Ministry of Health and Family Welfare
Government of India

Comprehensive National Nutrition Survey

2016 – 2018

Telangana
State Presentation

Birth to Adolescence

Largest Micronutrient Survey ever conducted:

112,316
Children and adolescents interviewed

51,029
Blood, stool and urine samples collected

360
Anthropometric measurers

30
Microscopists
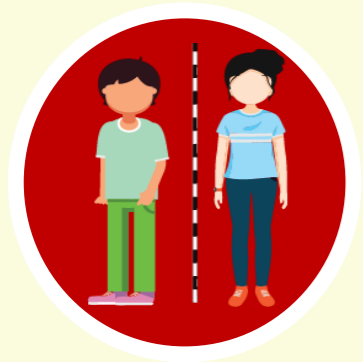
2500
Survey personnel in 30 states

100
Data Quality assurance monitors

200
Lab technicians

900
Interviewers

200
Trainers and coordinators

360
Phlebotomists

Justification and Objectives

- To assess the prevalence of malnutrition in both children and adolescents with special focus on assessment of micronutrient deficiencies through biochemical measures.

- To identify determinants and associations of various risk factors for anaemia in both children and adolescents.

- To assess biomarkers for hypertension, diabetes, cholesterol and kidney function and their associations with various risk factors for Non-Communicable Diseases (NCDs).

Malnutrition is responsible for 68% of total under five mortality in India*

*Soumya Swaminathan, et al. (2019), The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. https://doi.org/10.1016/S2352-4642(19)30273-1

CNNS
Birth to Adolescence

Survey Design

CNNS is a cross-sectional, household survey using a multi-stage sampling design.

CNNS covered **2035 Primary Sampling Units (PSUs)** from more than **82%** of all districts from the Census 2011 (516 out of 628 districts) across 30 states:
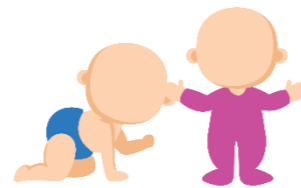
- 160 Districts- one PSU
- 356 Districts- two or more PSUs

- ● District with more than one PSU
- ● District with one PSU

Birth to Adolescence
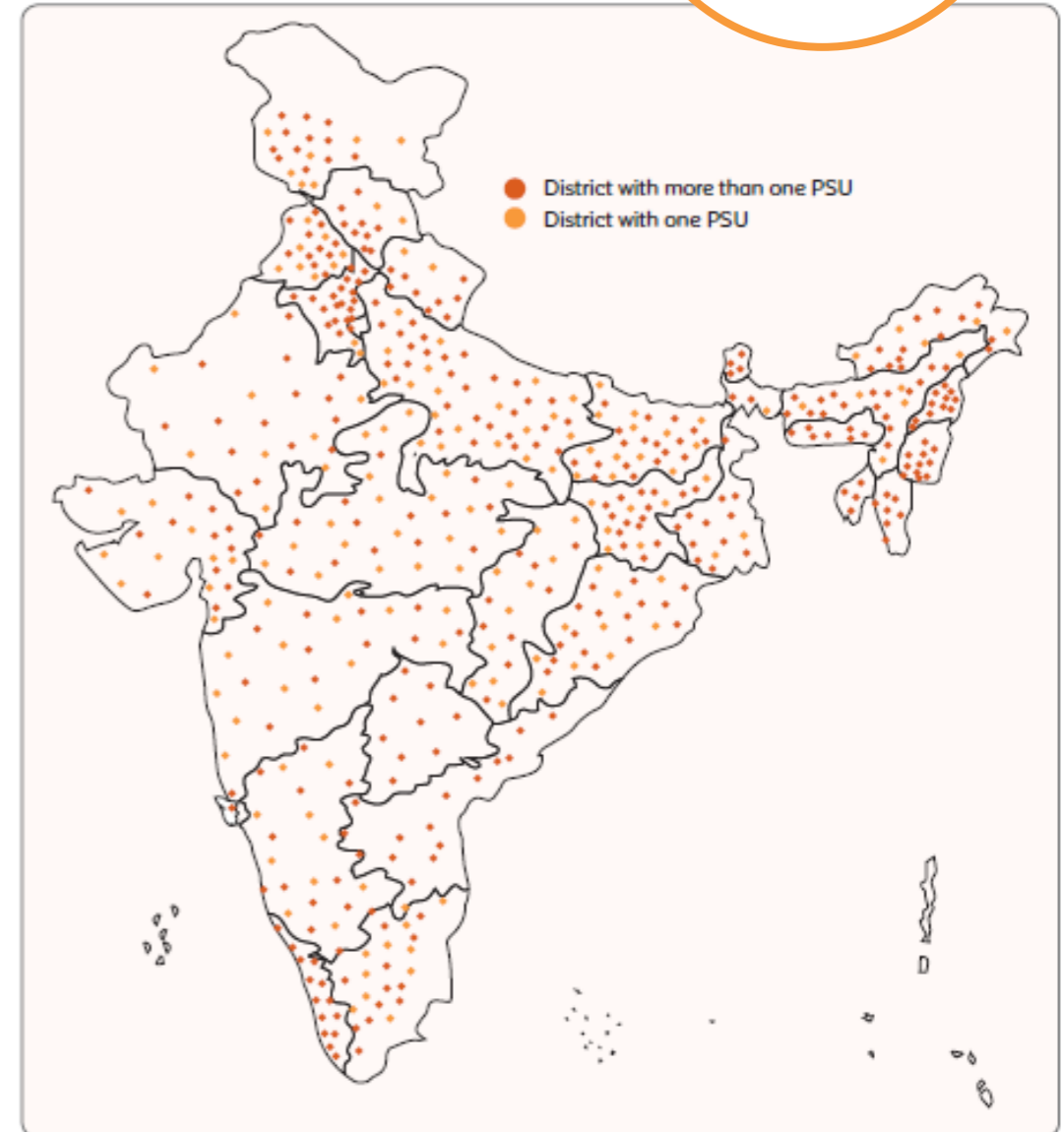
Anthropometry data

	Pre-school children (0-4 years)	School-age children (5-9 years)	Adolescents (10-19 years)
Anthropometric measurements	• Height • Weight • Mid-upper arm circumference (MUAC) • Triceps skinfold • Subscapular skinfold (1-19 years)		
		• Waist circumference	

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Biochemical indicators - micronutrient deficiencies and NCDs

Indicator Group			
Anaemia and haemoglobinopathies	• Haemoglobin • Variant haemoglobins		
Inflammatory biomarkers	• C-reactive protein		
Protein	• Serum protein and albumin		
Micronutrients	• Iron: Serum ferritin, serum transferrin receptor • Vitamin A: Serum retinol • Zinc: Serum zinc • B-vitamins: Erythrocyte folate, serum B12 • Vitamin D: Serum 25 (OH) D • Urinary Iodine		
Non-communicable diseases		• Blood Pressure • Blood glucose, HbA1c • Lipid profile: Serum cholesterol, LDL, HDL, and triglycerides • Renal function: Serum creatinine, urinary protein creatinine ratio	

Monitoring and Supervision

Three-tiers of Data Quality Assurance

- Field work/protocol/training monitoring: by quality control team
- Biological sample quality control : by AIIMS, NIN and US CDC

- 3-member Data Quality Assurance (DQA) team for re-interviews & observations
- Concurrent monitoring of biological sample collection, storage and transportation by CDSA

- Internal monitoring by the Quality Control Observer
- Daily supervision of the field work by Team Supervisor

Team Composition for data collection

Team Supervisor **Quality Control Observer**

Four Survey Investigators

Two Anthropometry Investigators **Two Phlebotomists for biological sample collection**

Birth to Adolescence
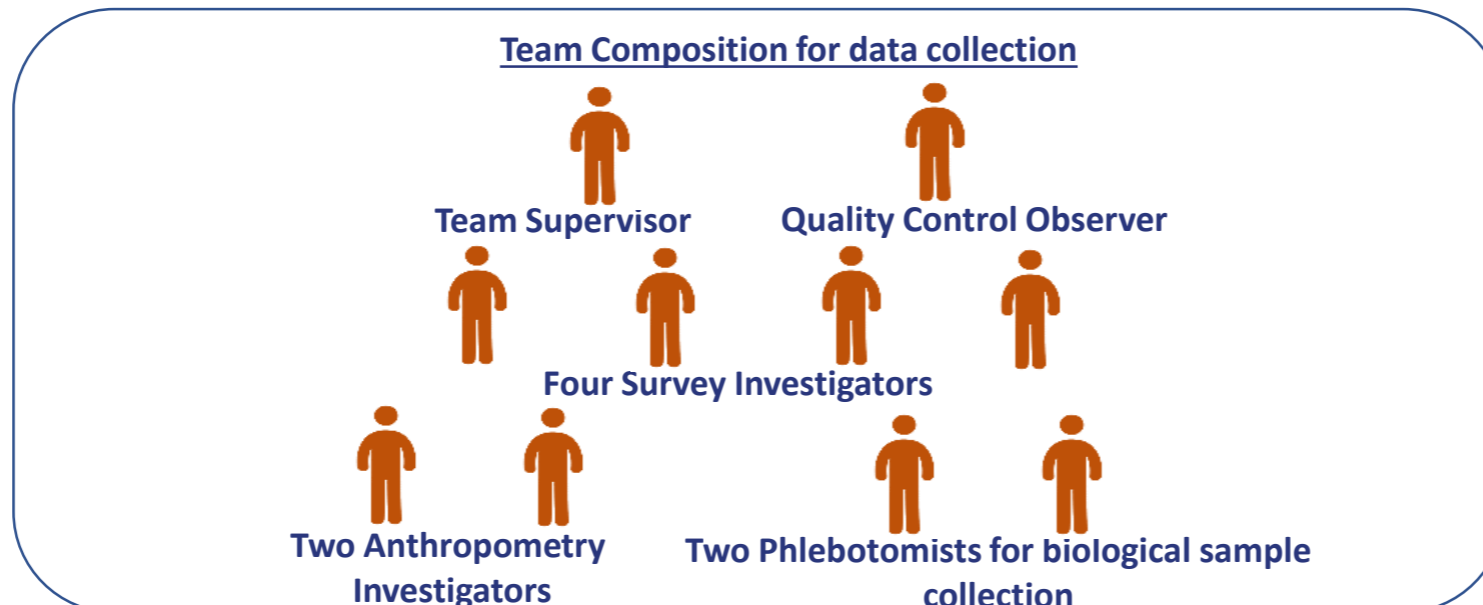
Quality Assurance Measures for Data Quality

Evaluation of Interviewers
prior to employment

Survey team
- Written and oral test
- Mock interview
- Ethics test

Anthropometry team
- Standardisation
- Selection based of demonstrated capacity measured by technical error of measurements (TEM)

Quality Assurance Measures

	DQA team conducted consistency checks, and provided feedback on real time basis
	No more than 4 interviews allowed in a day by an interviewer
	Daily SMS based monitoring/ alerts system for biological sample (from PSUs, collection points and reference labs).
	Sample transportation in thermal insulation bags maintaining temperature at 2-8° Celsius for up to 16 hours
	Time and temperature monitoring of samples by digital data loggers

