9	4.8	55.3	56.5	9.3	18.0

< 25% 25–50% 51–75% > 75%

Table 9: Consumption of food groups by 15-19 year old Girls, CNNS 2016-18 (%)

States	Percentage of adolescent girls with consumption as per ICMR-NIN recommendation										
	All 7 days/week									At least 2 days/week	At least 3 days/week
	Cereals	Milk or Curd	Pulses or Beans	Dark green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Fats and Oils	Sugar and Jaggery	Fish/Chicken	Eggs
India	**87.9**	**43.6**	**25.5**	**20.2**	**21.4**	**26.1**	**8.9**	**59.0**	**71.0**	**8.9**	**18.4**
North											
Delhi	97.5	71.8	18.3	12.6	10.2	11.9	28.4	75.2	94.6	8.0	18.0
Haryana	99.3	86.7	16.3	14.7	26.0	5.1	15.6	90.4	91.5	1.2	4.0
Himachal Pradesh	99.1	71.7	59.1	34.3	20.2	11.1	17.7	69.6	90.6	1.1	1.2
Jammu & Kashmir	100.0	64.9	8.0	35.3	2.8	6.6	20.7	43.9	46.8	14.5	32.4
Punjab	99.7	84.2	2.8	40.2	3.9	1.8	15.4	55.9	99.1	2.0	0.8
Rajasthan	99.5	81.3	11.1	16.7	11.6	5.3	6.5	80.9	91.3	2.4	2.7
Uttarakhand	97.1	34.6	26.9	15.5	8.1	34.8	19.8	91.4	91.5	12.5	13.2
Central											
Chhattisgarh	97.0	4.9	29.8	4.8	5.1	5.8	1.2	64.2	63.7	1.9	7.2
Madhya Pradesh	95.5	30.3	12.6	7.8	3.7	10.4	8.0	76.4	71.0	1.8	7.8
Uttar Pradesh	96.7	35.6	37.8	27.9	20.7	27.2	8.1	58.6	71.6	3.7	9.0
East											
Bihar	99.3	30.9	49.0	38.5	29.4	52.8	4.9	65.4	52.5	4.4	17.7
Jharkhand	100.0	23.8	40.9	20.5	20.2	71.8	4.0	40.7	31.4	6.5	10.0
Odisha	98.6	11.4	57.7	49.4	58.2	73.6	8.6	81.2	59.0	7.6	37.9
West Bengal	88.2	12.2	15.8	16.8	28.1	74.6	8.5	18.9	40.4	23.6	49.8

< 25% 25–50% 51–75% > 75%

(Continued)

(Continued)

States	Percentage of adolescent girls with consumption as per ICMR-NIN recommendation										
	All 7 days/week									At least 2 days/week	At least 3 days/week
	Cereals	Milk or Curd	Pulses or Beans	Dark green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Fats and Oils	Sugar and Jaggery	Fish/Chicken	Eggs
North-East											
Arunachal Pradesh	80.8	13.8	18.0	41.5	8.6	14.1	3.1	8.4	20.7	14.0	30.7
Assam	99.0	15.6	38.7	8.4	22.6	18.5	3.6	40.0	85.2	27.8	68.7
Manipur	80.0	13.8	3.0	25.2	8.8	8.2	12.0	18.7	38.3	18.5	48.3
Meghalaya	76.8	5.7	17.0	25.3	8.6	15.9	9.2	39.8	70.9	19.0	25.3
Mizoram	19.9	9.5	4.9	48.3	16.2	18.8	9.1	65.5	59.0	32.9	17.5
Nagaland	100.0	56.2	18.8	47.0	51.4	42.2	3.6	26.1	66.8	28.7	47.4
Sikkim	20.5	33.3	8.2	26.4	13.1	7.9	8.4	21.2	34.6	14.0	29.6
Tripura	95.4	13.5	20.5	16.1	11.6	38.0	2.6	49.7	46.3	31.8	69.5
West											
Goa	6.1	53.2	12.6	9.7	9.2	2.6	20.3	63.0	87.3	27.7	81.5
Gujarat	94.5	73.2	3.9	19.3	41.4	13.8	11.2	86.9	86.1	5.0	15.0
Maharashtra	19.7	69.3	22.2	16.8	13.1	6.3	8.2	65.8	92.7	11.2	27.3
South											
Andhra Pradesh	64.3	53.8	6.4	3.0	7.6	1.1	5.2	35.7	55.8	13.6	15.5
Karnataka	33.2	69.6	10.0	12.1	18.7	4.2	14.4	33.1	84.6	15.6	18.2
Kerala	100.0	33.5	13.0	3.6	74.4	11.8	16.0	83.4	96.4	23.6	77.1
Tamil Nadu	86.8	77.4	15.1	5.4	38.6	13.2	14.7	22.1	82.7	27.4	19.3
Telangana	80.0	52.1	6.3	0.9	3.2	1.5	6.0	66.7	72.4	15.9	8.1

< 25% 25–50% 51–75% > 75%

Table 10: Consumption of food groups by 15-19 year old Boys, CNNS 2016-18 (%)

States	Percentage of adolescent boys with consumption of food groups as per ICMR-NIN recommendations										
	All 7 days/week									At least 2 days/week	At least 3 days/week
	Cereals	Milk or Curd	Pulses or Beans	Dark green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Fats and Oils	Sugar and Jaggery	Fish/Chicken	Eggs
India	**82.6**	**47.3**	**22.1**	**16.8**	**14.2**	**21.8**	**8.5**	**41.9**	**63.1**	**13.7**	**20.8**
North											
Delhi	99.8	91.1	20.3	19.3	10.6	15.9	34.6	95.6	96.3	25.4	30.5
Haryana	96.5	85.5	19.0	17.1	33.5	8.0	18.1	73.8	85.5	2.6	3.6
Himachal Pradesh	99.8	76.5	62.6	34.7	22.4	22.8	17.4	80.5	92.3	2.1	0.7
Jammu & Kashmir	68.2	47.3	4.0	9.3	3.0	5.2	10.6	23.5	39.2	25.1	44.0
Punjab	98.4	79.6	12.3	32.4	1.1	2.5	11.0	44.8	90.7	12.0	7.2
Rajasthan	99.4	87.2	16.1	16.7	6.2	7.1	7.4	78.6	91.9	2.5	3.9
Uttarakhand	99.7	44.7	30.7	15.2	4.1	30.5	15.5	69.9	83.2	19.7	20.8
Central											
Chhattisgarh	87.8	12.4	22.7	5.5	2.4	9.7	2.1	41.1	46.7	12.0	16.1
Madhya Pradesh	100.0	35.5	10.7	7.0	0.7	11.6	4.2	58.6	79.5	6.3	6.4
Uttar Pradesh	86.1	43.0	27.5	20.0	13.5	23.3	8.9	28.5	57.0	8.1	13.7
East											
Bihar	99.8	36.6	39.7	26.7	10.3	53.1	2.9	39.7	40.7	4.8	11.8
Jharkhand	98.9	16.2	26.5	10.7	2.9	44.0	1.2	4.8	19.8	8.2	9.1
Odisha	95.5	11.9	42.6	45.7	18.3	49.9	1.6	48.4	44.7	7.9	34.8
West Bengal	81.9	22.4	31.0	25.6	22.7	67.8	7.5	19.5	31.2	34.2	55.9

< 25% 25–50% 51–75% > 75%

(Continued)

(Continued)

States	Percentage of adolescent boys with consumption of food groups as per ICMR-NIN recommendations										
	All 7 days/week									At least 2 days/week	At least 3 days/week
	Cereals	Milk or Curd	Pulses or Beans	Dark green leafy vegetables	Other vegetables	Roots and Tubers	Fruits	Fats and Oils	Sugar and Jaggery	Fish/Chicken	Eggs
North-East											
Arunachal Pradesh	85.0	13.0	16.1	41.4	5.0	9.2	3.8	10.1	21.8	14.1	34.6
Assam	99.0	15.9	40.1	16.2	23.3	23.9	3.6	37.1	85.4	20.7	68.7
Manipur	76.9	10.6	5.3	19.4	6.8	7.3	4.5	17.2	24.1	18.2	43.1
Meghalaya	64.4	6.4	13.1	22.3	11.2	24.7	5.5	36.3	63.3	15.7	24.6
Mizoram	19.2	6.1	5.9	45.7	17.7	11.1	5.5	65.5	61.4	36.7	23.0
Nagaland	99.4	60.8	24.3	32.1	37.4	27.3	3.8	23.1	74.4	19.2	36.2
Sikkim	20.9	38.0	10.4	24.7	9.2	8.3	4.6	17.5	32.0	15.6	32.2
Tripura	91.0	12.4	18.6	10.1	5.8	29.0	2.2	43.6	42.8	33.8	69.3
West											
Goa	3.2	53.8	8.6	11.3	6.0	3.3	18.0	44.5	73.4	32.0	77.3
Gujarat	94.9	69.9	5.4	16.7	27.6	12.2	9.4	54.0	70.9	12.7	18.5
Maharashtra	32.9	56.8	22.4	17.7	8.5	5.6	8.3	60.5	84.0	12.2	25.5
South											
Andhra Pradesh	71.1	45.6	9.3	3.0	11.2	1.8	6.5	30.4	36.9	16.5	15.3
Karnataka	18.8	68.5	5.7	10.4	34.4	6.1	13.3	16.5	76.3	22.2	28.4
Kerala	97.3	31.2	13.3	4.6	62.1	9.0	13.8	52.2	88.7	27.6	56.3
Tamil Nadu	90.3	74.2	12.8	2.6	22.3	7.8	21.0	28.2	79.8	38.2	23.2
Telangana	62.0	42.5	5.4	0.5	3.5	1.5	7.7	39.5	48.5	21.9	21.0

< 25% 25–50% 51–75% >75%

Foods to be avoided (daily consumption)

Among girls, in early adolescence, daily consumption of fried foods varied from <1% (Chhattisgarh) to 13% (Kerala). In late adolescence it varies from <1% (Rajasthan) to 13% (Goa). Daily junk food consumption varies from 0 (Karnataka, Rajasthan) to 13% (Manipur) in early adolescence and from 0 (Andhra Pradesh, Bihar, Chhattisgarh, Jammu and Kashmir) to 8% (Manipur) in late adolescence. Daily intake of sweets ranged from 0 (Bihar) to 11% (Tamil Nadu) in early adolescence and from 0 (Punjab) to 10% (Karnataka). Daily intake of aerated drinks ranges from 0 (Bihar, Jharkhand, Kerala, Maharashtra, Tripura) to 5% (Arunachal Pradesh) in early adolescence and from 0 (Haryana, Karnataka, Kerala, Tripura) to 7% (Himachal Pradesh) in late adolescence.

As in girls, among boys in early adolescence, the lowest proportion of daily consumers of fried foods is in Chhattisgarh (<1%) and highest in Kerala (11%). In late adolescence, it ranges from <1% (Haryana) to 15% (Odisha). Daily junk food consumption varies from 0 (Karnataka, Telangana) to 7% (Meghalaya) in early adolescence and from 0 (Jharkhand, Madhya Pradesh, Tripura) to 8% (Nagaland) in late adolescence. Daily intake of sweets ranged from <1% (Goa) to 7% (West Bengal) in early adolescence and from 0 (Haryana) to 10% (Tamil Nadu). Daily intake of aerated drinks ranges from 0 (Assam, Kerala, Maharashtra, Telanga, Tripura) to 6% (Nagaland) in early adolesence and from 0 (Tripura) to 14% (Nagaland) in late adolesence.

Figure 25: Daily Consumption of Fried food by Adolescents aged 10-14 years (%)

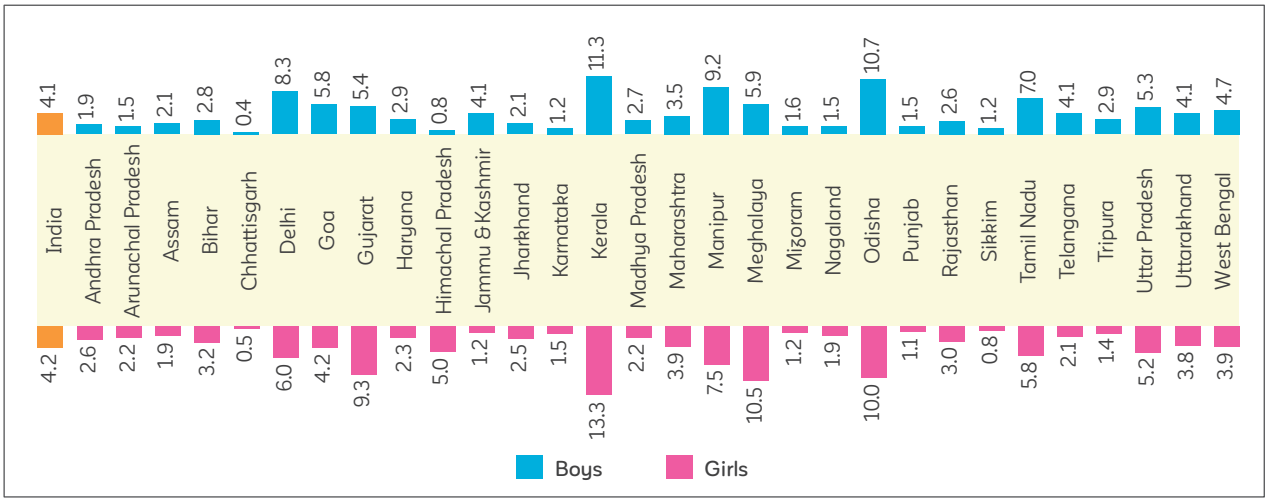


Figure 26: Consumption of Fried food by Adolescents aged 10-14 years (3 times a week) (%)

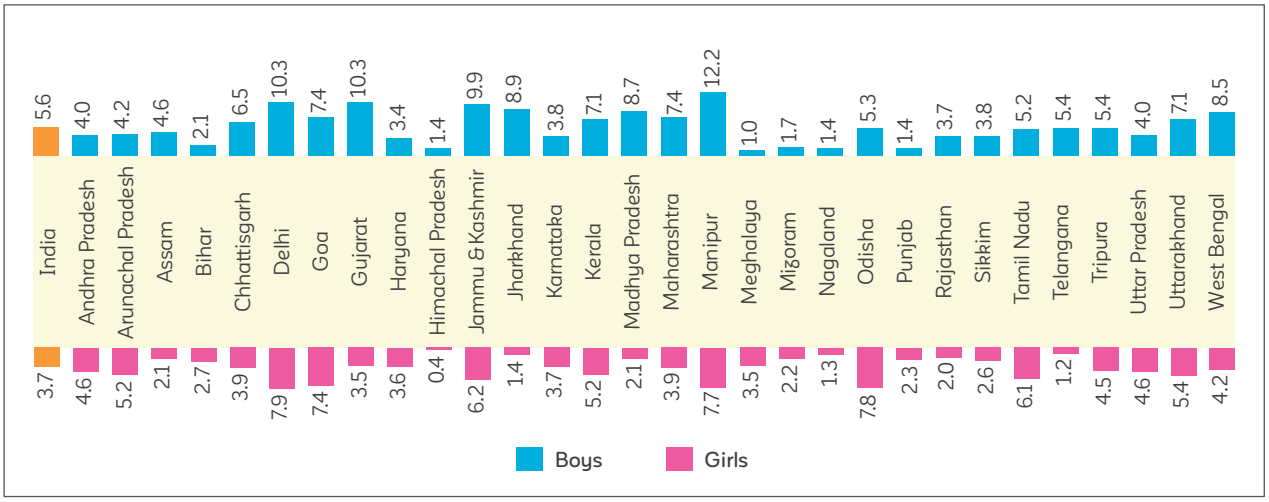


Figure 27: Daily Consumption of Junk food by Adolescents aged 10-14 years (%)

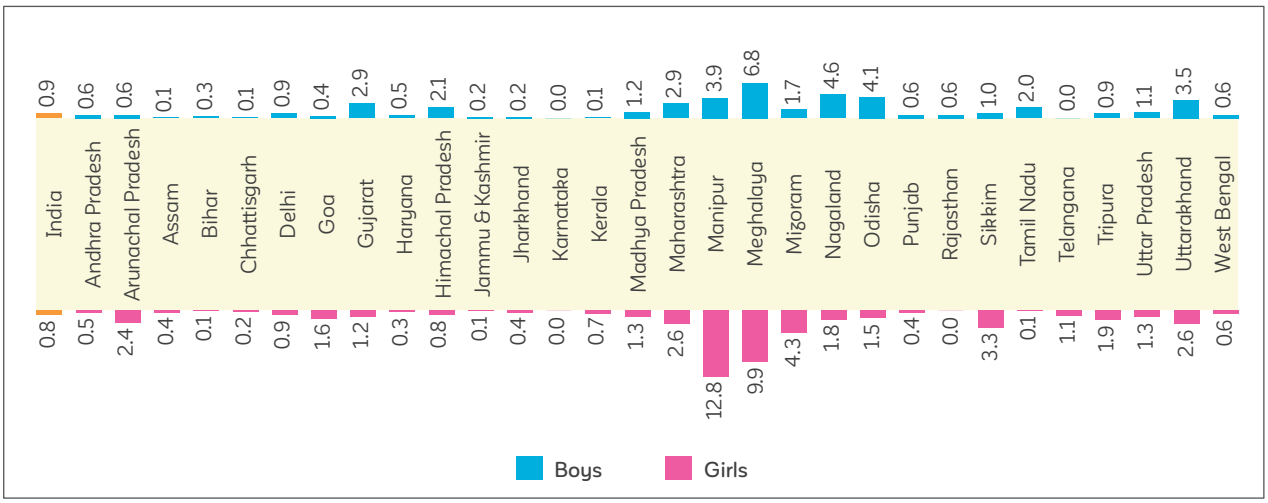


Figure 28: Consumption of Junk food by Adolescents aged 10-14 years (3 times a week) (%)

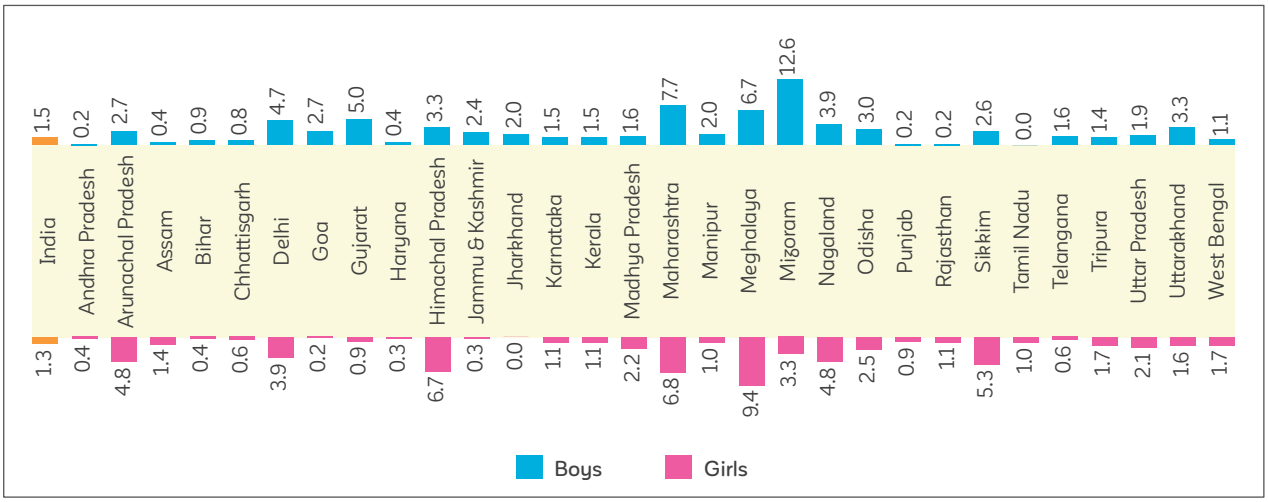


Figure 29: Daily Consumption of Sweets by Adolescents aged 10-14 years (%)

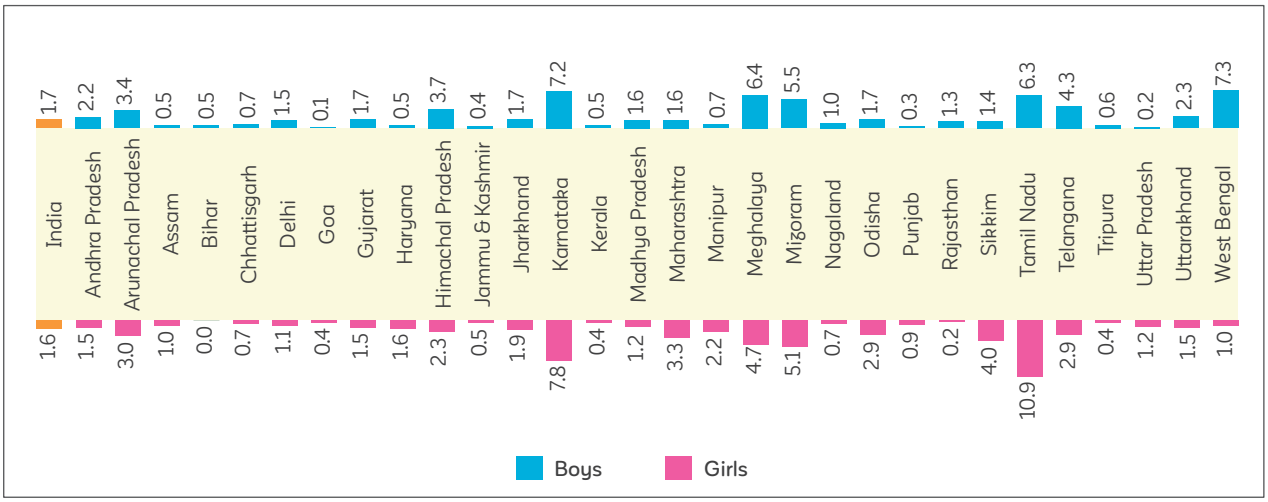


Figure 30: Consumption of Sweets by Adolescents aged 10-14 years (3 times a week) (%)

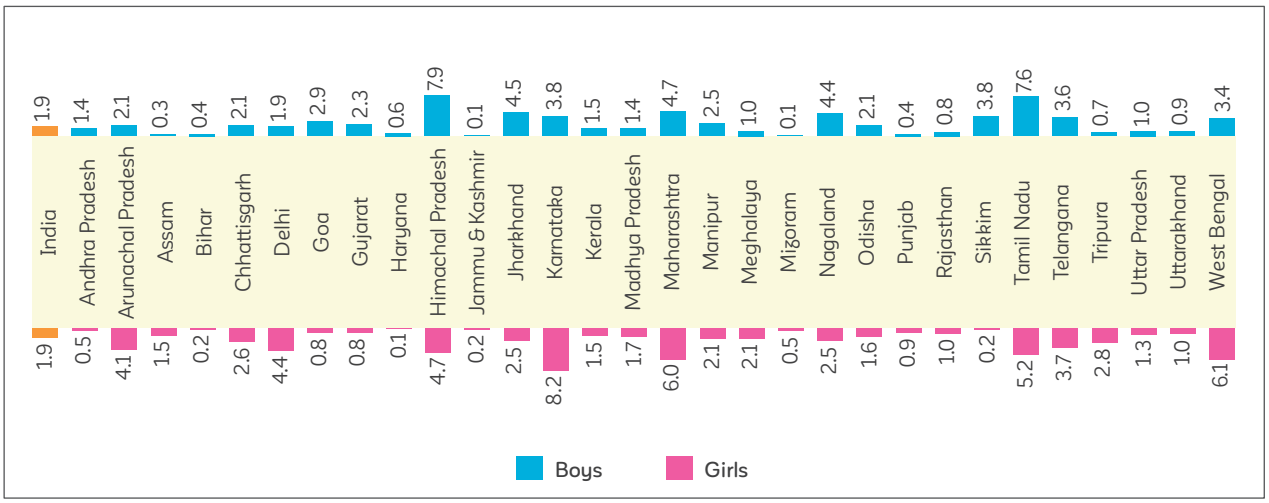


Figure 31: Daily Consumption of Aerated Drinks by Adolescents aged 10-14 years (%)

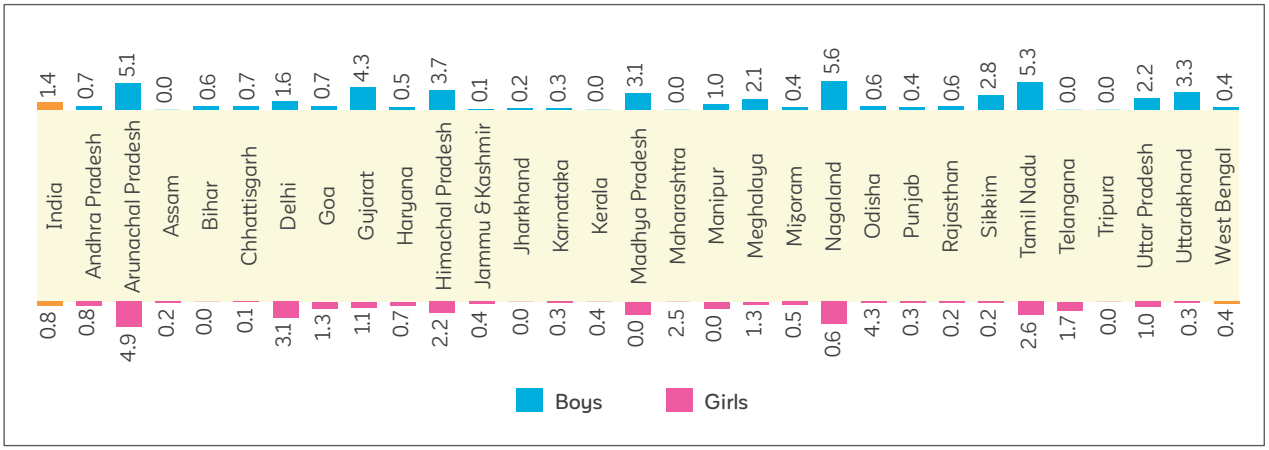


Figure 32: Consumption of Aerated Drinks by Adolescents aged 10-14 years (3 times a week) (%)

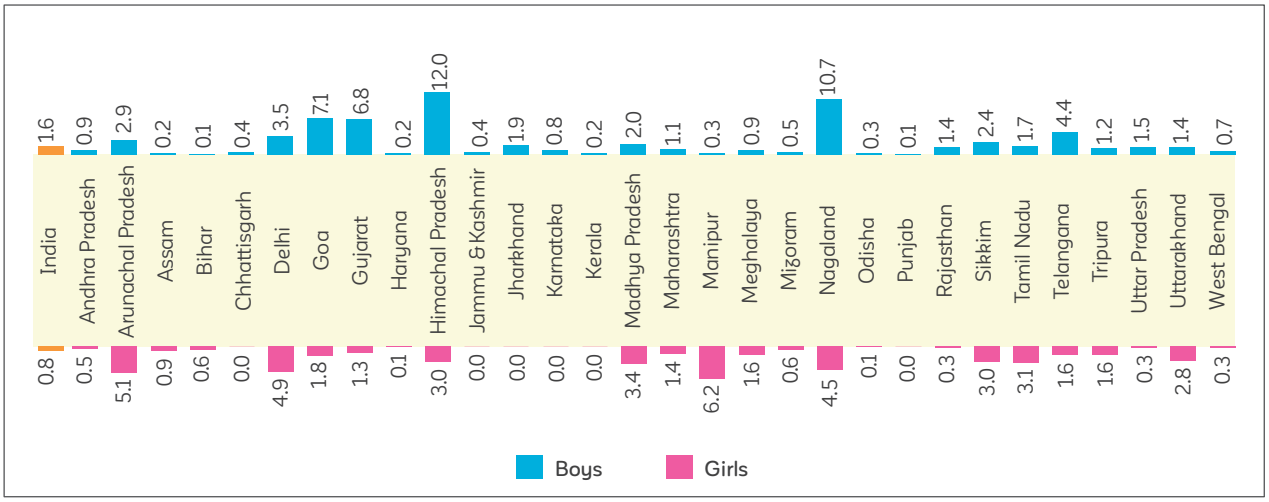


Figure 33: Daily Consumption of Fried food by Adolescents aged 15-19 years (%)

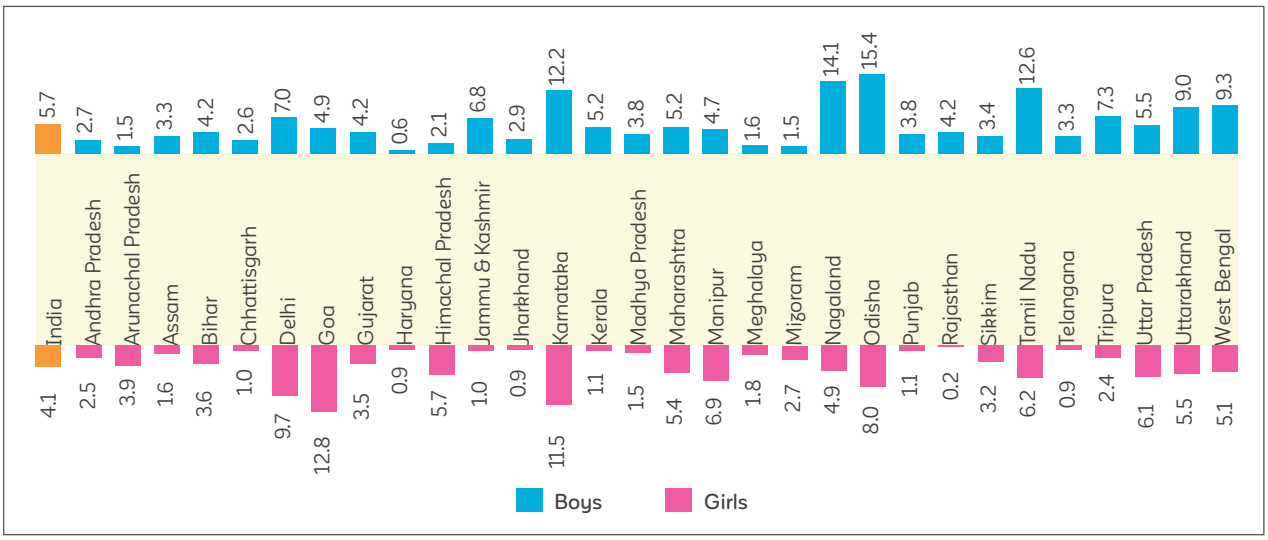


Figure 34: Consumption of Fried food by Adolescents aged 15-19 years (3 times a week) (%)

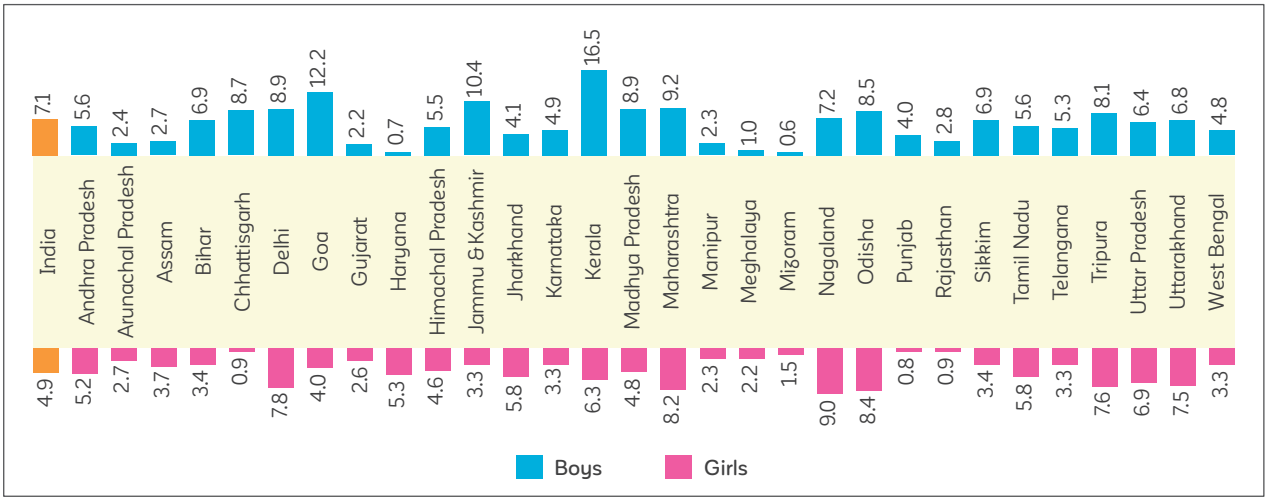


Figure 35: Daily Consumption of Junk food by Adolescents aged 15-19 years (%)

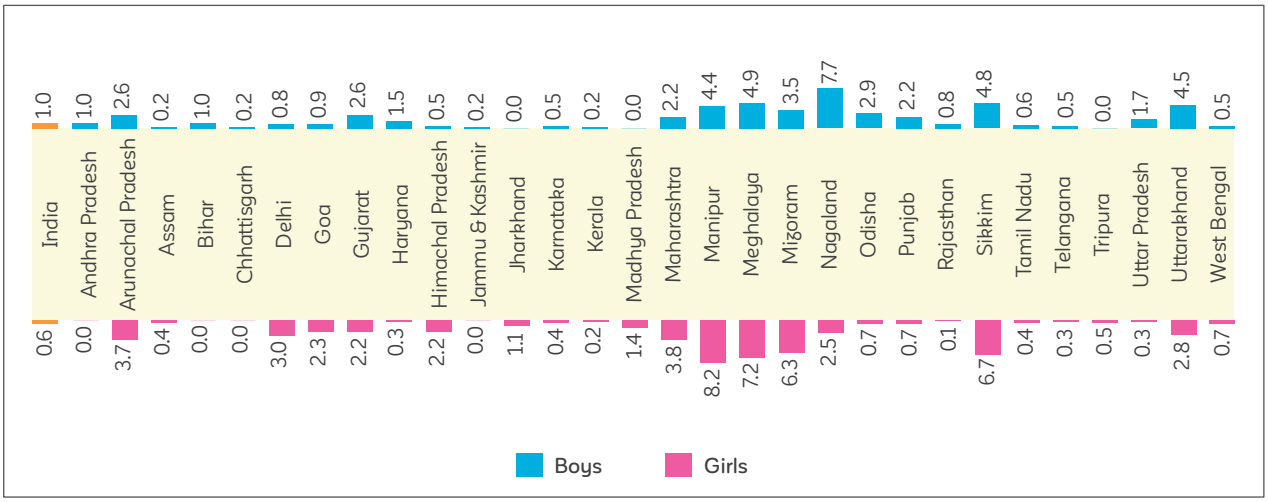


Figure 36: Consumption of Junk food by Adolescents aged 15-19 years (3 times a week) (%)

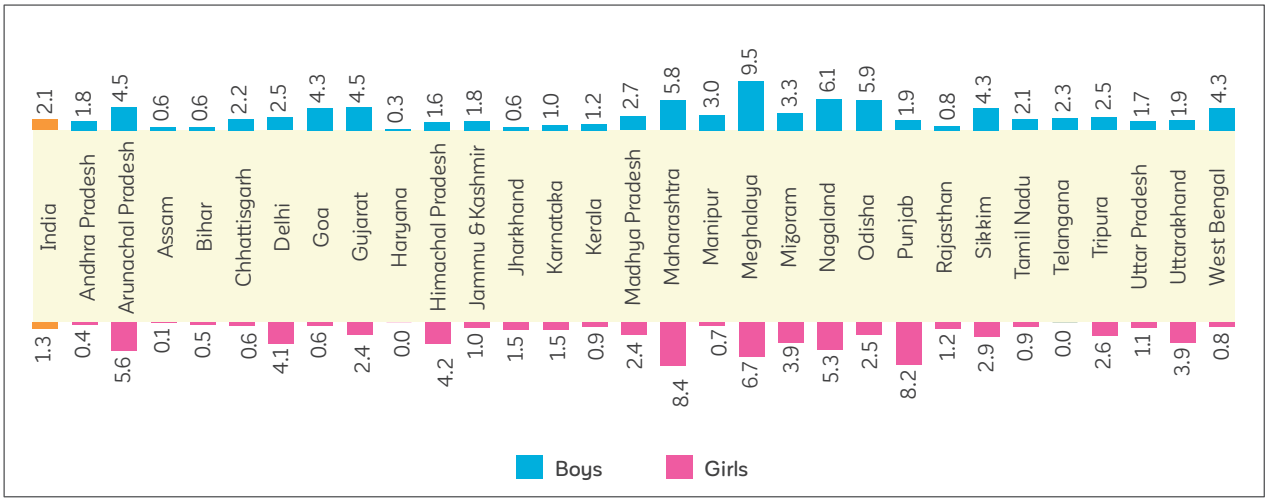


Figure 37: Daily Consumption of Sweets by Adolescents aged 15-19 years (%)

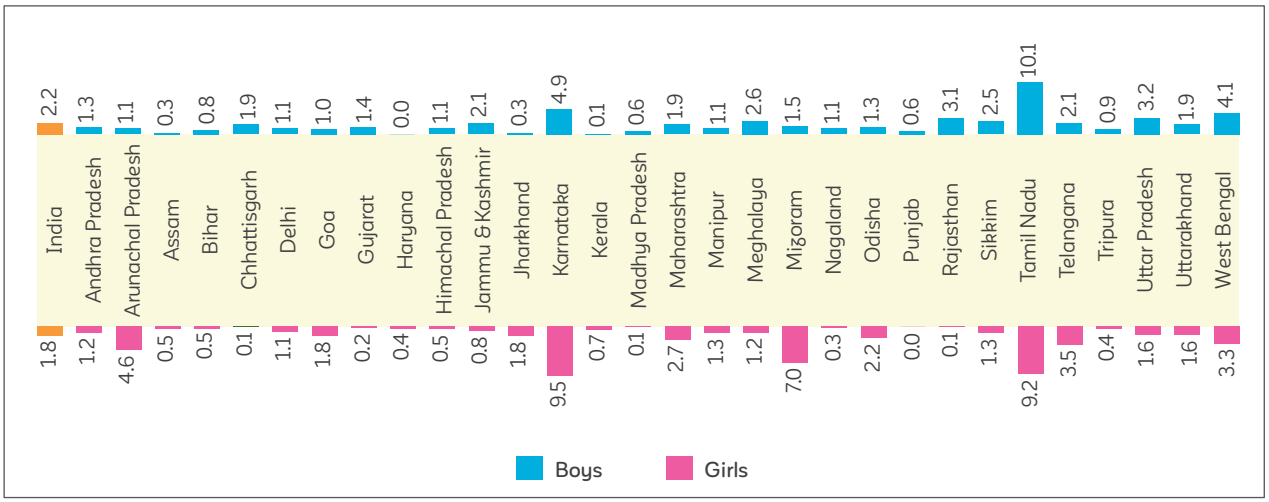


Figure 38: Consumption of Sweets by Adolescents aged 15-19 years (3 times a week) (%)

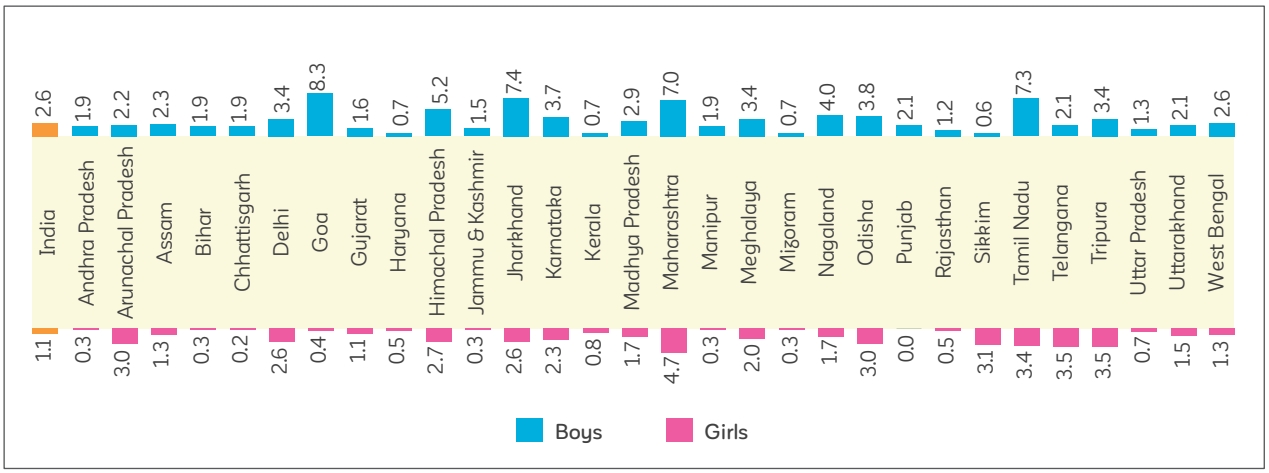


Figure 39: Daily Consumption of Aerated Drinks by Adolescents aged 15-19 years (%)

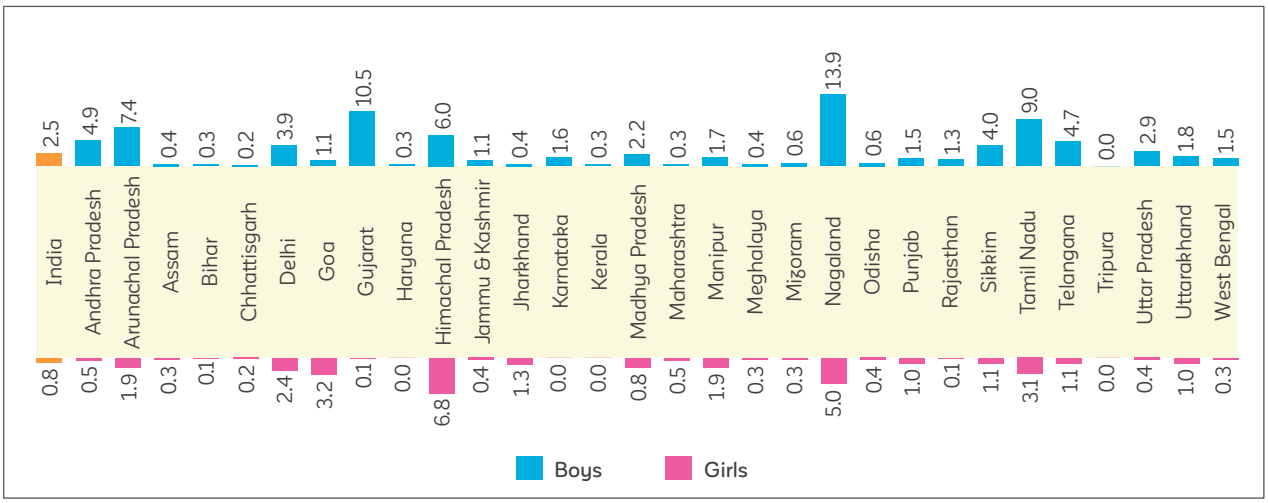
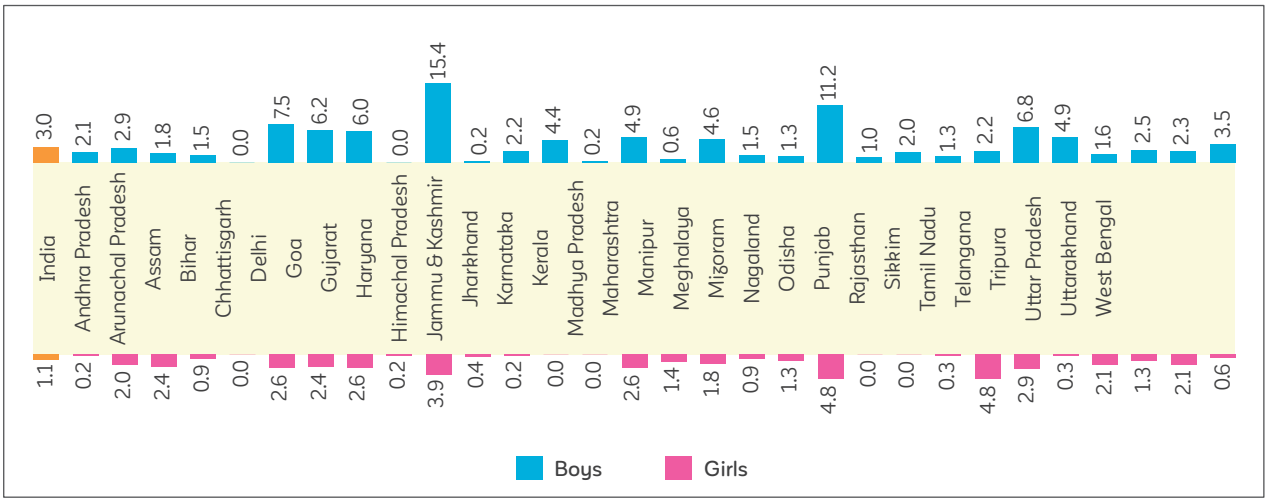


Figure 40: Consumption of Aerated Drinks by Adolescents aged 15-19 years (3 times a week) (%)



3.4.3 Comparison of Diets of Malnourished Adolescents

When the proportion complying to frequency of food intake among those not short, not thin, not overweight/obese, not moderately/severely anemic (standard) is compared with those having visible forms of malnutrition or anemia, very consistent patterns emerge across early and late adolescence and among girls and boys.

Milk and milk products

Compliance to daily milk / milk products intake is lower than standard among those anemic, thin and short for both boys and girls and both age groups. It is higher than standard for those overweight/obese

Pulses/beans

Like milk, a consistent pattern is noted, where in those thin or short comply lesser with daily pulses/bean intake compared with standard. Among those overweight/obese, compliance is similar to the standard.