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Birth to Adolescence

Agencies engaged in the implementation of CNNS

Survey Implementation by MoHFW, Government of India and supported by UNICEF

Technical support:
US Centre for Disease Control and UNICEF

Regular review and technical guidance: Technical advisory group constituted by MoHFW

Quality assurance and external monitoring: AIIMS, PGIMER, NIN, KSCH and CDSA

Overall field coordination, training, quality monitoring, data management and analysis: Population Council

Biological sample collection, transportation & analysis: SRL Limited

Survey and anthropometric data collection: IIHMR, Kantar Public, Gfk Mode and Sigma Consulting

Sample size in Telangana

CNNS covered 60 PSUs for data collection in Telangana

Achieved following sample size by age groups:

	0-4 years	5-9 years	10-19 years	Total
Household and anthropometry data	1,037	1,006	979	**3,022**
Biological sample	435	476	447	**1,358**

Period of data collection in Telangana

CNNS data collection period: February 26, 2016 to July 24, 2016

- CNNS collected data during the spring season through rainy season of 2016

- NFHS collected data during the spring season through early summer of 2015

Survey	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CNNS 2016		February to July, 2016										
NFHS 4 2015		February to May, 2015										

CNNS
Birth to Adolescence

Prevalence of stunting, underweight, and wasting among children under 5 years remained largely unchanged between CNNS and NFHS-4

■ NFHS-4　■ CNNS

	Stunting (Low height for age)	Wasting (Low weight for height)	Underweight (Low weight for age)
NFHS-4	28.0%	18.0%	28.3%
CNNS	29.3%	17.9%	30.8%

Stunting (Low height for age)

Wasting (Low weight for height)

Underweight (Low weight for age)
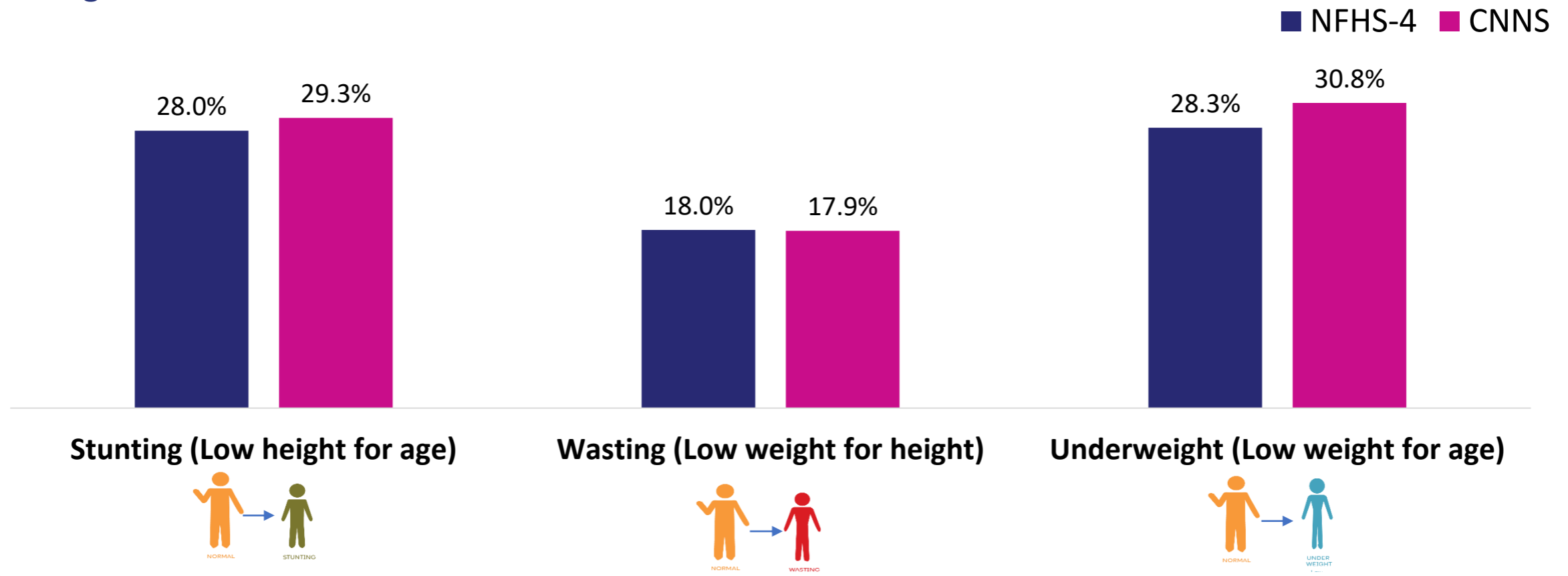
3/10 adolescents aged 10-19 years were thin for their age (BMI-Age <-2SD)

1/7 children aged 5-9 years was stunted. The school age period does not provide an opportunity for catch up growth in height.

6% of adolescents aged 10-19 years were overweight or obese.

5.6%

Overweight (high BMI for age)

13

Birth to Adolescence

NORMAL

OVERWEIGHT/
OBESITY
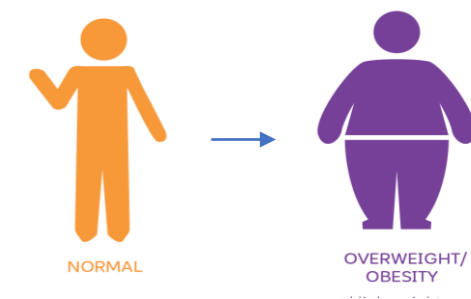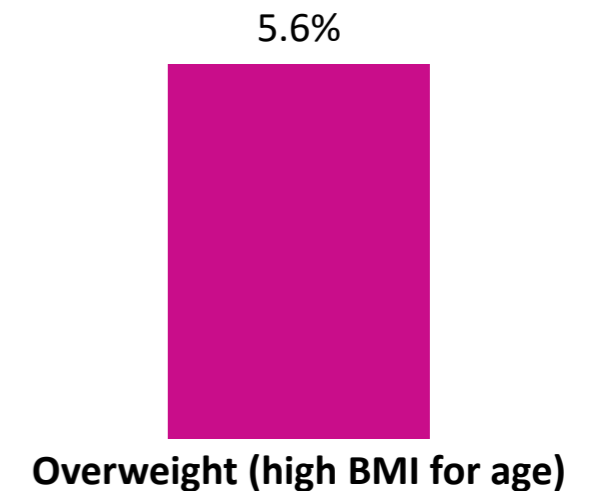
No change in stunting among children under five

Prevalence of stunting did not change in Telangana between CNNS and NFHS-4 – **28%** vs **29%**

Among all southern states decline in stunting was observed only in Tamil Nadu

Legend: ■ NFHS-4   ■ CNNS

State	NFHS-4	CNNS
India	38.4	34.7
Andhra Pradesh	31.4	31.5
Karnataka	36.2	32.5
Kerala	19.7	20.5
Tamil Nadu	27.1	19.7
Telangana	28.0	29.3

CNNS
Birth to Adolescence
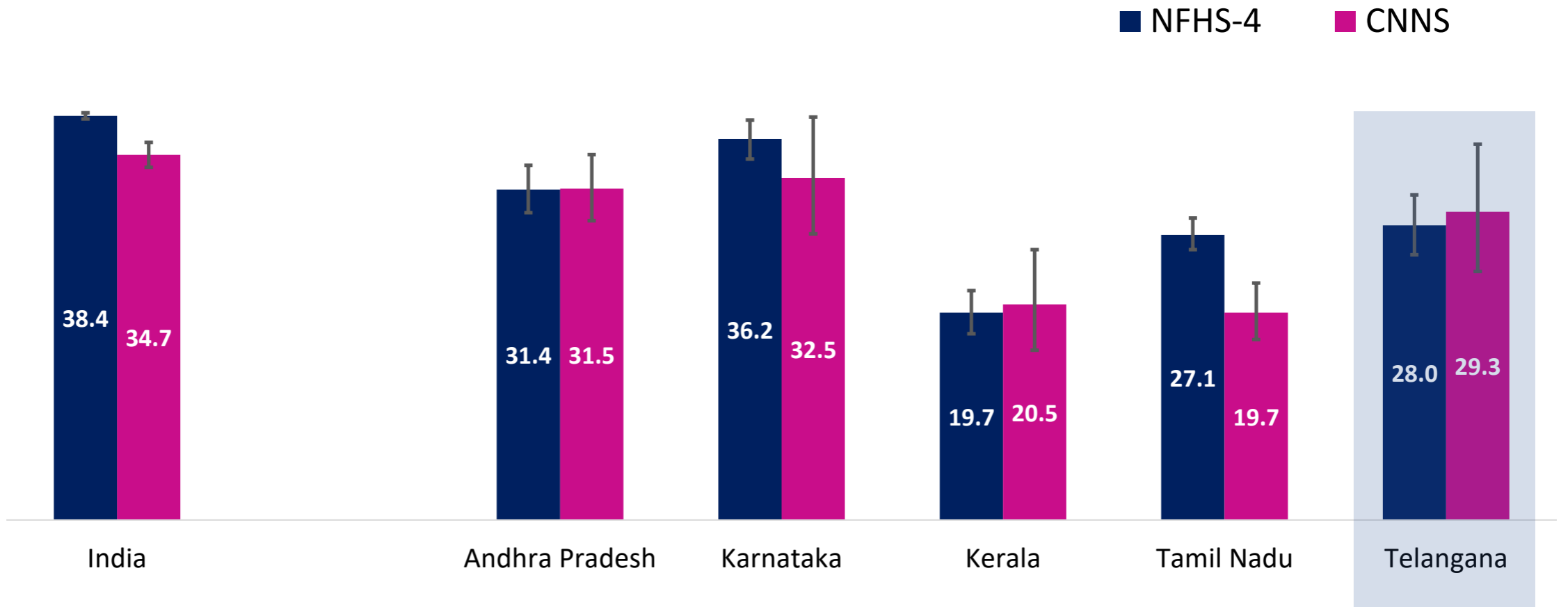
Wasting among children under five did not change

Prevalence of wasting remained unchanged in Telangana between NFHS-4 and CNNS – **18%**

Wasting did not decline significantly in any of the southern states except Karnataka

NFHS-4   CNNS

	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
NFHS-4	21.0	17.2	26.1	15.7	19.7	18.0
CNNS	17.3	17.1	19.3	12.6	20.7	17.9