Dark green leafy vegetables

Those who are anemic, thin or short are less compliant to daily intake of dark green leafy vegetables compared with standard. Among those overweight/obese, compliance is similar to the standard.

Fruits

Those who are anemic, thin or short are less compliant to daily intake of fruits compared with standard. Compliance is lowest among those short. Among those overweight/obese, compliance is similar to the standard.

Eggs

Those who are anemic, thin or short are less compliant to recommended intake of eggs compared with standard. Compliance is lowest among those anemic. Among those overweight/obese, compliance is similar to the standard.

Fish/chicken

Compliance to recommended intake of fish/chicken is lower among those thin, while it is comparable among those short or anemic and the standard. It is higher than standard for those overweight/obese.

Figure 41: Consumption of Specific Food Groups by Adolescent Girls aged 10-14 years (%)

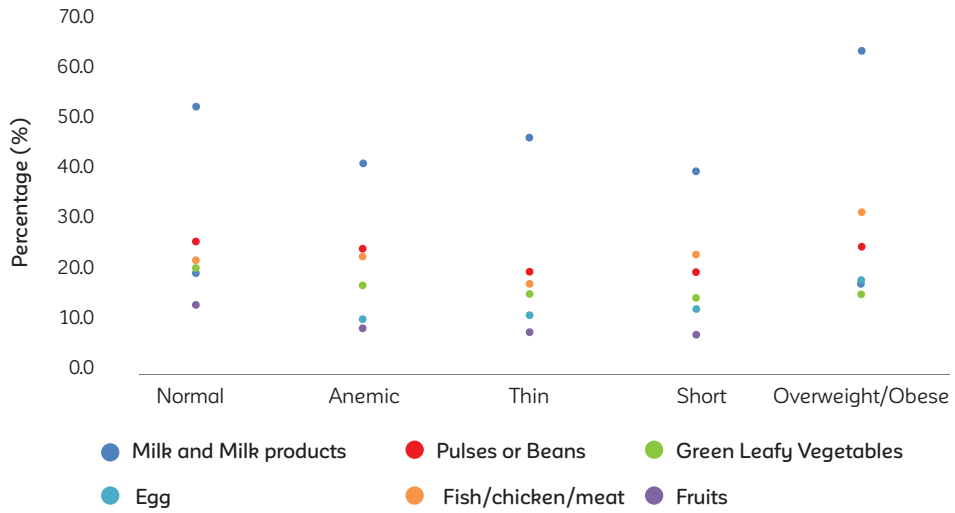


Figure 42: Consumption of Specific Food Groups by Adolescent Boys aged 10-14 years (%)

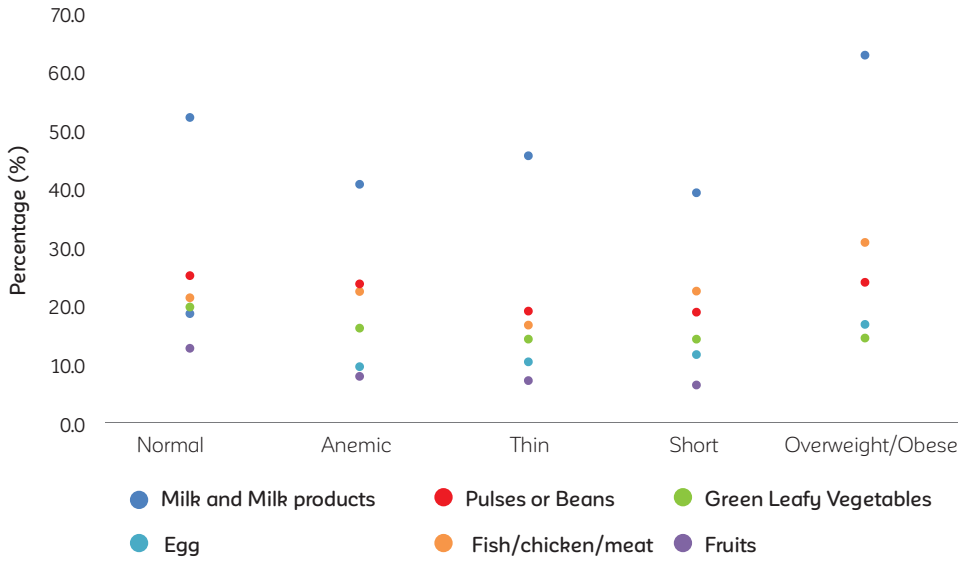


Figure 43: Consumption of Specific Food Groups by Adolescent Boys aged 15-19 years (%)

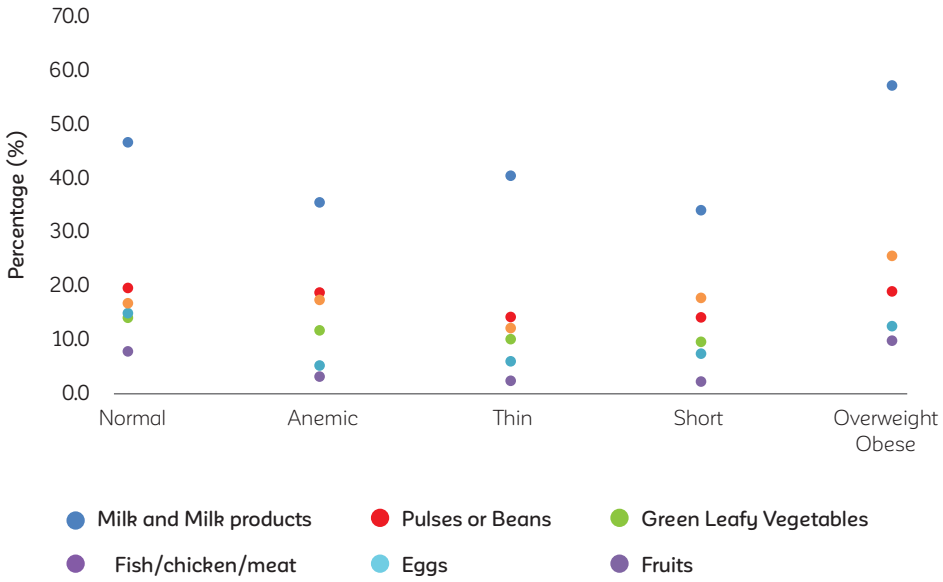
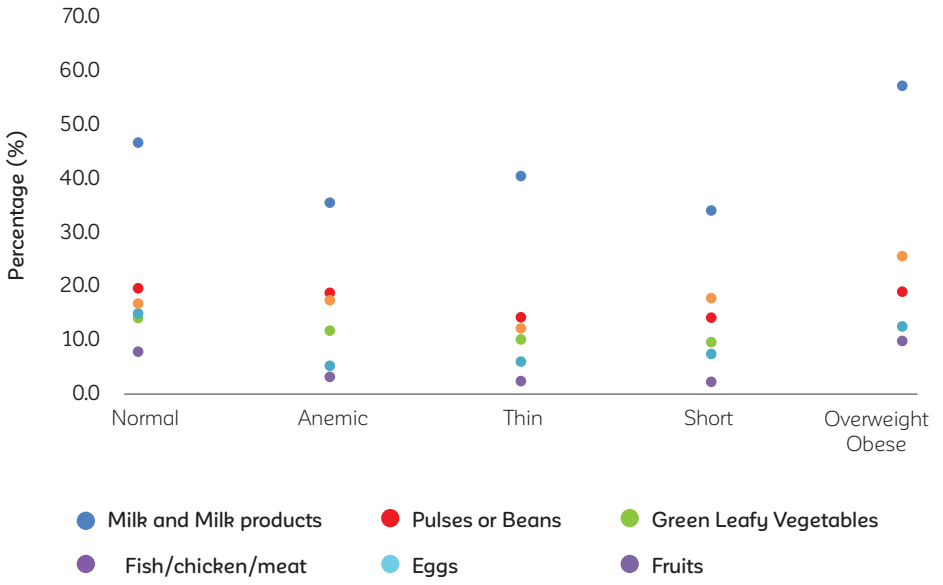


Figure 44: Consumption of Specific Food Groups by Adolescent Girls aged 15-19 years (%)



3.4.4 Comparison of Diets of Adolescents with or without Micronutrient Deficiencies

When diets of girls and boys with no micronutrient deficiencies (that we included in our analysis) is compared with those who have one or more deficiency a very consistent pattern on compliance to eating recommended foods emerges:

1. Compliance to all foods except milk is higher among those with no micronutrient deficiency than those with one or more micronutrient deficiencies. These include foods like eggs, fish/chicken, dark green leafy vegetables, pulses/beans and fruits, which are rich sources of micronutrients.

Figure 45: Consumption of Specific Food Groups by Adolescents Girls aged 10-14 years with or without Micronutrient Deficiencies (%)

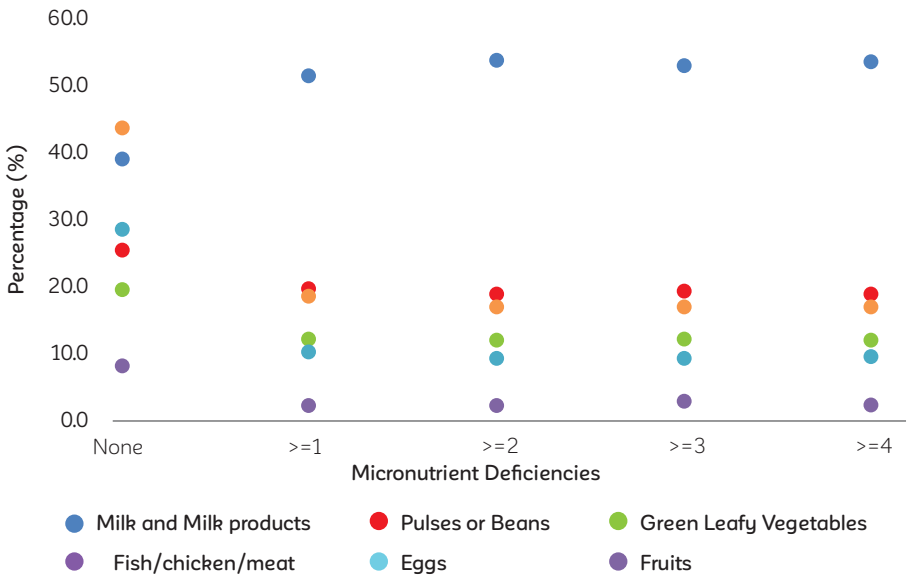
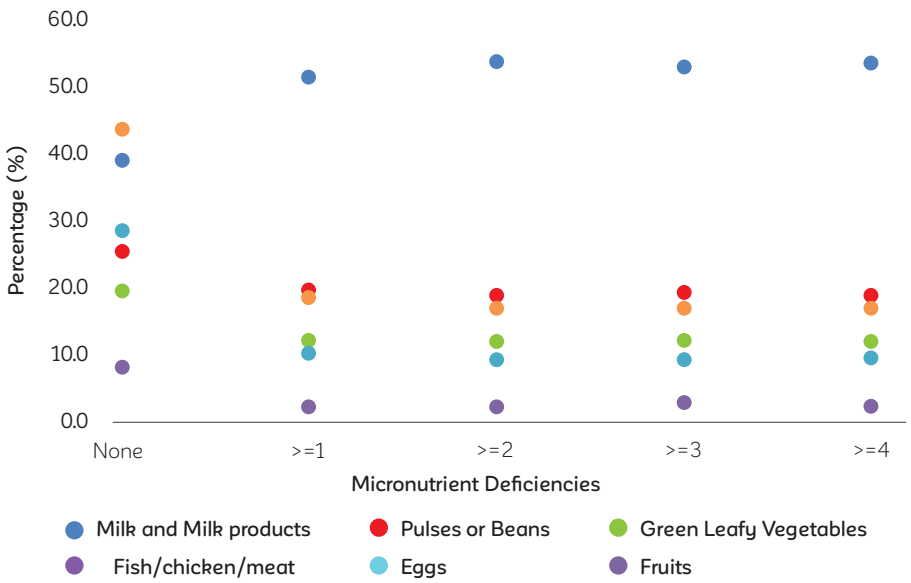


Figure 46: Consumption of Specific Food Groups by Adolescents Boys aged 10-14 years with or without Micronutrient Deficiencies (%)



2. Compliance to consumption of foods as per recommended frequency among those with one, two, three, four or more micronutrient deficiencies does not fluctuate much. Those who are deficient in one or more micronutrients have similar foods missing from the food plate as those with four or more micronutrient deficiencies.

Figure 47: Consumption of Specific Food Groups by Adolescents Girls aged 15-19 years with or without Micronutrient Deficiencies (%)

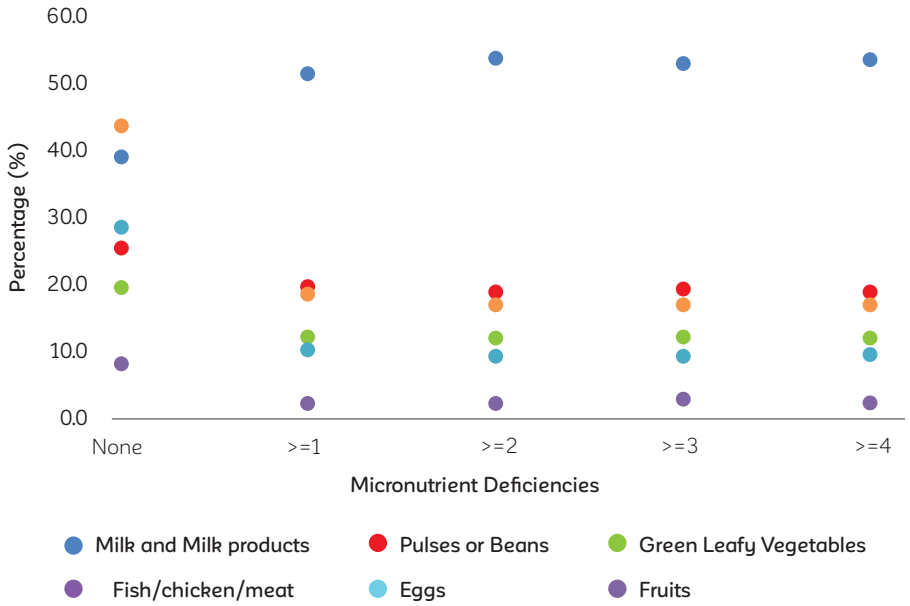
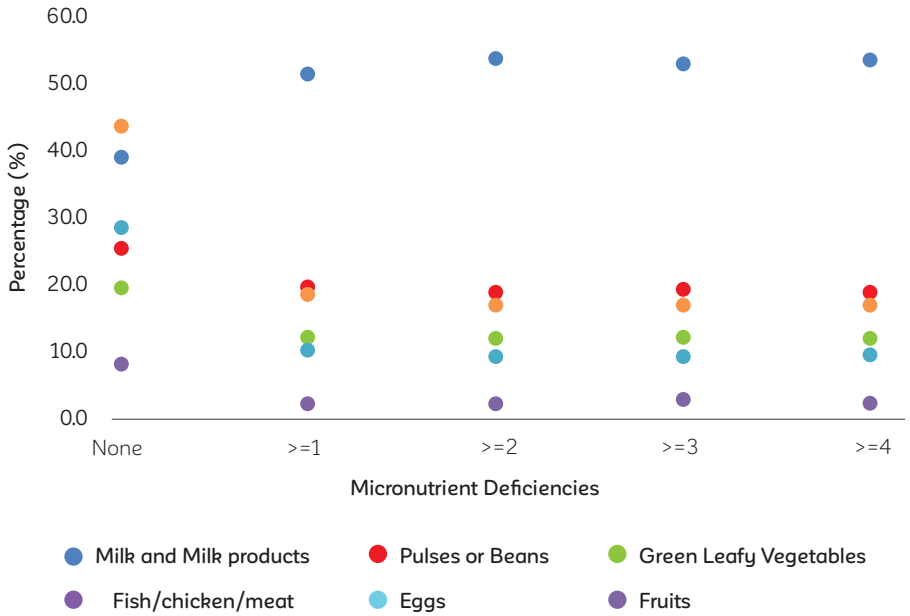


Figure 48: Consumption of Specific Food Groups by Adolescents Girls aged 15-19 years with or without Micronutrient Deficiencies (%)



3.4.5 Comparison of Diets of Adolescents at risk of Non-Communicable Diseases

Unlike healthy foods, when unhealthy food consumption was analysed, consistent patterns did not emerge across age groups as well by gender.

Among girls, in early adolescence, of the six risks analysed, daily consumption of sweets and aerated drinks is higher for four risks, followed by fried foods which is higher for three risks as compared with those who do not have any of the risks considered. Daily junk food is higher among those pre-diabetic (risk of diabetes). In late adolescence, daily consumption of aerated drinks is higher for four risks, followed by fried

Figure 49: Daily Consumption of Foods to be Avoided by Adolescent Girls aged 10-14 years (%)

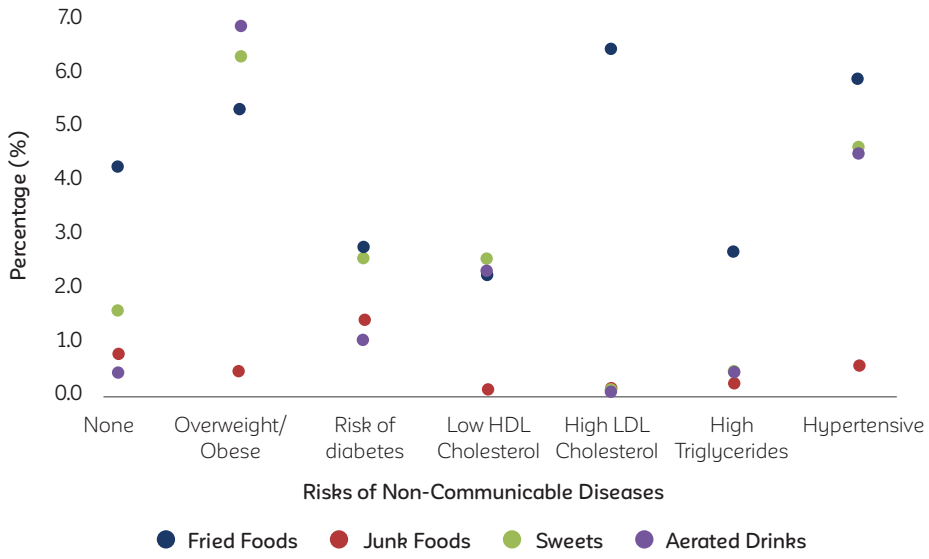
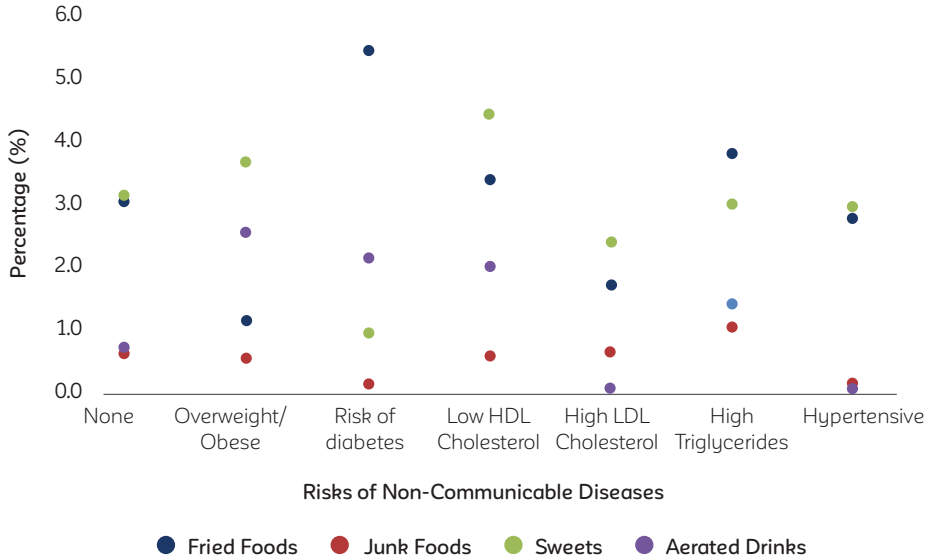


Figure 50: Daily Consumption of Foods to be Avoided by Adolescent Boys aged 10-14 years (%)



foods and sweets, which are higher for three risks as compared with those who do not have any of the risks considered. Daily junk food intake is marginally higher among those with high levels of triglycerides.

Among boys, in early adolescence, daily consumption of aerated drinks is higher for four risks, followed by fried foods which is higher for three risks and sweets for two risks as compared with those who do not have any of the risks considered. Daily junk food intake is marginally higher among those with high levels of triglycerides. Almost similar pattern is noted in late adolescence, among boys.

Figure 51: Daily Consumption of Food to be Avoided Adolescent Girls aged 15-19 years (%)

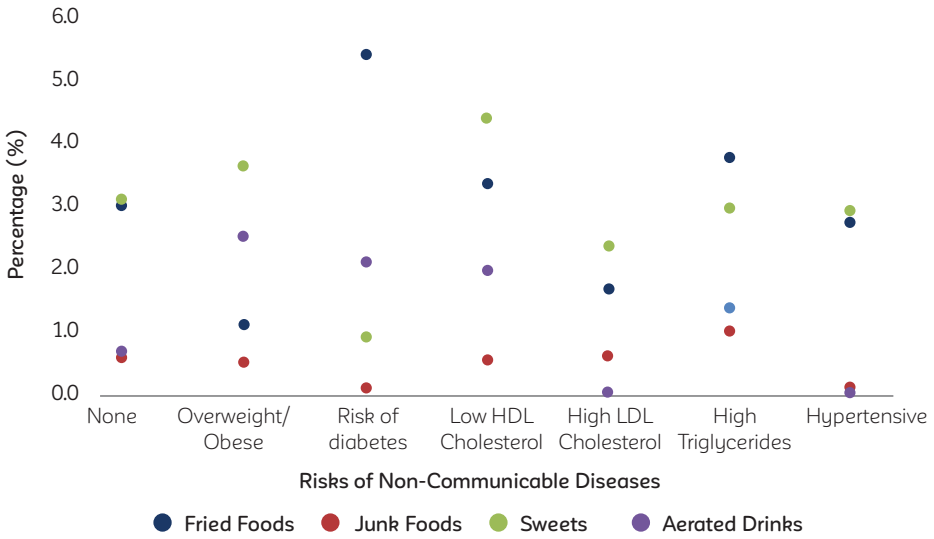
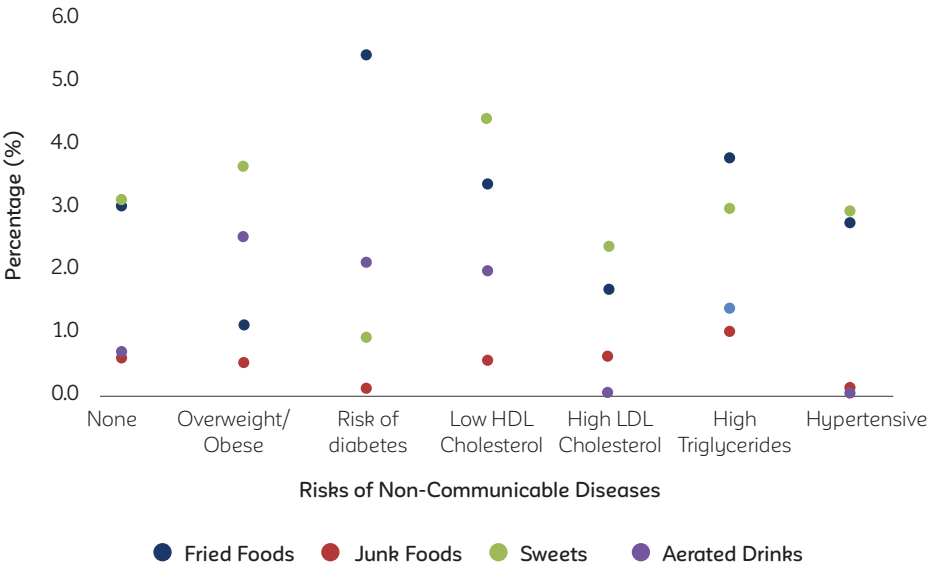


Figure 52: Daily Consumption of Food to be Avoided Adolescent Boys aged 15-19 years (%)



3.5 What are the physical activity patterns among adolescents?

Key messages

1. Both girls and boys comply with recommendations on <120 minutes (<2 hours) screen time per day but fail to meet requirements of 60 minutes (1 hour) vigorous physical activity.
2. Among girls, vigorous activity time is lower than boys and reduces from early to late adolescence.

Physical activity among adolescents has immediate and long-term benefits. Regular 60 minutes of outdoor sports or exercise helps in building strong bones and muscles, controlling weight, improving cardiovascular fitness and reducing symptoms of anxiety and depression. In the long term, it protects from chronic diseases like heart diseases, type 2 diabetes and some cancers. Adolescents who follow recommended physical activity pattern are less likely to be overweight/obese.

Early adolescence (10 to 14 years)

On an average, girls spend 3 hours sitting and travelling to school. Their average screen time is about 1 hour 20 minutes and they spend same

Recommended time per day (minutes)	Actual average time spent (minutes)			
	10 to 14 years		15 to 19 years	
	Girls	Boys	Girls	Boys
Screen time (<120)	80	70	90	90
Vigorous exercise (60)	25	40	10	50

Figure 53: Average time (in hours) spent per day in specific domains of physical activity by adolescents aged 10-14 years (%)

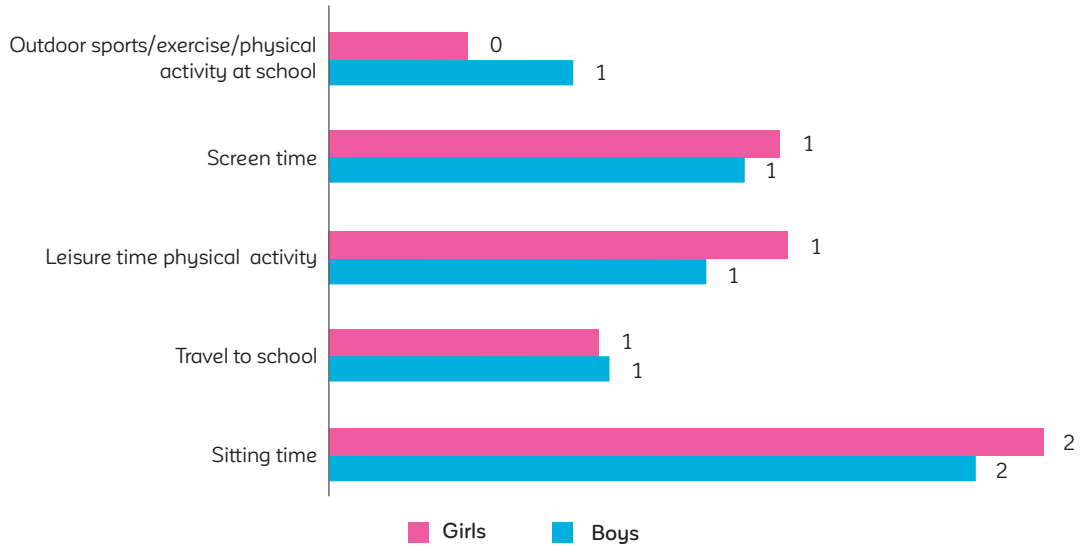
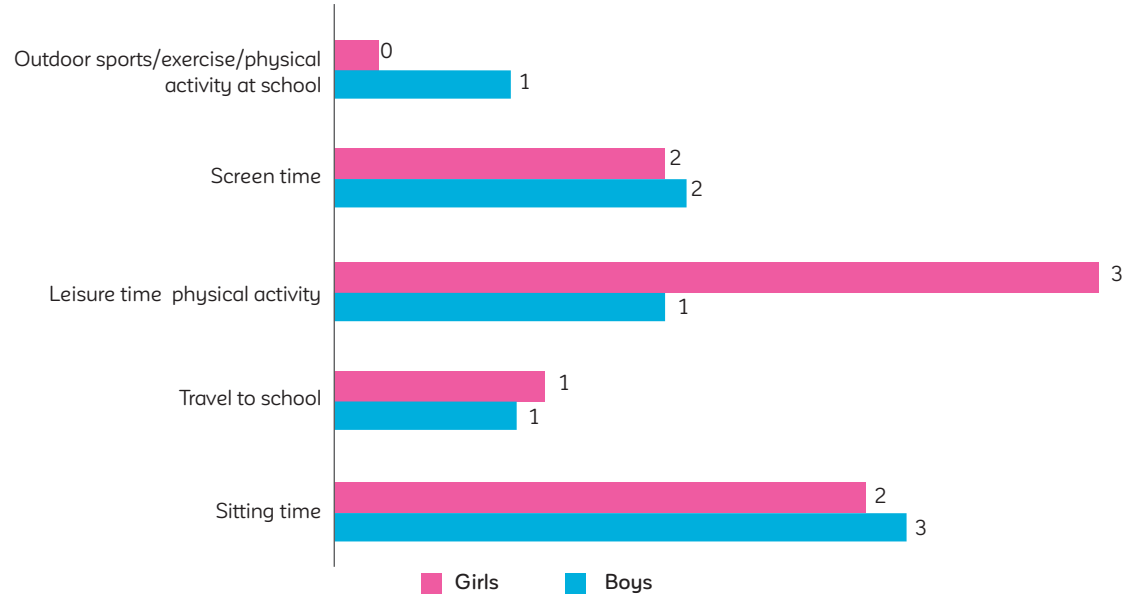


Figure 54: Average time (in hours) spent per day in specific domains of physical activity by Adolescents aged 15-19 years (%)



amount of time in leisure physical activity. They spend about 25 minutes playing outdoor sports, which may classify as vigorous activity.

Boys spend on an average 2 hours 40 minutes sitting and travelling to school. Their average screen time is about 1 hour 10 minutes and they spend almost equal time in leisure physical activities. They spend about 40 minutes playing outdoor sports, which may classify as vigorous activity.

Late adolescence (15 to 19 years)

Sitting and traveling to school time increases for girls in this age group compared to early adolescence (3 hours 20 minutes). Leisure time physical activity also increases to 3 hours 30 minutes. So does screen time (1 hour 30 minutes). However, time spent in vigorous activity reduces to about 10 minutes.

Among boys, sitting time and travel to school time increase compared with early adolescents (3 hours 20 minutes). Their average screen time is about 1 hour 30 minutes and they spend almost same time in leisure physical activity. Vigorous activity time on an average is about 50 minutes.

3.5.1 Physical activity patterns at each completed age from 10 to 19 years

Among girls, mean sitting time increases and outdoor sports or exercise time (vigorous activity) decreases consistently with age. There are no distinct peaks for these two activities, with girls spending most time in vigorous activity at the age of 10 years and most time sitting at the age of 19 years. Based on mean time, at no age, girls meet the 60 minutes recommended vigorous activity time. Screen time too increases along with sitting time, with a steep increase from ages 16 to 19 years. Leisure time peaks at 15 years.

Among boys, mean sitting time increases from 10 to 17 years but dives steeply to reach lowest mean time spent sitting at 19 years. Based on mean time, boys meet the recommended 60 minutes vigorous activity at 17 years and almost maintain that level the following year.

Figure 55: Average time (in hours) spent in different domains of physical activity by Adolescent Girls (%)

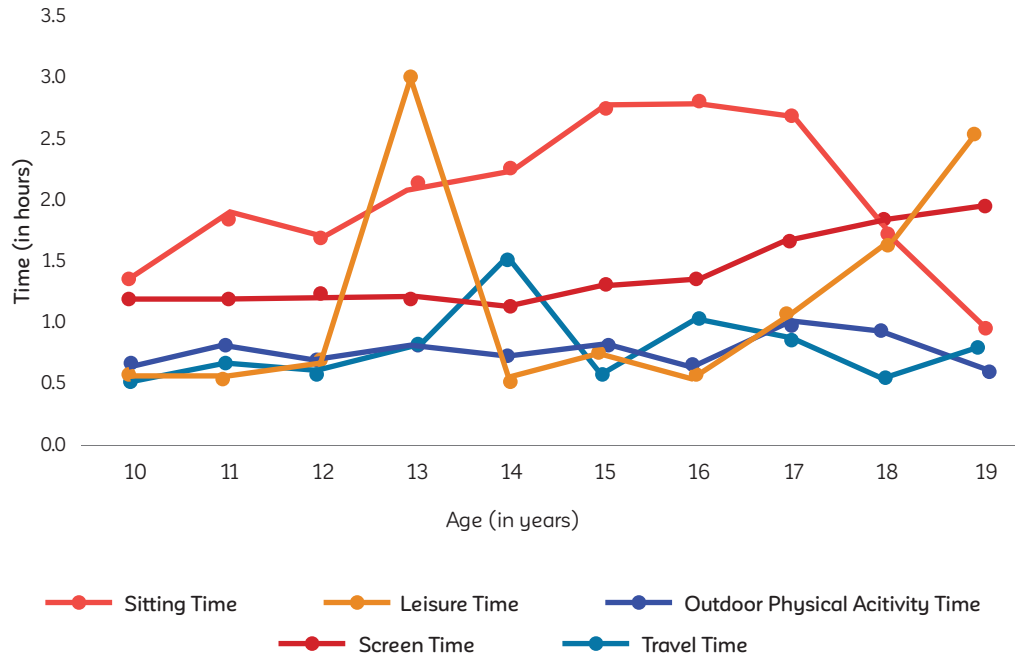
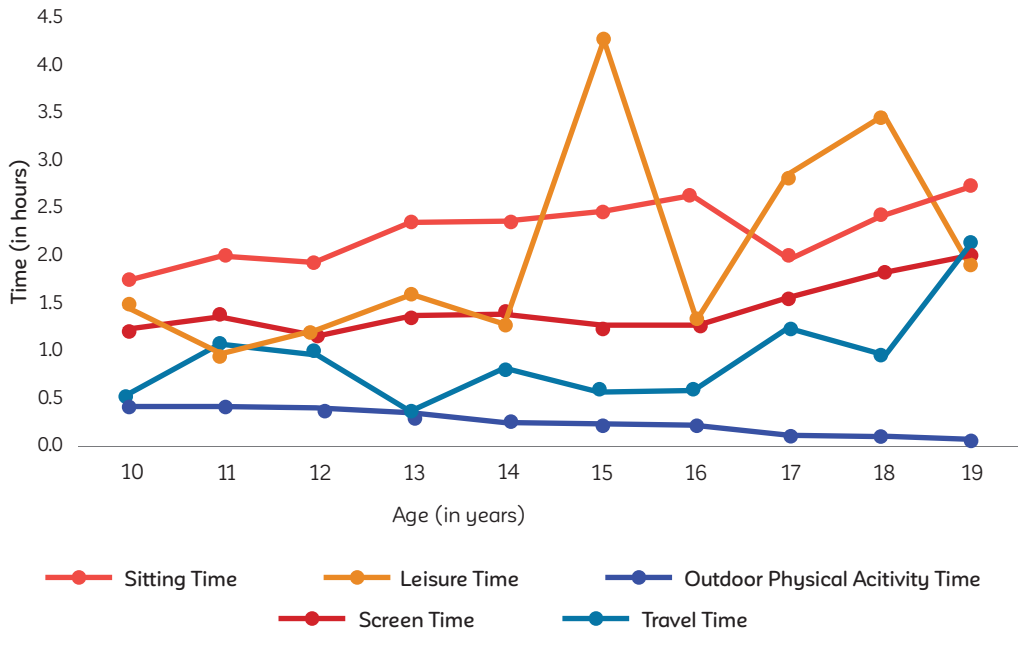


Figure 56: Average time (in hours) spent in different domains of physical activity by Adolescent Boys (%)



Single age and state-wise differences for screen time and vigorous activity (actual hours spent)

State-wide comparisons:

Screen time

Among girls, data on screen time is available for 23 states and mean screen time ranges from 1 hour (Nagaland) to a little less than 2 hours in Meghalaya in early adolescence. In late adolescence it ranges from 0 (Madhya Pradesh) to almost 4 hours in Delhi. While none of the states exceed screen time limit on 2 hours in early adolescence, in late adolescence mean screen time is almost double the recommendation in Delhi. It is also higher than the two hour cut-off in Goa (2.3 hours).

Among the 26 states for which data is available for boys in early adolescence, mean screen time ranges from 20 minutes (Bihar) to over 2.5 hours (Mizoram) in early adolescence. In late adolescence the range is from 0 (Andhra Pradesh) to over 2.5 hours (Delhi). Three states- Assam, Mizoram, Uttar Pradesh, exceed the recommended time limit of two hours for screen time in early adolescence, but in late adolescence it is higher than recommendation for Delhi and Jammu Kashmir.

Vigorous activity time

Among girls, mean vigorous activity time ranges from less than 20 minutes (Assam) to almost 2.5 hours (Sikkim) in early adolescence and from less than 10 minutes (Bihar) to more than 4.5 hours (Jammu and Kashmir) in late adolescence. Based on means, in early adolescence, girls in only 11 of 30 states, meet the minimum required vigorous activity time of 60 minutes. These states are Chhattisgarh, Karnataka, Kerala, Jammu and Kashmir, Manipur, Punjab, Sikkim, Tamil Nadu, Tripura, Uttarakhand and West Bengal. In late adolescence, girls in eight states meet the minimum required vigorous activity time of 60 minutes. In addition to Arunachal Pradesh, these include all of the above states, except- Karnataka, Punjab, Tripura and Uttarakhand.

Among boys, mean vigorous activity time ranges from 30 minutes (Bihar) to almost 3.5 hours (Tamil Nadu) in early adolescence and from less than 10 minutes (Punjab) to 5 hours (Karnataka) in late adolescence. Based on mean time, boys in 19 states meet the minimum required vigorous activity time in early adolescence and in 16 states in late adolescence.

Figure 57: Time spent in hours (screen time) 10–14 years aged 10-14 years (%)

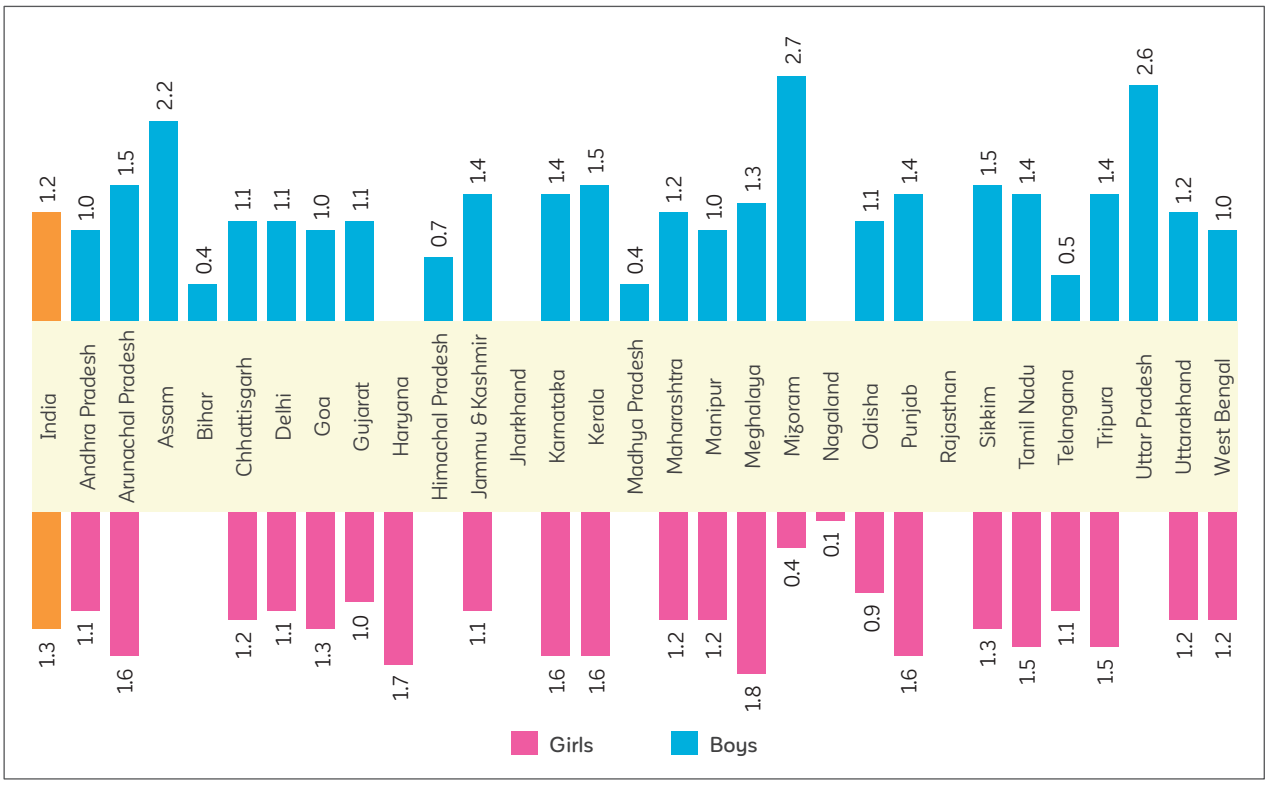


Figure 58: Time spent in hours (outdoor sports/exercise/physical activity at school) 10–14 years (%)

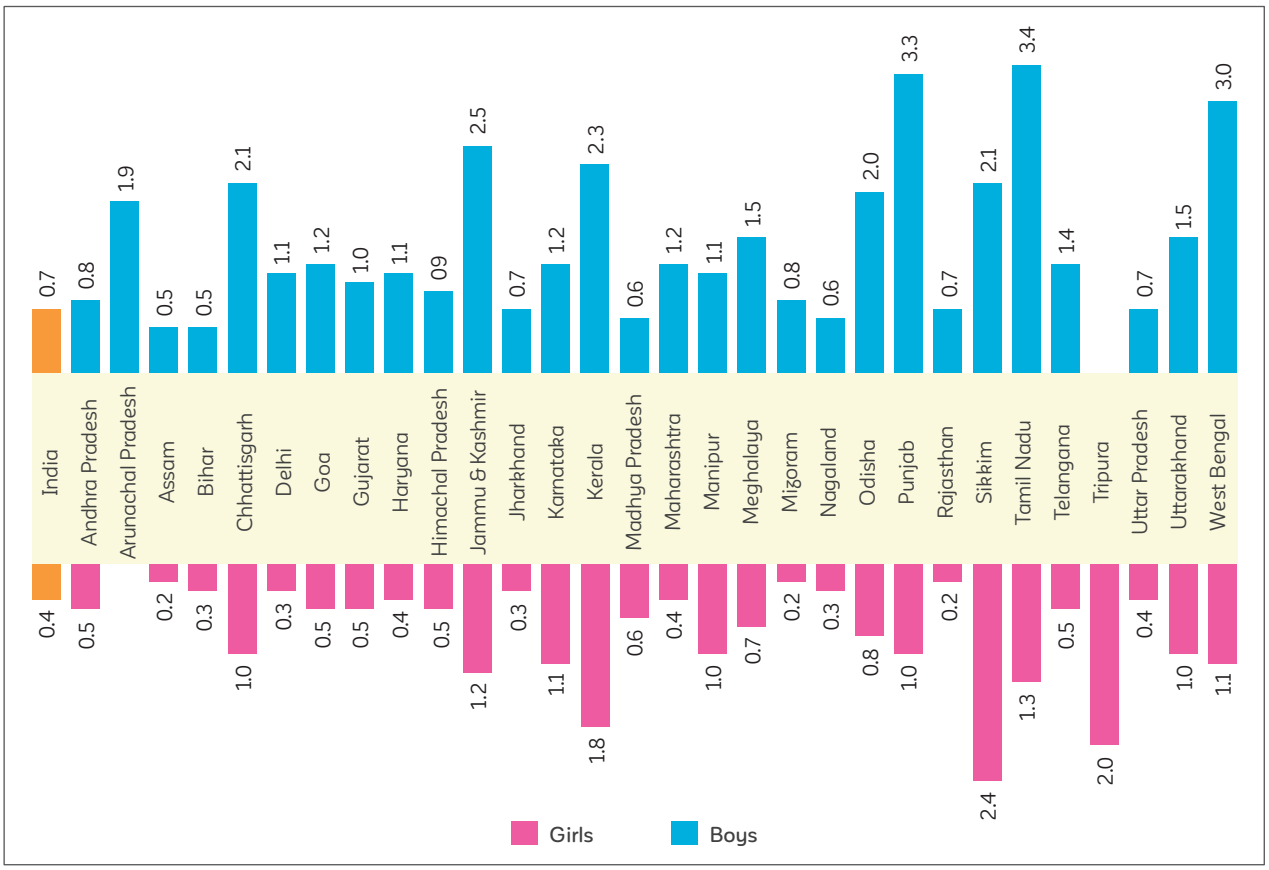


Figure 59: Time spent in hours (screen time) 15–19 years (%)

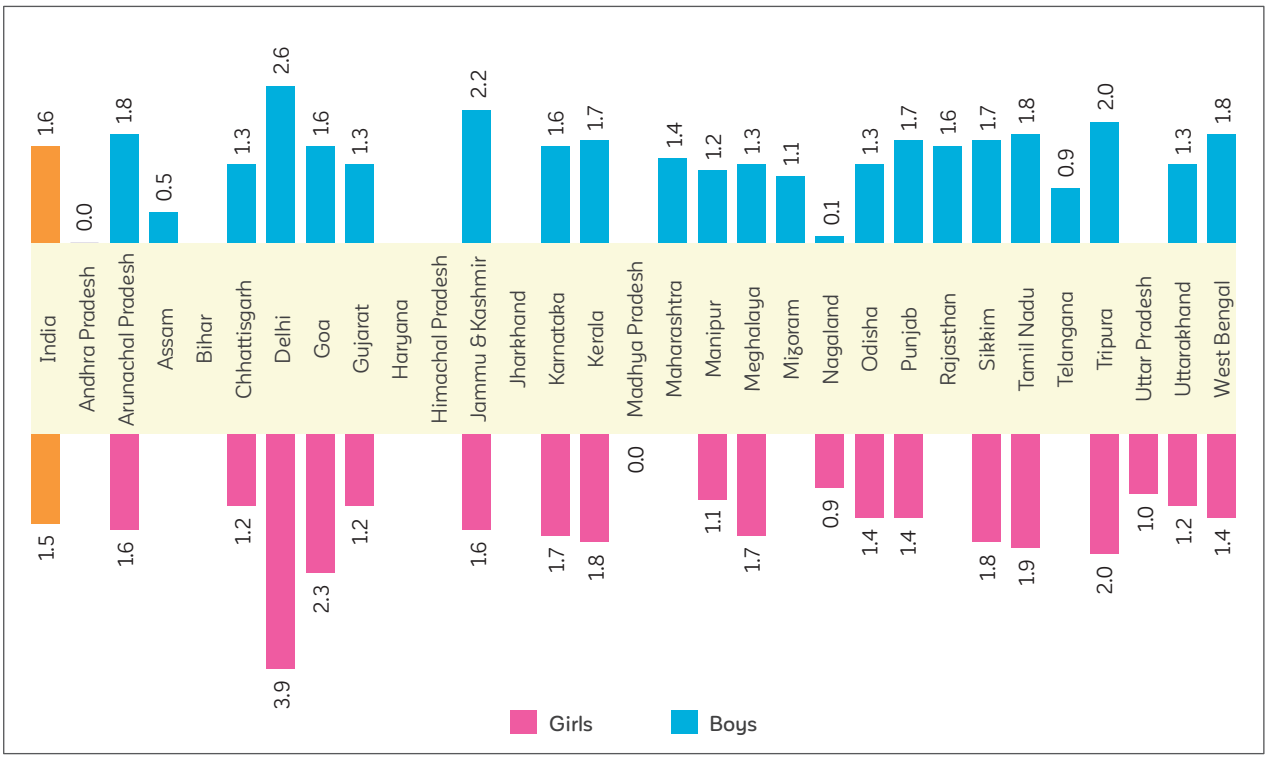
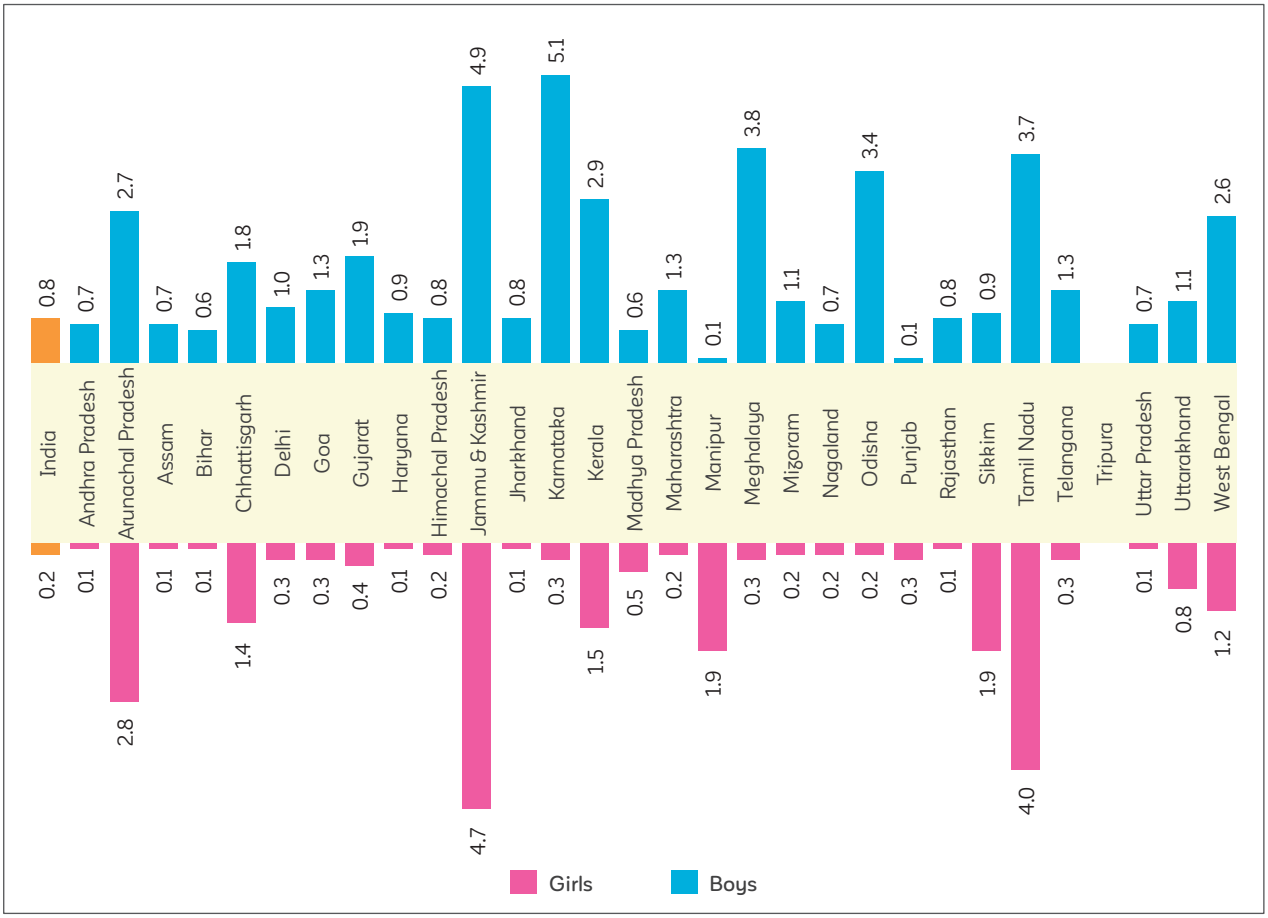


Figure 60: Time spent in hours (outdoor sports/exercise/physical activity at school) 15–19 years (%)



3.6 What are the decision making patterns in adolescent girls?

Key messages

1. Girls are most involved in decisions related to the duration of their schooling and least involved on marriage related decisions. The fact that they are not involved in decision on age of marriage, nullifies any positives around their role in decisions about length of schooling.
2. Girls especially in 10 to 14 years have little say on market purchases; programs to promote healthy diets and nutrition status should involve parents as well.
3. Odisha emerges as a state where girls have little to no say in their life choices and Mizoram as the state where almost all girls make their own life choices.