CNNS
Birth to Adolescence
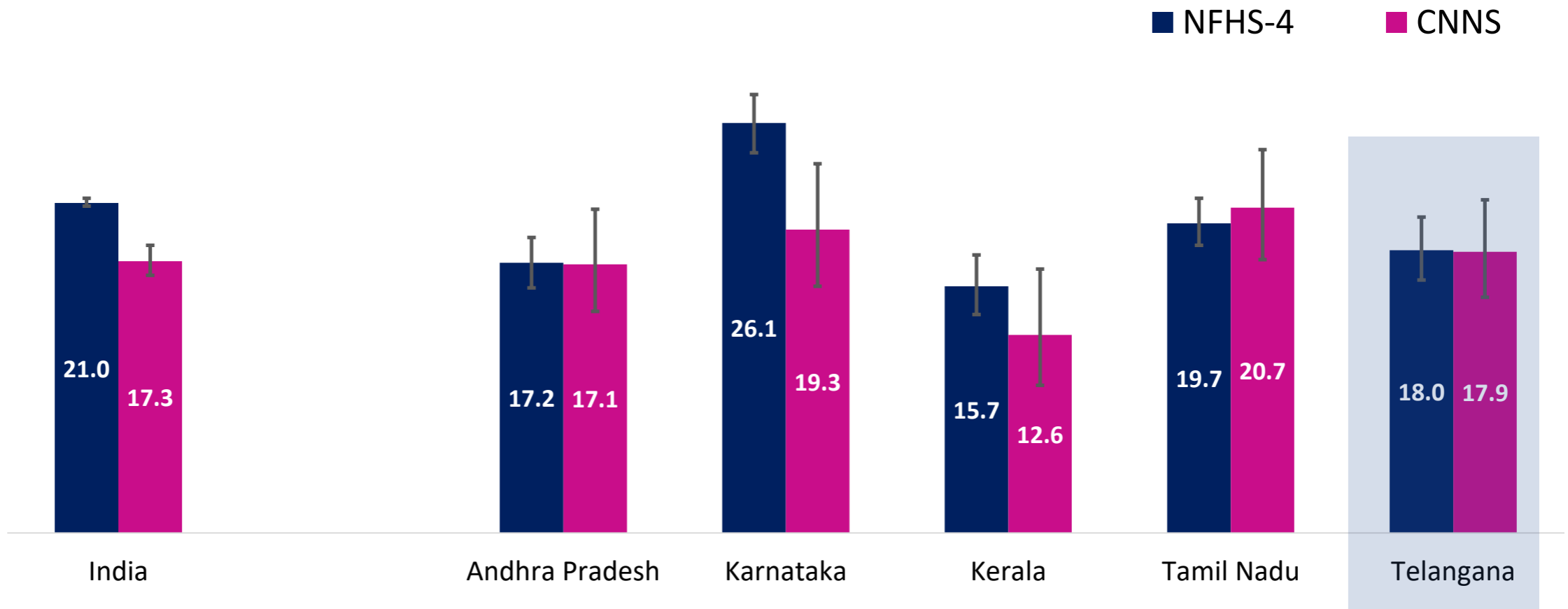
Prevalence of underweight among children under five unchanged

Underweight is a composite measure of chronic and acute malnutrition

The prevalence of underweight remained largely unchanged between NFHS-4 and CNNS
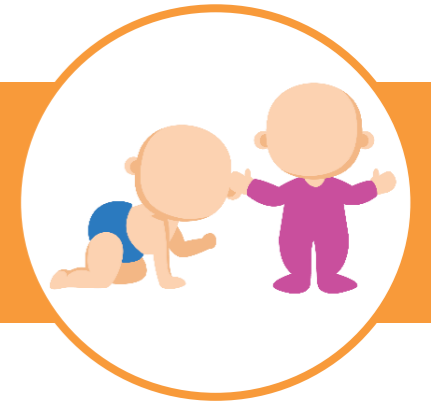
Prevalence remained nearly unchanged in all southern states

Legend: ■ NFHS-4 ■ CNNS

	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
NFHS-4	35.7	31.9	35.2	16.1	23.8	28.3
CNNS	33.4	33.5	32.4	18.7	23.5	30.8
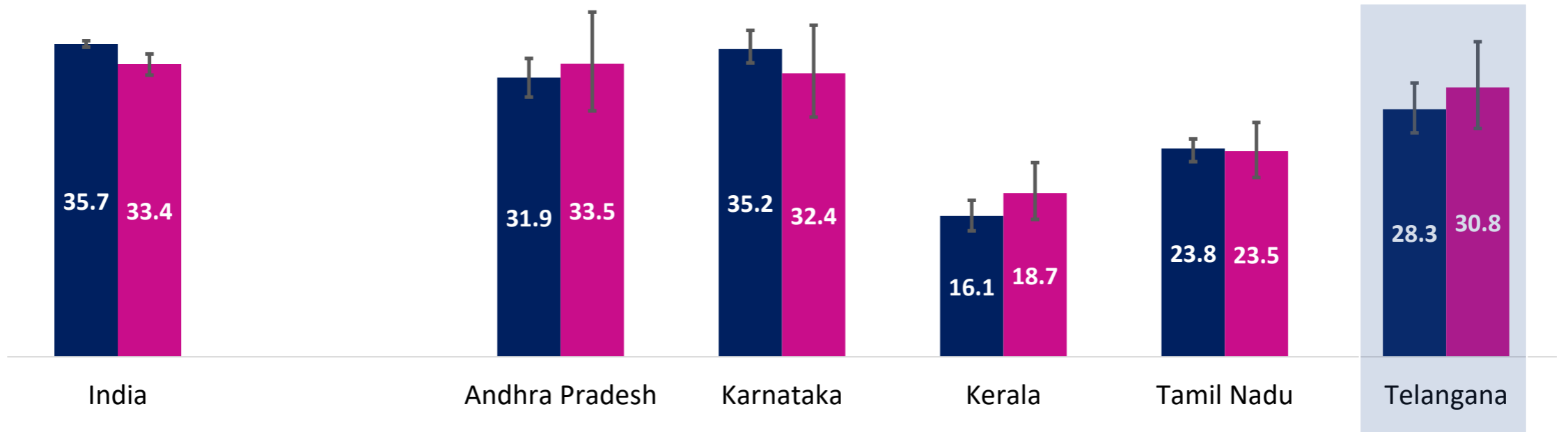
Triceps Skinfold Thickness (TSFT) for children under five
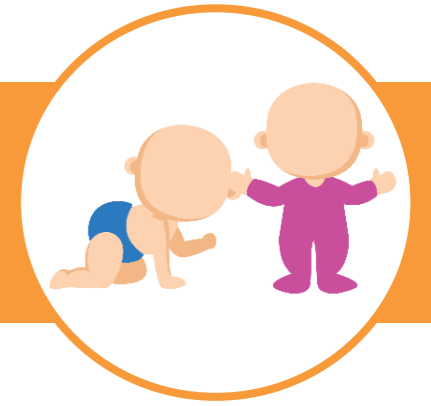
Low fat mass as reported by TSFT in Telangana (4%), much lower than national average (10%)

Legend: TSFT (-3SD to -2SD) ▨   TSFT (< -3SD) ■

	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
Total	9.7	4.4	4.7	5.9	9.9	3.8
TSFT (< -3SD)	2.4	0.5	1.1	1.3	1.7	0.0

CNNS
Birth to Adolescence
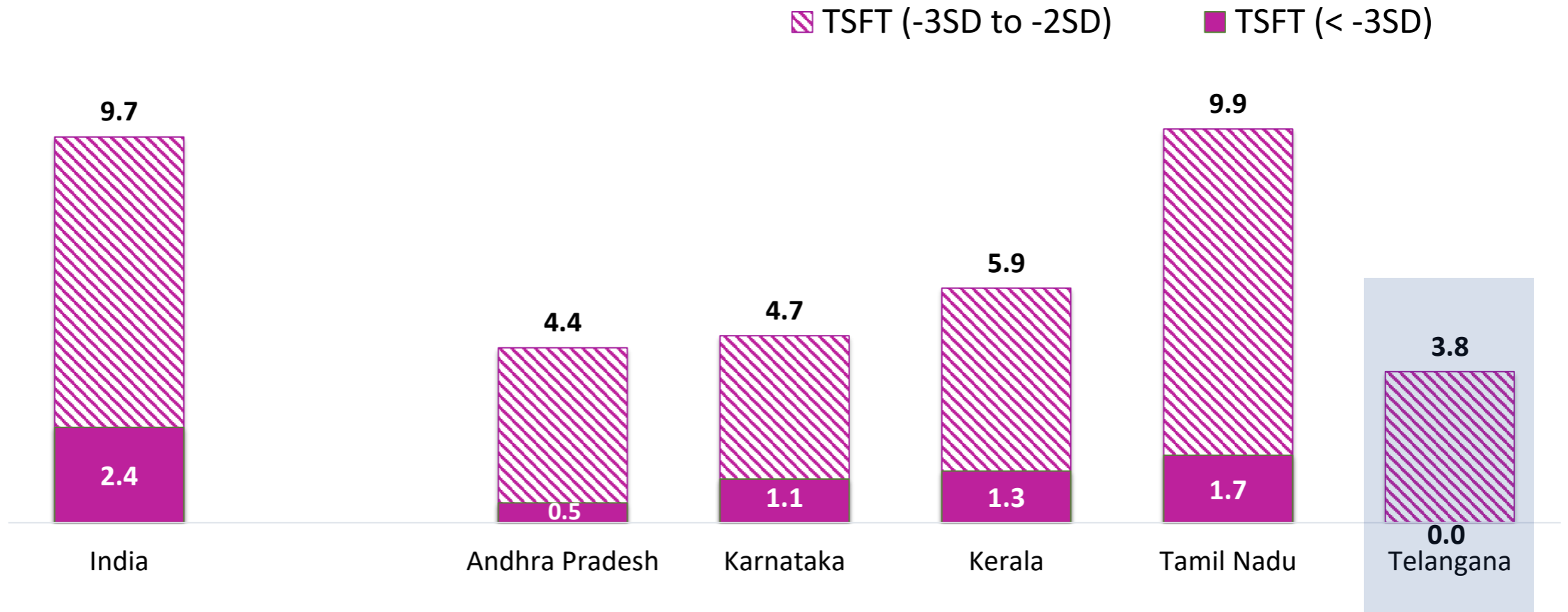
Subscapular Skinfold Thickness (SSFT) for children aged 1-4 years

Thinness as reported by SSFT in Telangana (4%) was significantly lower than Kerala (16%) and Tamil Nadu (9%) and the national average (9%)

Legend: SSFT (-3SD to -2SD) — hatched red; SSFT (< -3SD) — solid red

Region	SSFT (-3SD to -2SD) total	SSFT (< -3SD)
India	8.6	1.6
Andhra Pradesh	3.4	0.1
Karnataka	3.7	0.2
Kerala	15.8	2.1
Tamil Nadu	9.1	1.1
Telangana	3.8	0.9