A girl's decision making ability in addition to her education and health can impact social and economic indicators of a country. One of the key decisions is around duration and completion of education. Girls who complete secondary education are less likely to marry in adolescence than those who don't.

How long she studies?

An equal proportion of girls aged 10 to 14 years and 15 to 19 years (70%) reported being involved in decision on how long she will study?

Going to market

About 2 in 5 girls aged 10 to 14 years and half of those aged 15 to 19 years reported going to market to make their own purchases

Who to marry?

Girls appear to have little say in whom they marry? 1 in 4 reported having a say on the matter in both age groups (25% -10 to 14 years, 29% - 15 to 19 years).

When to marry?

They also are less involved in deciding on the age of marriage with about 1 in 3 reporting to have a say in the matter (30% -10 to 14 years, 36% - 15 to 19 years).

3.7.1 State-wide variations in decision making on life choices

How long she studies?

Decision making on length of schooling ranges from 39% (Odisha) to 89% (Punjab) among 10 to 14 years aged girls. In Andhra Pradesh, Manipur and Odisha less than half the girls reported not having a say on duration of their schooling. Among 15 to 19 years aged girls, it ranges from 45% (Odisha) to 89% (Goa). Odisha is the only state where less than half the girls are involved in this decision.

Goes to market

Girls involvement in market purchases ranges from 15% (Odisha) to 80% (Mizoram) in the 10 to 14 years age-group. In 19 states, less than half the girls can go to market to make their own purchases

Among 15 to 19 years aged girls, 29% (Odisha) to 90% (Mizoram) reported going to market to make their own purchases. In six states- Madhya Pradesh, Manipur, Odisha, Rajasthan, Uttar Pradesh and West Bengal less than half were involved in market purchases.

Whom to marry?

In early adolescence fewer girls reported being involved in decision on whom to marry ranging from 7% (Punjab) to 80% (Mizoram). Less than 1 in 10 reported being involved in this decision in

eight states- Delhi, Madhya Pradesh, Manipur, Odisha, Punjab, Rajasthan, Sikkim and Tamil Nadu.

In late adolescence the proportion improves ranging from 17% (Madhya Pradesh) to 89% (Mizoram). However, less than 1 in 5 reported being involved in this decision in Punjab, Madhya Pradesh and Uttar Pradesh.

When to marry?

Among 10 to 14 years aged girls 15% (Odisha) to 82% (Mizoram) reported being involved in decision on age of marriage. In late adolescence this proportion ranged from 23% (Madhya Pradesh) to 89% (Mizoram). In 21 states, less than half the girls are involved in decisions on age of marriage.

Figure 61: How long you attend school (10-14 years) (%)

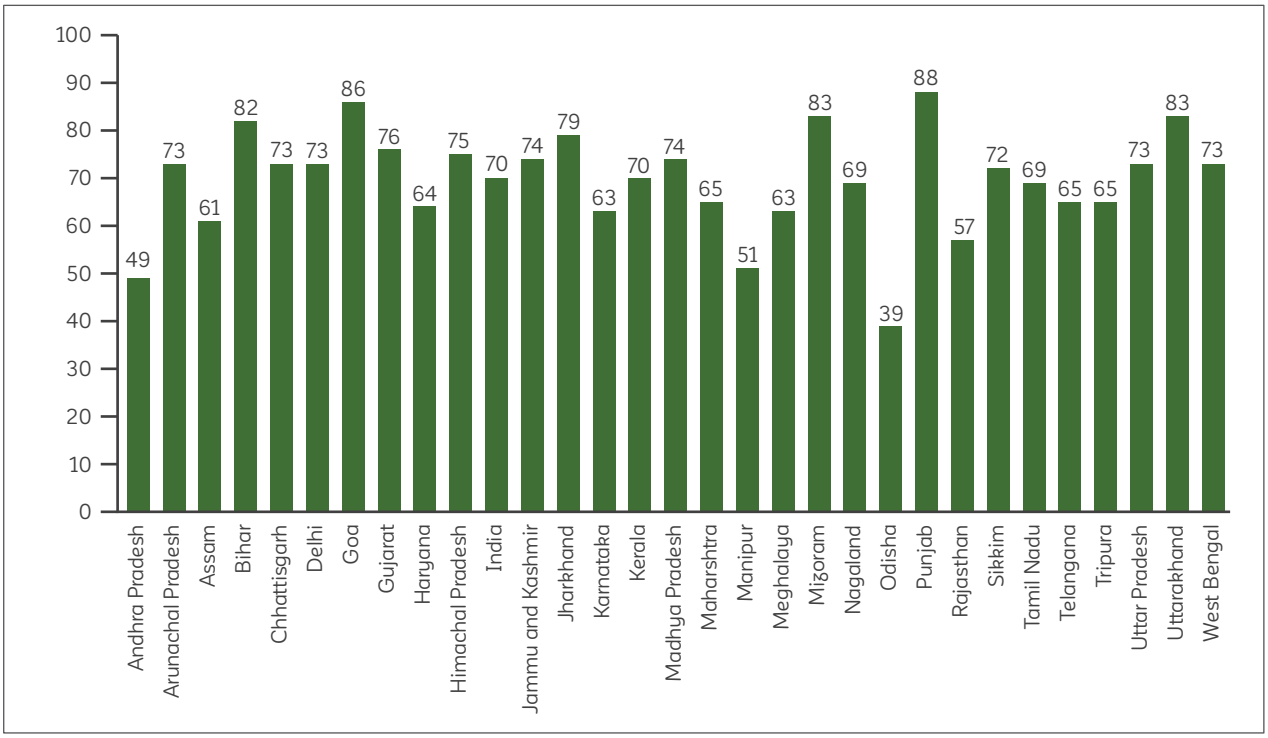


Figure 62: Go to the market (10-14 years) (%)

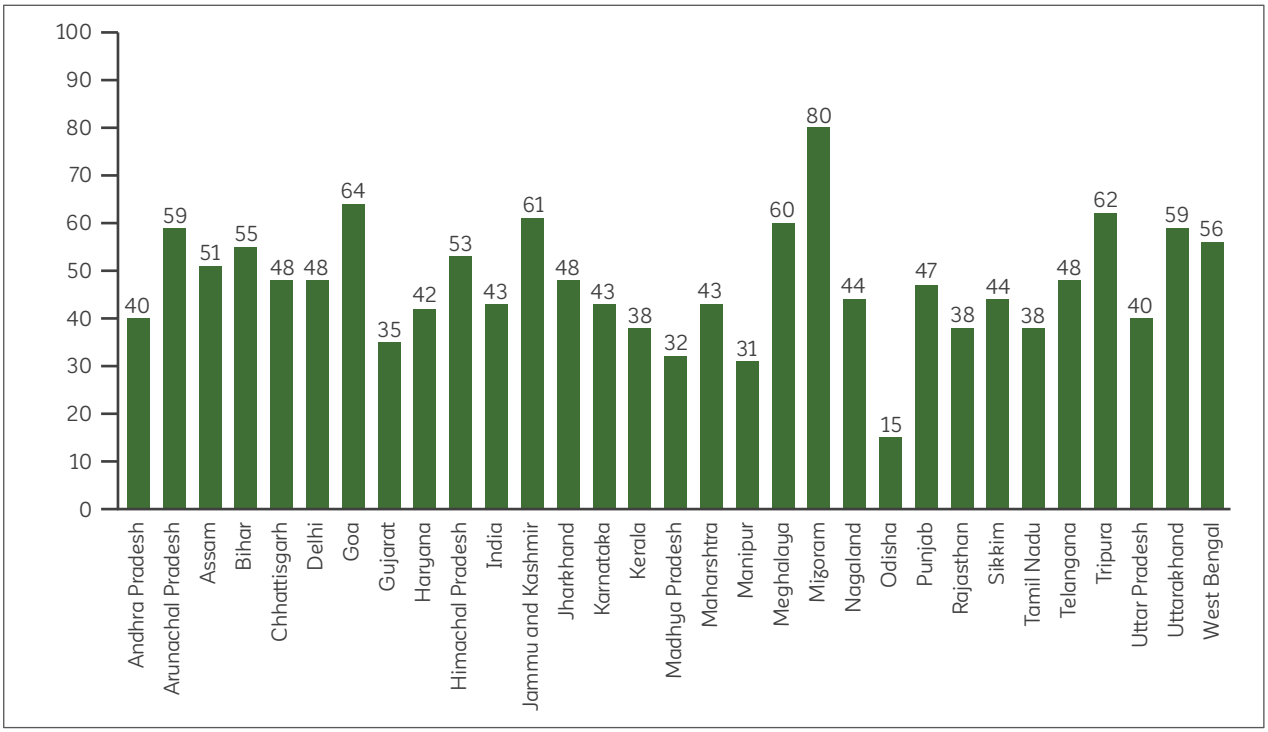


Figure 63: Who you marry (10-14 years) (%)

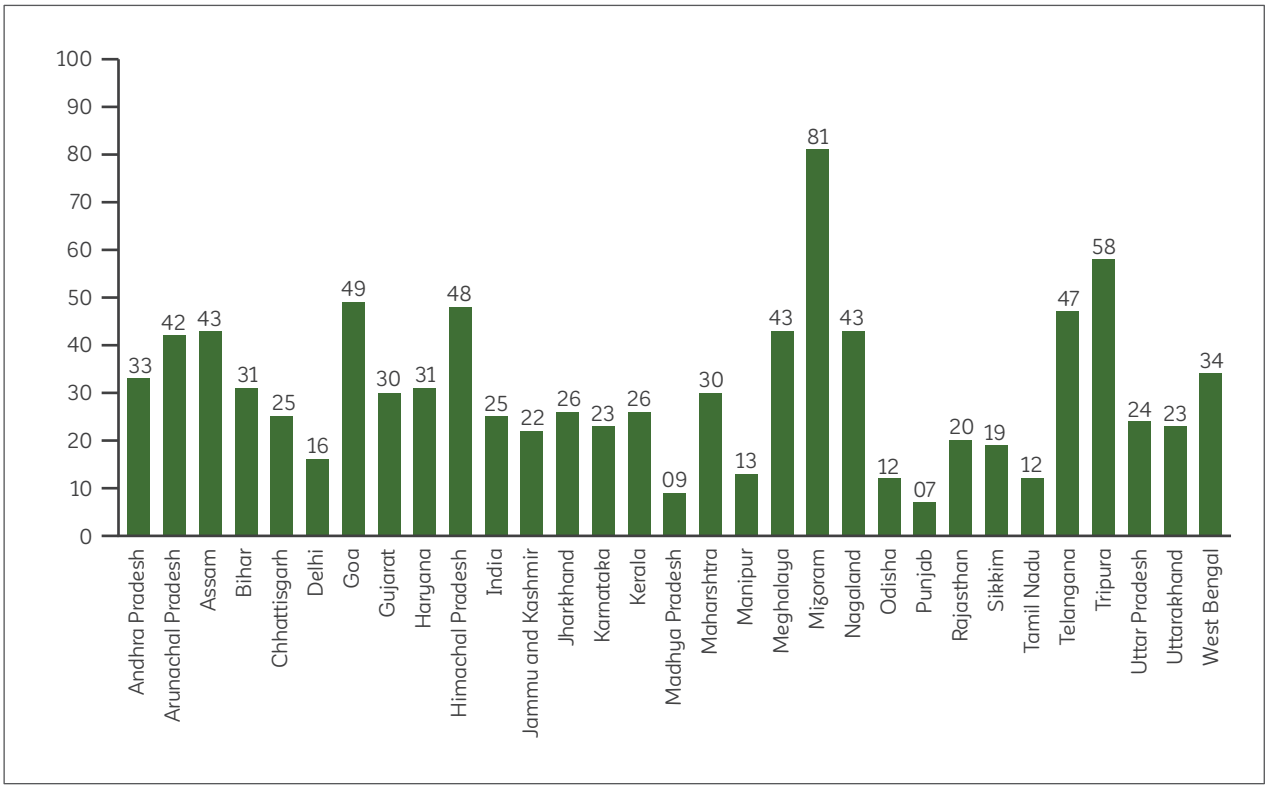


Figure 64: When you marry (10-14 years) (%)

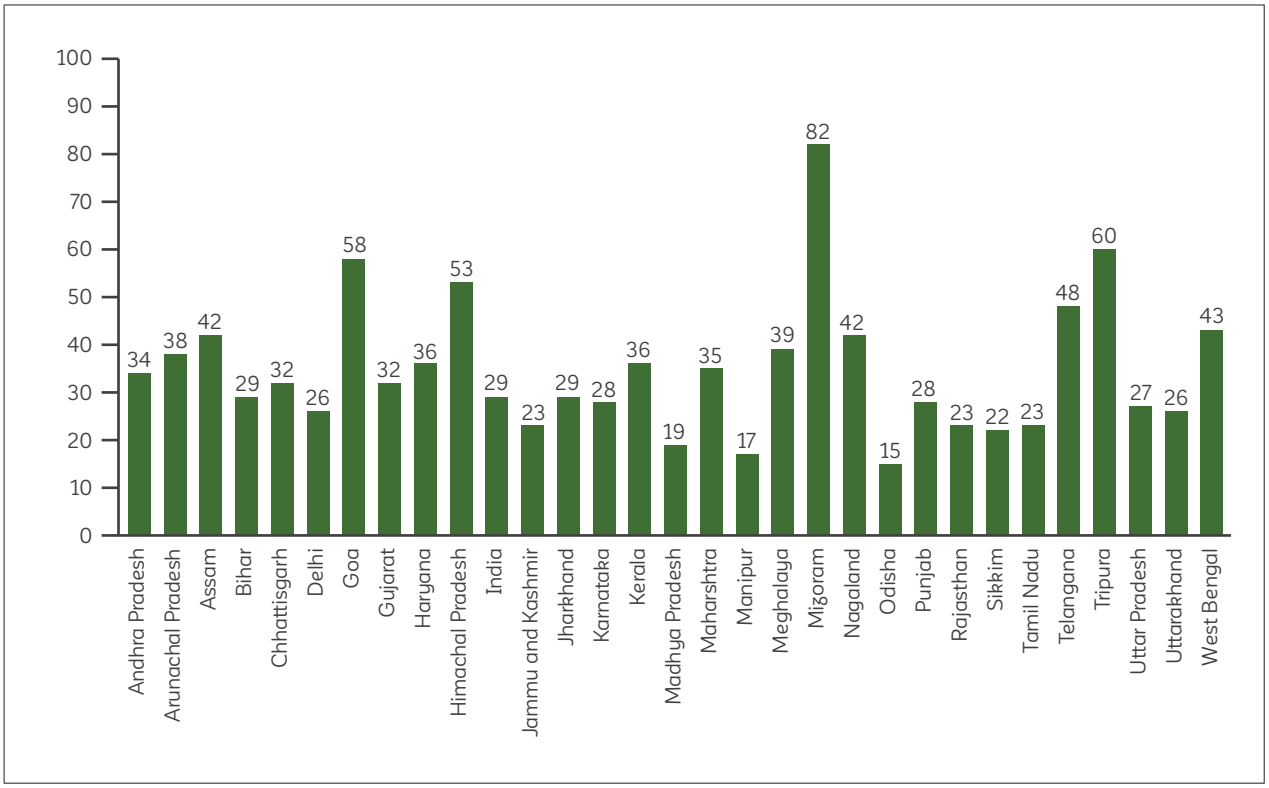


Figure 65: How long you attend school (15-19 years) (%)

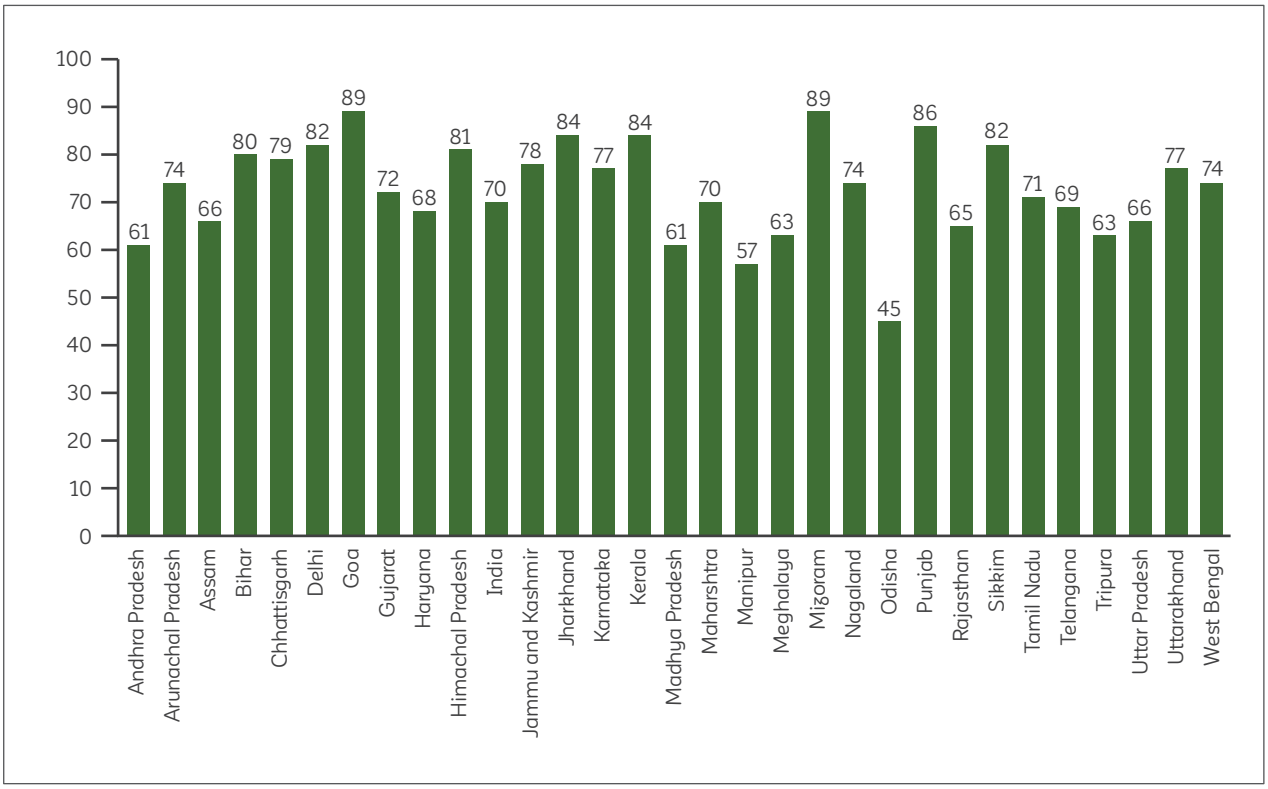


Figure 66: Go to the market (15-19 years) (%)

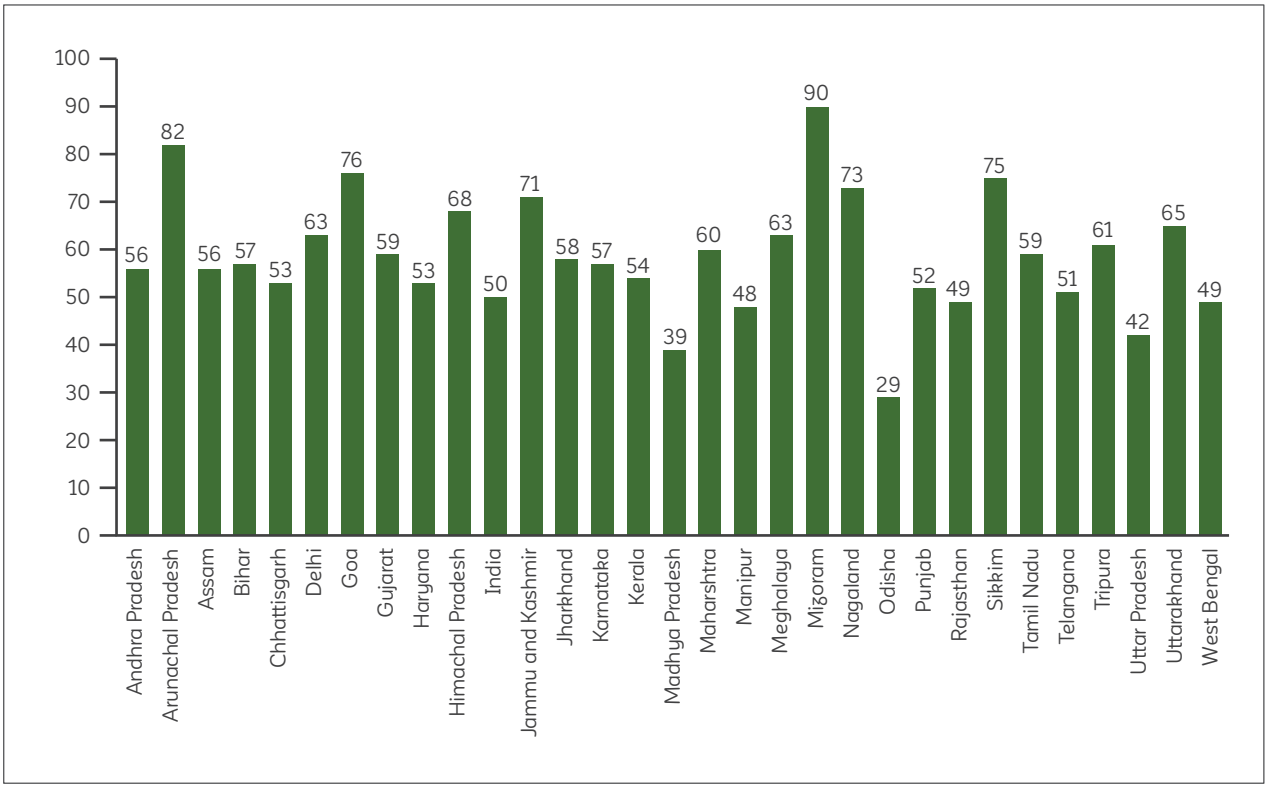


Figure 67: Who you marry (15-19 years) (%)

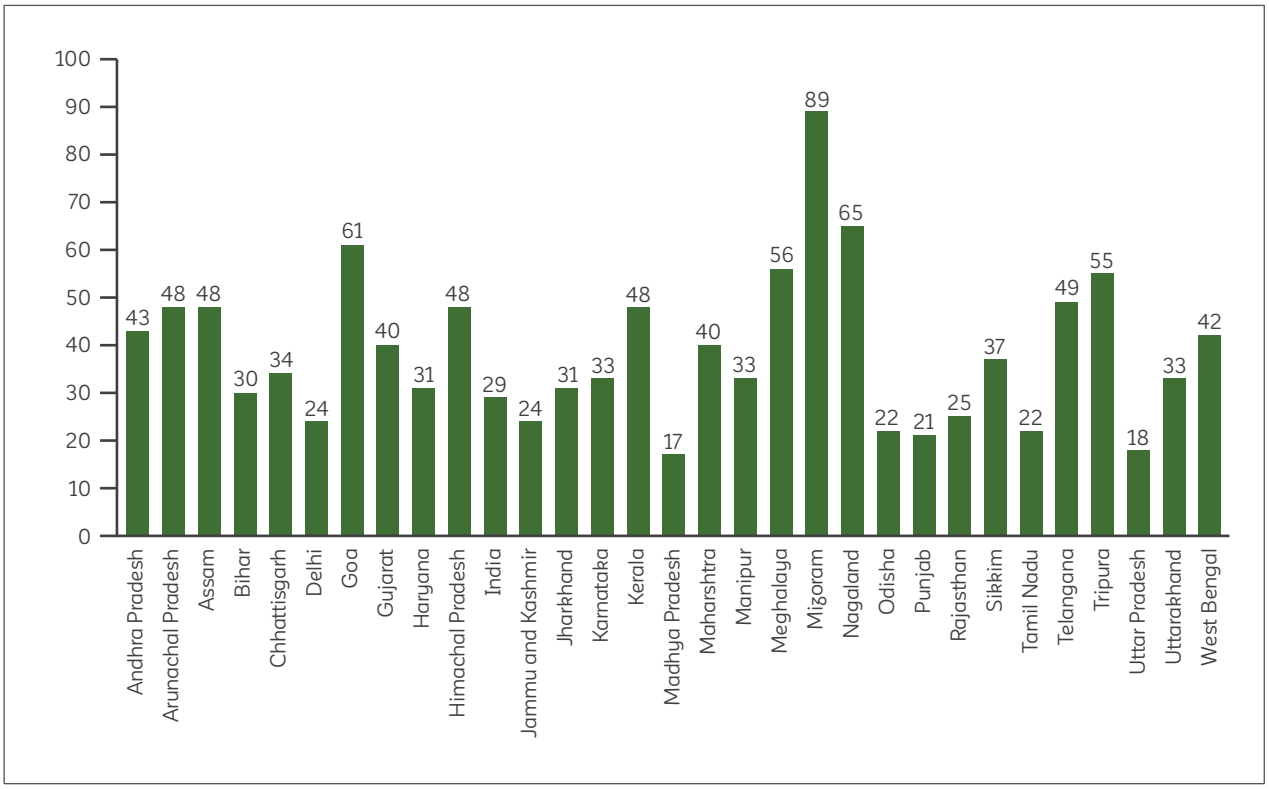
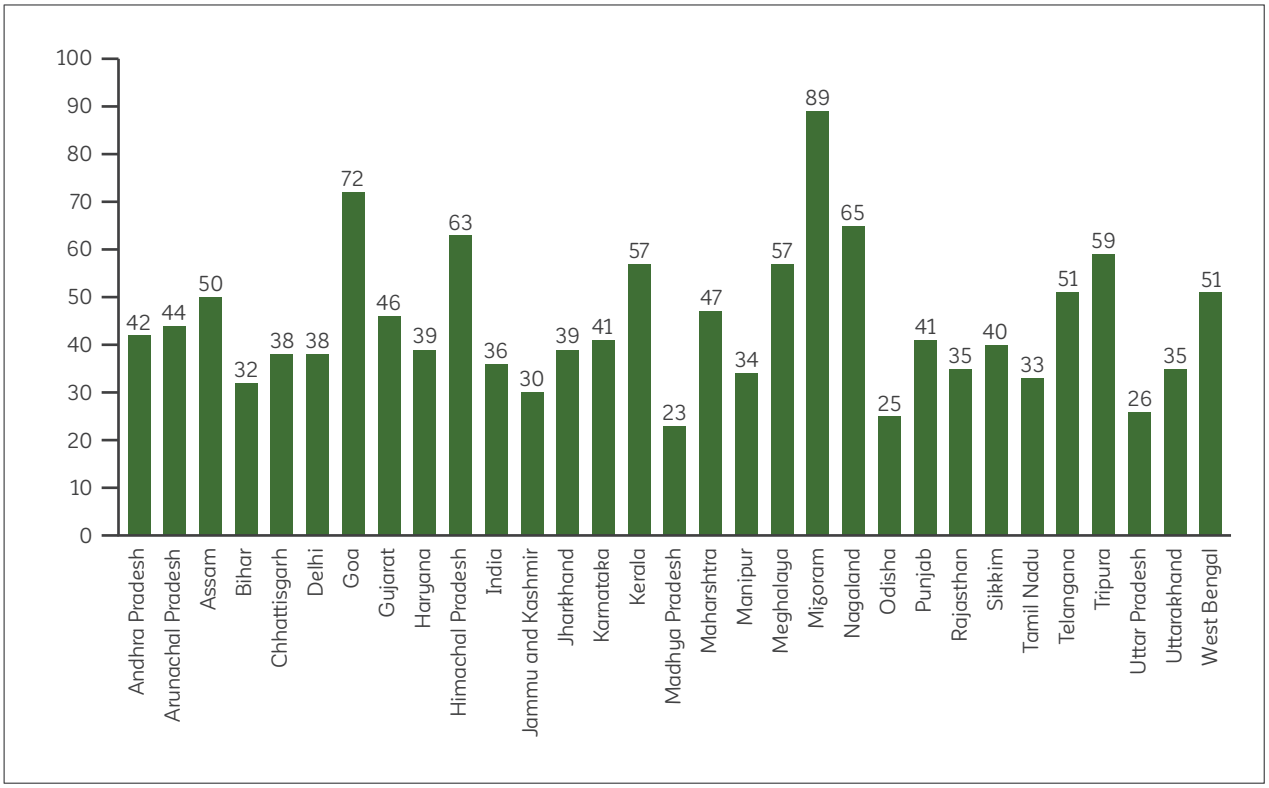


Figure 68: When you marry (15-19 years) (%)



3.7 What is the co-coverage of school-based nutrition services?

Key messages

1. Amongst school-going adolescents, coverage of IFA supplementation is the lowest: 13% girls and 11% boys aged 10-14 years receive iron and folic acid supplements. The coverage drops to 11% and 6% respectively for girls and boys in 15-19 years age group.
2. More than two-third adolescents in 10-14 years (67% girls and 61% boys) receive mid-day meals in schools.
3. Amongst adolescents aged 10-14 years, 41% girls and 34% boys reported being dewormed in the last six months. The coverage reduced in case of late adolescents.
4. Forty two percent girls and 31% boys aged 10-14 years attended bi-annual health check-up camps in the last one year. The attendance was lower in case of adolescents aged 15-19 years.
5. Nearly 25% percent girls and boys do not receive any of the above services.

Adolescents spend up to 7 hours of their waking time in schools making it an ideal platform for health and nutrition services provision. Under the Rashtriya Bal Swasthya Karyakram school going adolescents are entitled to at least annual screening of deficiencies, diseases and development delays (including disabilities). These services are aimed at early detection and timely intervention for any treatable/ manageable nutritional deficiencies and health condition/ disabilities. At the same time, considering the high burden of anemia, Government of India has a universal prophylactic weekly IFA supplementation and biannual deworming program for all adolescent in schools and girls not in school. Finally, all school going adolescents upto class eight (14 years) and in some states even beyond are entitled to hot cooked meal for 200 school days. The meal composition is aimed at meeting a third of the daily energy and protein requirements with inclusion of pulses, vegetables and oils in addition to cereals.

IFA supplementation

Early adolescence (10 to 14 years)

About **1 in 10** girls **(13%)** received IFA supplement in the week previous to the survey

Similar to girls, only **11%** boys received IFA supplement in the week previous to the survey

Late adolescence (15 to 19 years)

About **1 in 10** girls **(11%)** received IFA supplement in the week previous to the survey

Only **6%** boys received IFA supplement in the week previous to the survey

Deworming

Early adolescence (10 to 14 years)

2 in 5 girls **(41%)** reported being dewormed in the last six months

1 in 3 boys **(34%)** reported being dewormed in the last six months

Late adolescence (15 to 19 years)

1 in 5 girls and boys **(23% and 20%)** reported being dewormed in the last six months

Biannual health check up

Early adolescence (10 to 14 years)

2 in 5 girls **(41%)** reported health check up in the last six months

1 in 3 boys **(34%)** reported health check up in the last six months

Late adolescence (15 to 19 years)

More than **1 in 4 girls (29%)** and almost the same proportion of boys **(24%)** reported health check up in last six months

Mid-day meals

Early adolescence (10 to 14 years)

More than two-thirds girls **(67%)** and boys **(61%)** reported receiving mid-day meal.

Late adolescence (15 to 19 years)

Only 1 in 4 girls **(27%)** and 2 in 4 boys **(47%)** reported receiving mid-day meal.

Figure 69: Adolescents aged 10-14 years with access to services in school (%)

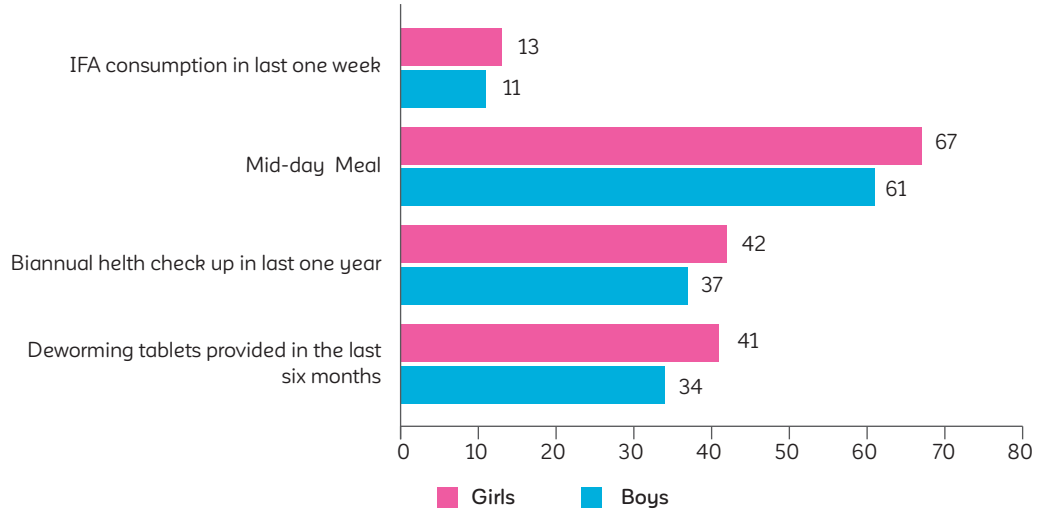
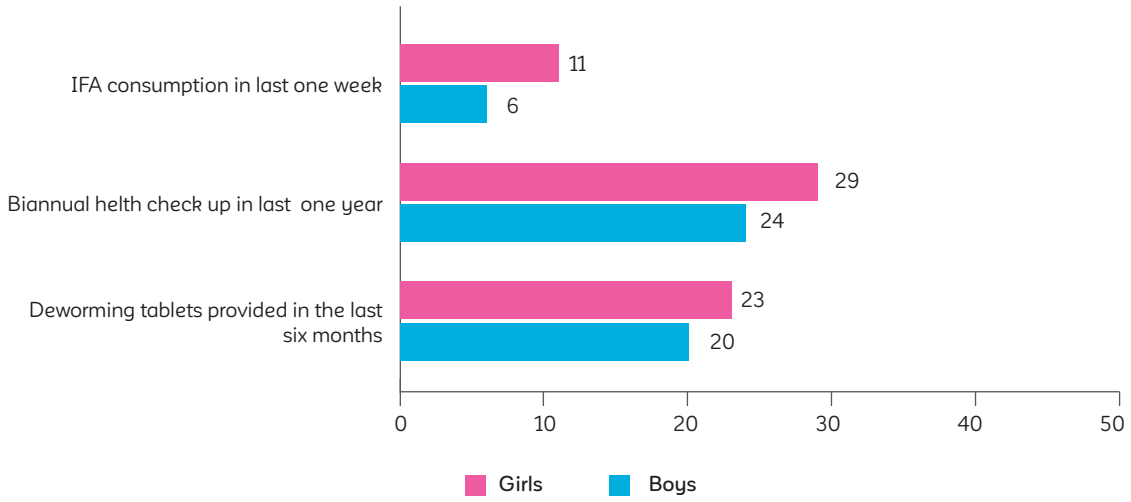


Figure 70: Adolescents aged 15-19 years with access to services in school (%)



3.7.1 School going students receiving none, 1, 2, or 3 services

Early adolescence (10 to 14 years)

1 in 5 girls and 1 in 4 boys receive none of the four services

Among girls, 25% received one service, 27% two services and 22% three services

Among boys a higher proportion than girls receive one service (30%), but lower proportion receive two and three services (24% and 17%, respectively)

Late adolescence (15 to 19 years)

1 in 4 girls received no service; almost half the boys (45%) received no service

Among girls, 22% received one service, 36% two services and 13% three services

Among boys an equal proportion to girls receive one service (22%), but lower proportion receive two and three services (26% and 5%, respectively)

Figure 71: Adolescents aged 10-14 years with access to services in school (%)

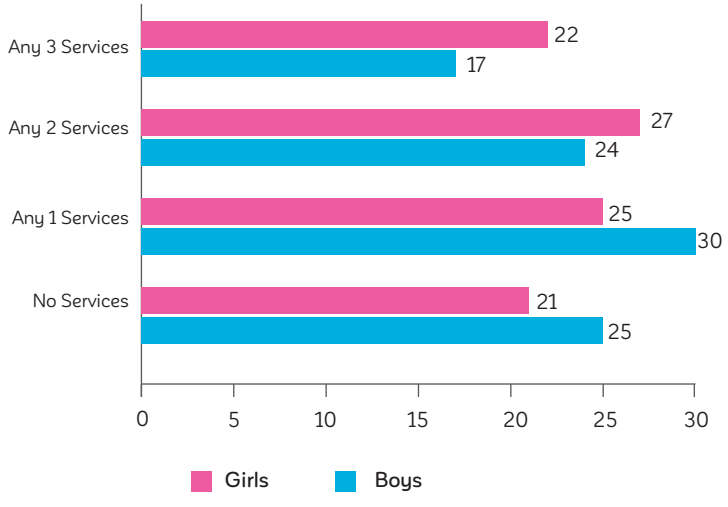
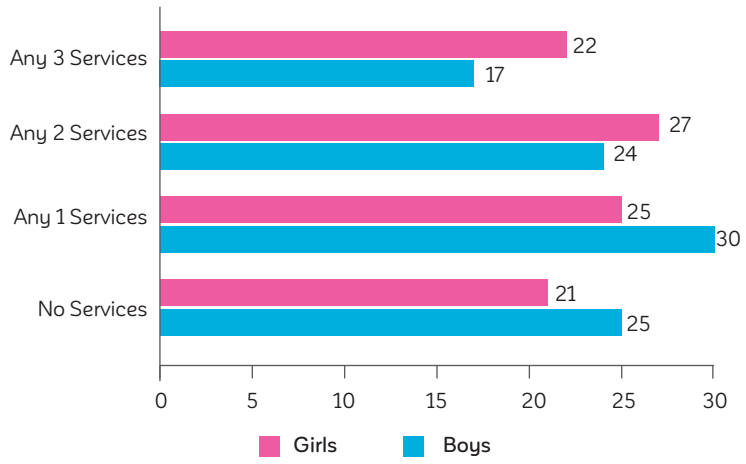


Figure 72: Adolescents aged 15-19 years with access to services in school (%)



3.7.2 Variations in receipt of services across states

IFA supplementation

Early adolescence (10 to 14 years)

Among girls, receipt of weekly IFA supplementation ranges from 1% (Nagaland) to 49% (Sikkim). In 14 states - Arunachal Pradesh, Assam, Bihar, Haryana, Jammu and Kashmir, Jharkhand, Manipur, Meghalaya, Mizoram, Nagaland, Rajasthan, Telangana, Tripura and Uttar Pradesh, 1 in 10 or fewer girls receive weekly IFA supplement.

Among boys, receipt of weekly IFA supplementation ranges from almost none (Nagaland) to 36% (Goa). In 12 states- Arunachal Pradesh, Assam, Bihar, Jammu and Kashmir, Jharkhand, Manipur, Meghalaya, Mizoram, Nagaland, Telangana, Tripura and Uttar Pradesh 1 in 10 or fewer boys receive weekly IFA supplement.

Late adolescence (15 to 19 years)

Among girls, receipt of weekly IFA supplementation ranges from 1% (Nagaland) to 32% (Sikkim). In half the states 1 in 10 or fewer girls are reached.

Among boys, receipt of weekly IFA supplementation ranges from 2% (Nagaland) to 37% (Manipur). In 23 states, 1 in 10 or fewer boys are reached

Deworming

Early adolescence (10 to 14 years)

Deworming among girls ranges from 7% (Assam) to 83% (Karnataka). In 12 states - Andhra Pradesh, Assam, Delhi, Gujarat, Jammu and Kashmir, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Uttar Pradesh and West Bengal, less than half the girls are dewormed biannually.

Deworming among boys ranges from 8% (Uttar Pradesh) to 82% (Sikkim). In half the states, less than half the boys are dewormed.

Late adolescence (15 to 19 years)

Deworming among girls ranges from 4% (Uttar Pradesh) to 65% (Tripura). In 25 states, less than half the girls are dewormed.

Deworming among boys ranges from 4% (Uttar Pradesh) to 69% (Sikkim). As among girls, in 25 states less than half the girls are dewormed.

Biannual health check up

Early adolescence (10 to 14 years)

Biannual school health check-ups services among girls range from 13% (Uttar Pradesh) to 89% (Goa). In 17 states, less than half the girls are covered.

Biannual school health check-ups services among boys range from 11% (Uttar Pradesh) to 89% (Goa). In 20 states, less than half the boys are covered.

Late adolescence (15 to 19 years)

Biannual school health check-ups services among girls range from 11% (Manipur) to 65% (Chhattisgarh). In 25 states, less than half the girls are covered.

Biannual school health check-ups services among boys range from 7% (Bihar) to 64% (Goa). In 26 states, less than half the boys are covered.

Mid-day meal

Early adolescence (10 to 14 years)

Coverage of mid-day meal among girls is 18% (Manipur) to 90% (Goa). In 11 states, more than 75% of the girls are covered.

Coverage of mid-day meal among boys is 15% (Manipur) to 91% (Goa). In 22 states, more than half the boys are covered; among these in eight states 75% boys are covered.

State Variation in receipt of Services in Adolescents aged 10-14 years

Figure 73: Deworming tablets provided to adolescents aged 10-14 years (%)

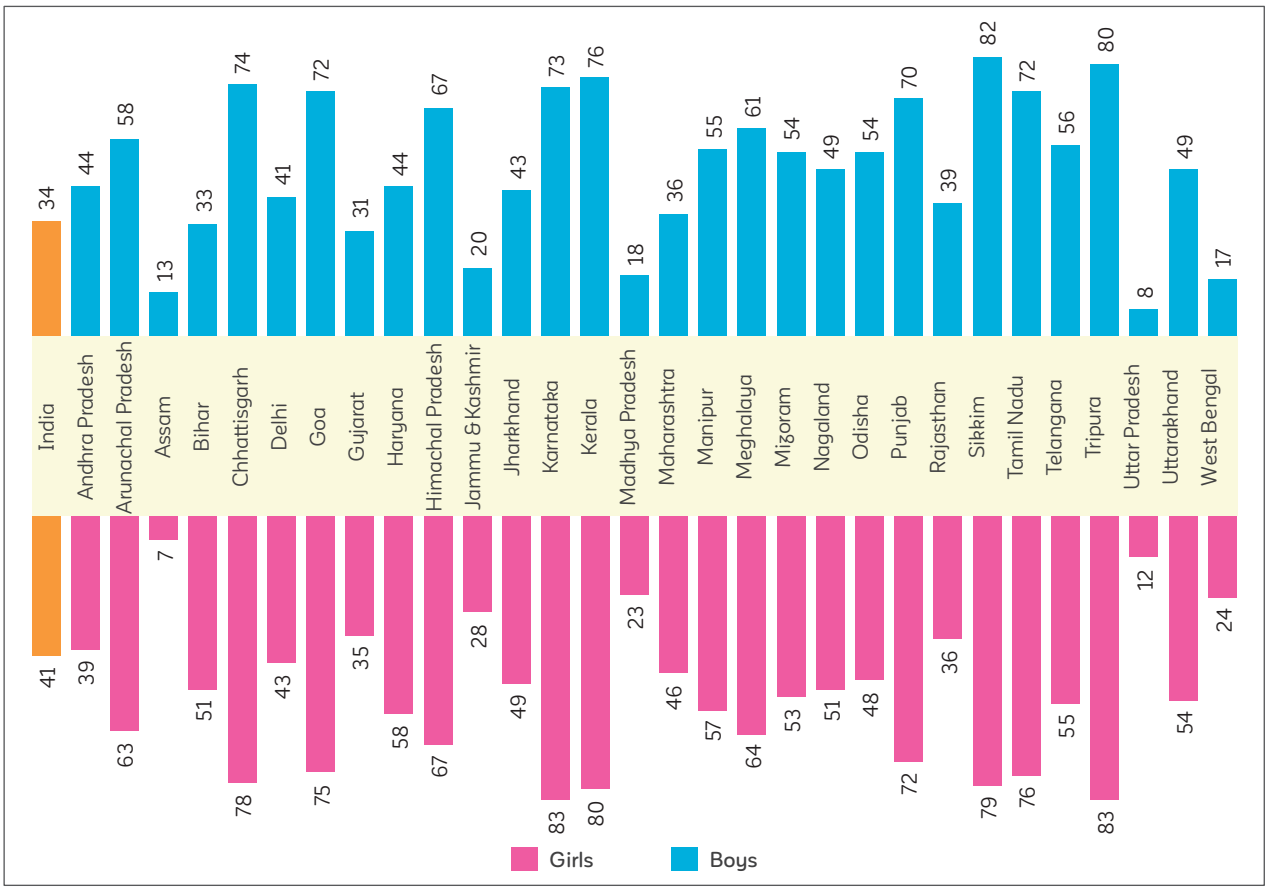


Figure 74: Biannual health check up in last 1 year for adolescents aged 10-14 years (%)

Figure 75: Adolescents aged 10-14 years receiving Mid-day Meal (%)

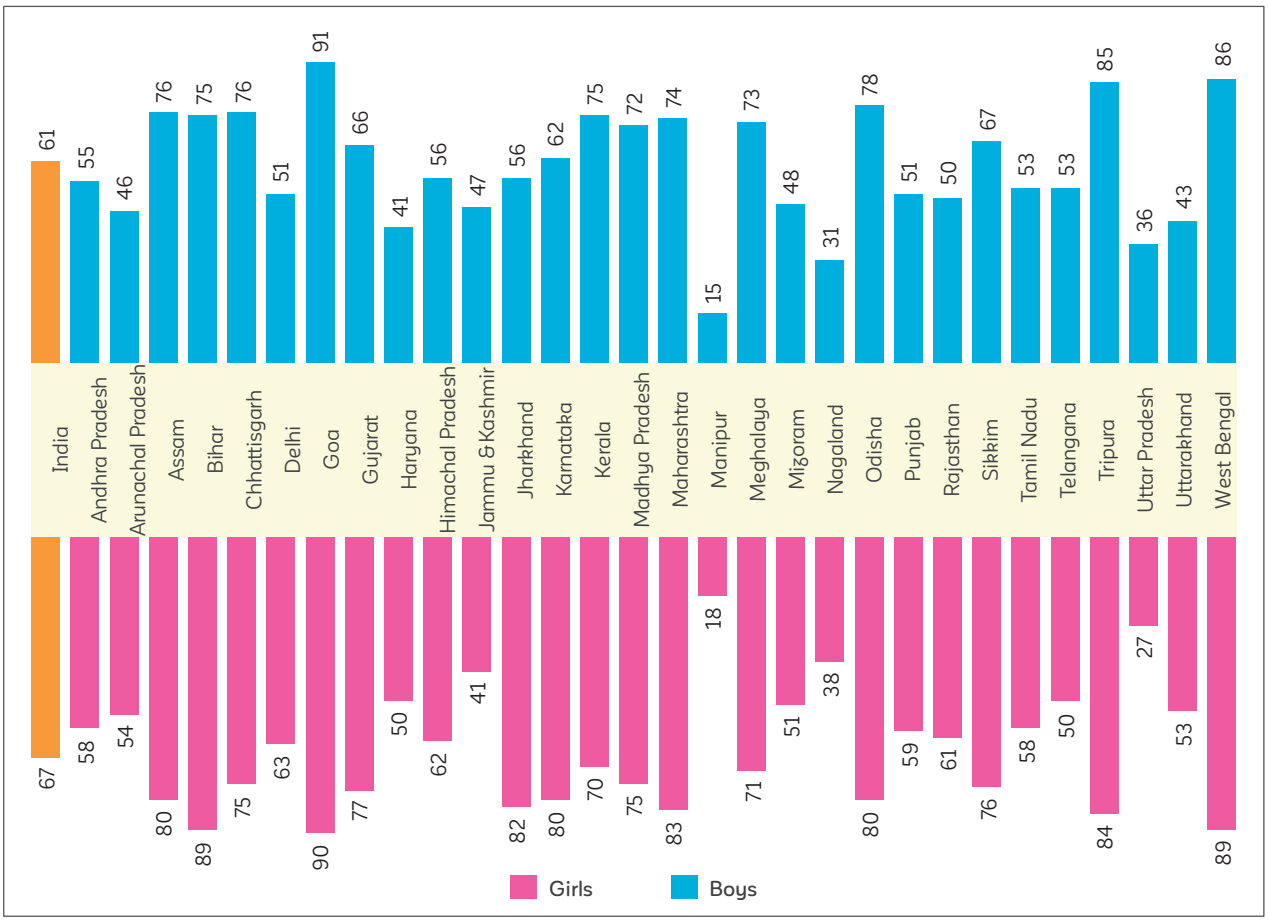
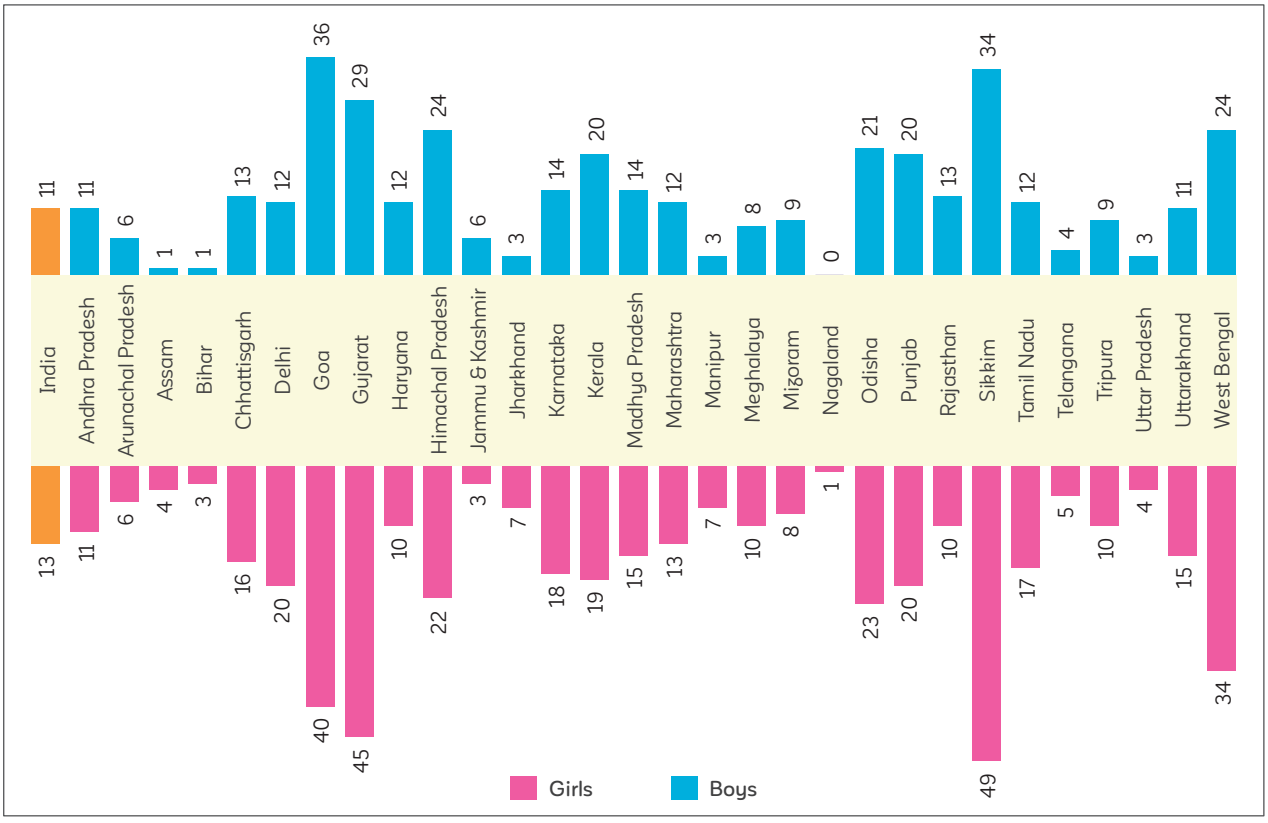


Figure 76: IFA consumption by adolescents aged 10-14 years in last one week (%)



Co-coverage of Services in Adolescents aged 10-14 years

Figure 77: Adolescents aged 10-14 years receiving None of the Services (%)

Figure 78: Adolescents aged 10-14 years receiving Any 1 of the Services (%)

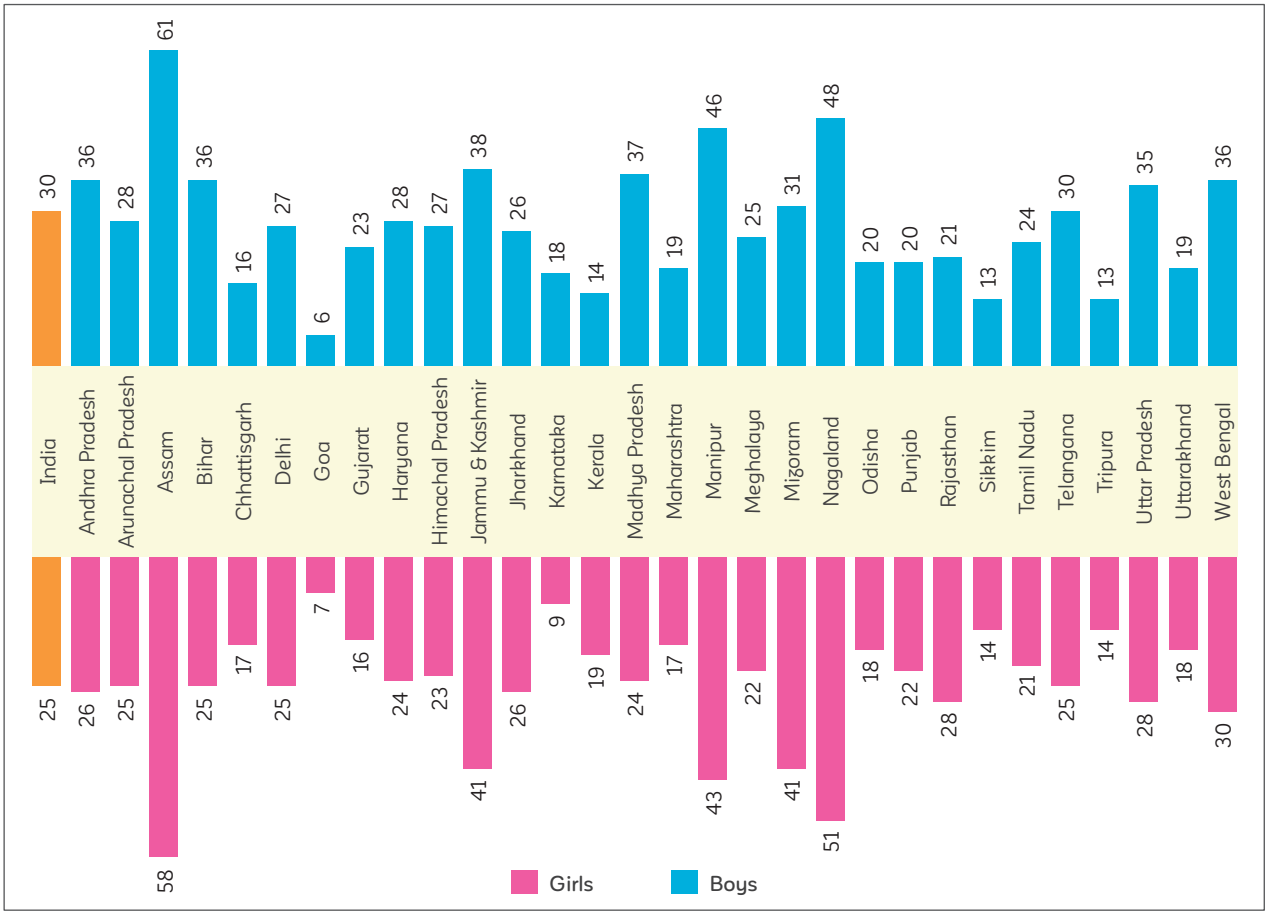


Figure 79: Adolescents aged 10-14 years receiving Any 2 of the Services (%)

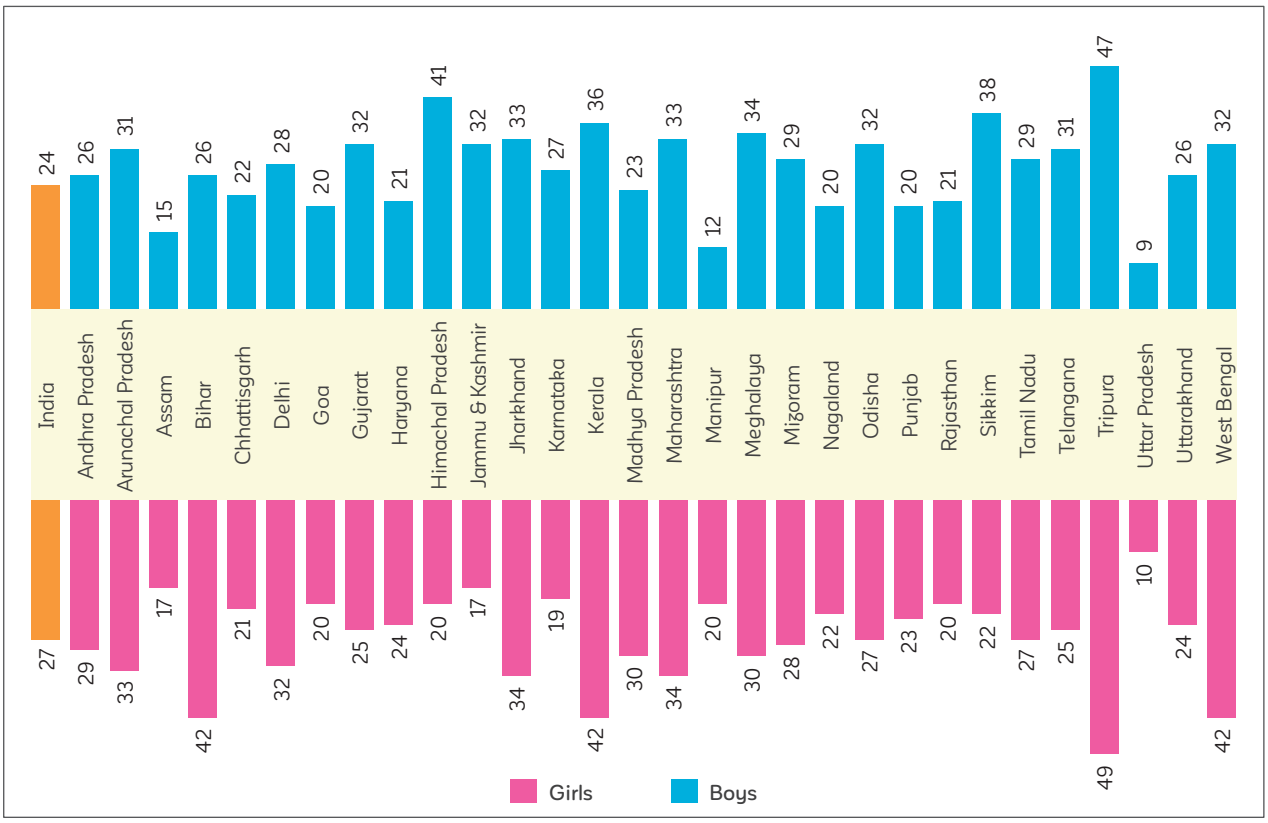
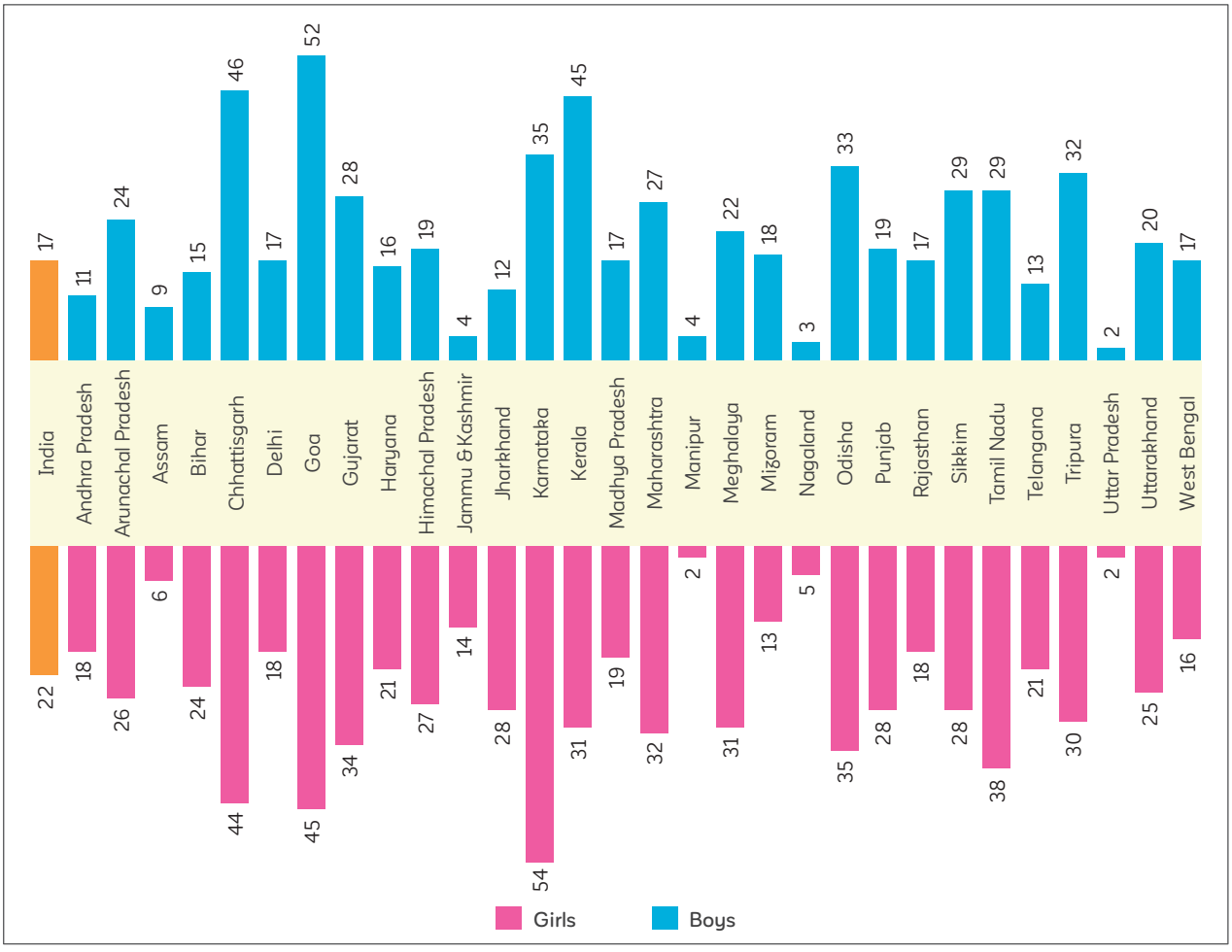


Figure 80: Adolescents aged 10-14 years receiving Any 3 of the Services (%)



State Variation in receipt of Services in Adolescents aged 15-19 years

Figure 81: Deworming tablets provided to adolescents aged 15-19 years (%)

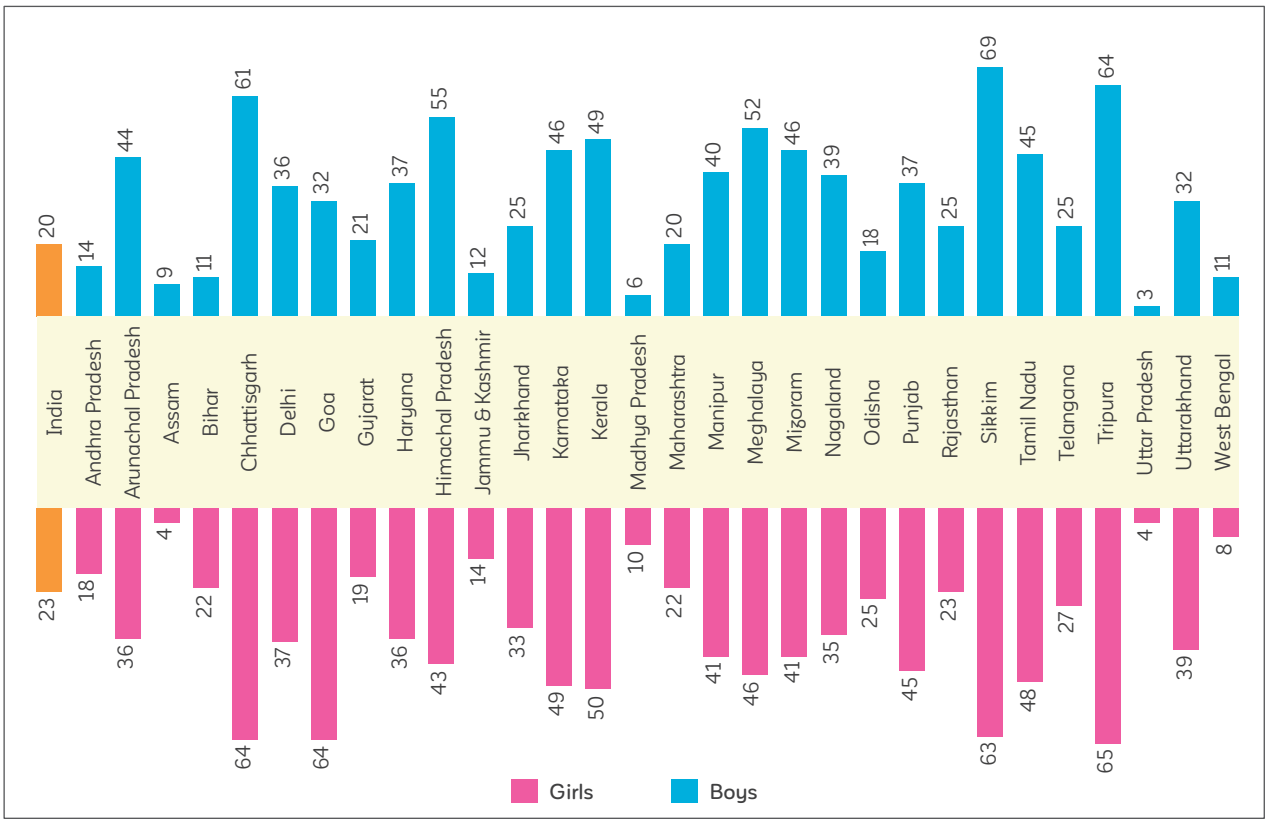


Figure 82: Biannual health check up in last 1 year for adolescents aged 15-19 years (%)

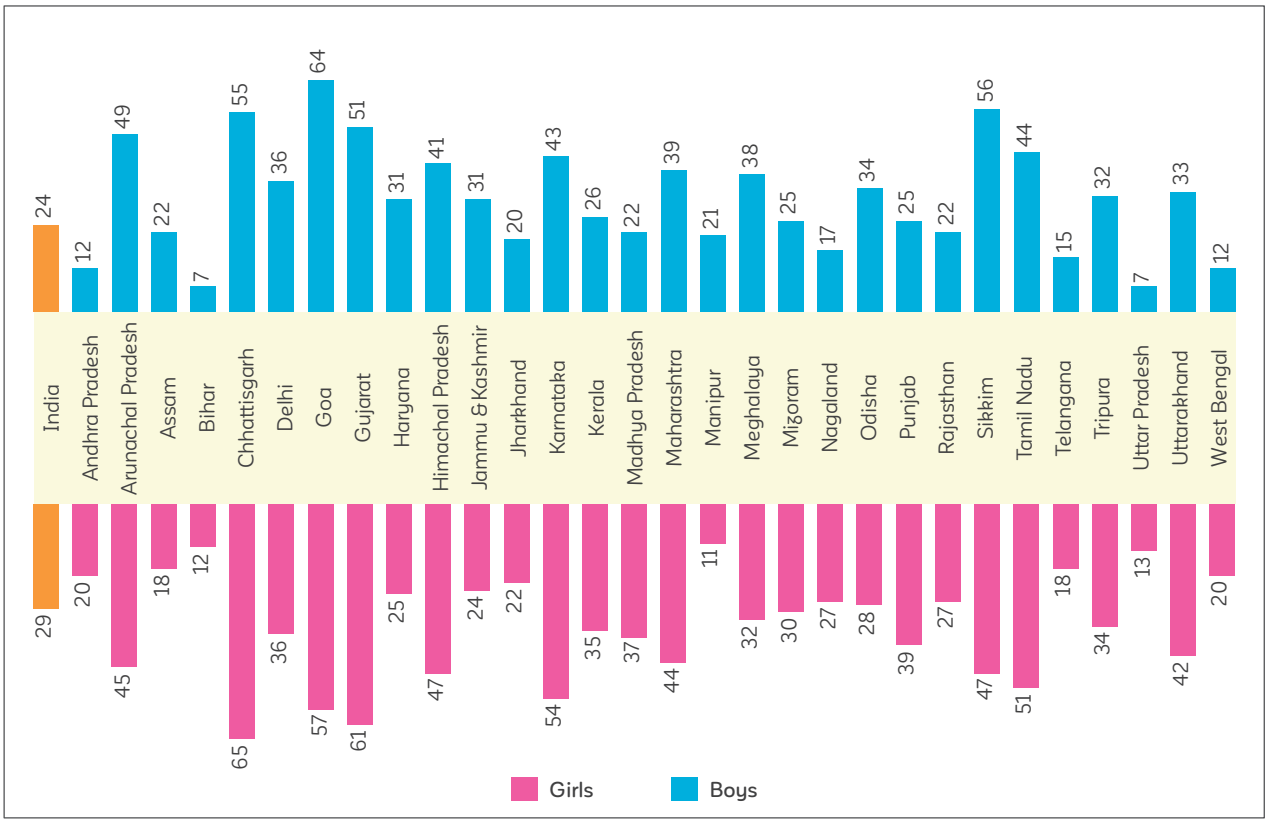
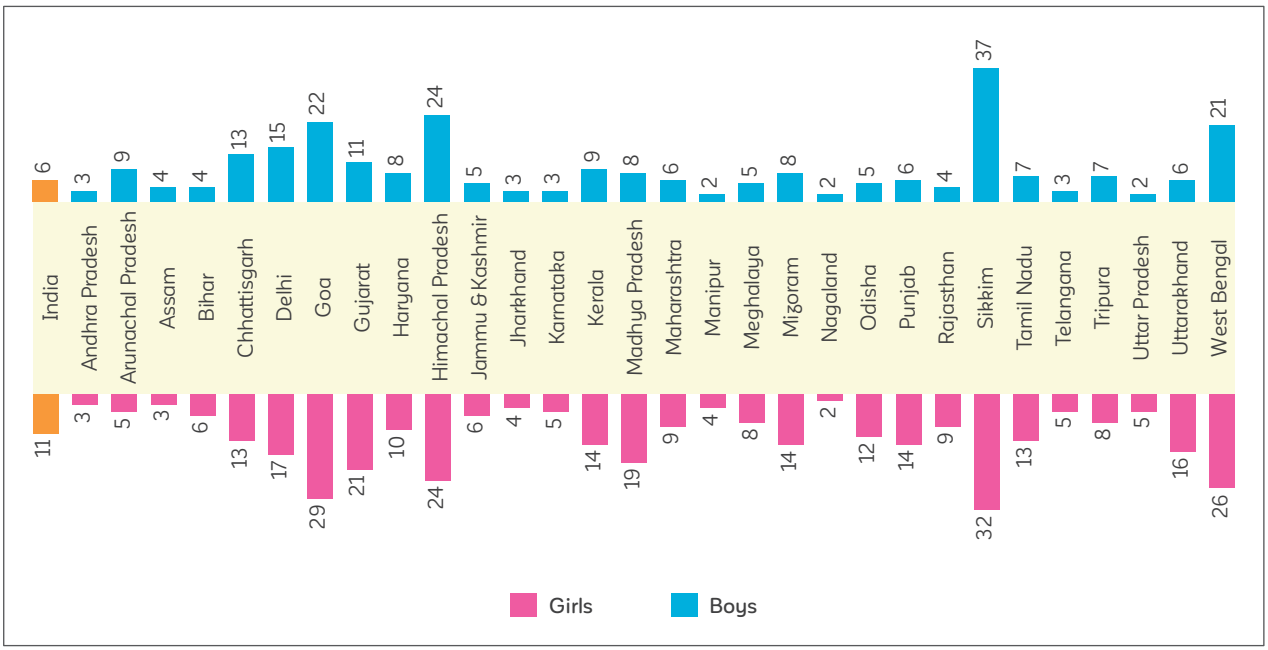


Figure 83: IFA consumption by adolescents aged 15-19 years in last one week (%)



Co-coverage of Services in Adolescents aged 15-19 years

Figure 84: Adolescents aged 15-19 years receiving none of the Services (%)

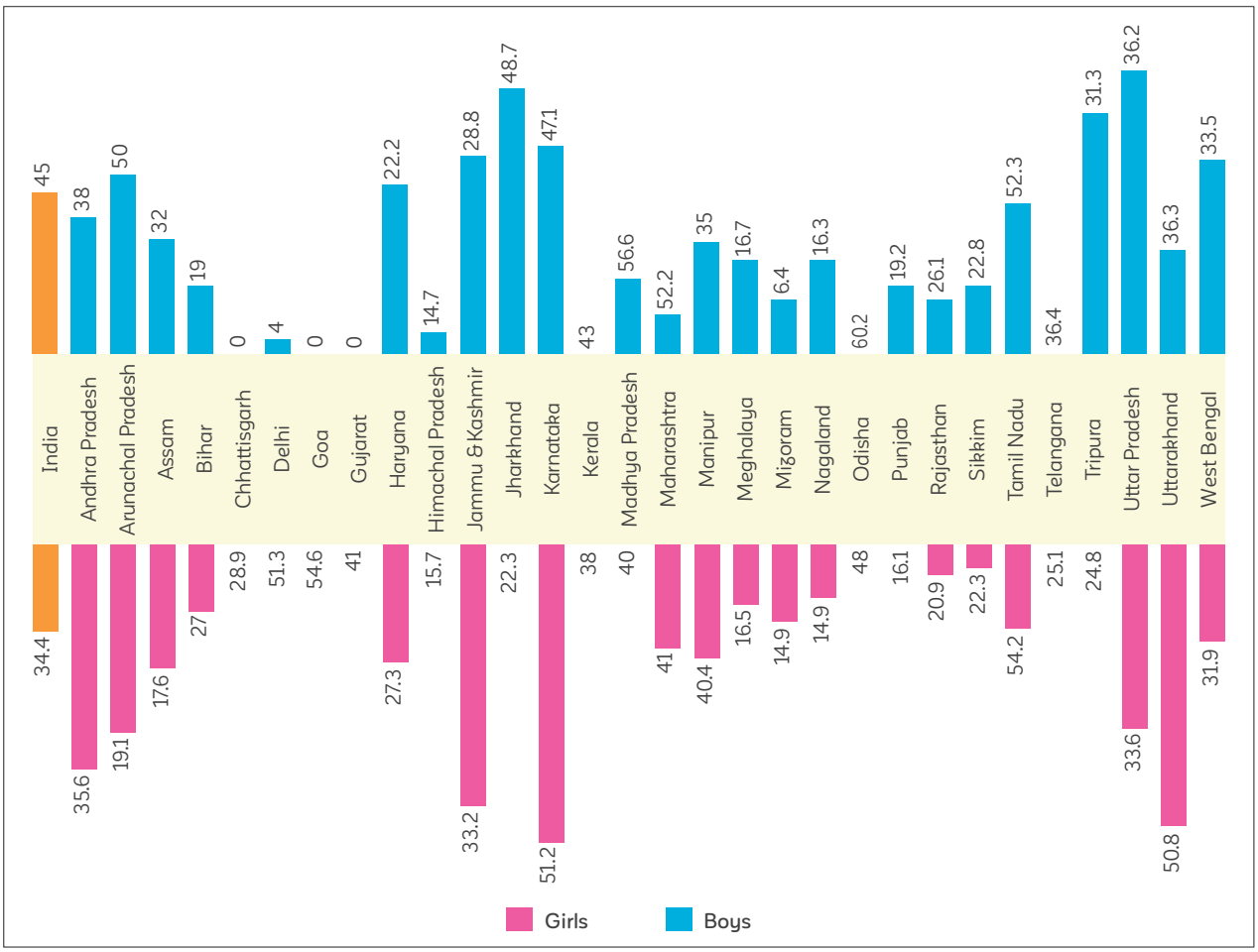
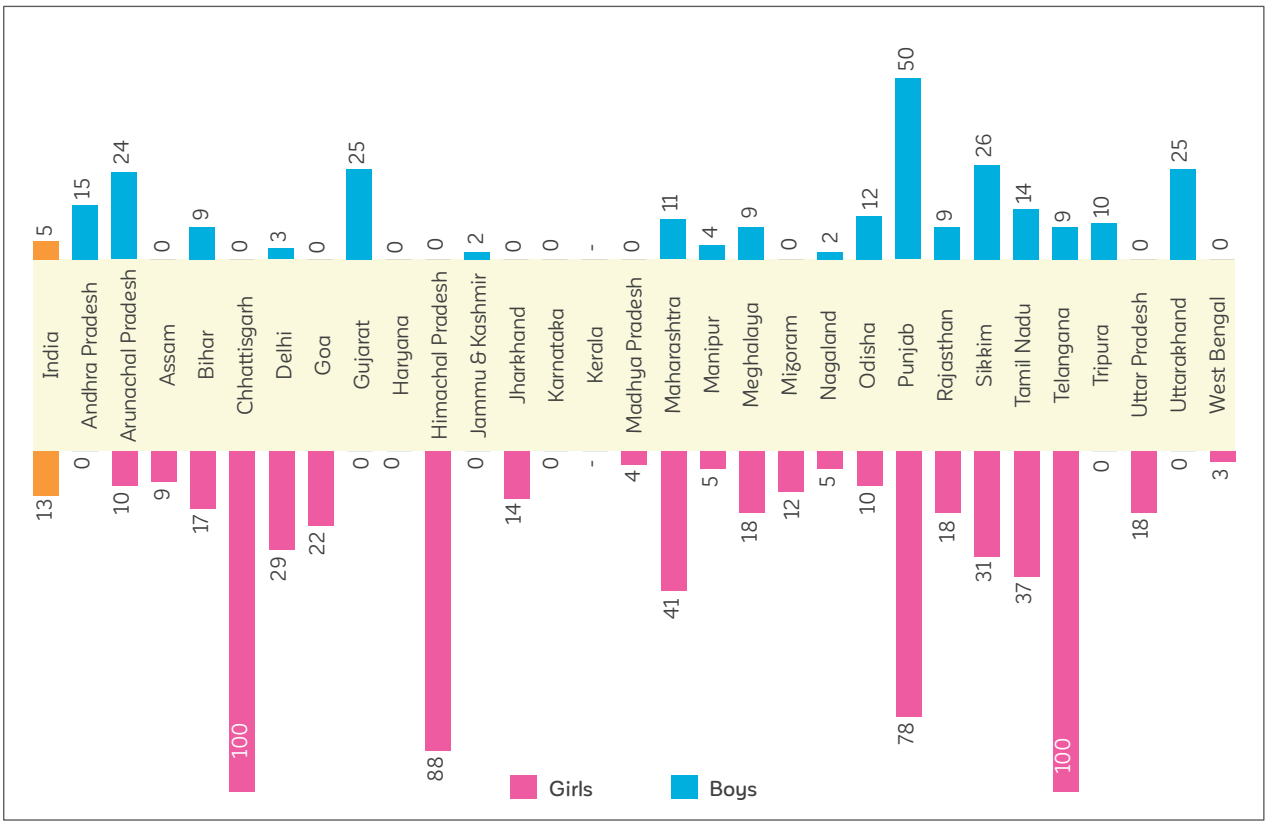


Figure 85: Adolescents aged 15-19 years receiving Any 1 of the Services (%)

Figure 86: Adolescents aged 15-19 years receiving Any 2 of the Services (%)

Figure 87: Adolescents aged 15-19 years receiving Any 3 of the Services (%)



4 Opportunities

The second decade of life is the second opportunity to make up for missed chances on better nutrition earlier in life. It is a much wider window than available in the first 1000 days from conception till child is two years. Another advantage is that adolescents are capable of making informed choices or influencing decisions about their own health and nutrition if equipped with correct and easily understood information. Their decision-making being dependent on the level of autonomy they have in the household.

Our analysis reveals what can be and should be done to maximize long term health and nutrition benefits in this bigger and influential second window of opportunity in the life-course. There are implications for policy in the ongoing *POSHAN Abhiyaan*, bolstering ongoing programs for adolescent health and nutrition and new research to better the design of programs for adolescents.

Four opportunities emerge. First, there is a need for a dedicated policy on adolescent health and nutrition under the Poshan Abhiyan for planning and managing services spread across departments of education, health and woman and child development. This has been attempted earlier under the weekly IFA supplementation program through joint commitment letters from the three departments to ensure fund allocation, supply and logistics, capacity building of teachers, behaviour change promotion and other actions from the department of health go hand in hand with service delivery at point of use (class room, village anganwadi)[24]. Our analysis reveals huge gaps in compliance to both diets and physical activity recommendations among adolescents both of which have not been addressed in any earlier program on adolescent health and nutrition program. An adolescent health and nutrition policy for the country must include guidance on this.

Second, the *Poshan Abhiyan* targets for undernutrition and anemia have resulted in fast pacing actions to meet these targets for women, girls and children albeit progress varies across states[25]. The problem of overweight/obesity and related non-communicable diseases risks has been missed in design. The problem is growing and still ignored in policy and programs. Considering the very early onset of these conditions in the Indian population, policy on assessment and management of these conditions in early adolescence is needed. There are 12 states in India where over 10% of the adolescents are overweight/obese; states of Goa, Gujarat, Haryana and most states in north-east have high burden of diabetes and cardiovascular risks. State-specific action plans need to follow a national policy on managing overweight/obesity among adolescents. State with diets skewed to carbohydrates, animal fats, avoidable foods (fried foods, junk foods, sweets and aerated drinks) need policies on restricting sale of such food within and in vicinity of the schools.

Thirdly, with the CNNS data, new dimensions on adolescent nutritional status especially related to the high burden of multiple micronutrient deficiencies have emerged. India does not have a policy to address vitamin B_{12}, vitamin D and zinc deficiency which have high burden among adolescents in addition to iron and folic acid deficiency. An expert review of evidence is needed to inform policy gap here.

The analysis of current receipt of public health service use by adolescents has implications for reviewing the ongoing adolescent health and nutrition programs. A bottleneck analysis to understand root causes of challenges in implementation of Anemia *Mukt Bharat* and Rashtriya Bal Swasthya Karyakram is much needed considering that a captive set of girls and boys in schools is missed out from these services. Both iron and folic acid deficiency continue to be highly prevalent in most states of India. This review should include financing, supply and logistics, human resource availability and capacity and support system to deliver services related to weekly IFA supplementation.

Secondly, each state should have an adolescent score card for girls and boys that captures the progress on service use every six months. Anemia Mukt Bharat portal provides monitoring data on IFA and deworming for this age-group which needs to be part of state level health and nutrition program reviews[26]. Similarly, data on biannual health check-ups and quarterly adolescent health days needs to be made available in the public domain.