CNNS
Birth to Adolescence
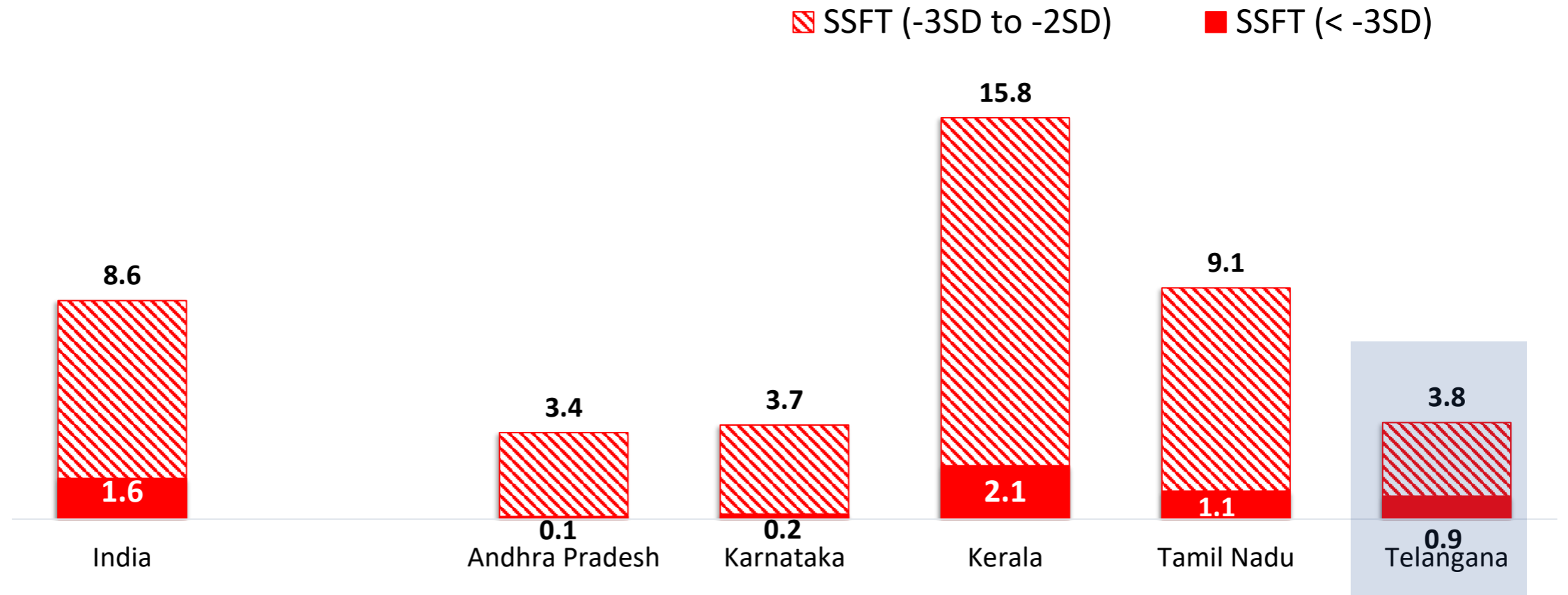
Mid Upper Arm Circumference (MUAC) for children aged 6-59 months
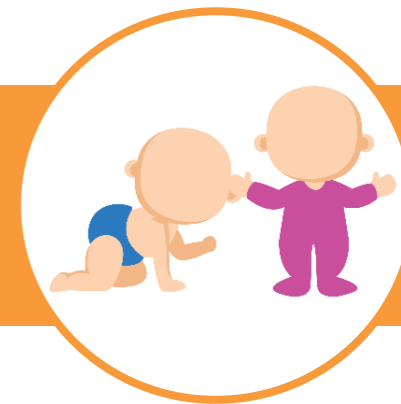
5% children in Telangana had low MUAC

Prevalence of low MUAC ranged between **2%** and **5%** across the southern states

⊠ MUAC (>=115mm & <125 mm)   ■ MUAC (<115 mm)

	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
MUAC (>=115mm & <125 mm)	4.9	3.9	4.1	1.7	3.4	5.2
MUAC (<115 mm)	0.9	0.8	1.0	0.9	0.7	0.9

CNNS
Birth to Adolescence
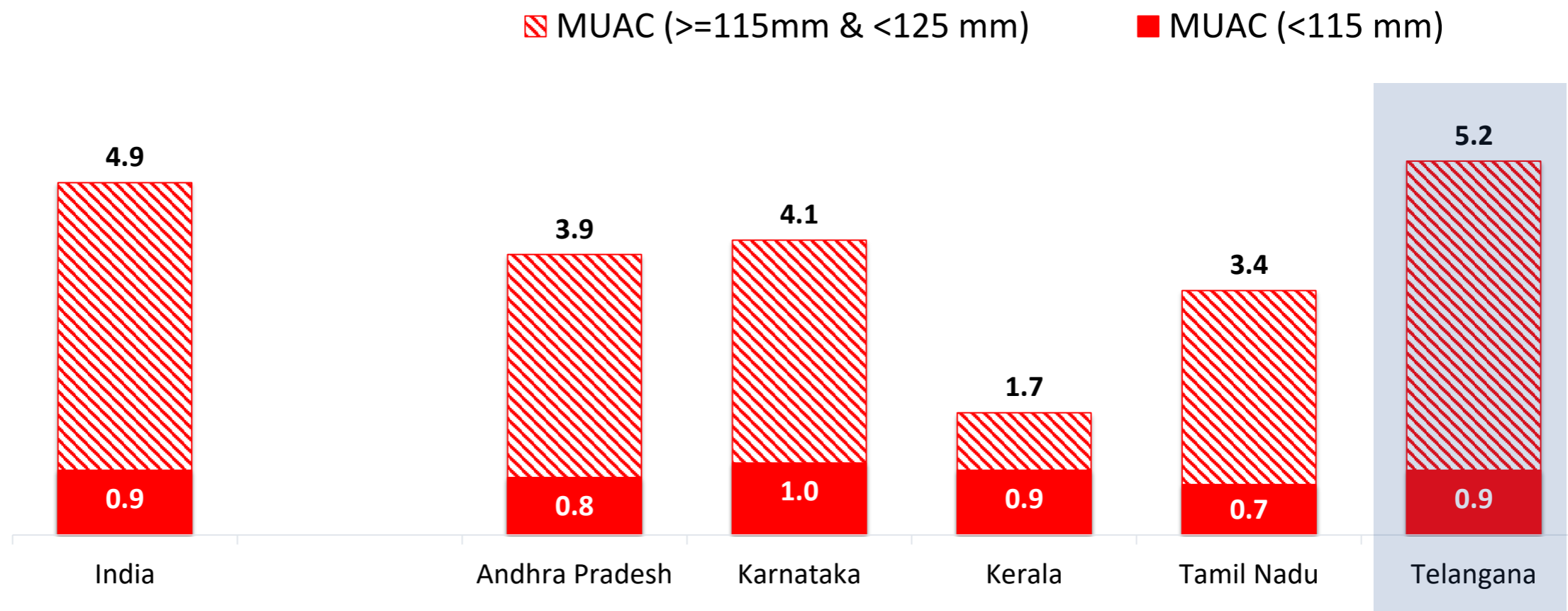
Stunting among school-age children (5-9 years)

Nearly **1/7** children aged 5-9 years was stunted; significant proportion of children who were stunted in childhood remained stunted into their schooling age reducing their potential capacity for education

Karnataka and Andhra Pradesh had the high prevalence of stunting among the southern states

Legend: ▨ Moderately stunted (-3SD to -2SD)   ■ Severely stunted (< -3SD)

State	Total	Severely stunted
India	21.9	5.5
Andhra Pradesh	21.2	4.3
Karnataka	21.5	4.5
Kerala	11.2	1.1
Tamil Nadu	9.7	2.2
Telangana	15.5	2.5

CNNS
Birth to Adolescence
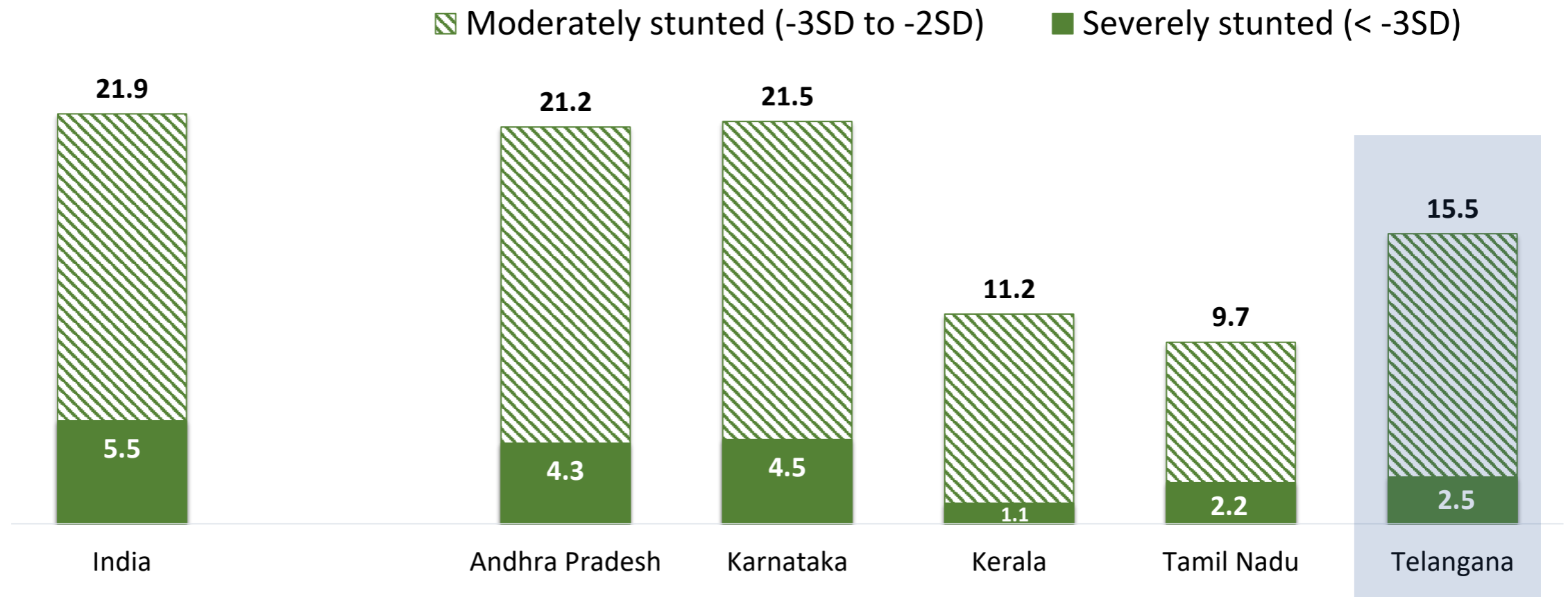
Thinness among school-age children (5-9 years)

Nearly **3/10** children aged 5-9 years were thin in Telangana

Prevalence of thinness in Telangana was higher than national average and most of the other southern region states except Karnataka

▨ Moderate thinness (-3SD to -2SD)　　■ Severe thinness (< -3SD)

	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
Total	23.0	20.8	28.2	16.3	19.2	28.1
Severe	4.9	4.8	6.7	4.0	5.9	7.7

CNNS
Birth to Adolescence
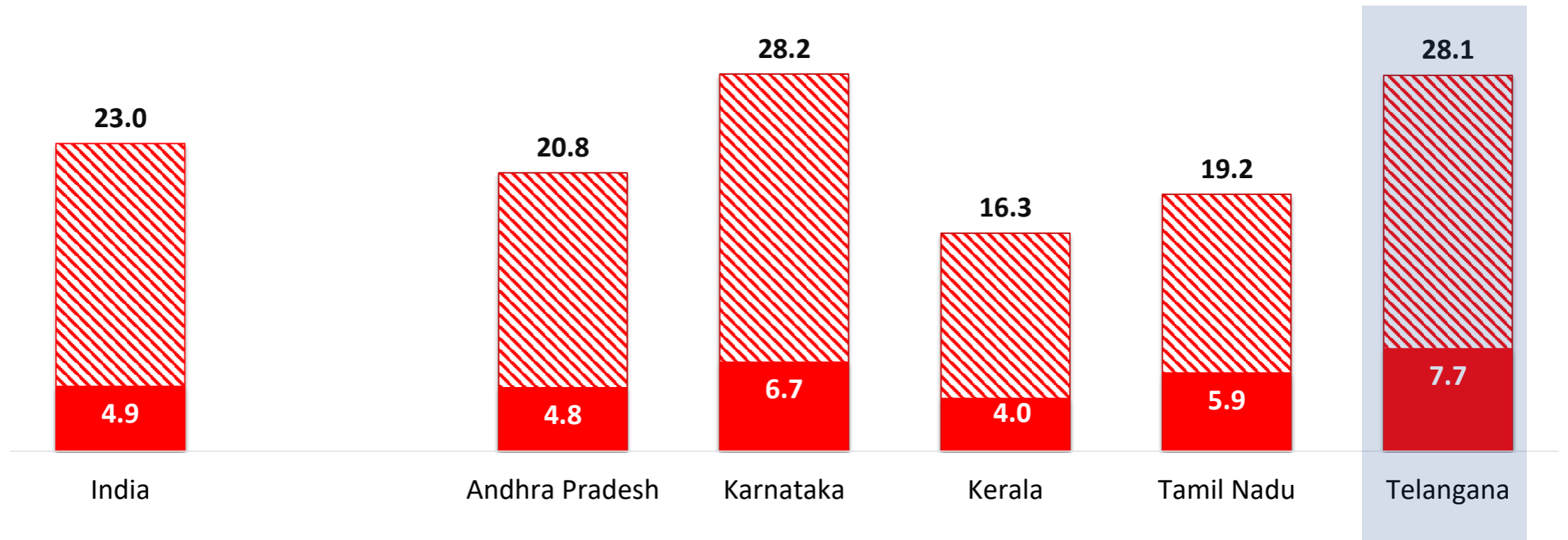
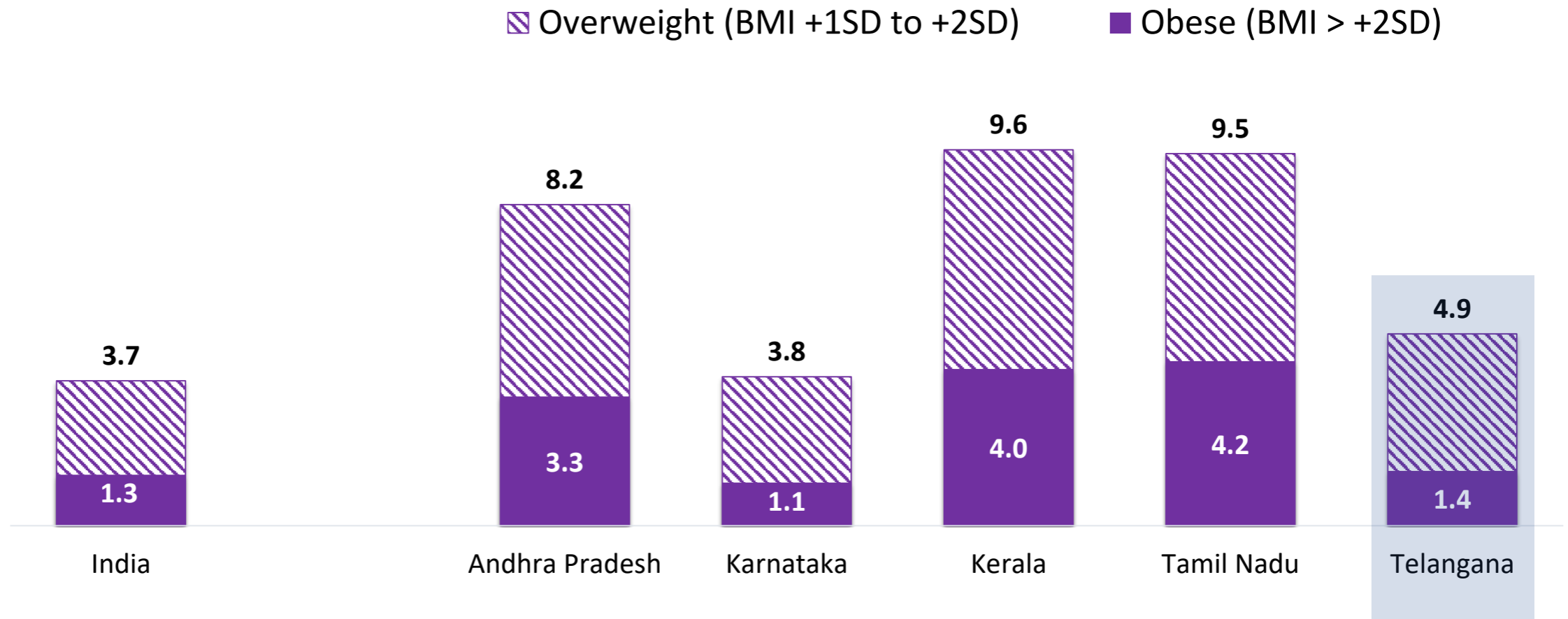# Overweight and obesity among school-age children (5-9 years) increasing

Overweight and obesity are on rise even among children aged 5-9 years

Prevalence of overweight in Telangana (5%) was at same level as national average

Among southern states, Karnataka and Telangana had low prevalence of overweight in this age group

Legend: ▨ Overweight (BMI +1SD to +2SD) ■ Obese (BMI > +2SD)

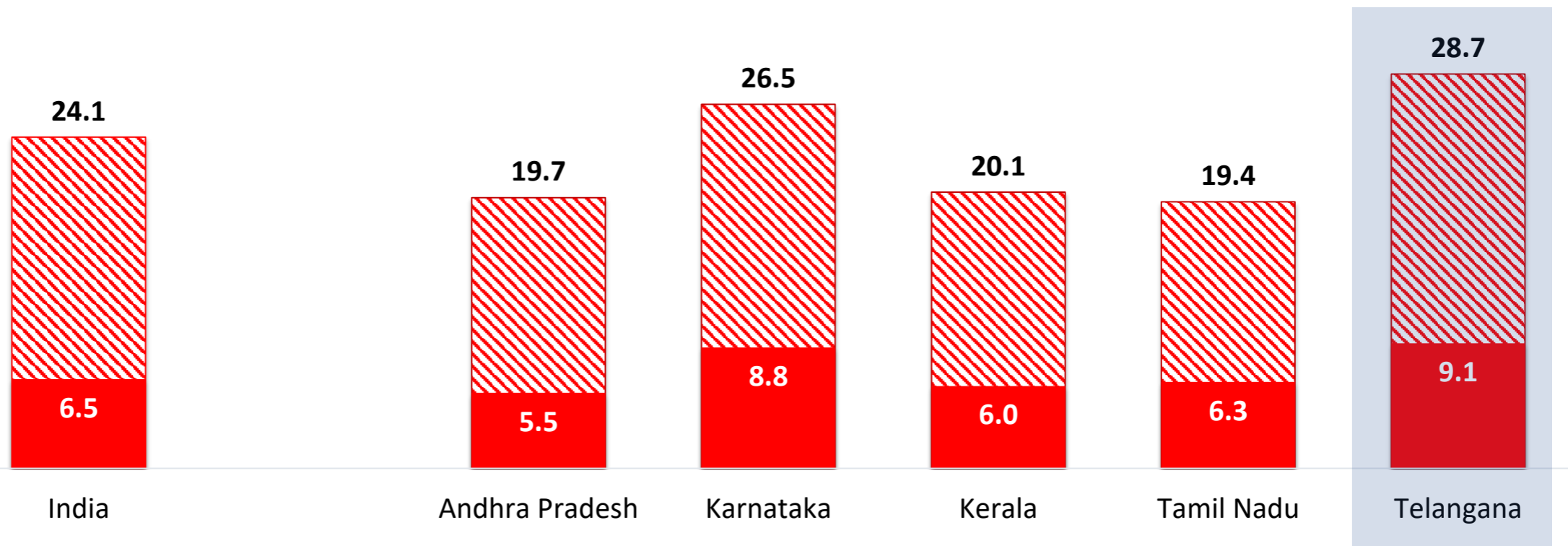|	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
Total	3.7	8.2	3.8	9.6	9.5	4.9
Obese	1.3	3.3	1.1	4.0	4.2	1.4

CNNS
Birth to Adolescence

Thinness among adolescents aged 10-19 years substantially high

Nearly **3/10** adolescents aged 10-19 years were thin in Telangana (**29%**), also higher than national average (**24%**)

Among the southern states, Telangana had highest prevalence of thinness

Legend: ⊠ Moderate thinness (-3SD to -2SD) ■ Severe thinness (< -3SD)
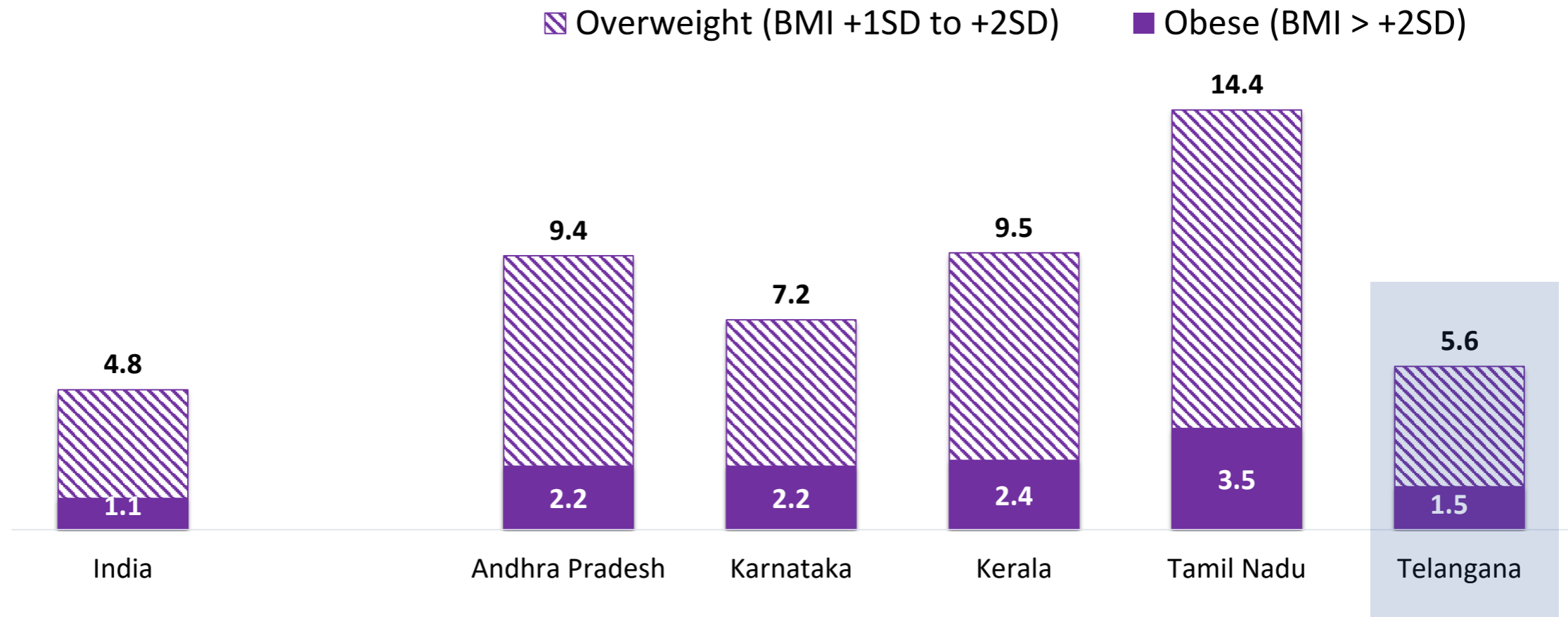
State	Severe thinness	Total
India	6.5	24.1
Andhra Pradesh	5.5	19.7
Karnataka	8.8	26.5
Kerala	6.0	20.1
Tamil Nadu	6.3	19.4
Telangana	9.1	28.7