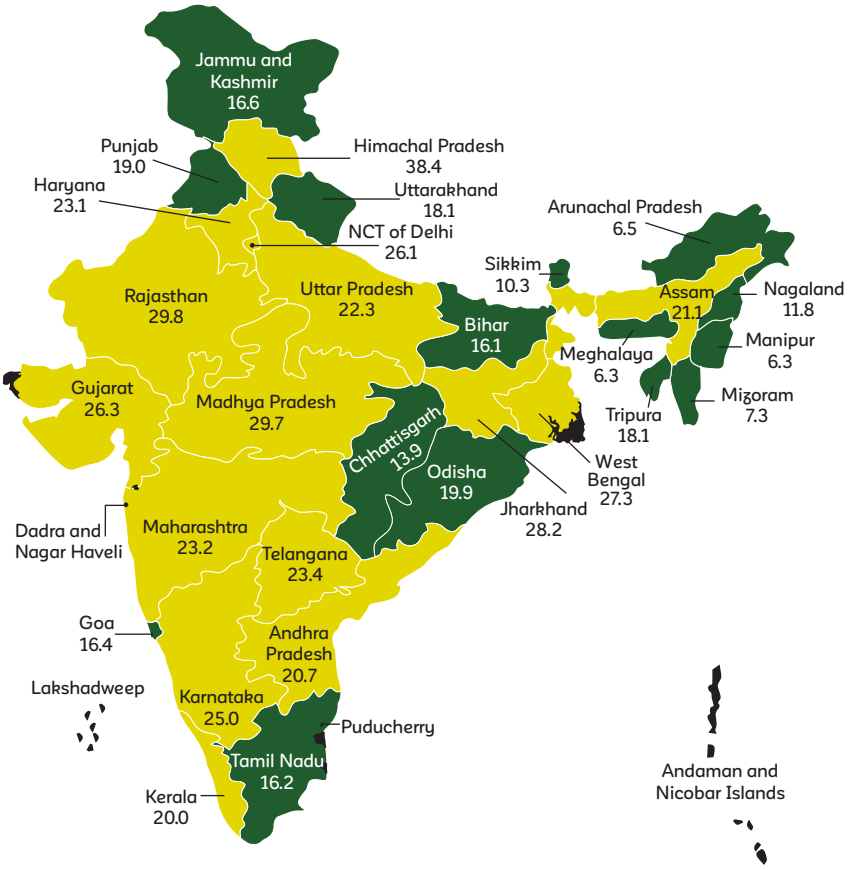
Thirdly, there is a need to build on the ongoing efforts in schools for promoting healthy habits and diets like those under Food Safety and Standards Authority of India and Anemia *Mukt Bharat*. Special nutrition and diet promotion campaign focusing on problem foods (fruits, eggs, fish/chicken, dark green leafy vegetables, pulses and milk) and adolescent health and nutrition services need to be designed, tested and popularised.

Research on adolescent health and nutrition in India is limited. Current efforts while still weak are focussed on schools. But the food plate is mostly decided at home and not much is known about translation of health and nutrition promotion in schools to food plate at home. Mothers and/or fathers remain key decision makers on what is purchased from the market and campaigns to reach them with correct information on food choices for adolescents and understanding their health needs have not been tested. Finally, in a food system where avoidable foods are much cheaper than healthier options more research and development on nutritious products that appeal to adolescents is needed.

Prevalence of Visible Forms of Malnutrition in Adolescent Girls, CNNS 2016-18

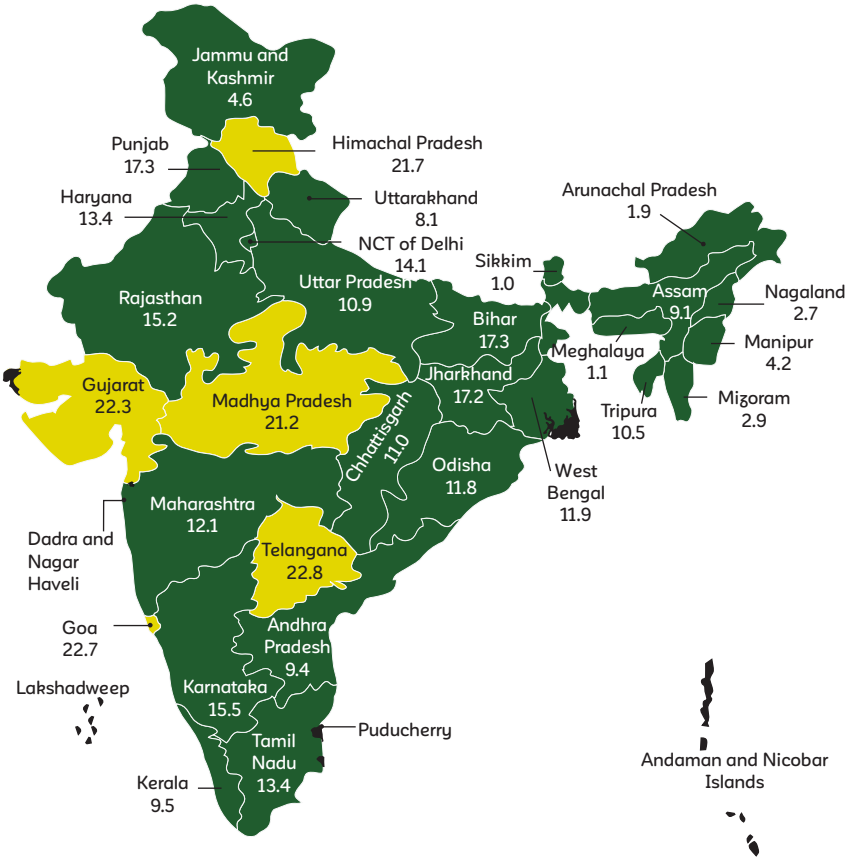
THIN

(BMI-for-age z-score<-2SD)



10-14 years (Girls)

Better Performing States
Manipur (6.3%)
Meghalaya (6.3%)
Arunachal Pradesh (6.5%)
Mizoram (7.3%)
Sikkim (10.3%)
States with most challenges
Himachal Pradesh (38.4%)
Rajasthan (29.8%)
Madhya Pradesh (29.7%)
Jharkhand (28.2%)
West Bengal (27.3%)
India (22.9%)



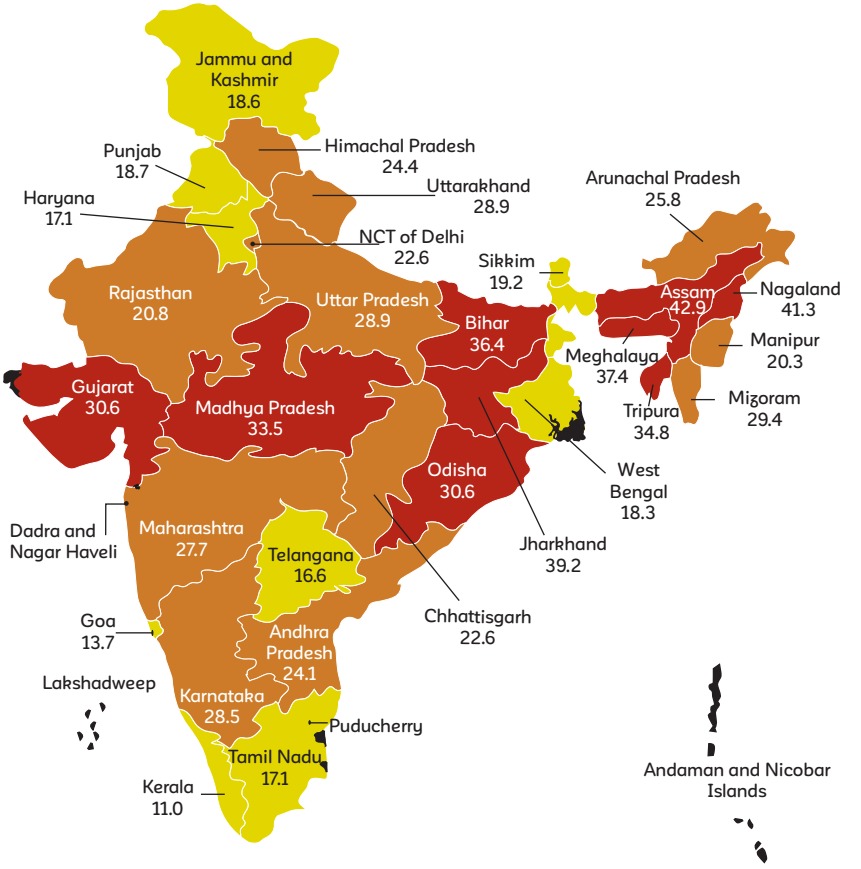
15-19 years (Girls)

Better Performing States
Sikkim (1.0%)
Meghalaya (1.1%)
Arunachal Pradesh (1.9%)
Nagaland (2.7%)
Mizoram (2.9%)
States with most challenges
Telangana (22.8%)
Goa (22.7%)
Gujarat (22.3%)
Himachal Pradesh (21.7%)
Madhya Pradesh (21.2%)
India (14.2%)

- <20% : Low public health significance
- 20–39.9% : High public health significance
- >40% : Very high public health significance
- No Data

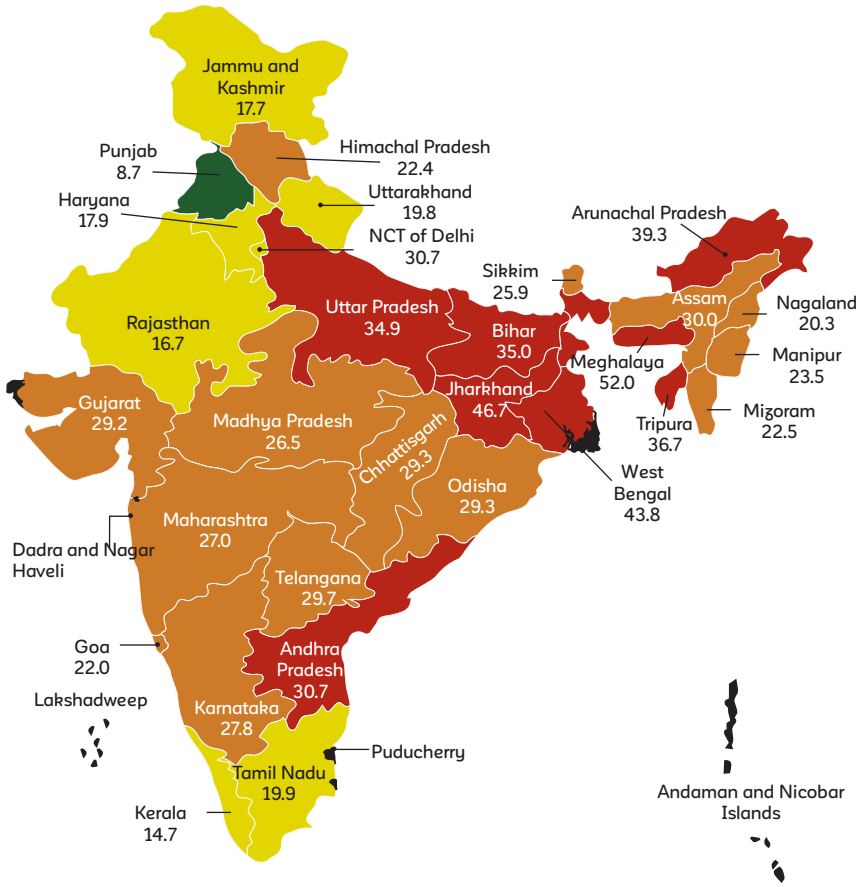
SHORT

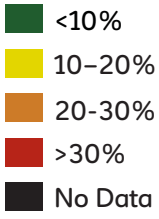
(Height-for-age z-score<-2SD)



10-14 years (Girls)

Better Performing States
Kerala (11.0%)
Goa (13.7%)
Telangana (16.6%)
Tamil Nadu (17.1%)
Haryana (17.1%)
States with most challenges
Assam (42.9%)
Nagaland (41.3%)
Jharkhand (39.2%)
Meghalaya (37.4%)
Bihar (36.4%)
India (27.8%)





15-19 years (Girls)

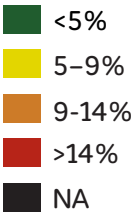
Better Performing States
Punjab (8.7%)
Kerala (14.7%)
Rajasthan (16.7%)
Jammu And Kashmir (17.7%)
Haryana (17.9%)
States with most challenges
Meghalaya (52.0%)
Jharkhand (46.7%)
West Bengal (43.8%)
Arunachal Pradesh (39.3%)
Tripura (36.7%)
India (30.2%)

OVERWEIGHT/OBESE

(BMI-for-age z-score>+1SD)

10-14 years (Girls)

Better Performing States
Bihar (1.3%)
Madhya Pradesh (1.6%)
Jharkhand (2.0%)
Haryana (3.1%)
Uttar Pradesh (3.3%)
States with most challenges
Goa (19.9%)
Tamil Nadu (16.5%)
Arunachal Pradesh (14.6%)
Nagaland (13.4%)
Delhi (13.4%)
India (5.3%)



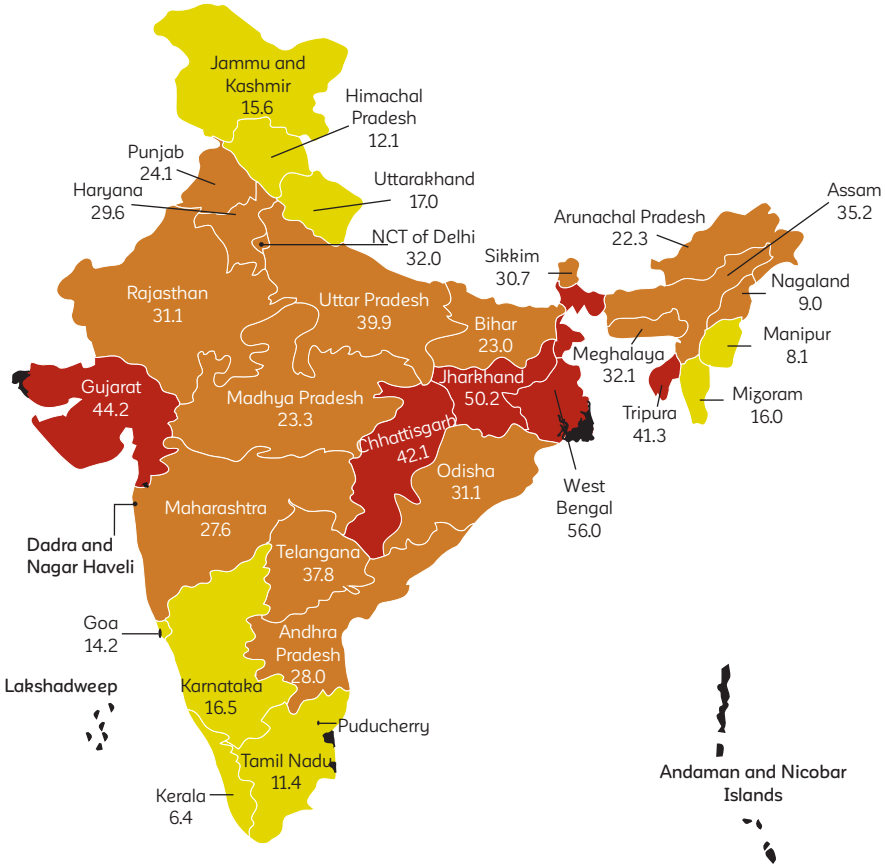
15-19 years (Girls)

Better Performing States
Jharkhand (1.4%)
Rajasthan (1.5%)
Madhya Pradesh (1.7%)
Himachal Pradesh (2.2%)
Bihar (2.3%)
States with most challenges
Sikkim (13.2%)
Arunachal Pradesh (10.8%)
Karnataka (10.7%)
Andhra Pradesh (9.9%)
Tamil Nadu (9.4%)
India (4.1%)

Prevalence of Anemia in Adolescent Girls, CNNS 2016-18

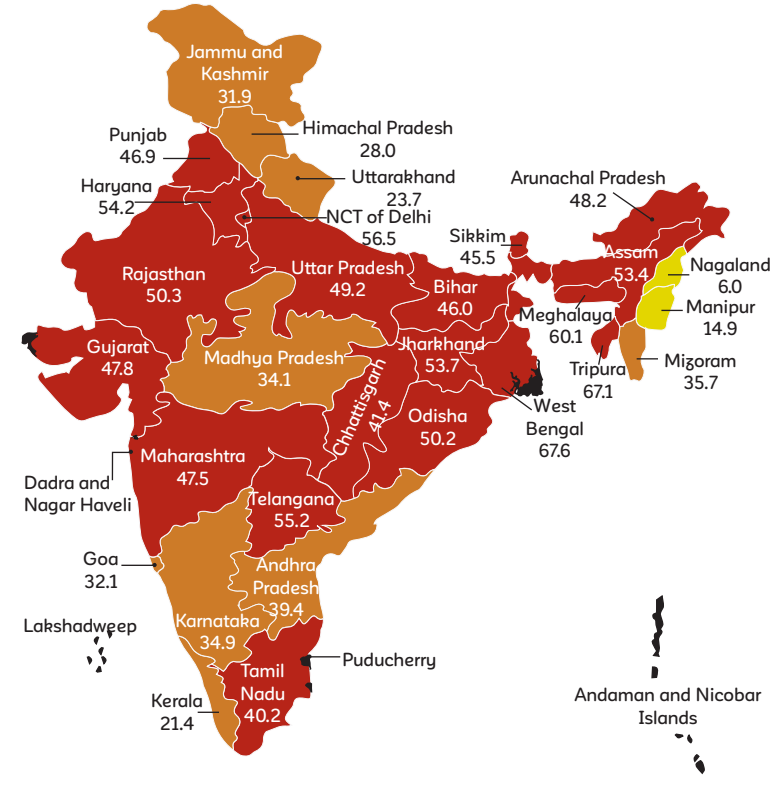
ANEMIC

(Hemoglobin levels <11.5 g/dl for 10–11 years, <12.0 g/dl for 12–14 years and <12.0 g/dl for 15–19 years)



10-14 years (Girls)

Better Performing States
Kerala (6.4%)
Manipur (8.1%)
Nagaland (9.0%)
Tamil Nadu (11.4%)
Himachal Pradesh (12.1%)
States with most challenges
West Bengal (56.0%)
Jharkhand (50.2%)
Gujarat (44.2%)
Chhattisgarh (42.1%)
Tripura (41.3%)
India (32.1%)



- <5% : Public health problem
- 5–19.9% Mild public health problem
- 20-39.9% : Moderate public health problem
- >=40% : Severe health public health problem
- NA

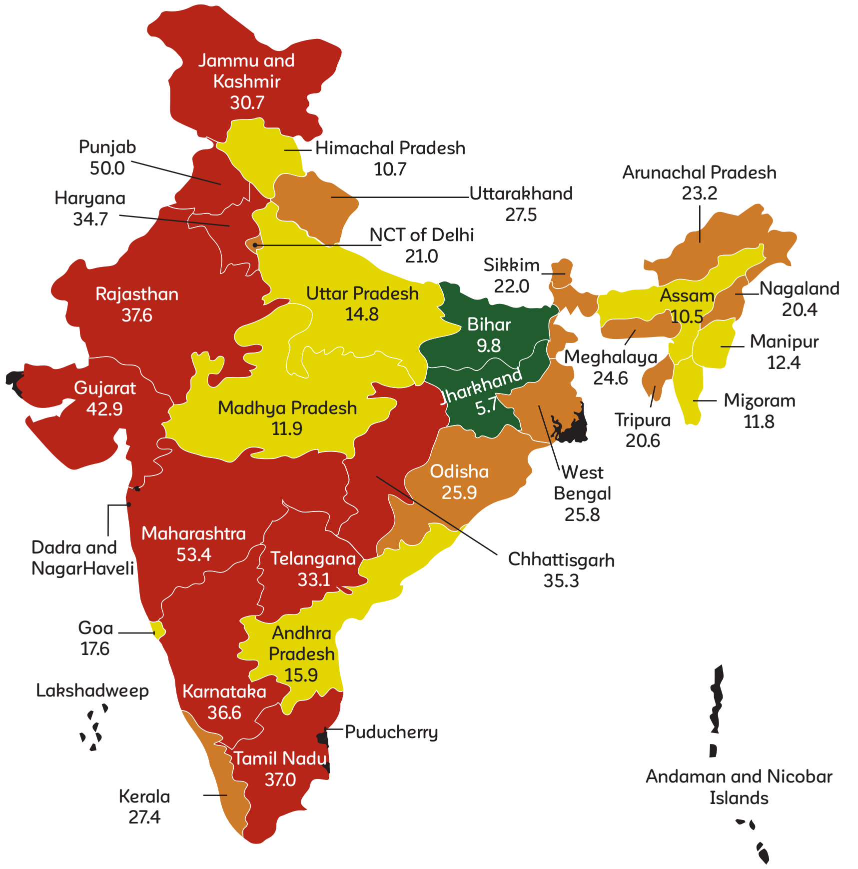
15-19 years (Girls)

Better Performing States
Nagaland (6.0%)
Manipur (14.9%)
Kerala (21.4%)
Uttarakhand (23.7%)
Himachal Pradesh (28.0%)
States with most challenges
West Bengal (67.6%)
Tripura (67.1%)
Meghalaya (60.1%)
Delhi (56.5%)
Telangana (55.2%)
India (47.5%)

Prevalence of Micronutrient Deficiencies in Adolescent Girls, CNNS 2016-18

IRON DEFICIENCY

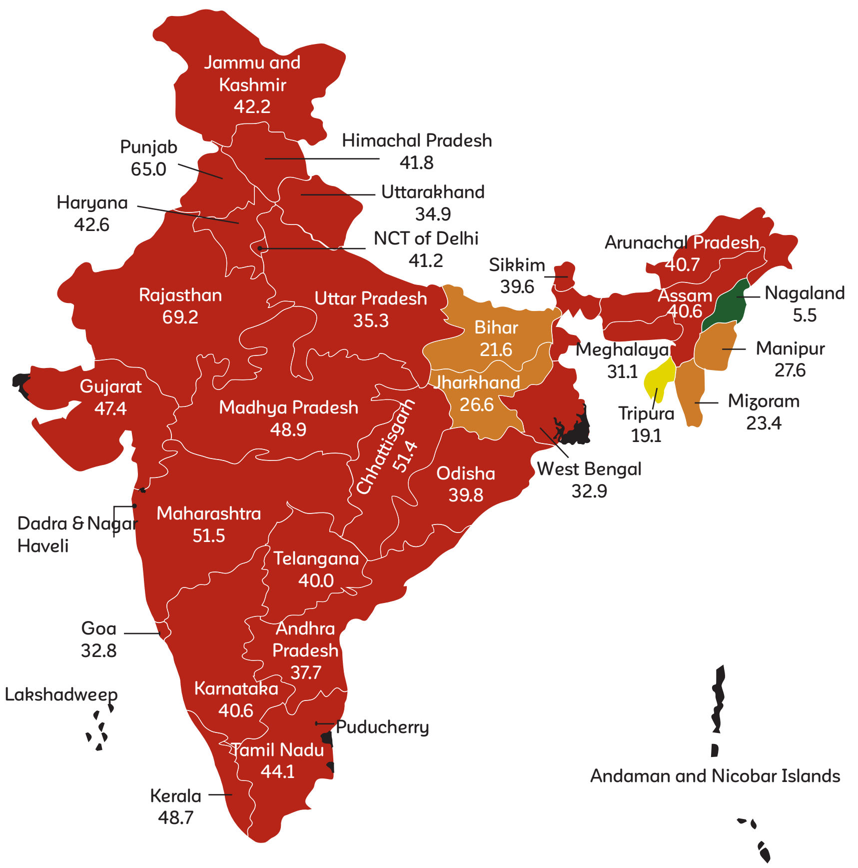
(Serum ferritin levels <15 g/l; excluding cases with C-reactive protein > 5 mg/L)



10-14 years (Girls)

Better Performing States
Jharkhand (5.7%)
Bihar (9.8%)
Assam (10.5%)
Himachal Pradesh (10.7%)
Mizoram (11.8%)
States with most challenges
Maharashtra (53.4%)
Punjab (50.0%)
Gujarat (42.9%)
Rajasthan (37.6%)
Tamil Nadu (37.0%)
India (24.1%)

- <10%
- 10–20%
- 20-30%
- >30%
- No Data

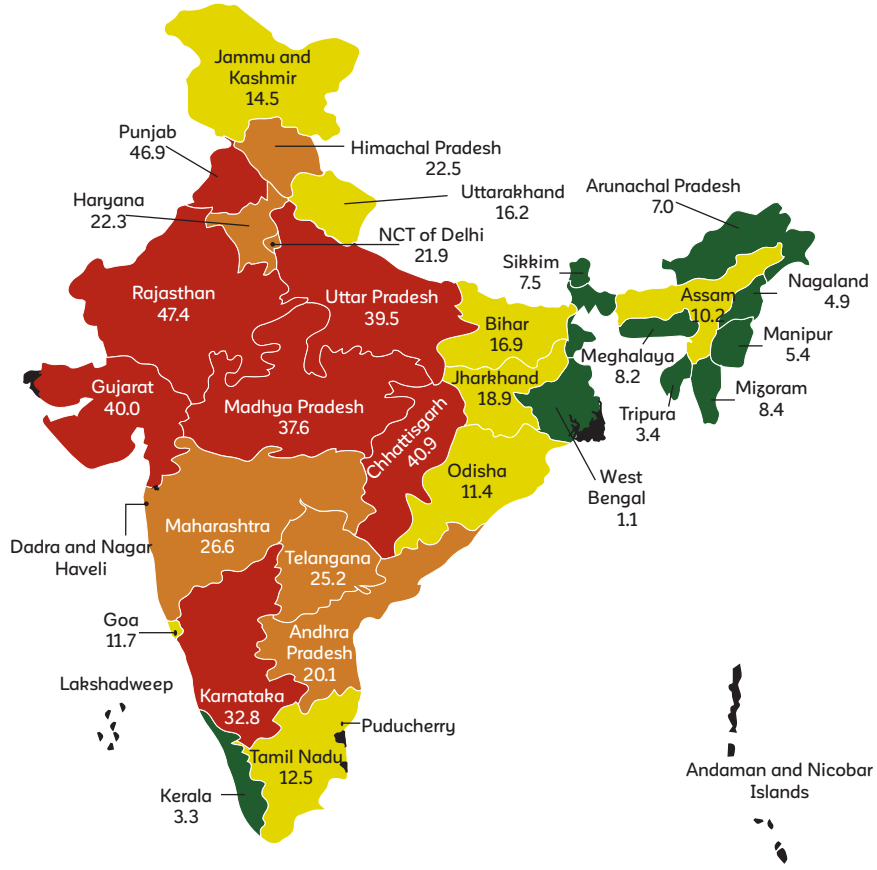


15-19 years (Girls)

Better Performing States
Nagaland (5.5%)
Tripura (19.1%)
Bihar (21.6%)
Mizoram (23%)
Jharkhand (26.6%)
States with most challenges
Rajasthan (69.2%)
Punjab (65%)
Maharashtra (51.5%)
Chattisgarh (51.4%)
Madhya Pradesh (48.9%)
India (39.0%)

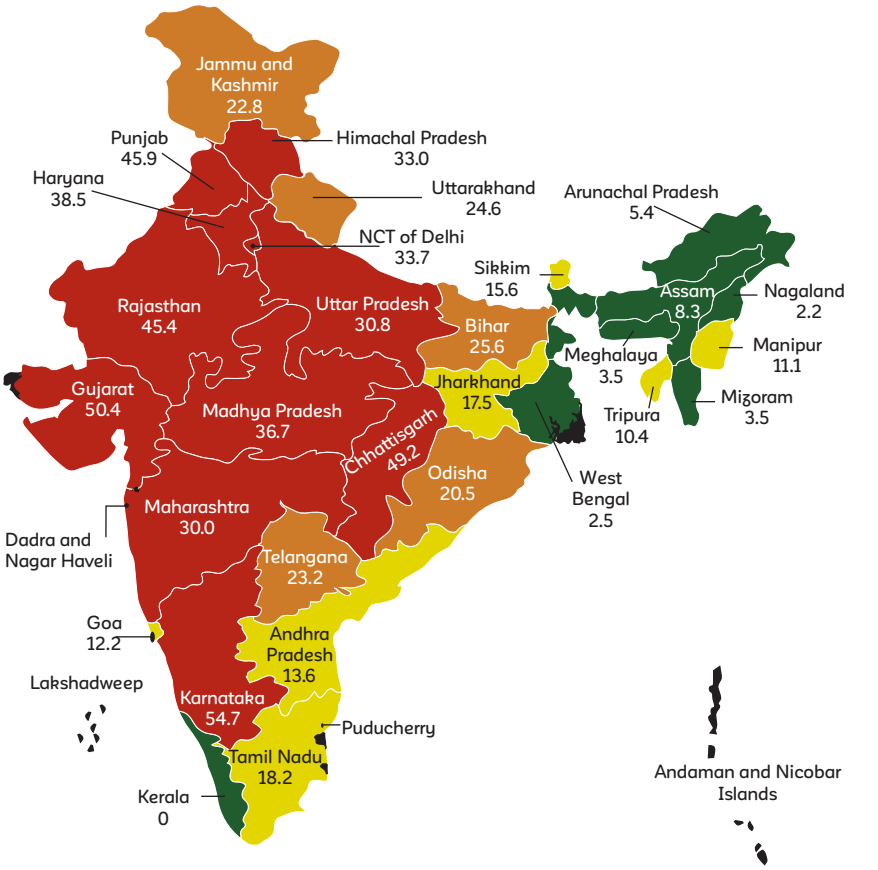
VITAMIN B_{12} DEFICIENCY

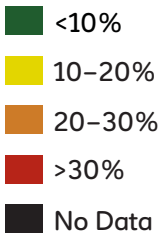
(Serum vitamin B_{12} < 203 pg/ml)



10-14 years (Girls)

Better Performing States
West Bengal (1.1%)
Kerala (3.3%)
Tripura (3.4%)
Nagaland (4.9%)
Manipur (5.4%)
States with most challenges
Rajasthan (47.4%)
Punjab (46.9%)
Chhattisgarh (40.9%)
Gujarat (40.0%)
Uttar Pradesh (39.5%)
India (25.6%)



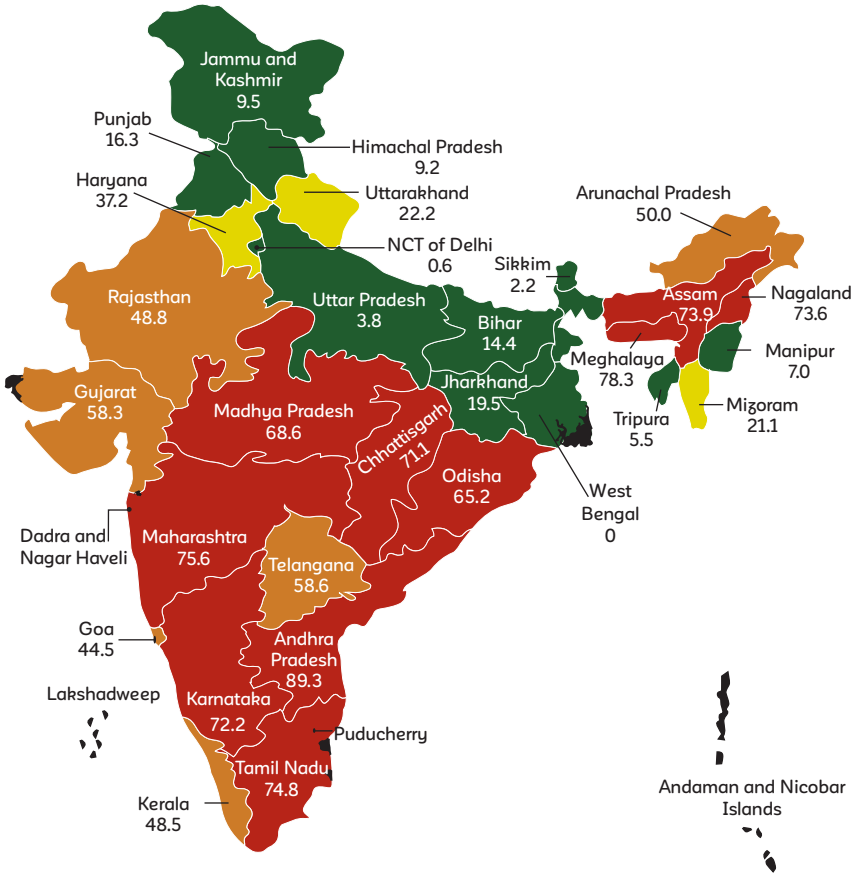


15-19 years (Girls)

Better Performing States
Kerala (0)
Nagaland (2.2%)
West Bengal (2.5%)
Meghalaya (3.5%)
Mizoram (3.5%)
States with most challenges
Karnataka (54.7%)
Gujarat (50.4%)
Chattisgarh (49.2%)
Punjab (45.9%)
Rajasthan(45.4%)
India (28.1%)

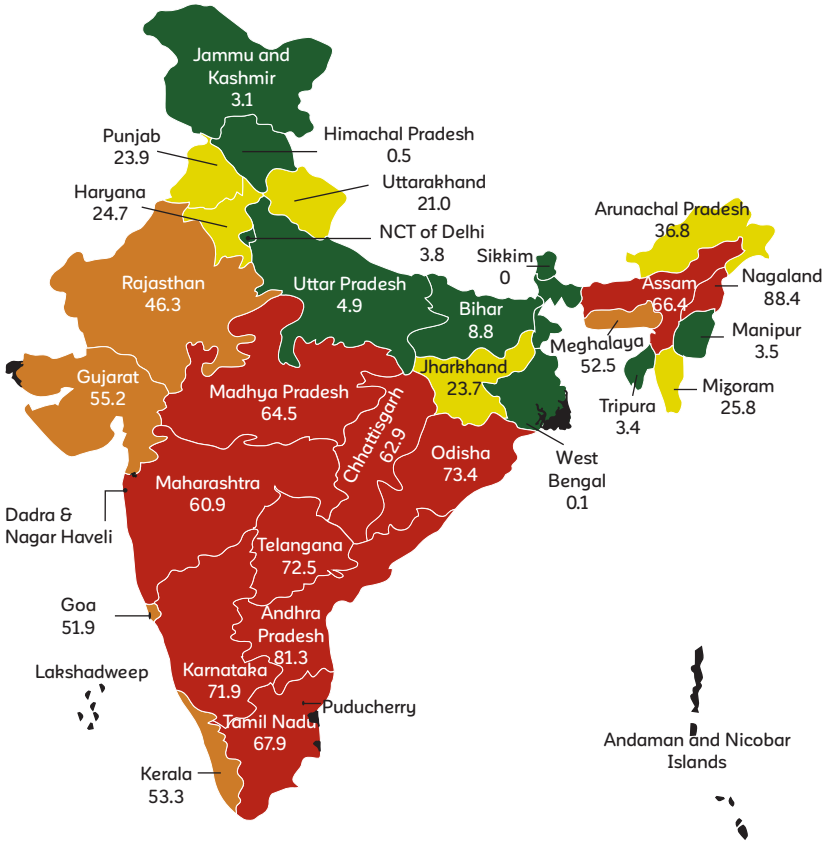
FOLATE DEFICIENCY

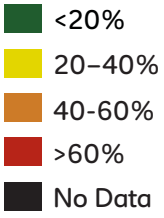
(Serum erythrocyte folate < 151 ng/ml)



10-14 years (Girls)

Better Performing States
West Bengal (0%)
Delhi (0.6%)
Sikkim (2.2%)
Uttar Pradesh (3.8%)
Tripura (5.5%)
States with most challenges
Andhra Pradesh (89.3%)
Meghalaya (78.3%)
Maharashtra (75.6%)
Tamil Nadu (74.8%)
Assam (73.9%)
India (36.1%)



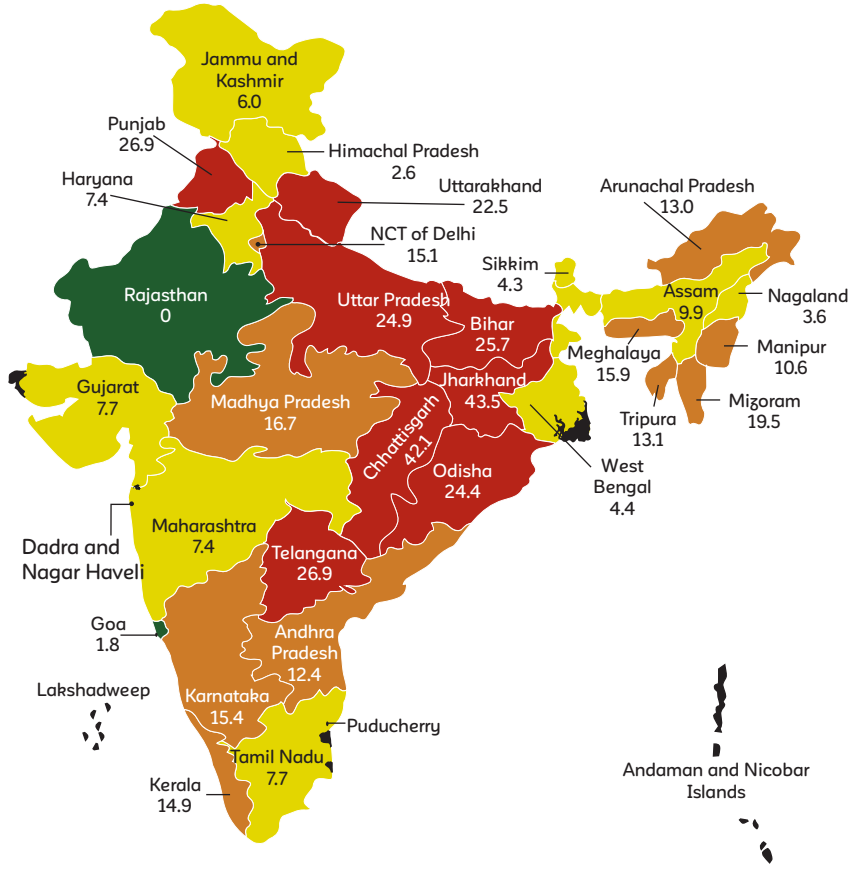


15-19 years (Girls)

Better Performing States
Sikkim (0)
West Bengal (0.1%)
Himachal Pradesh (0.5%)
Jammu and Kashmir (3.1%)
Tripura (3.4%)
States with most challenges
Nagaland (88.4%)
Andhra Pradesh (81.3%)
Odhisa (73.4%)
Telangana (72.5%)
Karnataka (71.9%)
India (32.0%)

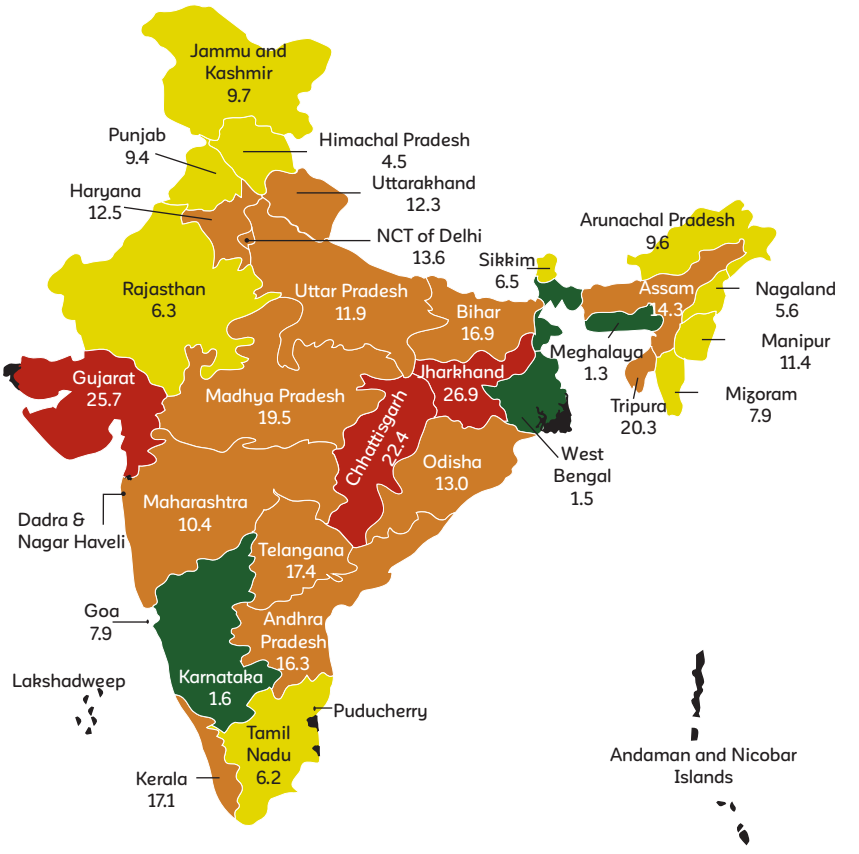
VITAMIN A DEFICIENCY

(Serum retinol concentration <20 µg/dL; excluding cases with C-reactive protein > 5 mg/L)



10-14 years (Girls)

Better Performing States
Rajasthan (0%)
Goa (1.8%)
Himachal Pradesh (2.6%)
Nagaland (3.6%)
Sikkim (4.3%)
States with most challenges
Jharkhand (43.5%)
Chhattisgarh (42.1%)
Punjab (26.9%)
Telangana (26.9%)
Bihar (25.7%)
India (18.7%)



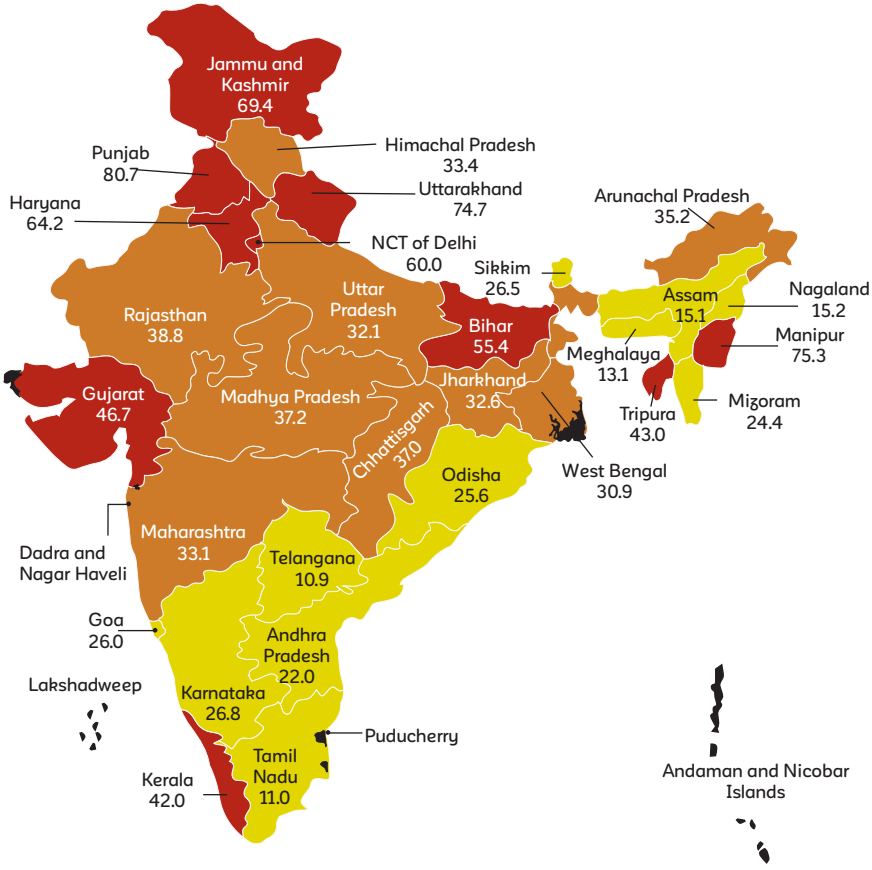
- <2% : No public health problem
- 2–9.9% : Mild public health problem
- 10–19.9% : Moderate public health problem
- >=20% : Severe health public health problem
- No Data

15-19 years (Girls)

Better Performing States
Meghalaya (1.3%)
West Bengal (1.5%)
Karnataka (1.6%)
Himachal Pradesh (4.5%)
Nagaland (5.6%)
States with most challenges
Jharkhand (26.9%)
Gujarat (25.7%)
Chattishgrah (22.4%)
Tripura (20.3%)
Madhya Pradesh (19.5%)
India (12.2%)

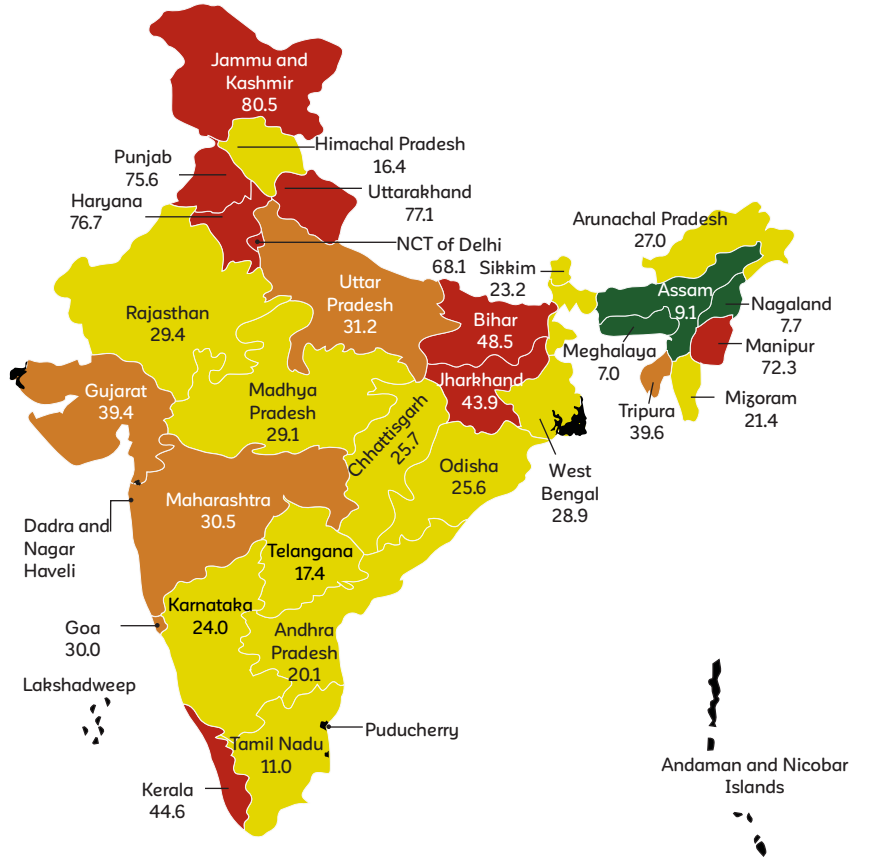
VITAMIN D DEFICIENCY

(Serum 25(OH)D concentration <12ng/mL)