Birth to Adolescence

Anaemia

37.8
27.2
32.1

In Telangana, like in most states, anaemia was significantly higher among children aged 1-4 years compared to children aged 5-9 years and adolescents aged 10-19 years

Iron deficiency

33%
23%
26%
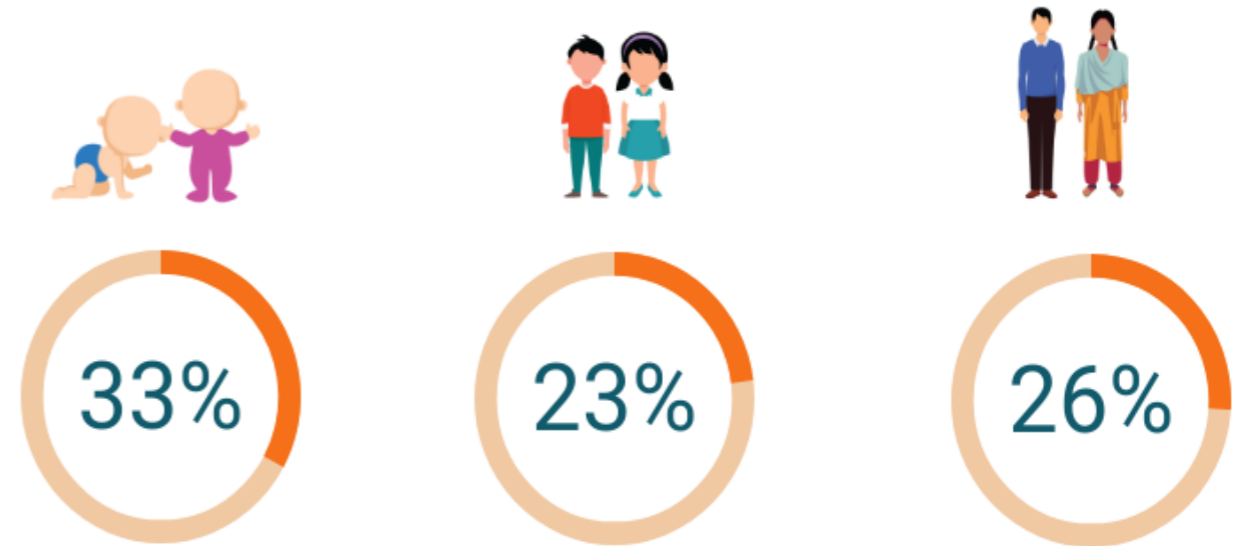
Findings indicate that children aged 1-4 years had higher iron deficiency (measured by serum ferritin) than other children or adolescents

CNNS
Birth to Adolescence

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Prevalence of Anaemia among children and adolescents

More than **1/3** children aged 1-4 years was anaemic in Telangana (**38**%), slightly lower than national average (**41%**)

Prevalence of anaemia was highest among children aged 1-4 years, increased again among adolescents

■ 1-4 Years ■ 5-9 Years ■ 10-19 Years

Anaemia Cut Offs (WHO)
1-4 years: Hb<11.0 g/dl
5-11 years: Hb<11.5 g/dl
12-14 years: Hb< 12 g/dl
Girls ≥15years: Hb< 12g/dl
Boys ≥15 years: Hb< 13 g/dl
(Adjusted for altitude)

	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
1-4 Years	40.5	39.6	34.7	12.5	27.3	37.8
5-9 Years	23.5	19.2	14.8	3.1	10.4	27.2
10-19 Years	28.4	21.7	17.2	9.1	16.4	32.1

26

Birth to Adolescence
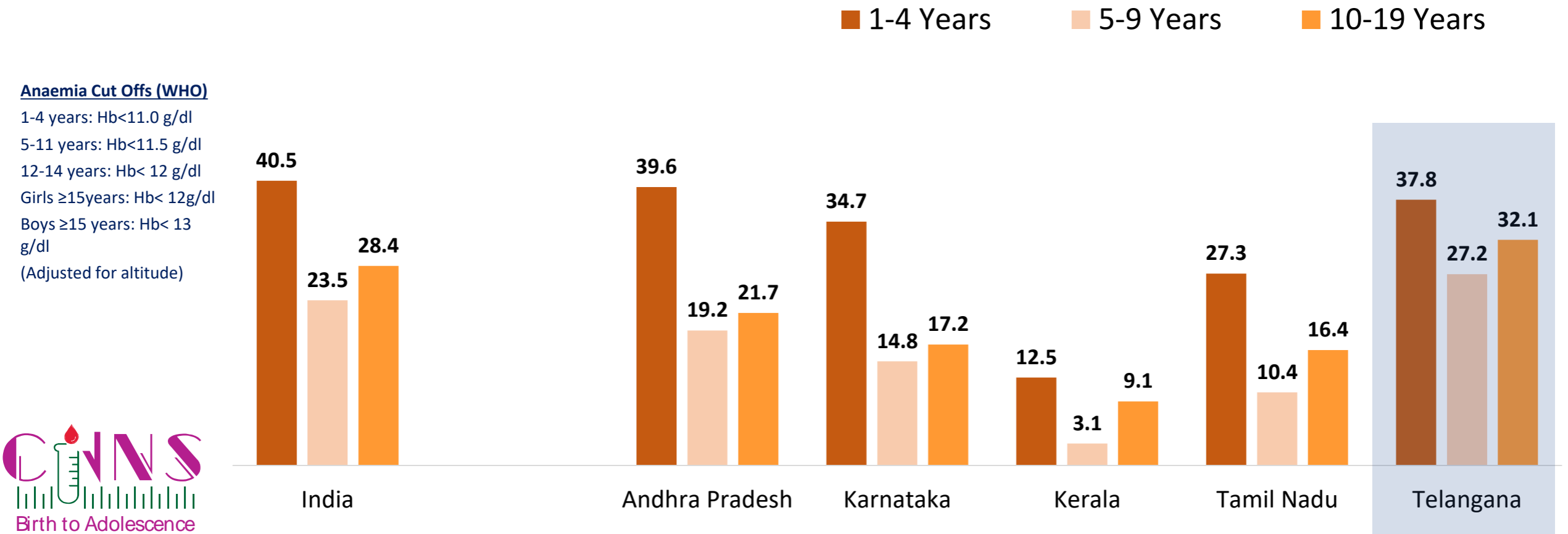
Prevalence of Anaemia among adolescents (10-19 years)

Overall, in the country, anaemia prevalence among adolescent girls was twice than adolescent boys

In Telangana, as in many other southern states, adolescent girls more than twice as likely as adolescent boys to be anaemic

Legend: ■ Male ■ Female

State	Male	Female
India	17.5	39.6
Andhra Pradesh	11.7	33.3
Karnataka	8.8	25.6
Kerala	4.1	13.7
Tamil Nadu	7.5	26.4
Telangana	18.5	46.0

CNNS
Birth to Adolescence
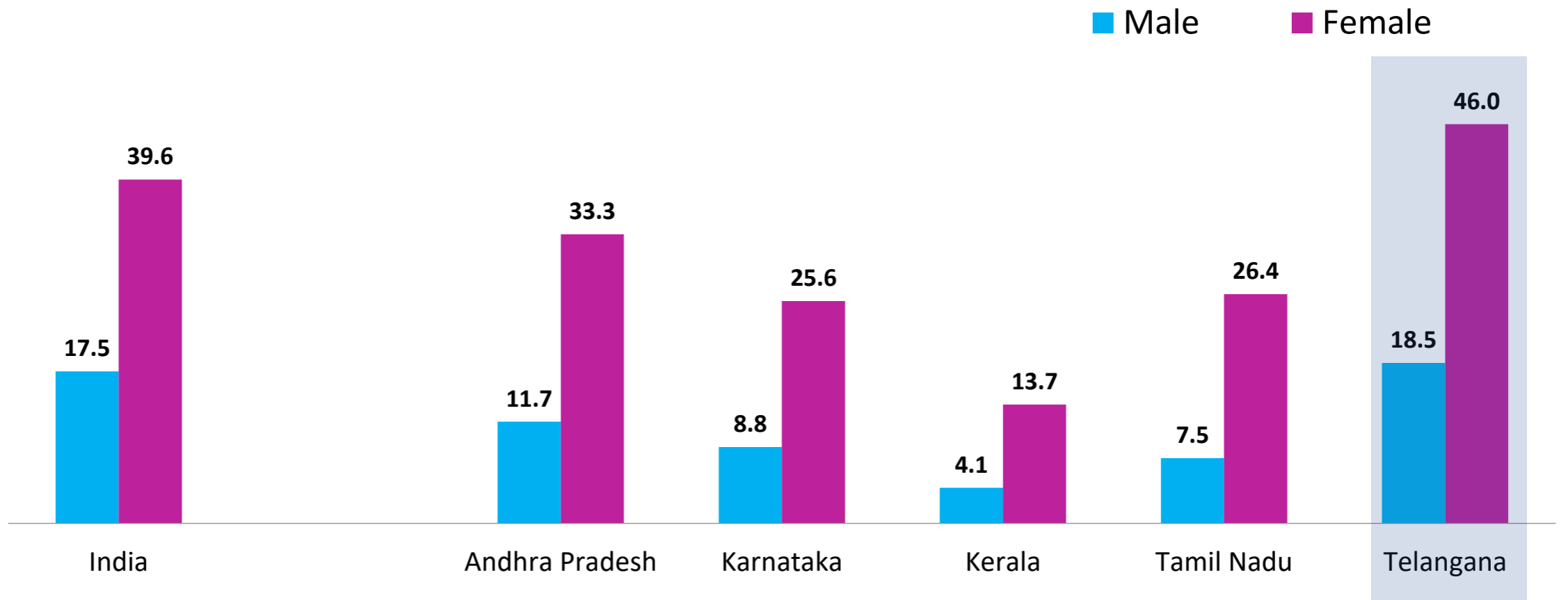
Iron deficiency measured by serum ferritin among children and adolescents

1/3 children aged 1-4 years had iron deficiency in Telangana (**33**%), equivalent to the national average (**32%**);

Among southern states, children from Karnataka had highest prevalence of iron deficiency

■ 1-4 Years   ■ 5-9 Years   ■ 10-19 Years

Cut Offs (WHO)
1-4 years: SF <12 µg/l;
≥5 years: SF <15 µg/l
(high CRP excluded)

State	1-4 Years	5-9 Years	10-19 Years
India	31.9	17.0	21.5
Andhra Pradesh	13.0	10.6	15.2
Karnataka	50.1	31.2	30.5
Kerala	35.2	18.0	25.3
Tamil Nadu	41.7	20.3	26.1
Telangana	33.4	22.7	26.0

Birth to Adolescence

A
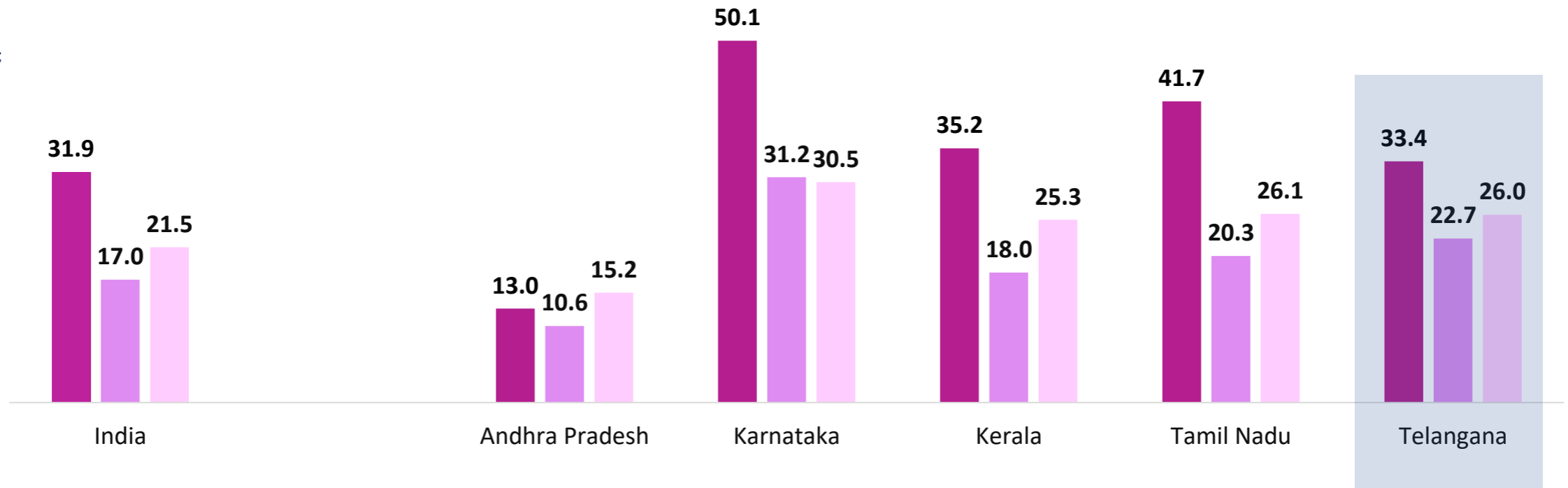
Vitamin A deficiency was high (35%) in school-aged children indicating the need for policy review.

Children under five and adolescents had significantly lower prevalence (27% and 20%) compared to school-aged children.

D

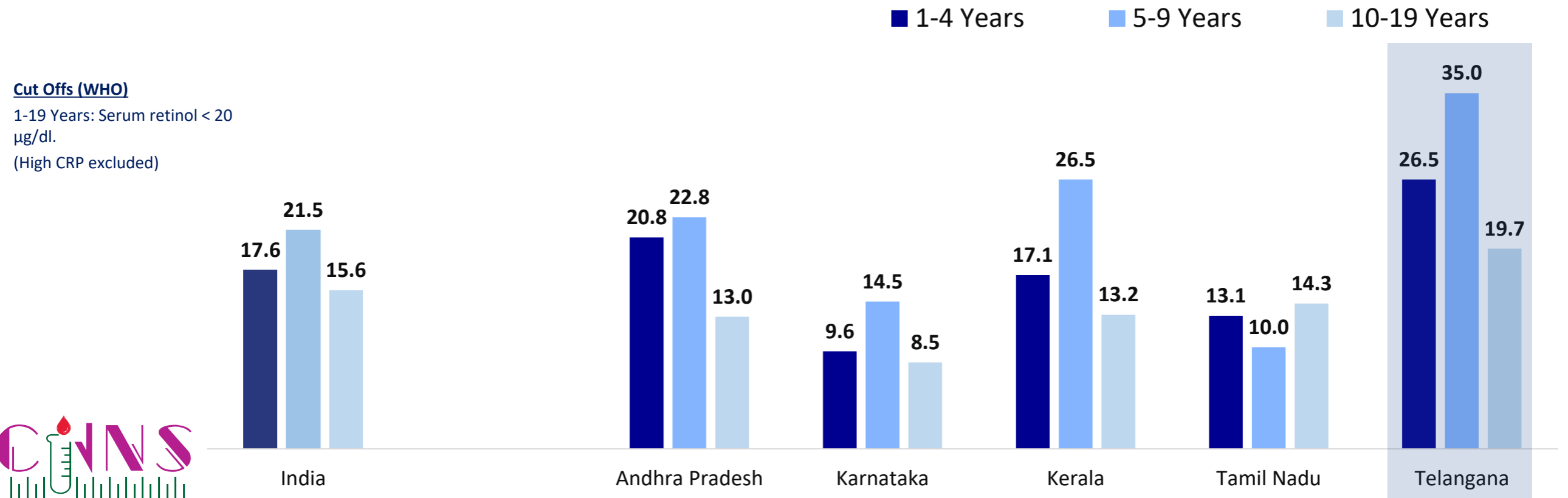Vitamin D deficiency ranged from 6% to 10% in 1-19 years age group as per cut off by expert panel of IOM.

Children aged 1-4 years had high prevalence of Vitamin D deficiency as compared to school-aged children, prevalence again increased in adolescents.

CNNS
Birth to Adolescence

Vitamin A deficiency among children and adolescents

The vitamin A deficiency prevalence varies from 20% to 35% in children and adolescents in Telangana, which is significantly higher than the national average (**16-22%**)

Among southern states, Telangana had highest prevalence of Vitamin A deficiency

Legend: ■ 1-4 Years ■ 5-9 Years ■ 10-19 Years

Cut Offs (WHO)
1-19 Years: Serum retinol < 20 µg/dl.
(High CRP excluded)

State	1-4 Years	5-9 Years	10-19 Years
India	17.6	21.5	15.6
Andhra Pradesh	20.8	22.8	13.0
Karnataka	9.6	14.5	8.5
Kerala	17.1	26.5	13.2
Tamil Nadu	13.1	10.0	14.3
Telangana	26.5	35.0	19.7

CNNS
Birth to Adolescence
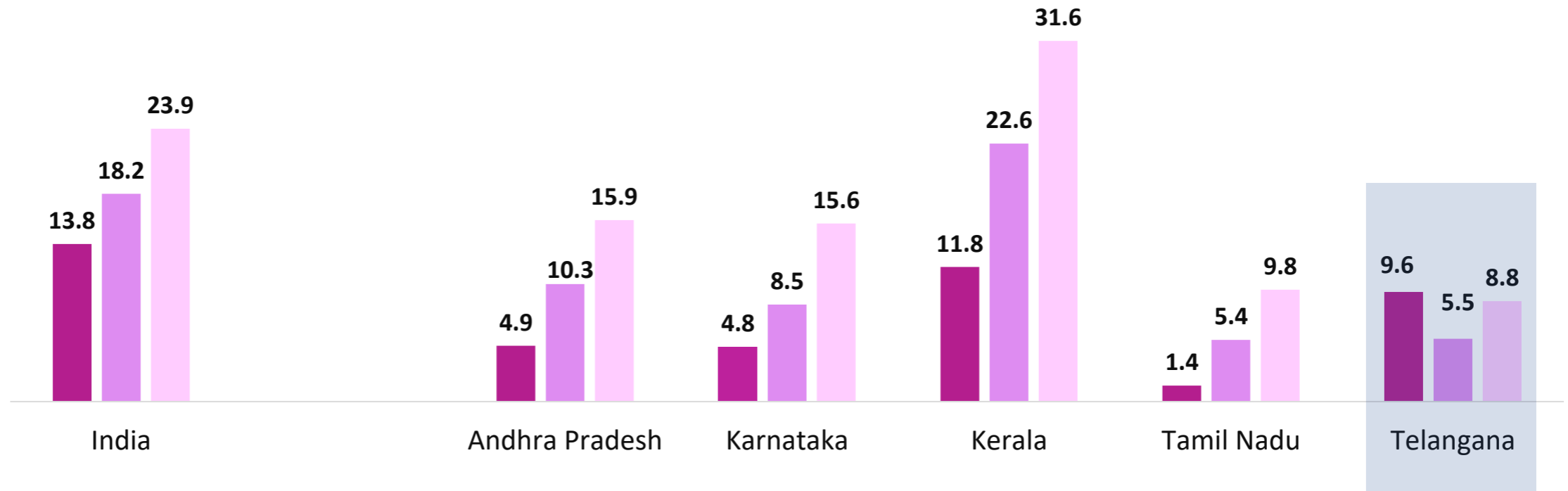
Vitamin D deficiency increases with age

6-10% children and adolescents had Vitamin D deficiency in Telangana, significantly lower than the national average (**14-24%**)

In most southern states, except Kerala, Vitamin D deficiency among children and adolescents was lower than national average.