10-14 years(Girls)

Better Performing States
Telangana (10.9%)
Tamil Nadu (11.0%)
Meghalaya (13.1%)
Assam (15.1%)
Nagaland (15.2%)
States with most challenges
Punjab (80.7%)
Manipur (75.3%)
Uttarakhand (74.7%)
Jammu & Kashmir (69.4%)
Haryana (64.2%)
India (35%)



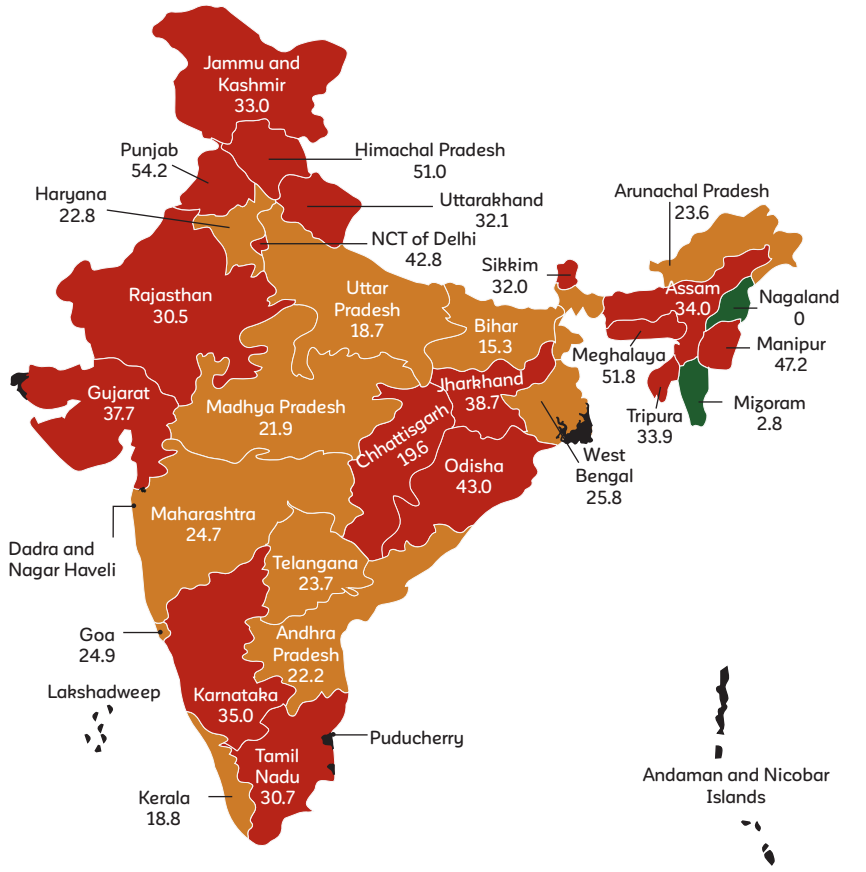
- <10%
- 10-30%
- 30-40%
- >40%
- No Data

15-19 years (Girls)

Better Performing States
Meghalaya (7.0%)
Nagaland (7.7%)
Assam (9.1%)
Tamil Nadu (11.0%)
Himachal Pradesh (16.4%)
States with most challenges
Jammu and Kashmir (80.5%)
Uttarakhand (77.1%)
Haryana (76.7%)
Punjab (75.6%)
Manipur (72.3%)
India (33.6%)

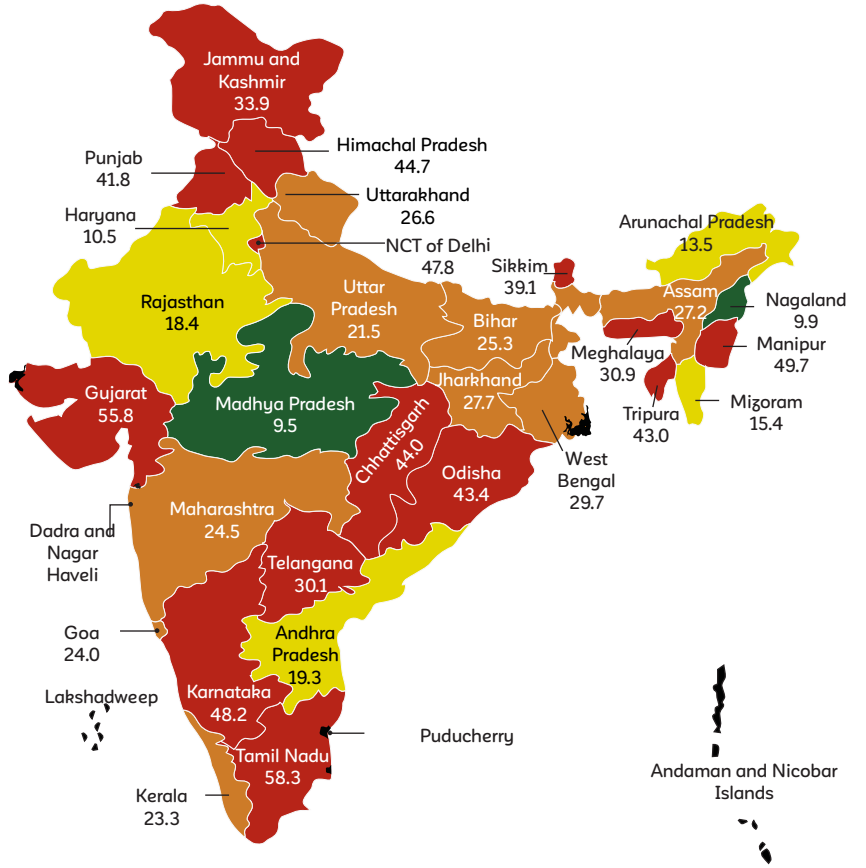
ZINC DEFICIENCY

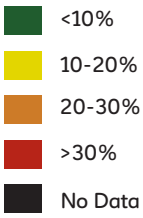
(Serum Zinc concentration < 70 µg/dl (morning fasting) and < 66 µg/dl (morning non-fasting) in non-pregnant females)



10-14 years(Girls)

Better Performing States
Nagaland (0%)
Mizoram (2.8%)
Bihar (15.3%)
Uttar Pradesh (18.7%)
Kerala (18.8%)
States with most challenges
Punjab (54.2%)
Meghalaya (51.8%)
Himachal Pradesh (51.0%)
Manipur (47.2%)
Odisha (43.0%)
India (26.6%)





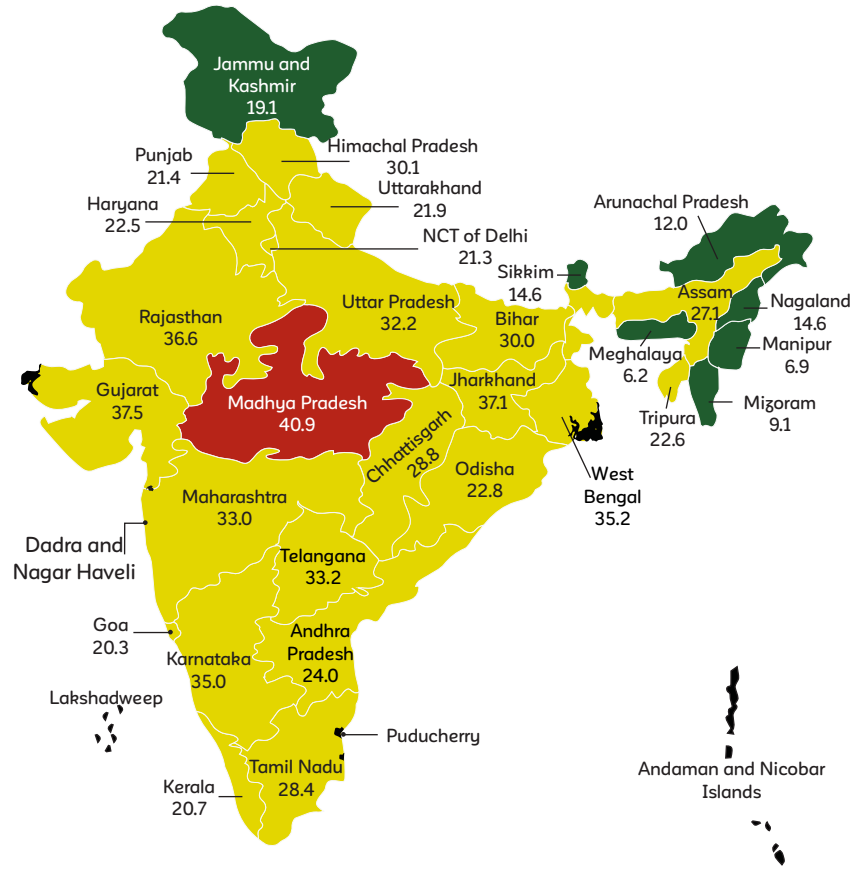
15-19 years(Girls)

Better Performing States
Madhya Pradesh (9.5%)
Nagaland (9.9%)
Haryana (10.5%)
Arunachal Pradesh (13.5%)
Mizoram (15.4%)
States with most challenges
Tamil Nadu (58.3%)
Gujarat (55.8%)
Manipur (49.7%)
Karnataka (48.2%)
Delhi (47.8%)
India (30.2%)

Prevalence of Visible Forms of Malnutrition in Adolescent Boys, CNNS 2016-18

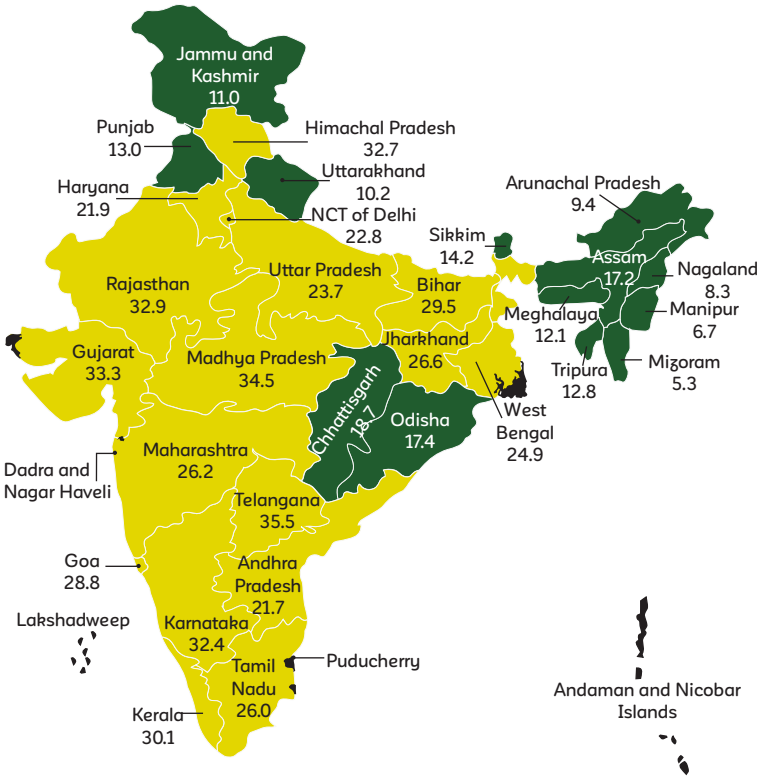
THIN

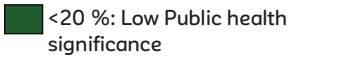
(BMI-for-age z-score<-2SD)



10-14 years (Boys)

Better Performing States
Meghalaya (6.2%)
Manipur (6.9%)
Mizoram (9.1%)
Arunachal Pradesh (12.0%)
Sikkim (14.6%)
States with most challenges
Madhya Pradesh (40.9%)
Gujarat (37.5%)
Jharkhand (37.1%)
Rajasthan (36.6%)
West Bengal (35.2%)
India (31.8%)



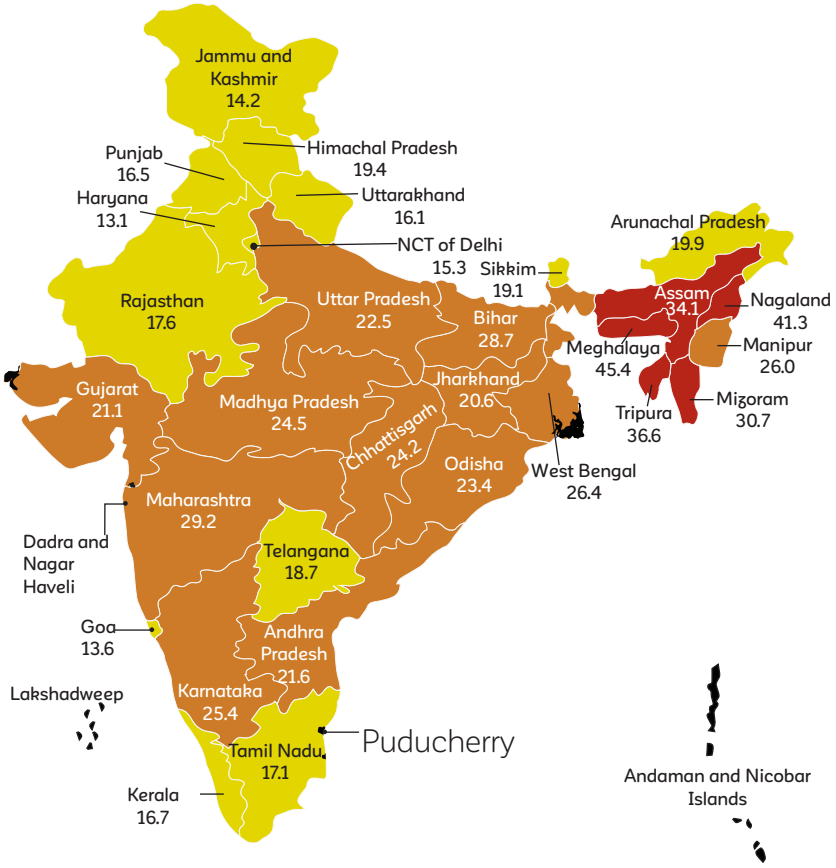


15-19 years (Boys)

Better Performing States
Mizoram (5.3%)
Manipur (6.7%)
Nagaland (8.3%)
Arunachal Pradesh (9.4%)
Uttarakhand (10.2%)
States with most challenges
Telangana (35.5%)
Madhya Pradesh (34.5%)
Gujarat (33.3%)
Rajasthan (32.9%)
Himachal Pradesh (32.7%)
India (26.3%)

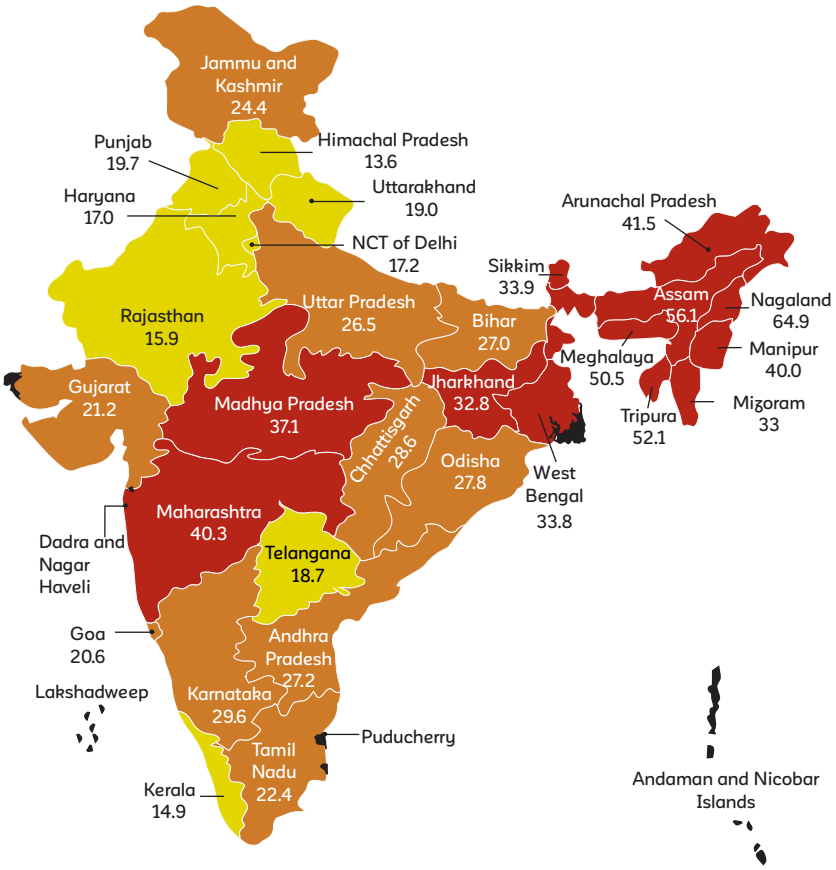
SHORT

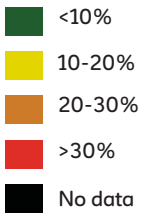
(Height-for-age z-score<-2SD)



10-14 years (Boys)

Better Performing States
Haryana (13.1%)
Goa (13.6%)
Jammu and Kashmir (14.2%)
Delhi (15.3%)
Uttarakhand (16.1%)
States with most challenges
Meghalaya (45.4%)
Nagaland (41.3%)
Tripura (36.6%)
Assam (34.1%)
Mizoram (30.7%)
India (23.2%)



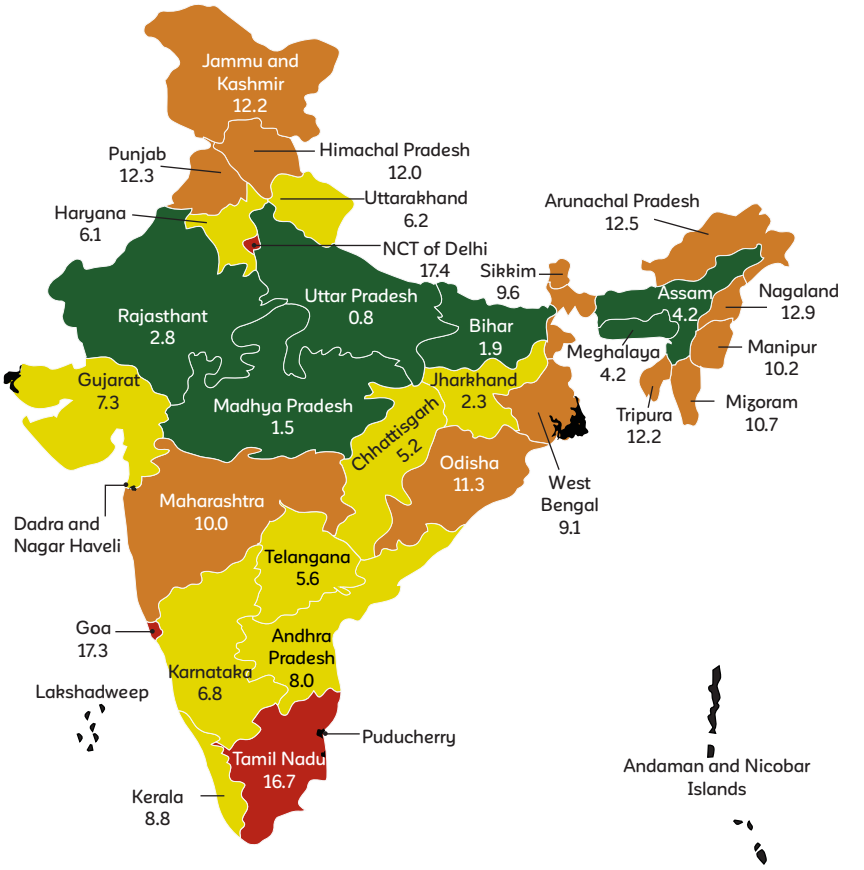


15-19 years(Boys)

Better Performing States
Himachal Pradesh (13.6%)
Kerala (14.9%)
Rajasthan (15.9%)
Haryana (17.0%)
Delhi (17.2%)
States with most challenges
Nagaland (64.9%)
Assam (56.1%)
Tripura (52.1%)
Meghalaya (50.5%)
Arunachal Pradesh (41.5%)
India (28.3%)

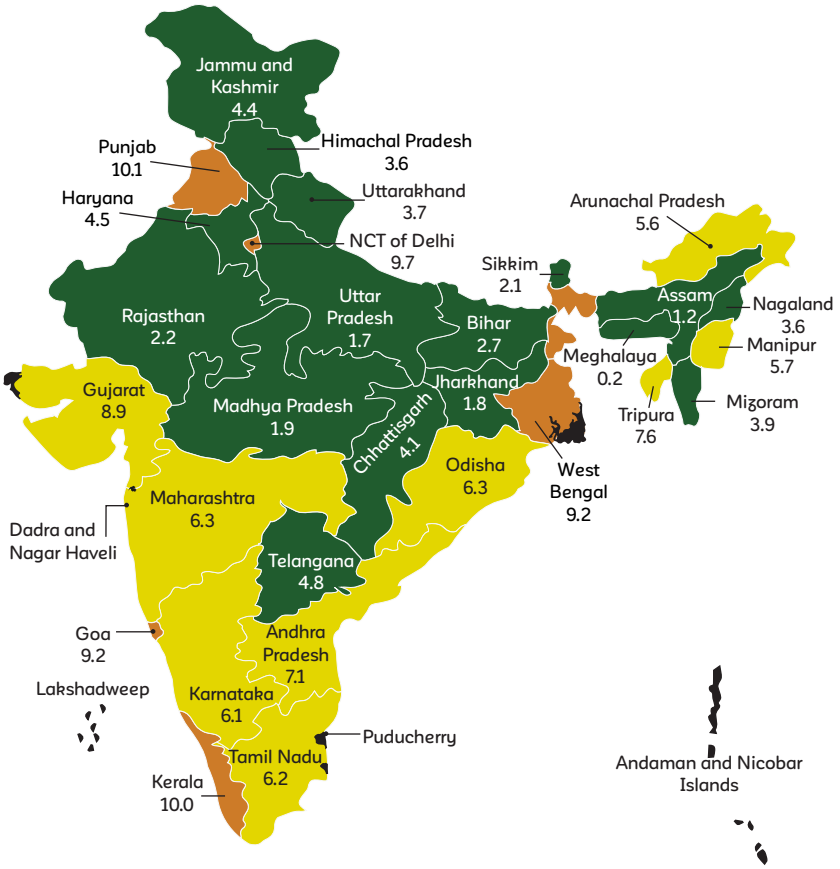
OVERWEIGHT/OBESE

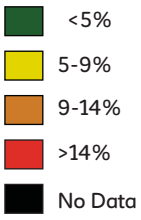
(BMI-for-age z-score>+1SD)



10-14 years (Boys)

Better Performing States
Uttar Pradesh (0.8%)
Madhya Pradesh (1.5%)
Bihar (1.9%)
Jharkhand (2.3%)
Rajasthan (2.8%)
States with most challenges
Delhi (17.4%)
Goa (17.3%)
Tamil Nadu(16.7%)
Nagaland (12.9%)
Arunachal Pradesh (12.5%)
India (5.3%)





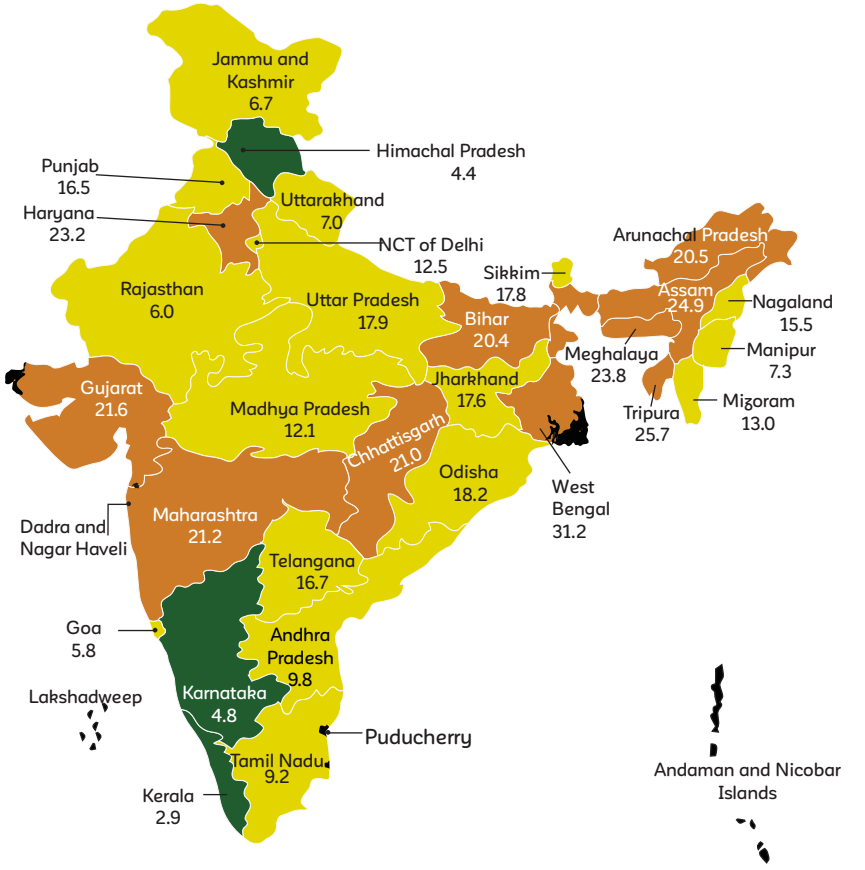
15-19 years (Boys)

Better Performing States
Meghalaya (0.2%)
Assam (1.2%)
Uttar Pradesh (1.7%)
Jharkhand (1.8%)
Madhya Pradesh (1.9%)
States with most challenges
Punjab (10.1%)
Kerala (10.0%)
Delhi (9.7%)
West Bengal (9.2%)
Goa (9.2%)
India (4.4%)

Prevalence of Anemia in Adolescent Boys, CNNS 2016-18

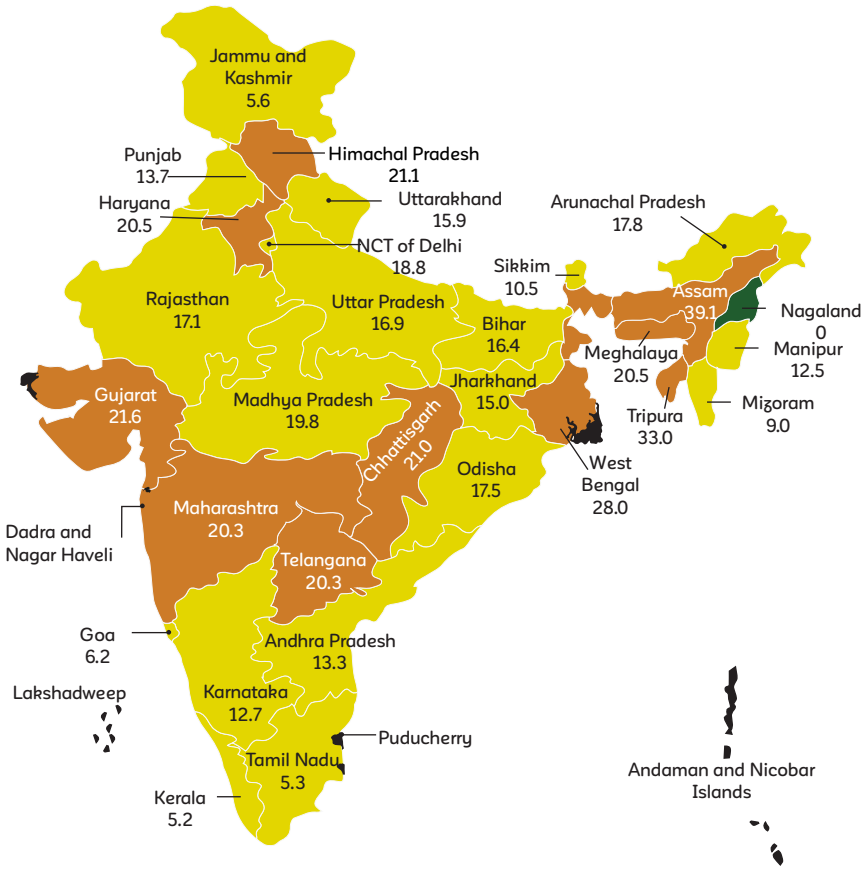
ANEMIC

(Hemoglobin levels <11.5 g/dl for 10–11 years, <12.0 g/dl for 12–14 years and <13.0 g/dl for 15–19 years)



10-14 years (Boys)

Better Performing States
Kerala (2.9%)
Himachal Pradesh (4.4%)
Karnataka (4.8%)
Goa (5.8%)
Jammu And Kashmir (6.7%)
States with most challenges
West Bengal (31.2%)
Meghalaya (23.8%)
Tripura (25.7%)
Assam (24.9%)
Haryana (23.2%)
India (17.1%)



<5%: No public health problem

5-19.9%: Mild public health problem

20-39.9%:Moderate public health problem

>40%:Severe public health problem

N/A

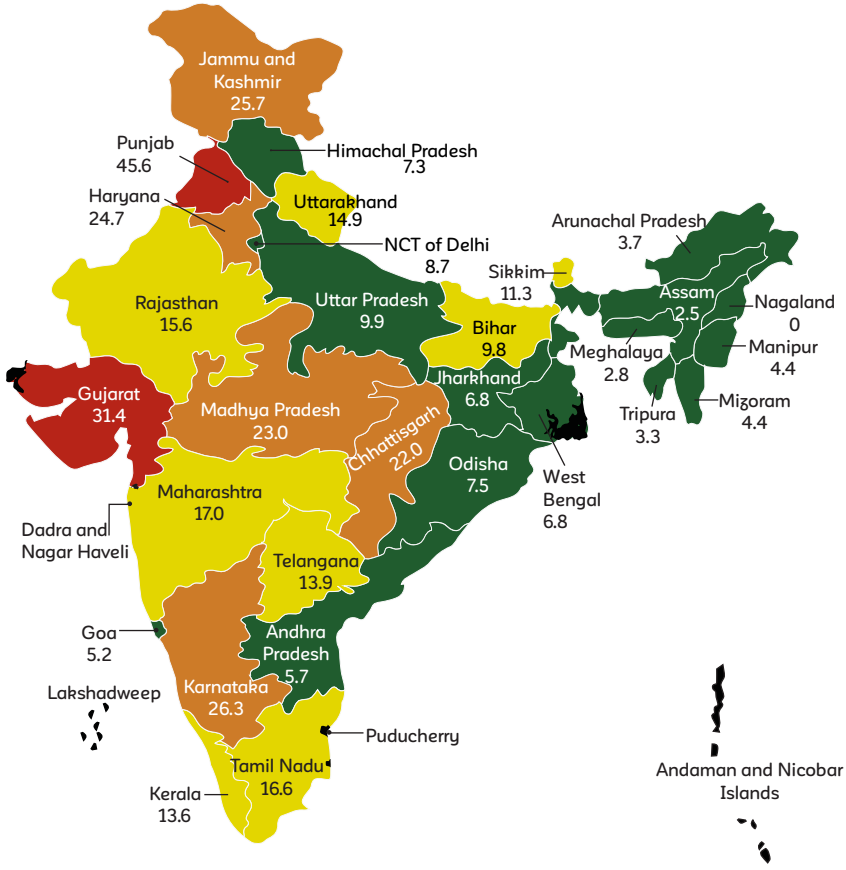
15-19 years (Boys)

Better Performing States
Nagaland (0.0)
Kerala (5.2%)
Tamil Nadu (5.3%)
Jammu & Kashmir (5.6%)
Goa (6.2%)
States with most challenges
Assam (39.1%)
Tripura (33.0%)
West Bengal (28.0%)
Himachal Pradesh (21.1%)
Chhattisgarh (21.0%)
India (18.1%)

Prevalence of Micronutrient Deficiencies in Adolescent Boys, CNNS 2016-18

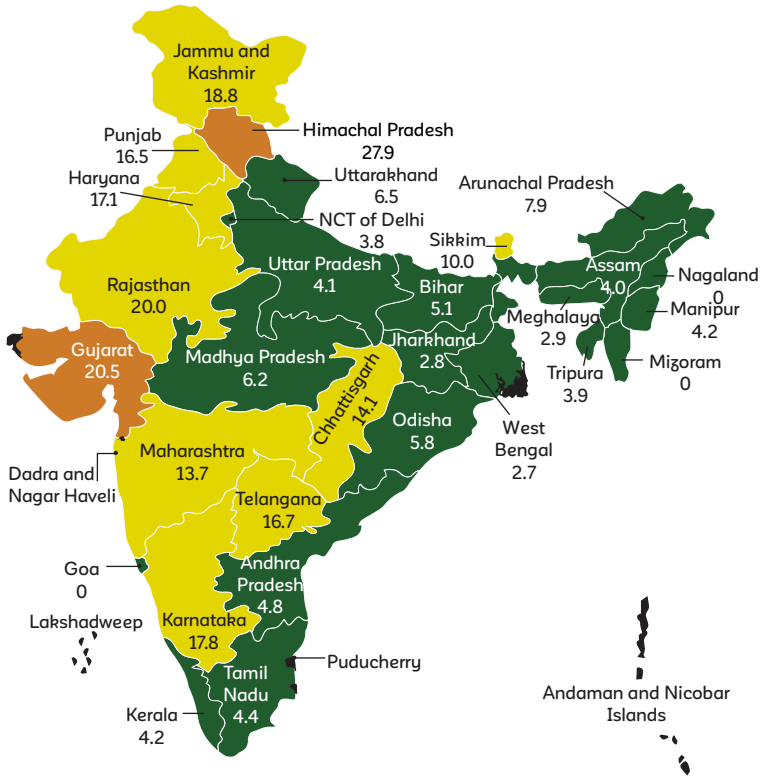
IRON DEFICIENCY

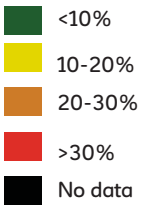
(Serum ferritin levels <15 µg/l; excluding cases with C-reactive protein > 5 mg/L)



10-14 years (Boys)

Better Performing States
Nagaland (0.0%)
Assam (2.5%)
Meghalaya (2.8%)
Tripura (3.3%)
Arunachal Pradesh (3.7%)
States with most challenges
Punjab (45.6%)
Gujarat (31.4%)
Karnataka (26.3%)
Jammu and Kashmir (25.7%)
Haryana (24.7%)
India (14.0%)



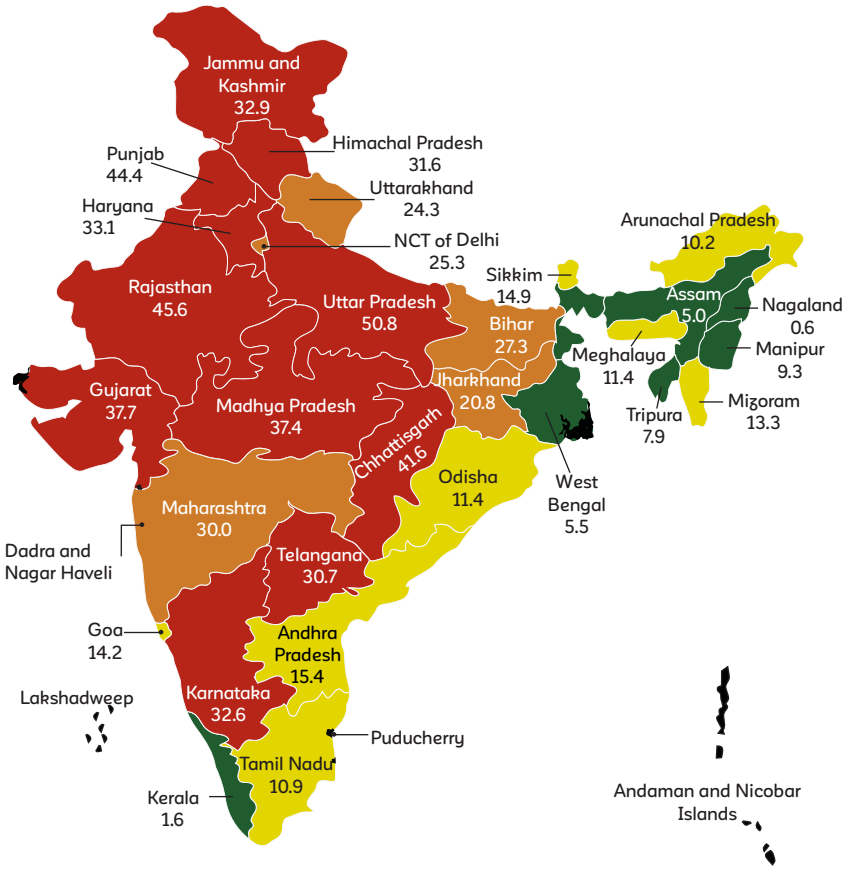


15-19 years (Boys)

Better Performing States
Goa (0.0%)
Mizoram (0.0%)
Nagaland (0.0%)
West Bengal (2.7%)
Jharkhand (2.8%)
States with most challenges
Himachal Pradesh (27.9%)
Gujarat (20.5%)
Rajasthan (20.0%)
Jammu And Kashmir (18.8%)
Karnataka (17.8%)
India (8.5%)

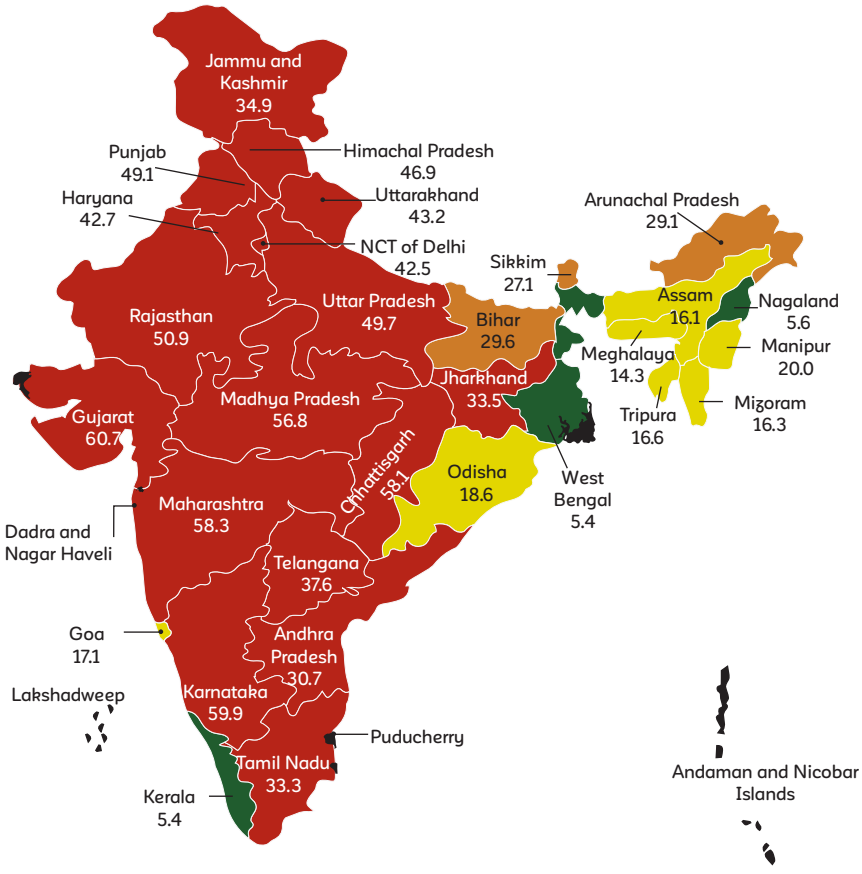
VITAMIN B_{12} DEFICIENCY

(Serum vitamin B_{12} < 203 pg/ml)



10-14 years (Boys)

Better Performing States
Nagaland (0.6%)
Kerala (1.6%)
Assam (5.0%)
West Bengal (5.5%)
Tripura (7.9%)
States with most challenges
Uttar Pradesh (50.8%)
Rajasthan (45.6%)
Punjab (44.4%)
Chhattisgarh (41.6%)
Gujarat (37.7%)
India (30.4%)



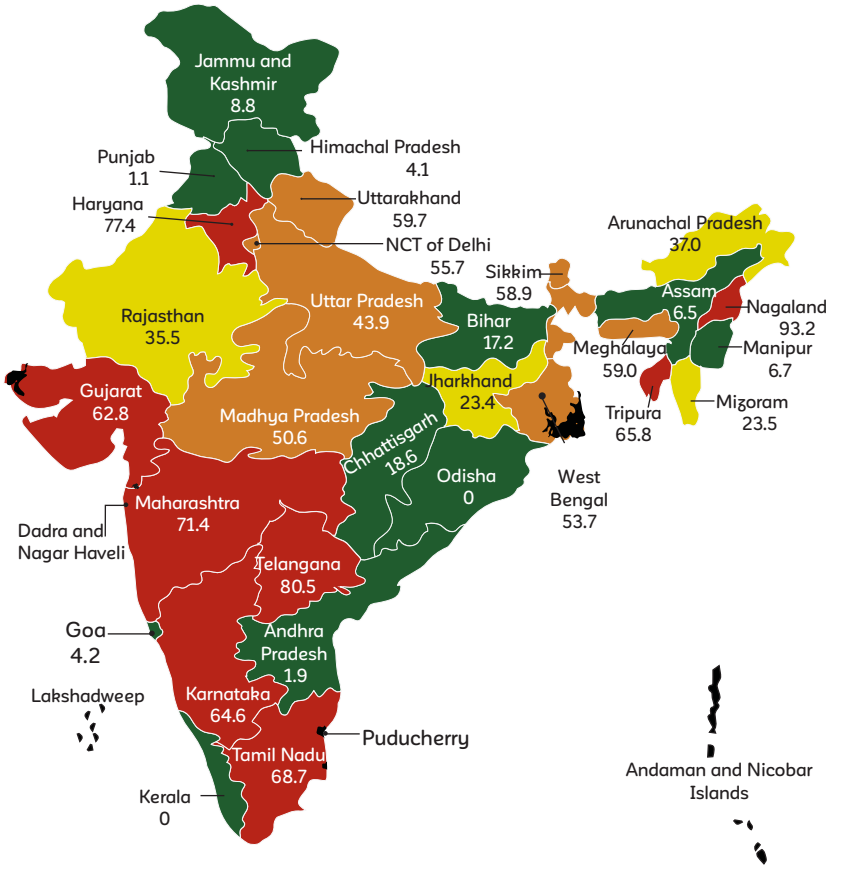
15-19 years (Boys)

Better Performing States
Nagaland (5.6%)
Kerala (5.4%)
West Bengal (5.4%)
Meghalaya (14.3%)
Assam (16.1%)
States with most challenges
Gujarat (60.7%)
Karnataka (59.9%)
Maharashtra (58.3%)
Chhattisgarh (58.1%)
Madhya Pradesh (56.8%)
India (40.5%)

- <10%
- 10-20%
- 20-30%
- >30%
- No data

FOLATE DEFICIENCY

(Serum erythrocyte folate < 151 ng/ml)



10-14 years (Boys)

Better Performing States
Kerala (0.0%)
Odisha (0.0%)
Punjab (1.1%)
Andhra Pradesh (1.9%)
Himachal Pradesh (4.1%)
States with most challenges
Nagaland (93.2%)
Telangana (80.5%)
Haryana (77.4%)
Maharashtra (71.4%)
Tamil Nadu (68.7%)
India (35.6%)

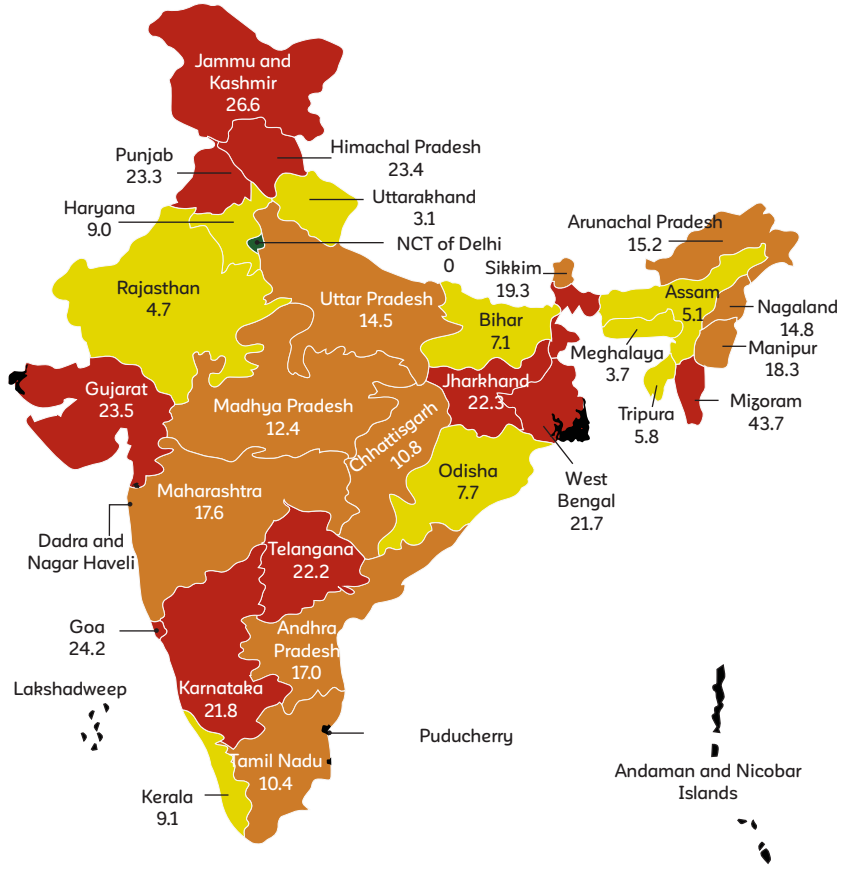
<20%
20-40%
40-60%
>60%
No data

15-19 years (Boys)