■ 1-4 Years ■ 5-9 Years ■ 10-19 Years

Cut Off (IOM) Vit D Expert Panel :
Serum 25-hydroxy vitamin D <12 ng/ml

	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
1-4 Years	13.8	4.9	4.8	11.8	1.4	9.6
5-9 Years	18.2	10.3	8.5	22.6	5.4	5.5
10-19 Years	23.9	15.9	15.6	31.6	9.8	8.8

CNNS
Birth to Adolescence

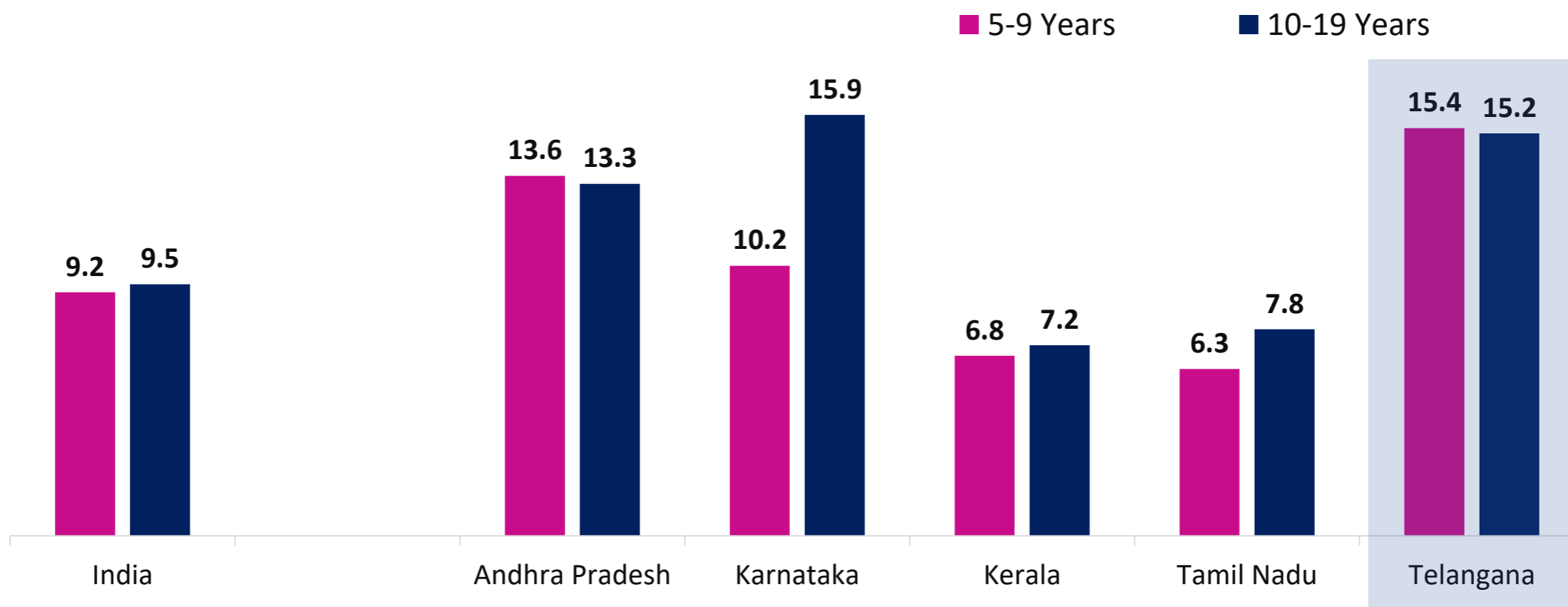Around 15% school-aged children and adolescents were found with high level of glycosylated haemoglobin (HbA1c).

Other indicators of risks of NCDs, such as level of cholesterol, triglycerides, LDL and HDL point to increased risks of NCDs among adolescents.

Birth to Adolescence

Risk of diabetes among school-age children and adolescents

Based on Glycosylated hemoglobin (HbA1c), **15%** of children and adolescents had increased risk of diabetes in Telangana, significantly higher than the country as a whole (**9-10%**)

Among all southern states, risk of diabetes was the lowest in Tamil Nadu and Kerala

Legend: ■ 5-9 Years ■ 10-19 Years

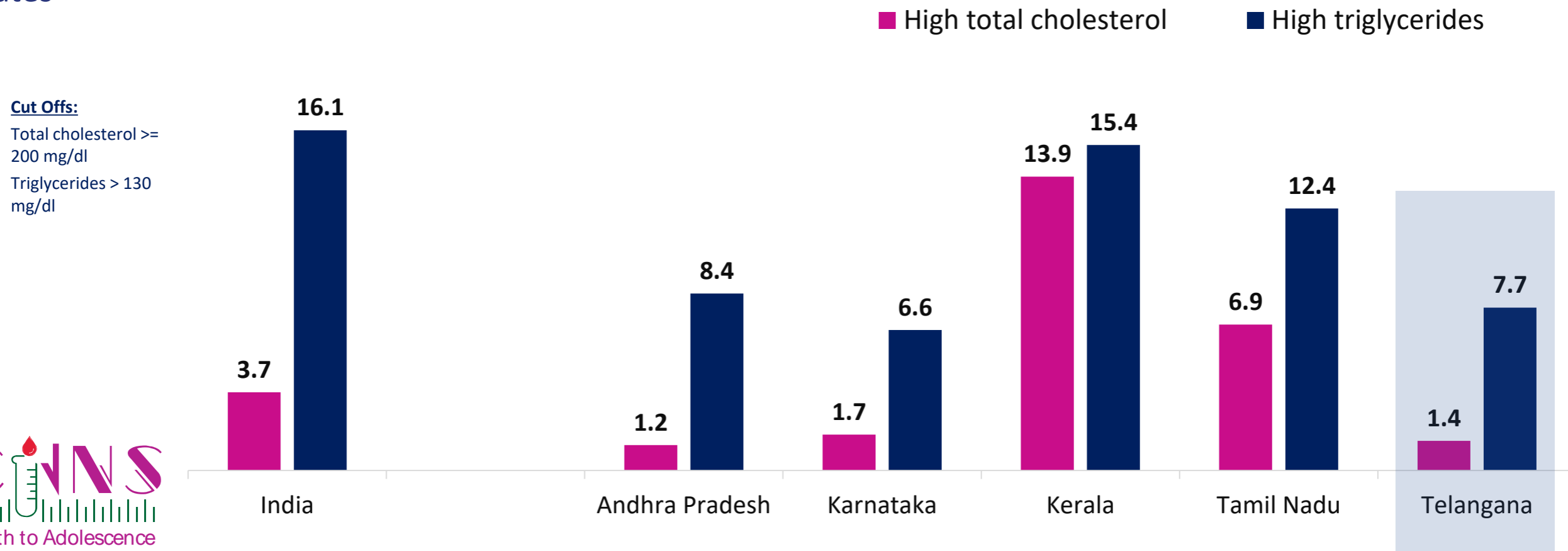|	5-9 Years	10-19 Years
India	9.2	9.5
Andhra Pradesh	13.6	13.3
Karnataka	10.2	15.9
Kerala	6.8	7.2
Tamil Nadu	6.3	7.8
Telangana	15.4	15.2

CNNS
Birth to Adolescence

High total cholesterol and high triglycerides among adolescents

Elevated risk of NCDs in Telangana among adolescents – **1%** had high level of total cholesterol and **8%** with high level of triglycerides

Prevalence of high total cholesterol and high triglycerides did not show any particular pattern in southern states

Cut Offs:
Total cholesterol >= 200 mg/dl
Triglycerides > 130 mg/dl

■ High total cholesterol ■ High triglycerides

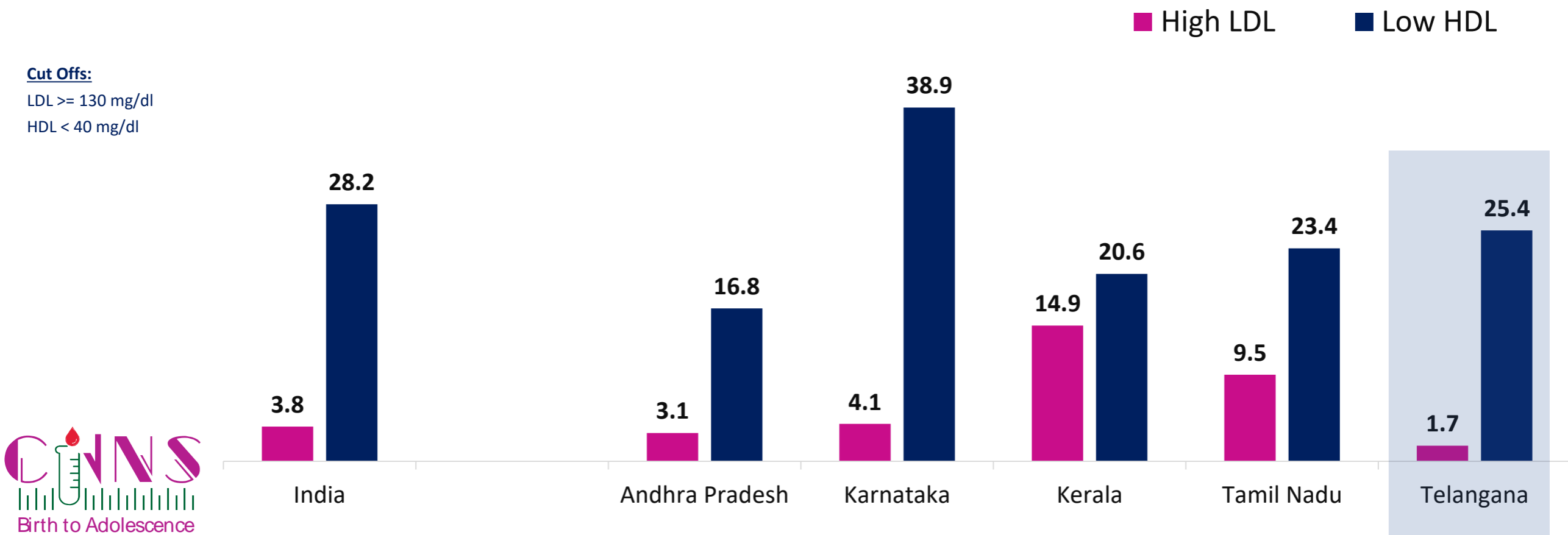| State	High total cholesterol	High triglycerides
India	3.7	16.1
Andhra Pradesh	1.2	8.4
Karnataka	1.7	6.6
Kerala	13.9	15.4
Tamil Nadu	6.9	12.4
Telangana	1.4	7.7

CNNS
Birth to Adolescence

High LDL and low HDL among adolescents

Risk of NCDs among adolescents in Telangana was high – **2%** had high level of LDL and **25%** had low level of HDL

Among the southern states, in Kerala and Tamil Nadu, prevalence of both high LDL and low HDL was high

■ High LDL ■ Low HDL

Cut Offs:
LDL >= 130 mg/dl
HDL < 40 mg/dl

	India	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Telangana
High LDL	3.8	3.1	4.1	14.9	9.5	1.7
Low HDL	28.2	16.8	38.9	20.6	23.4	25.4

CNNS
Birth to Adolescence

Preliminary Policy Discussions from CNNS

- Only about half of anaemia is caused by iron deficiency. Programmes must address all causes of anaemia but continue to address iron deficiency in children under five and adolescent girls (population with largest burden).

- Vitamin A deficiency is less prevalent than expected. Policy review is warranted. Interventions such as dietary diversification and fortification can be taken to scale to address the remaining burden.

- Vitamin D deficiency is an emerging public health issue among urban children and adolescents. Scaling up of fortification efforts can be considered. Further research is required to uncover the effects of pollution and other factors to design better programmes.

- Urinary Iodine data need to be examined in conjunction with salt consumption data for the population and level of iodine in salt at the household level.

- Control of NCDs such as diabetes and cardiovascular disease must start in the early ages to instil lifelong healthy habits as adult diseases start in childhood.

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