Better Performing States
West Bengal (0.0%)
Sikkim (0.7%)
Jammu and Kashmir (3.8%)
Himachal Pradesh (5.3%)
Tripura (5.5%
States with most challenges
Nagaland (96.4%)
Madhya Pradesh (84.8%)
Andhra Pradesh (81.1%)
Assam (80.5%)
Tamil nadu (80.0%)
India (43.7%)

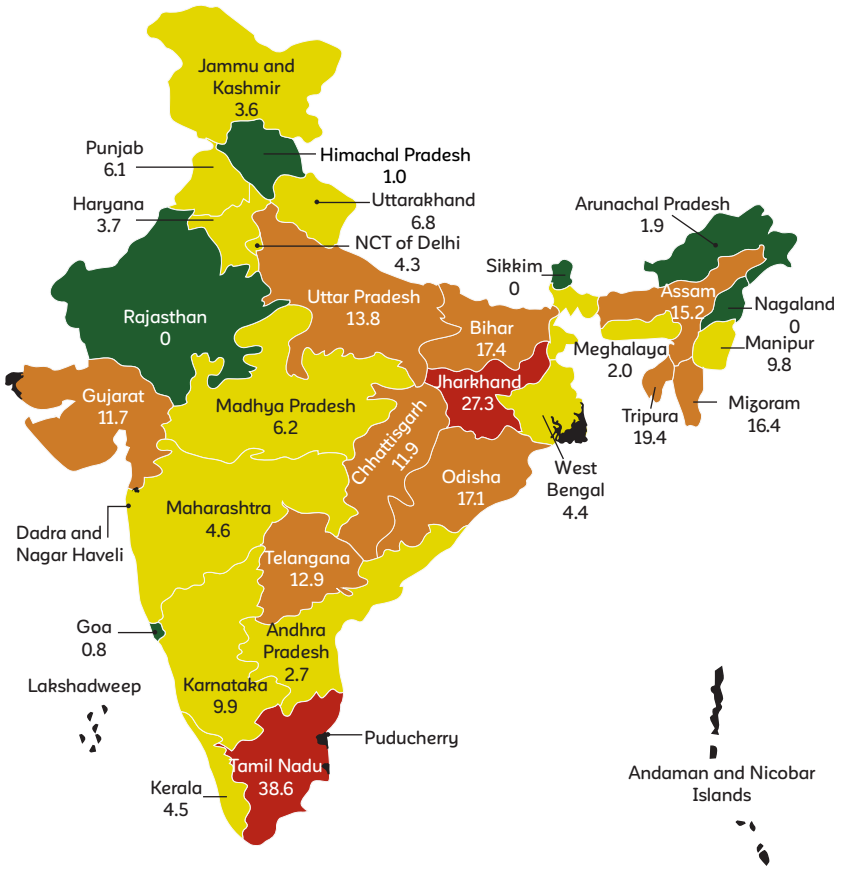
VITAMIN A DEFICIENCY

(Serum retinol concentration <20 µg/dL; excluding cases with C-reactive protein > 5 mg/L)



10-14 years (Boys)

Better Performing States
Delhi (0.0%)
Uttarakhand (3.1%)
Meghalaya (3.7%)
Rajasthan (4.7%)
Assam (5.1%)
States with most challenges
Mizoram (43.7%)
Jammu and Kashmir (26.6%)
Goa (24.2%)
Gujarat (23.5%)
Himachal Pradesh (23.4%)
India (17.8%)



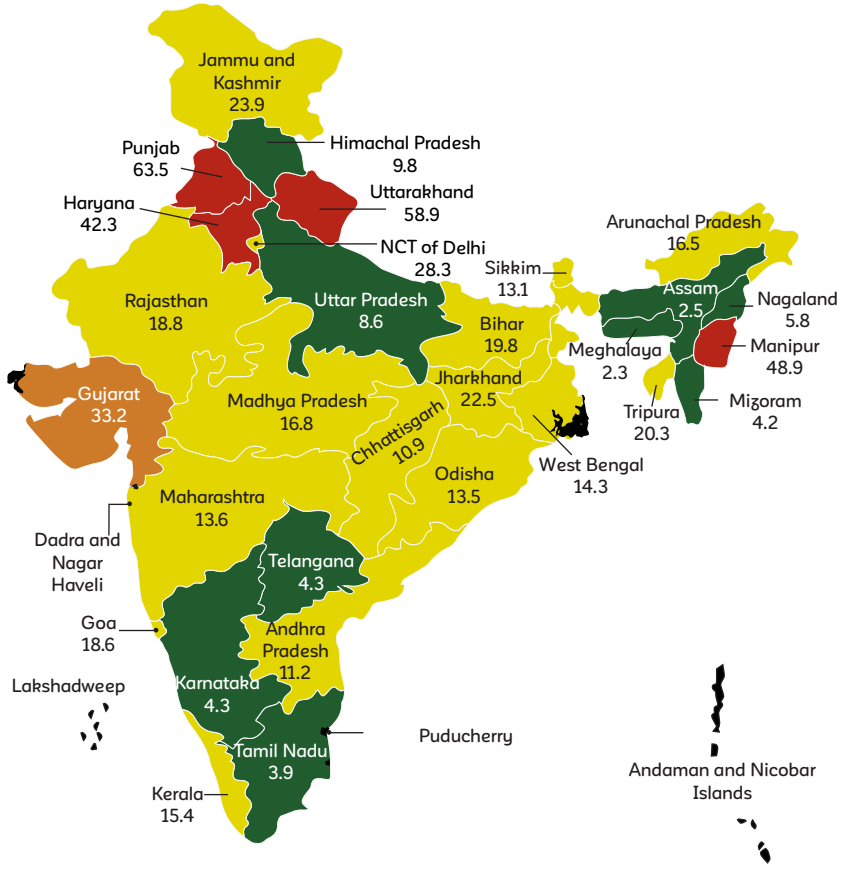
- <2%: No public health problem
- 2-9.9%: Mild public health problem
- 10-19.9%:Moderate public health problem
- >=20%:Severe public health problem
- No data

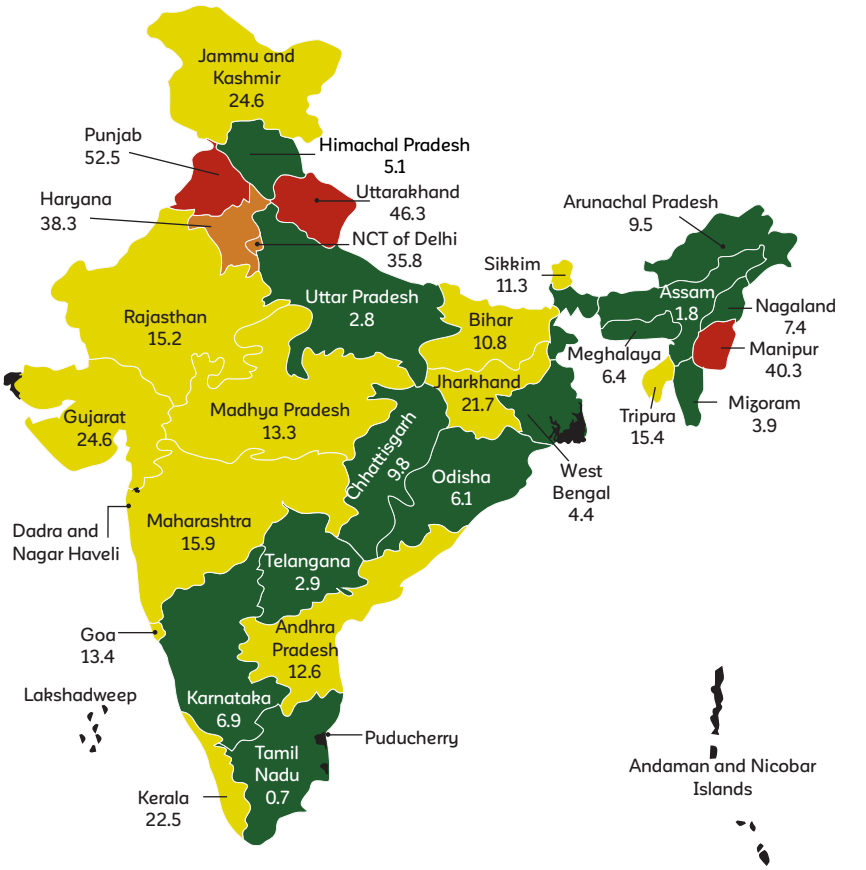
15-19 years (Boys)

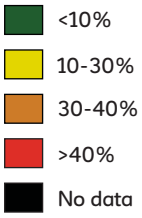
Better Performing States
Nagaland (0.0%)
Rajasthan (0.0%)
Sikkim (0.0%)
Goa (0.8%)
Himachal Pradesh (1.0%)
States with most challenges
Tamil Nadu (38.6%)
Jharkhand (27.3%)
Tripura (19.4%)
Bihar (17.4%)
Odisha (17.1%)
India (13.0%)

VITAMIN D DEFICIENCY

(Serum 25(OH)D concentration <12ng/mL)ä







10-14 years (Boys)

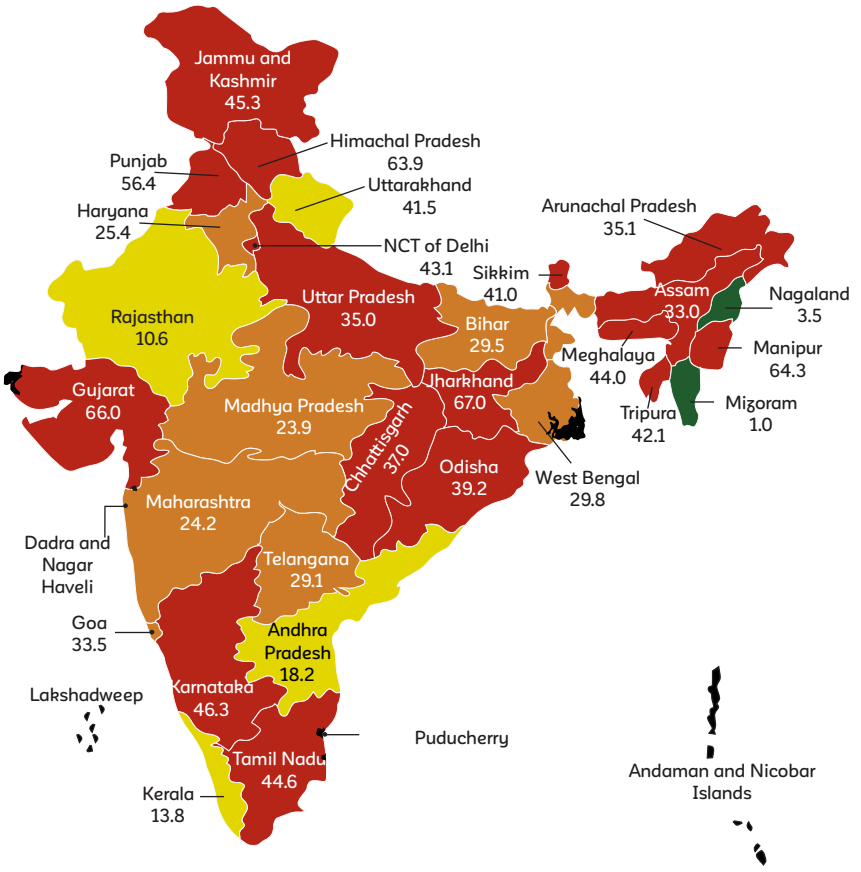
Better Performing States
Meghalaya (2.3%)
Assam (2.5%)
Tamil Nadu (3.9%)
Mizoram (4.2%)
Karnataka (4.3%)
States with most challenges
Punjab (63.5%)
Uttarakhand (58.9%)
Manipur (48.9%)
Haryana (42.3%)
Gujarat (33.2%)
India (15.6%)

15-19 years (Boys)

Better Performing States
Tamil Nadu (0.7%)
Assam (1.8%)
Uttar Pradesh (2.8%)
Telangana (2.9%)
Mizoram (3.9%)
States with most challenges
Punjab (52.5%)
Uttarakhand (46.3%)
Manipur (40.3%)
Haryana (38.3%)
Delhi (35.8%)
India (11.6%)

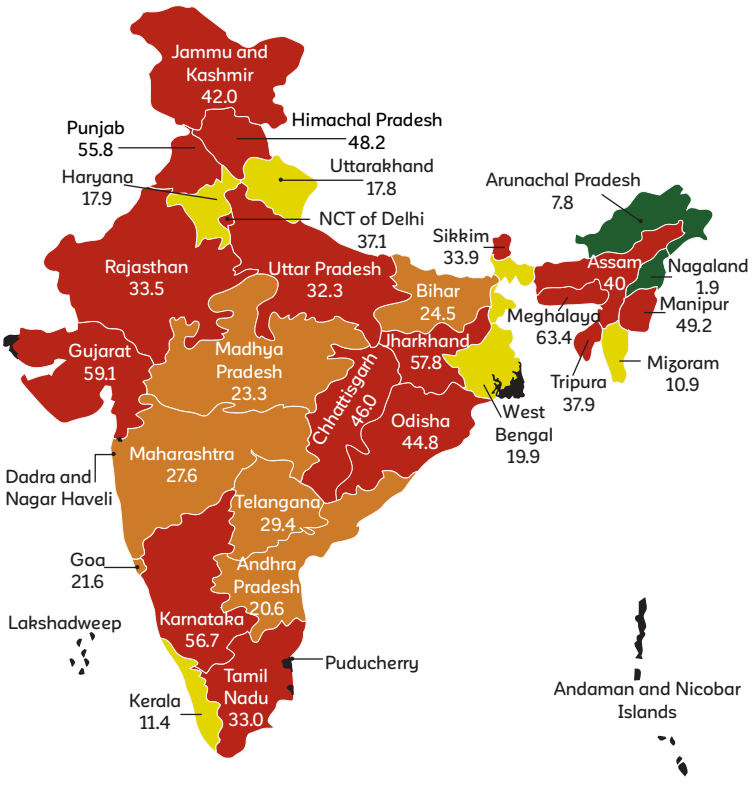
ZINC DEFICIENCY

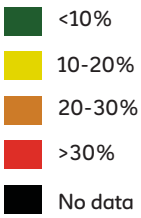
(Serum zinc concentration < 74 µg/dl (morning fasting) and < 70 µg/dl (morning non-fasting) in males)



10-14 years (Boys)

Better Performing States
Mizoram (1.0%)
Nagaland (3.5%)
Rajasthan (10.6%)
Kerala (13.8%)
Andhra Pradesh (18.2%)
States with most challenges
Jharkhand (67.0%)
Gujarat (66.0%)
Manipur (64.3%)
Himachal Pradesh (63.9%)
Punjab (56.4%)
India (36.08%)





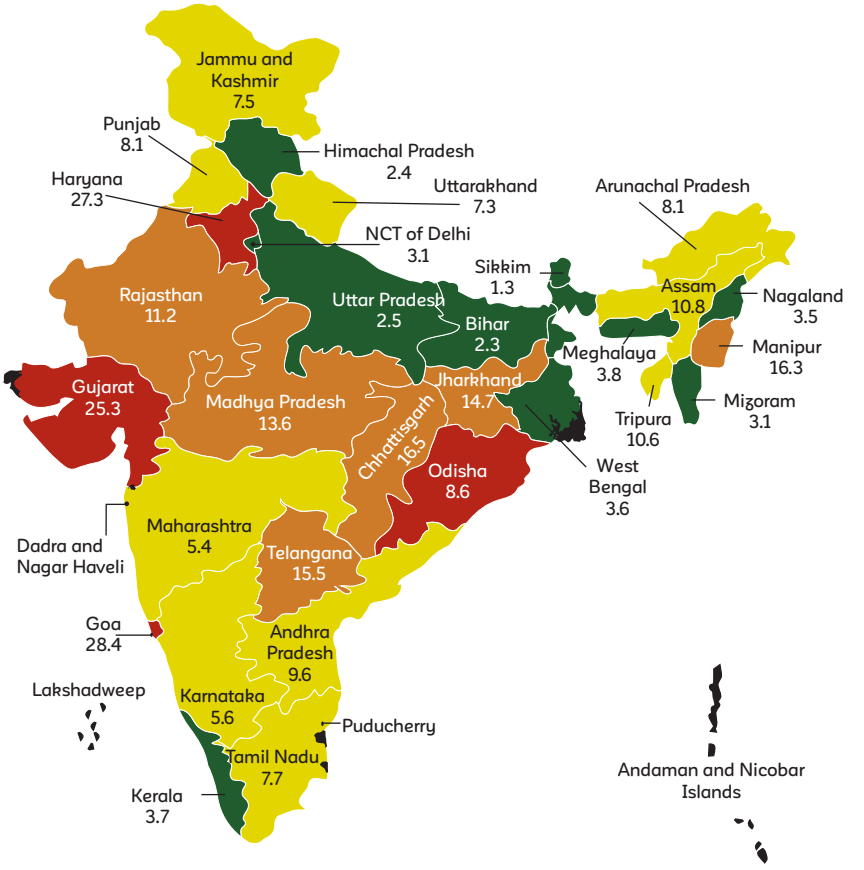
15-19 years (Boys)

Better Performing States
Nagaland (1.9%)
Arunachal Pradesh (7.8%)
Mizoram (10.9%)
Kerala (11.4%)
Uttarakhand (17.8%)
States with most challenges
Meghalaya (63.4%)
Gujarat (59.9%)
Jharkhand (57.8%)
Karnataka (56.7%)
Punjab (55.8%)
India (34.2%)

Prevalence of Risk Factors for Non-Communicable Diseases in Adolescent Girls, CNNS 2016-18

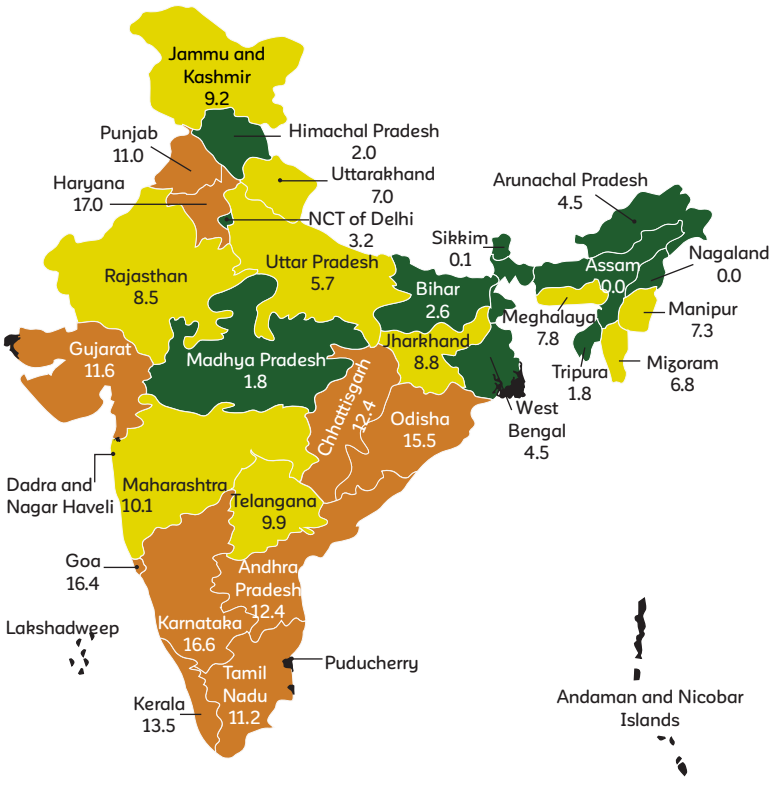
RISK OF DIABETES

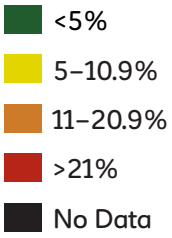
(Glycosylated Haemoglobin (HbA1c) level >5.6% &≤6.4%)



10-14 years (Girls)

Better Performing States
Sikkim (1.3%)
Bihar (2.3%)
Himachal Pradesh (2.4%)
Uttar Pradesh (2.5%)
Delhi (3.1%)
States with most challenges
Goa (28.4%)
Haryana (27.3%)
Gujarat (25.3%)
Chhattisgarh (16.5%)
Manipur(16.3%)
India (7.9%)



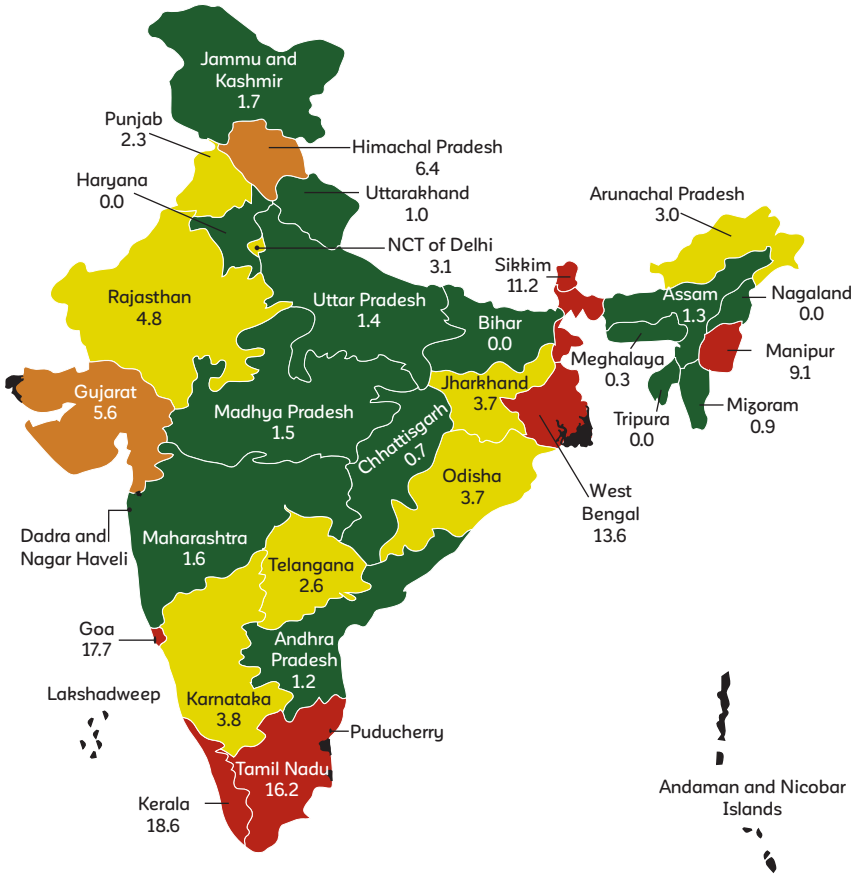


15-19 years (Girls)

Better Performing States
Assam (0.0%)
Nagaland (0.0%)
Sikkim (0.1%)
Madhya Pradesh (1.8%)
Tripura (1.8%)
States with most challenges
Haryana (17.0%)
Karnataka (16.6%)
Goa (16.4%)
Odisha (15.5%)
Kerala (13.5%)
India (7.4%)

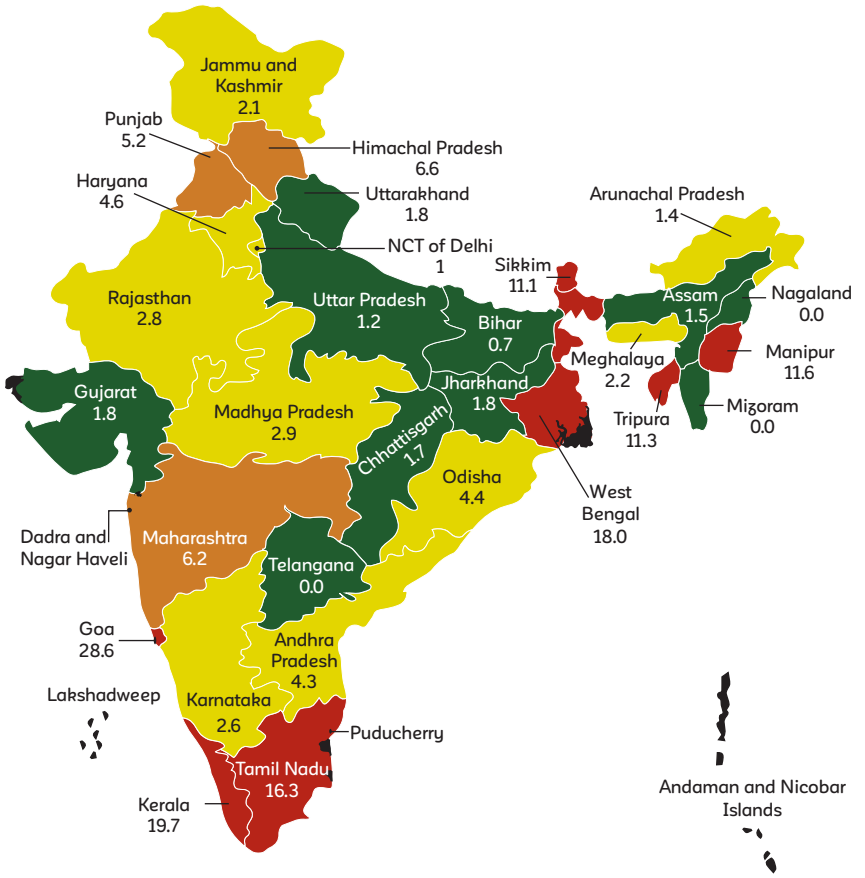
HIGH LDL ("BAD") CHOLESTEROL

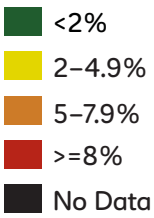
(High LDL or "Bad" cholesterol ≥ 130 mg/dl)



10-14 years (Girls)

Better Performing States
Bihar (0.0%)
Nagaland (0.0%)
Tripura (0.0%)
Haryana (0.0%)
Meghalaya (0.33%)
States with most challenges
Kerala (18.6%)
Goa (17.7%)
Tamil Nadu (16.2%)
West Bengal (13.6%)
Sikkim (11.2%)
India (4.1%)



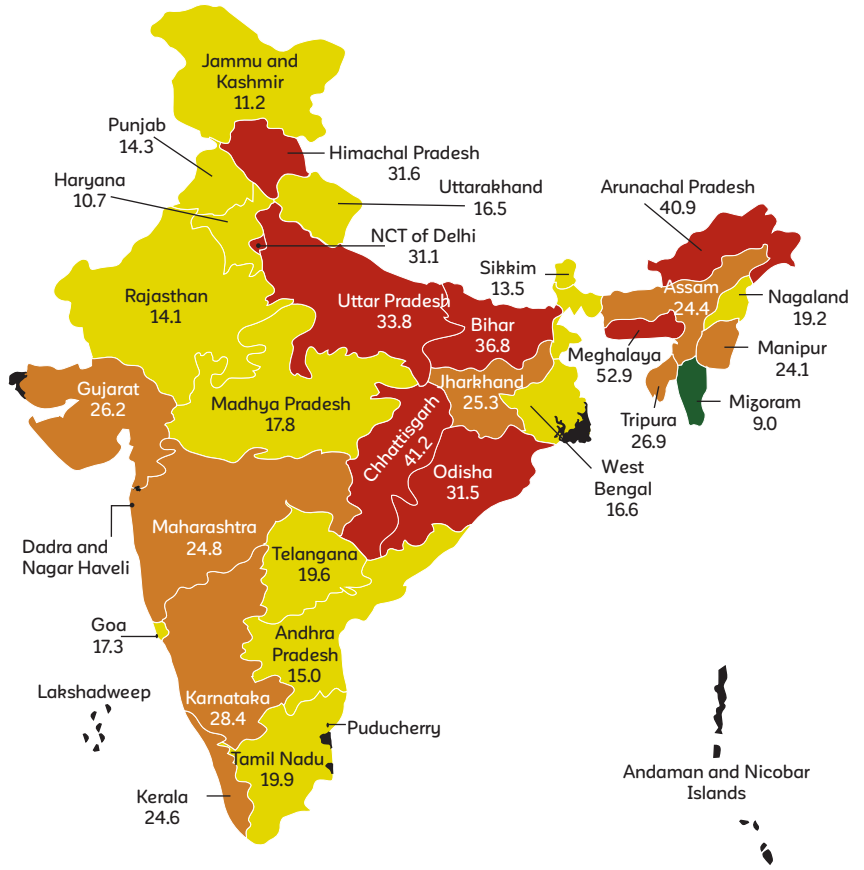


15-19 years (Girls)

Better Performing States
Nagaland (0.0%)
Mizoram (0.0%)
Telangana (0.0%)
Bihar (0.7%)
Uttar Pradesh (1.2%)
States with most challenges
Goa (28.6%)
Kerala (19.7%)
West Bengal (18.0%)
Tamil Nadu (16.3%)
Manipur (11.6%)
India (4.3%)

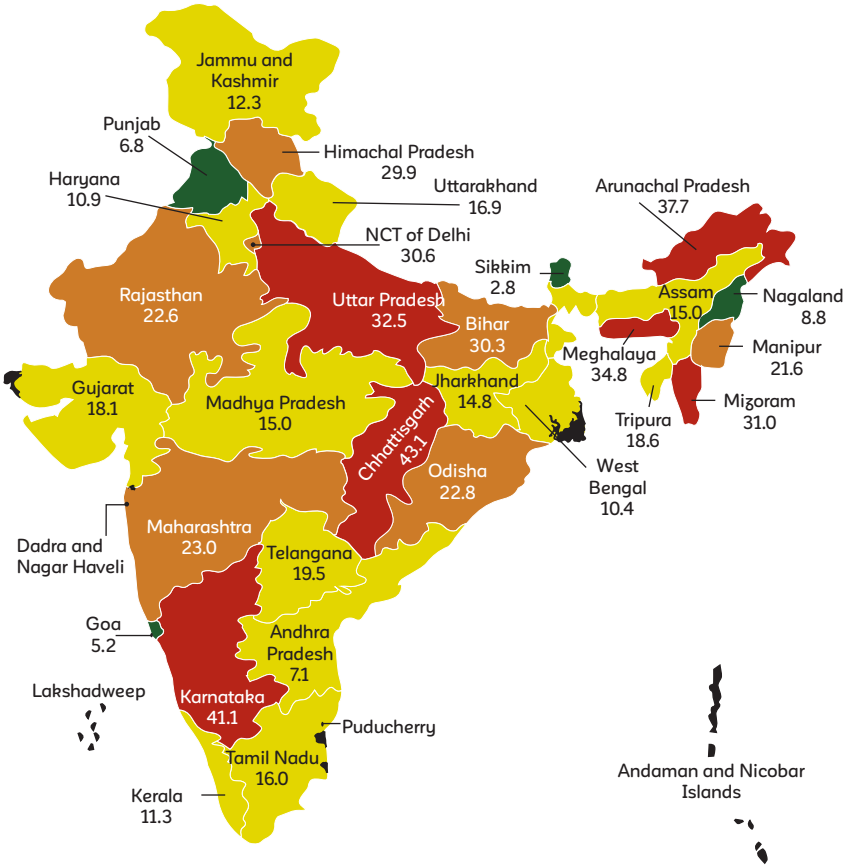
LOW HDL ("GOOD") CHOLESTEROL

(Low HDL or "Good" cholesterol < 40 mg/dl)



10-14 years(Girls)

Better Performing States
Mizoram (9.0%)
Haryana (10.7%)
Jammu And Kashmir (11.2%)
Sikkim (13.5%)
Rajasthan (14.1%)
States with most challenges
Meghalaya (52.9%)
Chhattisgarh (41.2%)
Arunachal Pradesh (40.9%)
Bihar (36.8%)
Uttar Pradesh (33.8%)
India (26.0%)



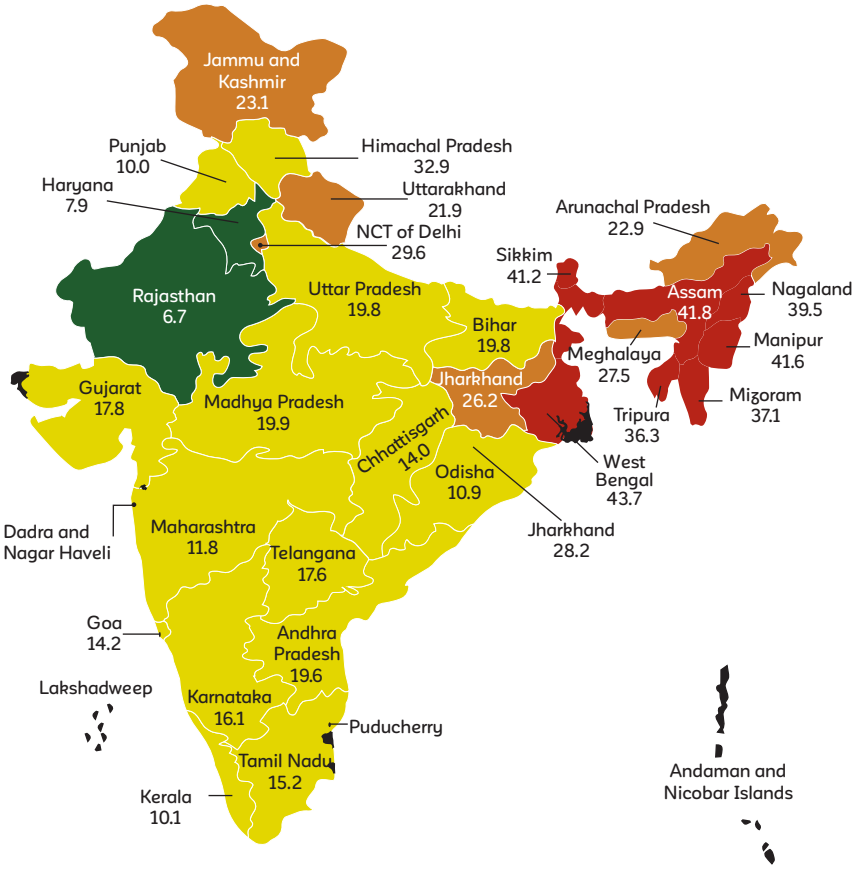
<10%
10–20.9%
21–30.9%
>=31%
No Data

15-19 years (Girls)

Better Performing States
Sikkim (2.8%)
Goa (5.2%)
Punjab (6.8%)
Andhra Pradesh (7.1%)
Nagaland (8.78%)
States with most challenges
Chhattisgarh (43.1%)
Karnataka (41.1%)
Arunachal Pradesh (37.7%)
Meghalaya (34.8%)
Uttar Pradesh (32.5%)
India (23.8%)

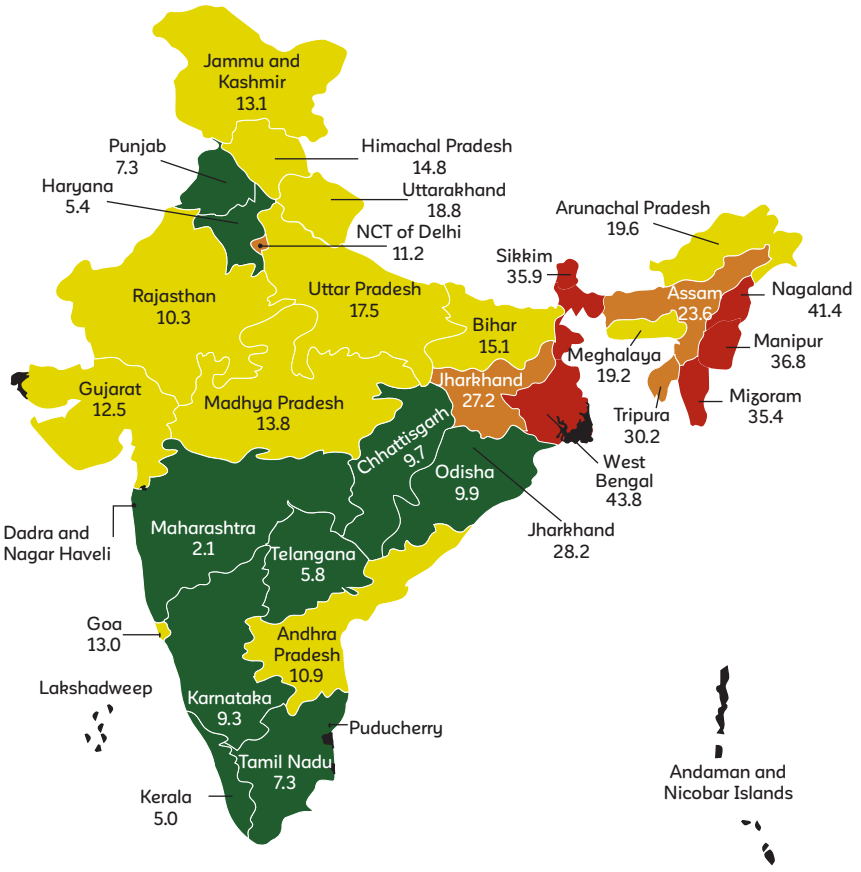
HIGH TRIGLYCERIDES

(High Triglycerides ≥ 130 mg/dl)



10-14 years (Girls)

Better Performing States
Rajasthan (6.7%)
Haryana (7.9%)
Punjab (10.0%)
Kerala (10.1%)
Odisha (10.9%)
States with most challenges
West Bengal (43.7%)
Assam (41.8%)
Manipur (41.6%)
Sikkim (41.2%)
Nagaland (39.5%)
India (20.3%)



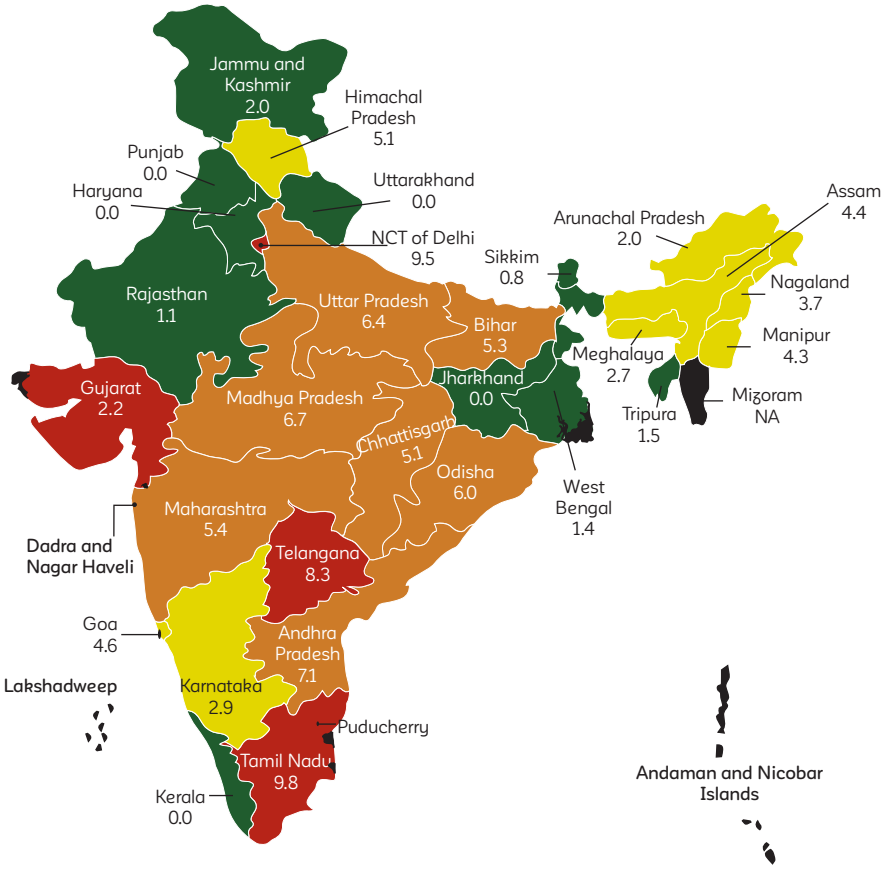
- <10%
- 10–20.9%
- 21–30.9%
- >=31%
- No Data

15-19 years (Girls)

Better Performing States
Maharashtra (2.1%)
Kerala (5.0%)
Haryana (5.4%)
Telangana (5.8%)
Punjab (7.3%)
States with most challenges
West Bengal (43.8%)
Nagaland (41.4%)
Manipur (36.8%)
Sikkim (35.9%)
Mizoram (35.4%)
India (15.8%)

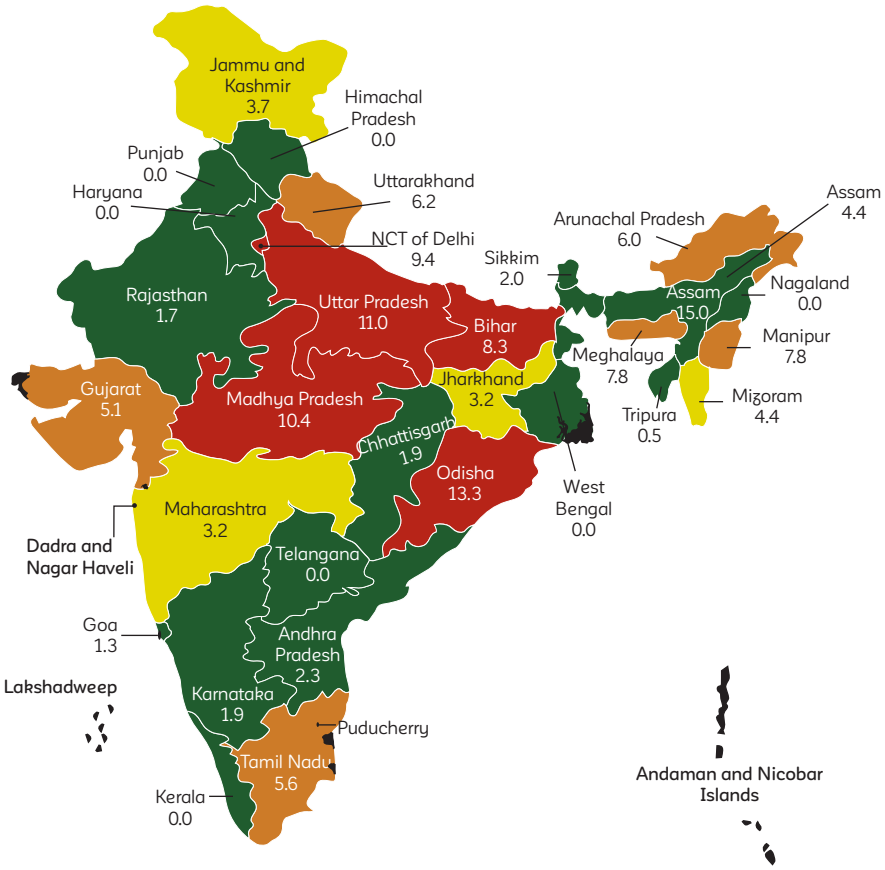
HYPERTENSIVE

(systolic blood pressure level ≥ 140 mmHg, or diastolic blood pressure level ≥ 90 mmHg)



10-14 years (Girls)

Better Performing States
Haryana (0.0%)
Jharkhand (0.0%)
Kerala (0.0%)
Punjab (0.0%)
Uttarakhand (0.0%)
States with most challenges
Tamil Nadu (9.8%)
Delhi (9.5%)
Telangana (8.3%)
Andhra Pradesh (7.1%)
Madhya Pradesh (6.7%)
India (5.0%)



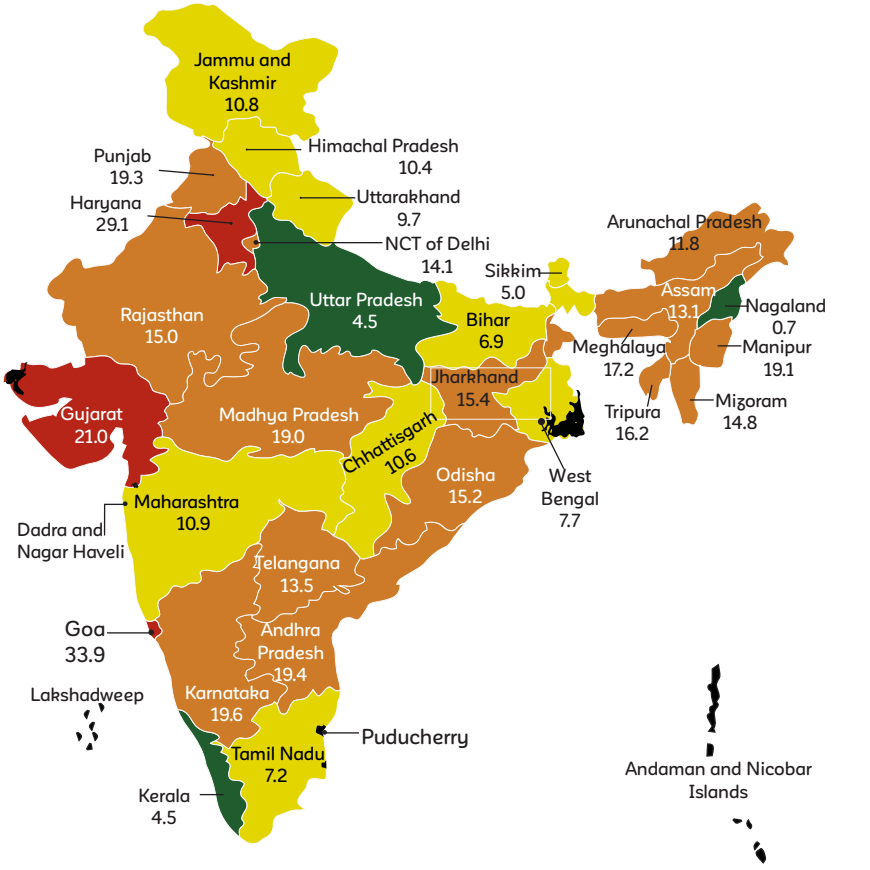
15-19 years (Girls)

Better Performing States
Haryana (0.0%)
Himachal Pradesh (0.0%)
Nagaland (0.0%)
Punjab (0.0%)
Telangana (0.0%)
States with most challenges
Odisha (13.3%)
Uttar Pradesh (11.0%)
Madhya Pradesh (10.4%)
Delhi (9.4%)
Bihar (8.3%)
India (5.0%)

Prevalence of Risk Factors for Non-Communicable Diseases in Adolescent Boys, CNNS 2016-18

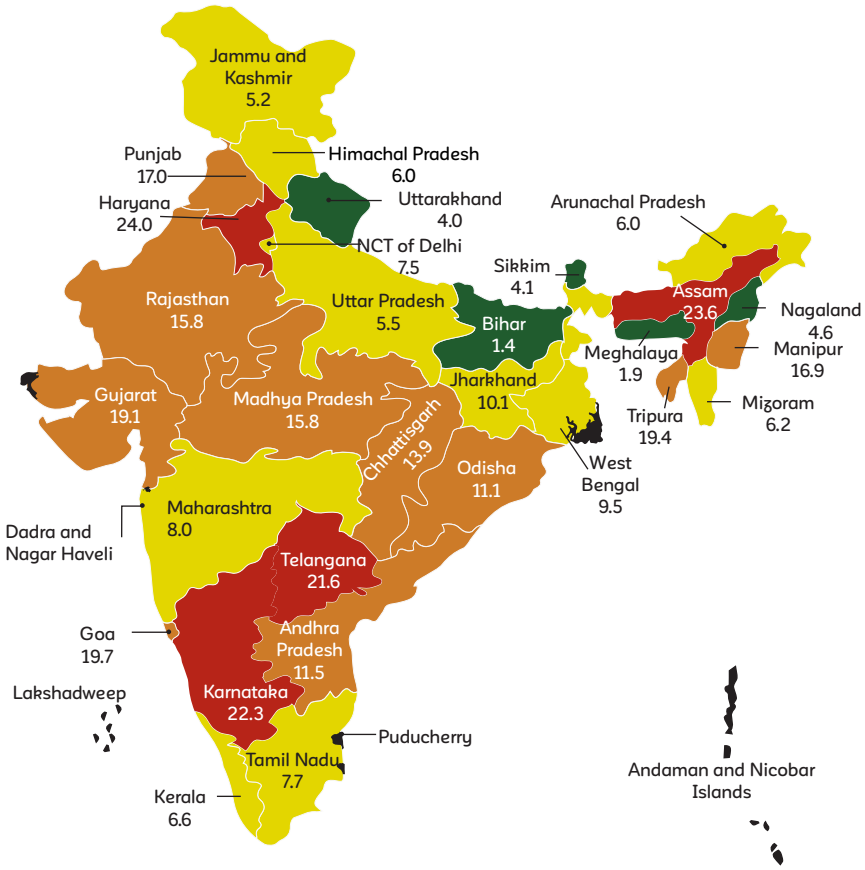
RISK OF DIABETES

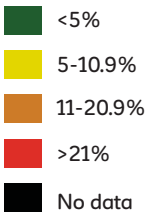
(Glycosylated Haemoglobin (HbA1c) level >5.6% &≤6.4%)



10-14 years (Boys)

Better Performing States
Nagaland (0.7%)
Kerala (4.5%)
Uttar Pradesh (4.5%)
Sikkim (5.0%)
Bihar (6.9%)
States with most challenges
Goa (33.9%)
Haryana (29.1%)
Gujarat (21.0%)
Karnataka (19.6%)
Andhra Pradesh (19.4%)
India (11.7%)



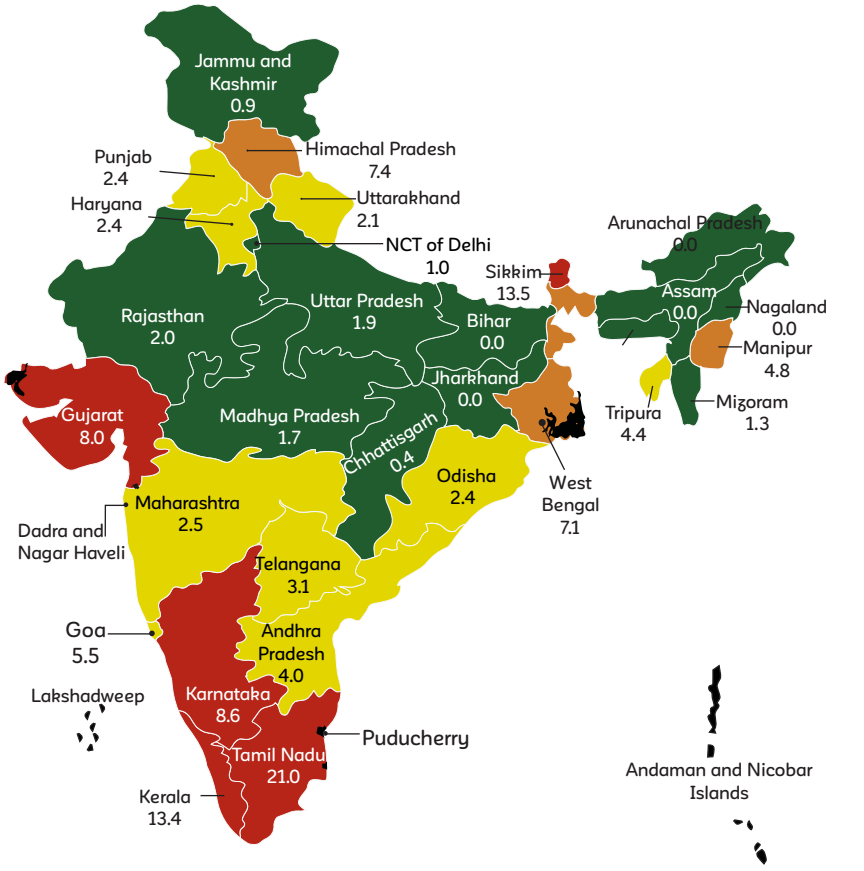


15-19 years (Boys)

Better Performing States
Bihar (1.4%)
Meghalaya (1.9%)
Uttarakhand (4.0%)
Sikkim (4.1%)
Nagaland (4.6%)
States with most challenges
Haryana (24.0%)
Assam (23.6%)
Karnataka (22.3%)
Telangana (21.6%)
Goa (19.7%)
India (10.9%)

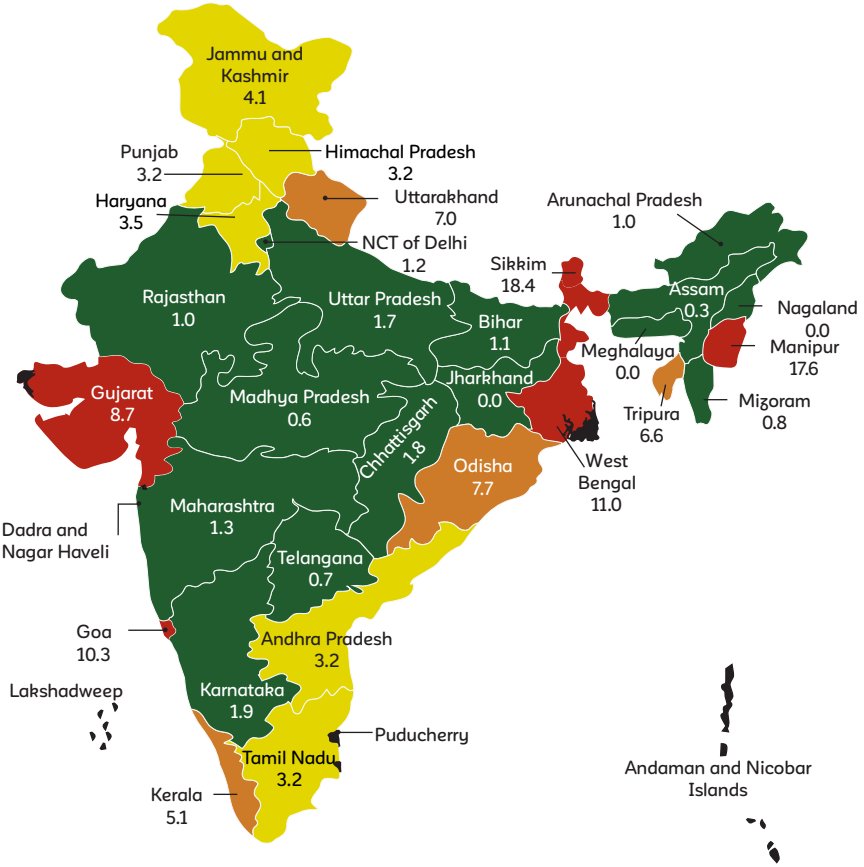
HIGH LDL ("BAD") CHOLESTEROL

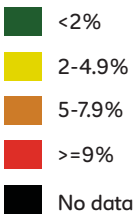
(High LDL or "Bad" cholesterol ≥ 130 mg/dl)



10-14 years (Boys)

Better Performing States
Arunachal Pradesh (0.0%)
Assam (0.0%)
Bihar (0.0%)
Jharkhand (0.0%)
Nagaland (0.0%)
States with most challenges
Tamil Nadu (21.0%)
Sikkim (13.5%)
Kerala (13.4%)
Karnataka (8.6%)
Gujarat (8.0%)
India (3.8%)



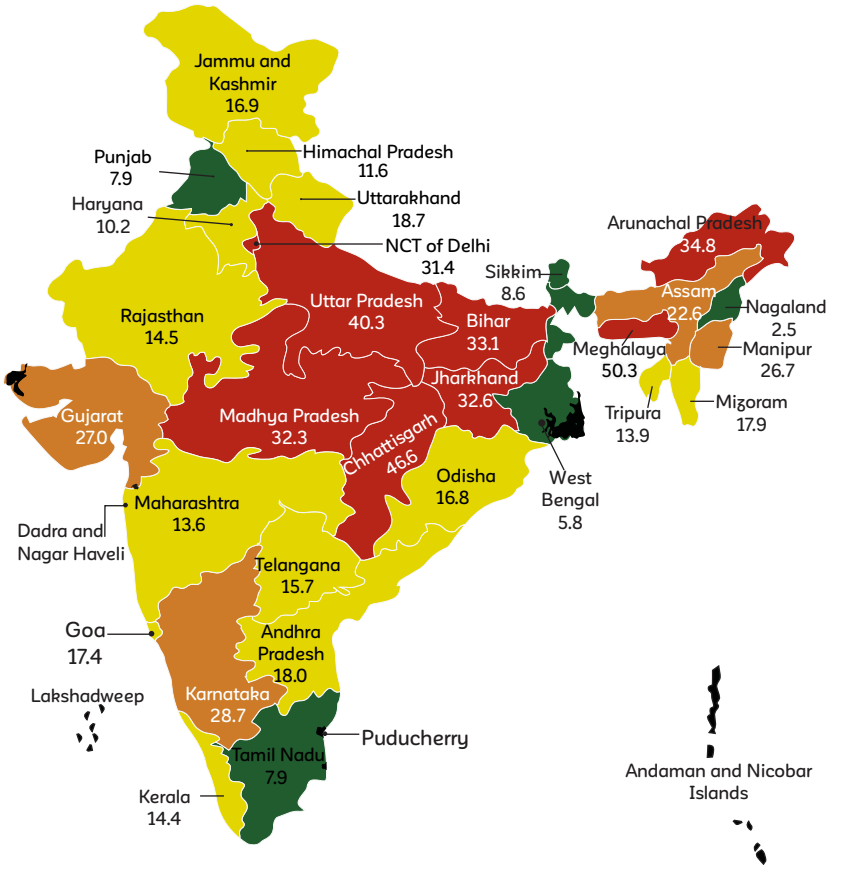


15-19 years (Boys)

Better Performing States
Jharkhand(0.0%)
Meghalaya(0.0%)
Nagaland(0.0%)
Assam(0.3%)
Madhya Pradesh(0.6%)
States with most challenges
Sikkim(18.4%)
Manipur(17.6%)
West Bengal(11.0%)
Goa(10.3%)
Gujarat(8.7%)
India (3.0%)

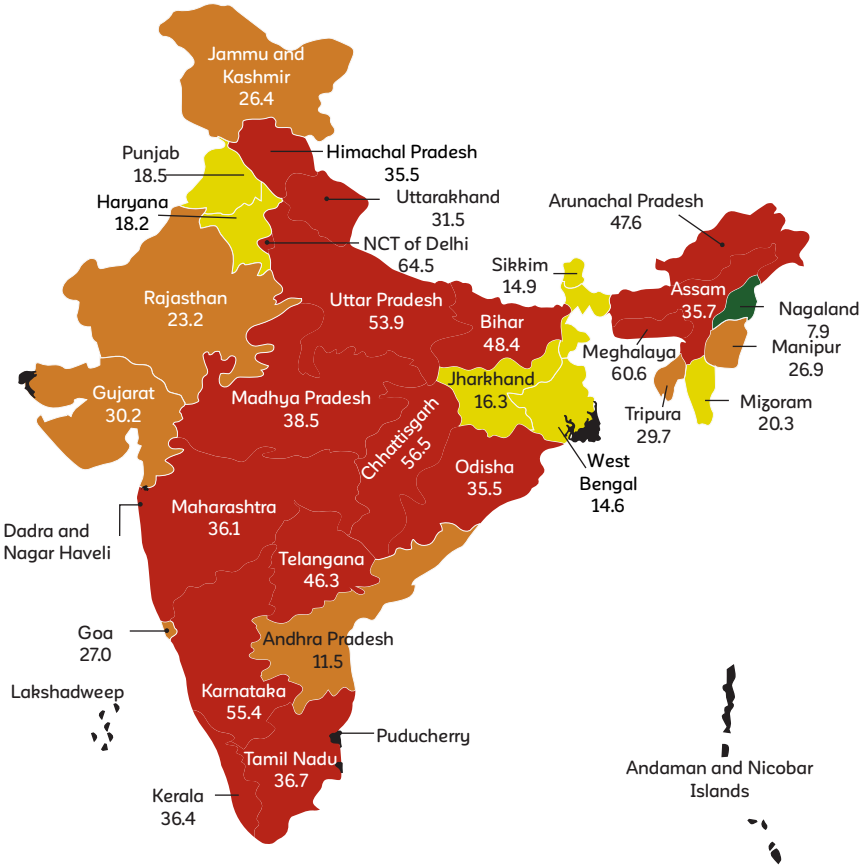
LOW HDL ("GOOD") CHOLESTEROL

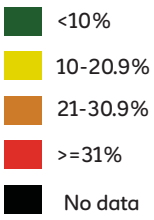
(Low HDL or "Good" cholesterol < 40 mg/dl)



10-14 years (Boys)

Better Performing States
Nagaland (2.5%)
West Bengal (5.8%)
Punjab (7.9%)
Tamil Nadu (7.9%)
Sikkim (8.6%)
States with most challenges
Meghalaya (50.3%)
Chhattisgarh (46.6%)
Uttar Pradesh (40.3%)
Arunachal Pradesh (34.8%)
Bihar (33.1%)
India (25.6%)



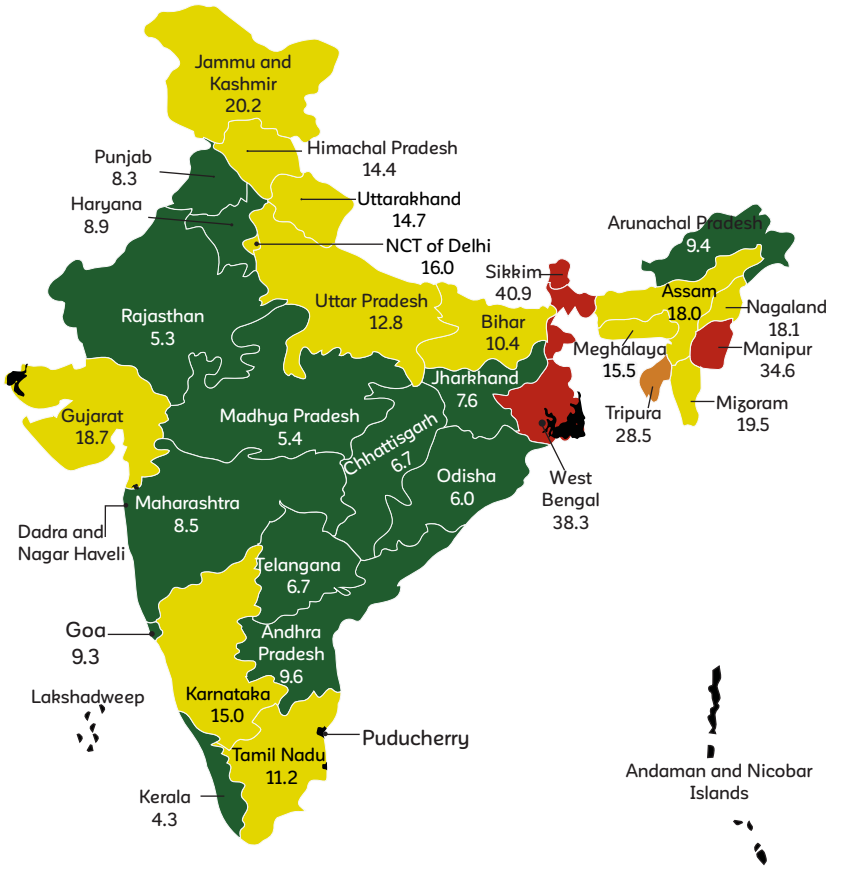


15-19 years (Boys)

Better Performing States
Nagaland (7.9%)
West Bengal (14.6%)
Sikkim (14.9%)
Jharkhand (16.3%)
Haryana (18.2%)
States with most challenges
Delhi (64.5%)
Meghalaya (60.6%)
Chhattisgarh (56.5%)
Karnataka (55.4%)
Uttar Pradesh (53.9%)
India (38.6%)

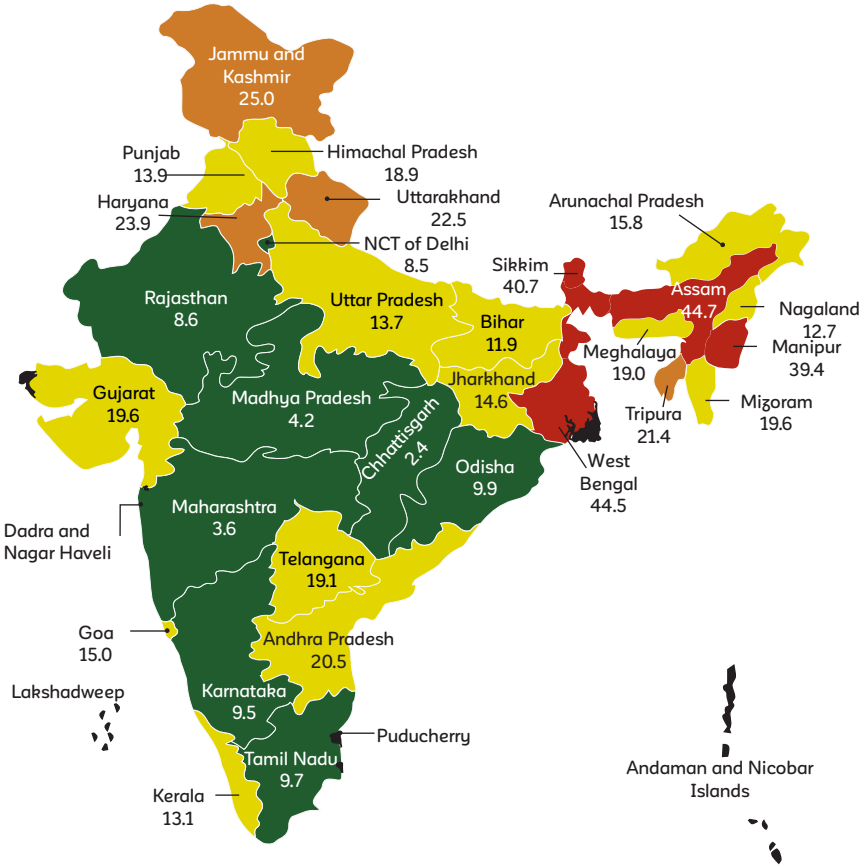
HIGH TRIGLYCERIDES

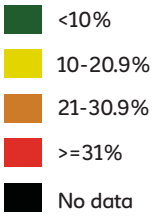
(High Triglycerides ≥ 130 mg/dl)



10-14 years (Boys)

Better Performing States
Kerala (4.3%)
Rajasthan (5.3%)
Madhya Pradesh (5.4%)
Odisha (6.0%)
Chhattisgarh (6.7%)
States with most challenges
Sikkim (40.9%)
West Bengal (38.3%)
Manipur (34.6%)
Tripura (28.5%)
Jammu & Kashmir (20.2%)
India (12.9%)



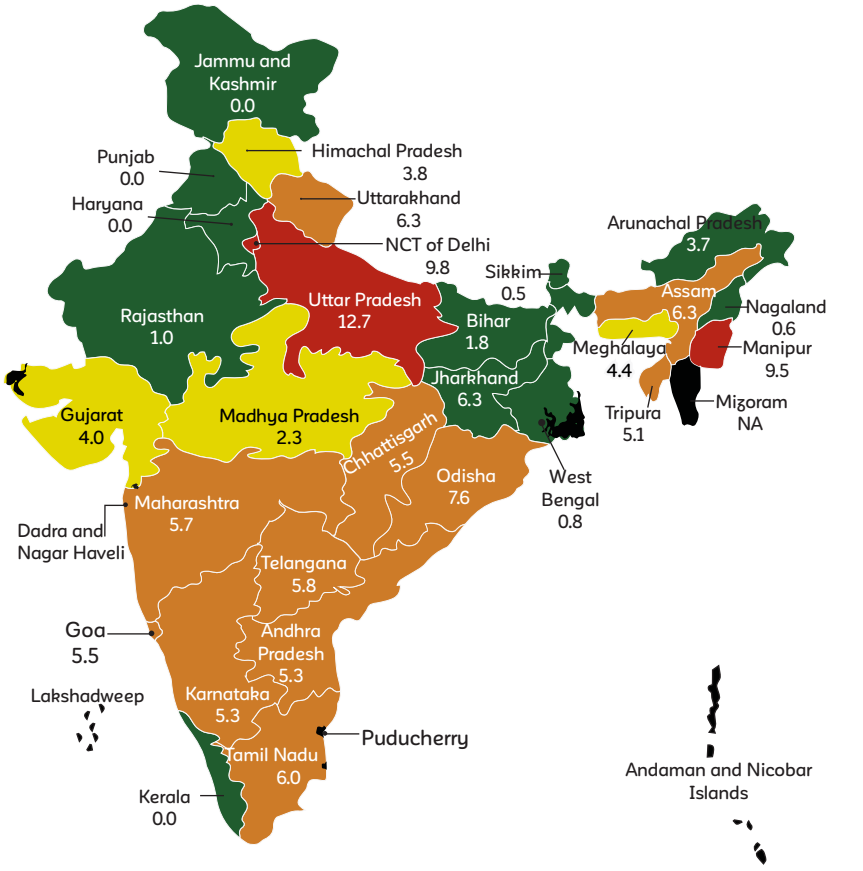


15-19 years (Boys)

Better Performing States
Chhattisgarh (2.4%)
Maharashtra (3.6%)
Madhya Pradesh (4.2%)
Delhi (8.5%)
Rajasthan (8.6%)
States with most challenges
Assam (44.7%)
West Bengal (44.5%)
Sikkim (40.7%)
Manipur (39.4%)
Jammu & Kashmir (25.0%)
India (15.5%)

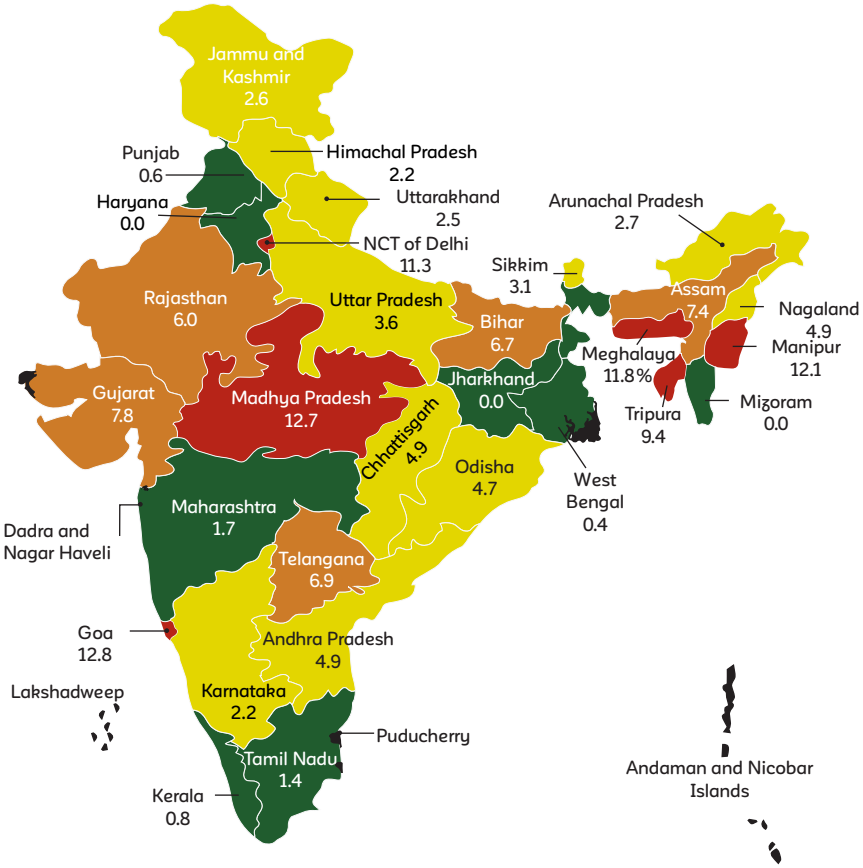
HYPERTENSIVE

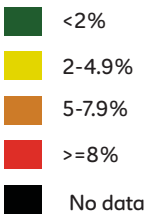
(systolic blood pressure level ≥ 140 mmHg, or diastolic blood pressure level ≥ 90 mmHg)



10-14 years (Boys)

Better Performing States
Haryana (0.0%)
Jammu & Kashmir (0.0%)
Kerala (0.0%)
Punjab (0.0%)
Sikkim (0.0%)
States with most challenges
Uttar Pradesh (12.7%)
Delhi (9.8%)
Manipur (9.5%)
Odisha (7.6%)
Uttarakhand (6.3%)
India (4.8%)





15-19 years (Boys)

Better Performing States
Haryana (0.0%)
Jharkhand (0.0%)
Mizoram (0.0%)
West Bengal (0.44%)
Punjab (0.58%)
States with most challenges
Goa (12.8%)
Madhya Pradesh (12.7%)
Manipur (12.1%)
Meghalaya (11.8%)
Delhi (11.3%)
India (4.6%)

Annexure 1: Sociodemographic characteristics of analytical sample based on which findings are presented in this report

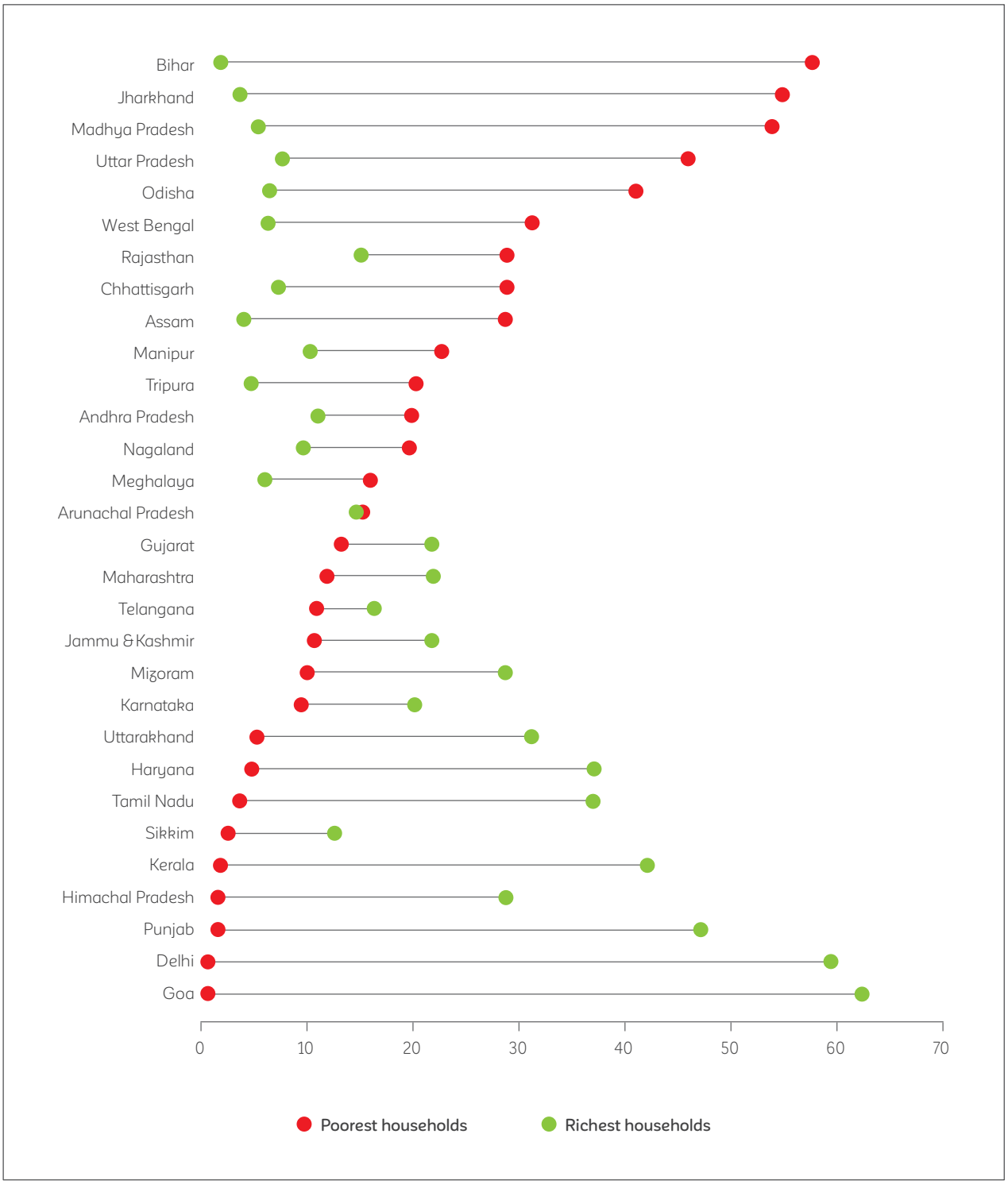
Sociodemographic characteristics (%)	Age group					
	10-14 years			15-19 years		
	Overall	Girls	Boys	Overall	Girls	Boys
Schooling Status						
Currently in School	86	85	87	63	59	67
Not in School	14	15	13	37	41	33
Residence						
Urban	24	24	24	26	25	27
Rural	76	76	76	74	75	73
Religion						
Hindu	80	79	81	80	79	82
Muslim	15	16	15	15	16	14
Christian	2	2	2	2	2	2
Sikh	1	1	1	1	1	1
Others	1	1	1	1	1	1
Caste/Tribe						
Scheduled Caste	22	22	23	23	23	23
Schedulef Tribe	11	10	12	11	12	10
Other Backward Class	41	42	40	42	42	43
Other	26	26	25	24	23	25
Wealth Index						
Poorest	22	21	22	18	20	16
Poor	21	21	21	19	19	19
Middle	19	19	19	21	20	21
Rich	19	20	18	21	21	22
Richest	19	18	20	21	20	21
Mother's Education						
No schooling	50	51	49	56	58	54
<5 years completed	7	7	7	7	6	7

(Continued)

(Continued)

Sociodemographic characteristics (%)	Age group					
	10-14 years			15-19 years		
	Overall	Girls	Boys	Overall	Girls	Boys
5-7 years completed	14	14	14	13	13	13
8-9 years completed	12	13	12	11	11	12
10-11 years completed	8	8	9	7	6	8
12 or more years completed	8	8	8	6	6	7
Mother's Occupation						
Unemployed	61	62	60	64	64	64
Employed	38	37	39	34	34	34
Father's Occupation						
Unemployed	2	3	2	4	4	4
Working in Agricultural Sector	33	32	34	36	35	36
Working in non-agricultural sector	64	65	64	60	60	59

Annexure 2: Where do the poorest adolescents live in India (%)



Annexure 3: Nutrient rich sources (Top 10) and consequences of deficiency/excess among adolescents

Nutrients	Consequences of deficiency/excess	Food items (Top 10)	Nutritive Value (per 100 g)
Iron	• Low blood hemoglobin concentration (Iron deficiency anemia) • Impaired motor and neural development, and cognitive function • Limits growth spurt • Impaired immune function and reduced resistance to infection • Produces fatigue and reduces physical endurance • Adversely affects learning and scholastic performance, and diminished work productivity later in life • Produces behavior alteration • Negatively affect bone mass (bone protective effects) • Affects reproductive physiology	Poultry, chicken, liver Bengal gram whole Horse gram whole Amaranth leaves, red Raisins Bajra Fenugreek leaves Ragi Lotus root Egg, whole, raw	9.9mg 9.5 mg 8.8mg 7.3mg 6.8mg 6.4mg 5.7mg 4.6mg 3.3mg 1.8mg
Folate	• Causes megaloblastic anemia • Elevates plasma homo-cysteine levels which increases susceptibility to cardiovascular diseases • May cause peripheral neuropathy, mental confusion and depression	Catla fish Moth beans Rajma Soybean Spinach Field beans (tender, lean) Field beans (tender, broad) Mustard leaves Beetroot Mango, ripe, Himsagar	1926µg 349µg 316µg 297µg 142µg 127µg 123µg 110µg 97.4µg 90.9µg
Vitamin B_{12}	• Impairs utilization of folate, causing increase in homo-cysteine levels. Hence, may lead to development of cardiovascular symptoms • Megaloblastic anemia • Irreversible poor memory and cognitive function, leading to neurological problems	Clams (steamed) Mussels (steamed) Mackerel (Atlantic, cooked, dry-heat) Crab (Alaska king, steamed) Salmon (chinook, cooked, dry-heat) Rockfish (cooked, dry-heat) Milk (skim) Brie (cheese) Egg (poached) Chicken (light, cooked, roasted)	84.1µg 20.4µg 16.1µg 9.8µg 6.9µg 2.4µg 1.0µg 0.8µg 0.5µg 0.4µg

Nutrients	Consequences of deficiency/excess	Food items (Top 10)	Nutritive Value (per 100 g)
Vitamin A	• Adverse effects on bone growth and sexual maturation • Increases risk for infectious diseases • Increased risk to visual implications. Severe vitamin A deficiency leads to xerophthalmia (specially among children)	Goat liver Drumstick leaves Fenugreek leaves Carrot, orange Sweet potato Egg poultry, whole raw Tomato Muskmelon Papaya Milk whole, cow	15655mcg 2193mcg 1156mcg 678mcg 672mcg 198mcg 189mcg 96mcg 87mcg 60mcg
Vitamin D	• Linked with non-skeletal disorders including autoimmune disorders (Crohn's disease, multiple sclerosis, rheumatoid arthritis, and type 1 diabetes), infections, and risk of developing cancers of the breast, colon, prostate and ovaries • Failure of bone mineralization leading to rickets and bowed limbs • Prevent the attainment of peak bone mass and final height	Oyster mushroom dried Gingelly seeds, brown Soybean, white Walnut Maize tender local Ragi Corn, baby Wood apple Amaranth leaves, green Milk, whole, cow	109µg 76.51µg 69.9µg 46.31µg 42.34µg 41.46µg 31.20µg 28.71µg 16.01µg 1.22µg
Zinc	• Impaired behavioural and brain development • Delayed sexual maturation • Increased bone loss and reduced bone formation • Defects in immune system • Impaired taste acuity • Dermatitis	Oyster mushroom dried Gingelly seeds, white Poppy seeds Soyabean, brown Bengal gram dal Egg, whole boiled Wheat flour, whole Bajra Khoa Amaranth leaves, green	8.67mg 7.7mg 6.38mg 4.01mg 3.65mg 3.59mg 2.85mg 2.76mg 2.74mg 1.57mg
Iodine	• Goitre and cretinism (short stature) and hypothyroidism • Brain damage • Mental retardation (low IQ) • Psychomotor defects • Hearing and speech impairment	Seaweed Milk (cow's) Cod Salt (iodized) Potato with peel, baked Shrimp Fish sticks Turkey breast, baked Navy beans, cooked Tuna, canned in oil Egg, boiled	4500µg 99µg 99µg 77µg 60µg 35µg 35µg 34µg 32µg 17µg 12µg

Nutrients	Consequences of deficiency/excess	Food items (Top 10)	Nutritive Value (per 100 g)
Vitamin C	• Weakness • Bleeding, swollen gums • Defective bone growth • Inadequate iron absorption • Follicular hyperkeratosis • Perifollicular hemorrhages • Delayed wound healing • Increased risk of developing secondary infections	Gooseberry Guava Agathi leaves Green mango, raw Amaranth leaves, red Green gram whole sprouts Drumstick Lime sweet Lemon Orange	252mg 222mg 121mg 90mg 86mg 80mg 72mg 50mg 48mg 43mg
Calcium	• Affects bone mineralization leading to a increased risk of bone fracture and osteoporosis in adulthood • May lead to memory loss, tingling, confusion, depression or hallucinations • Muscle spasms and muscle cramps	Poppy seeds Gingelly seeds, white Paneer Khol-Khol leaves Ragi Amaranth leaves, green Horse gram, whole Phalsa Milk, whole, cow Cluster beans	1372mg 1174mg 476mg 368mg 364mg 330mg 269mg 153mg 121mg 121mg
Energy	• Inappropriate energy intake may cause malnutrition (obesity or undernutrition) • Delayed puberty and hormonal alterations • Nutritional growth retardation • Increased risk to non-communicable diseases	Cooking oil Walnut Sugar Wheat flour, whole Maize, dry Soyabean Khoa Chicken, hen, thigh with skin Egg, whole, raw Milk, whole, buffalo	900 kcal 671 kcal 400 kcal 352 kcal 348 kcal 377 kcal 316 kcal 188 kcal 168 kcal 107 kcal
Protein	• Inadequate intake leads to retardation of linear growth and sexual maturation • Nutritional growth-development retardation (protein energy malnutrition) • Reduction in fat free body mass and muscle mass • Reduction in immune functions and organ functions; and if reaches to advanced stage it may even cause death	Soyabean, white Tuna fish Lentil, dal Groundnut Chicken, hen, breast with skin Paneer Egg, whole, raw Bajra Wheat flour Milk, whole, cow	37.8 g 24.5 g 24.4 g 23.7 g 22.1 g 18.9 g 13.1 g 11.0 g 10.6 g 3.3 g

Nutrients	Consequences of deficiency/excess	Food items (Top 10)	Nutritive Value (per 100 g)
Carbohydrates	• Excess intake causes increased risk of non-communicable diseases (obesity, diabetes, cardiovascular diseases and colon cancer)	Sugar Jaggery, cane Rice, raw, milled Wheat flour, refined Horse gram, whole Red gram, dal Mushroom, oyster, dried Banana Sweet potato Milk, whole, buffalo	100 g 83 g 78 g 74 g 87 g 55 g 33 g 25 g 24 g 9 g
Fat	• Hinders protein sparing action • Reduced absorption of fat-soluble vitamins (vitamins A, D, E and K) and • Negatively affect growth development in children • Excess intake causes increased risk of non-communicable diseases	Cooking oil/ghee Butter Walnut Coconut, dry Sunflower seeds Khoa Pork ham Egg, whole raw Chicken hen, thigh with skin Milk, whole, buffalo	100 g 83 g 64.3 g 53.3 g 51.8 g 20.6 g 18.6 g 13 g 12.8 g 6.6 g
Dietary Fibre	• Constipation and diverticular disease • High risk for development of non-communicable diseases (CVDs, type 2 diabetes mellitus, metabolic disorders and various types of cancers) • Obesity	Bengal gram, whole Red gram, whole Barley Maize, dry Sapota Guava Drumstick leaves Jackfruit Drumstick Lotus root	25.2 g 22.8 g 15.6 g 12.2 g 9.6 g 8.6 g 8.2 g 7.7 g 6.8 g 4.7 g
Vitamin K	• Hinders the process of blood clotting	Drumstick leaves Drumstick Gingelly seeds, brown Broad beans Red gram, whole Egg whole, raw Custard apple Soyabean white Lotus root Jowar	479mg 358mg 113mg 93.2mg 91.8mg 64mg 58mg 46.2mg 44.5mg 43.8mg

Nutrients	Consequences of deficiency/excess	Food items (Top 10)	Nutritive Value (per 100 g)
Riboflavin	• Endocrine abnormalities • Skin disorders • Hyperemia (excess blood) • Edema (mouth and throat) • Angular stomatitis (lesions at the corner of mouth) • Cheilosis (swollen, cracked lips) • Hair loss • Reproductive problems • Sore throat • Itchy and red eyes • Degeneration of liver and nervous system	Amaranth leaves Drumstick leaves Goat liver Green gram, whole Fenugreek leaves Bajra Milk, whole, cow Brinjal Papaya, ripe Khoa	0.51 mg 0.45 mg 0.37 mg 0.27 mg 0.22 mg 0.20 mg 0.13 mg 0.11 mg 0.11 mg 0.11 mg
Thiamine	• Wet beri-beri (neurologic symptoms, cardiovascular manifestations, rapid heart rate, enlargement of heart, edema, difficulty in breathing and congestive heart failure) • Dry beri-beri (neuropathy, abnormal, reflexes, diminished sensation, weakness in the legs and arms, muscle pain and tenderness) • Cerebral beri-beri (Wernicke's encephalopathy, Korsakoff's psychosis) • Gastro-intestinal beri-beri (nausea, vomiting and severe abdominal pain) • Low plasma concentration and high renal clearance (diabetic patients) • Impairment of endocrine functions • Hyperglycemia • Thiamine responsive megaloblastic anemia	Poppy seeds Red gram, whole Soyabean, brown Wheat, whole Ragi Jowar Apricot, processed Spinach Broad beans Mustard leaves	0.87 mg 0.74 mg 0.59mg 0.46 mg 0.37 mg 0.35 mg 0.25 mg 0.16 mg 0.12 mg 0.08 mg
Pyridoxine	• Immune dysfunction • Neurological symptoms (irritability, depression, confusion) • Inflammation of tongue • Sores or ulcers of mouth • Ulcers of skin at corners of mouth	Rohu, fish Sunflower seeds Drumsticks leaves Walnut Black gram, whole Banana ripe Lentil, whole, yellow French beans, hybrid Fenugreek leaves Rice, raw, brown	240 mg 0.94 mg 0.87 mg 0.80 mg 0.53 mg 0.51 mg 0.47 mg 0.44 mg 0.38 mg 0.37 mg

Nutrients	Consequences of deficiency/excess	Food items (Top 10)	Nutritive Value (per 100 g)
Naicin	• Pellagra (D's: Dermatitis, Diarrhoea, Dementia, and Death, if left untreated) • Inflammation of mouth and tongue • Vomiting • Constipation • Abdominal pain • Gastro-intestinal disorders • Neurological symptoms (headache, apathy, fatigue, depression, disorientation, memory loss)	Goat liver Groundnut Chicken, poultry, breast Tuna fish Brown rice Wheat whole Peas, dry Dates, dry, pale brown Potato, brown skin Drumstick leaves	12.9 mg 11.4 mg 8.1 mg 5.0 mg 3.4 mg 2.7 mg 2.7 mg 1.5 mg 1.4 mg 1.8 mg
Vitamin E	• Neurologic symptoms (impaired balance and coordination) • Injury to the sensory nerves (peripheral neuropathy) • Muscle weakness (myopathy) • Damage to the retina of the eye (retinopathy)	Safflower seeds Almonds Coconut dry Egg, whole, raw Catla fish Bengal gram, whole Spinach Phalsa Pumpkin, green Mustard leaves	35.09 mg 25.86 mg 6.06 mg 2.97 mg 2.35 mg 1.72 mg 1.29 mg 0.93 mg 0.87 mg 0.57 mg

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Anwesha Lahiri	Indian Institute of Technology Bombay
Arti Bhanot	National Centre of Excellence and Advanced Research on Diets, Lady Irwin College, New Delhi
Dr. Mansi Chopra	National Centre of Excellence and Advanced Research on Diets, Lady Irwin College, New Delhi
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Dr. Rahul Mishra	Institute of Economic Growth, New Delhi

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