सत्यमेव जयते

Ministry of Health and Family Welfare
Government of India

Comprehensive National Nutrition Survey

2016 – 2018

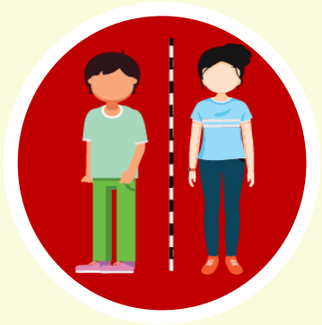
Tamil Nadu
State Presentation

Birth to Adolescence

Largest Micronutrient Survey ever conducted: CNNS 2016-

112,316
Children and adolescents interviewed

51,029
Blood, stool and urine samples collected



360
Anthropometric measurers

2500
Survey personnel in 30 states

30
Microscopists

100
Data Quality assurance monitors

200
Trainers and coordinators

200
Lab technicians

900
Interviewers

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*

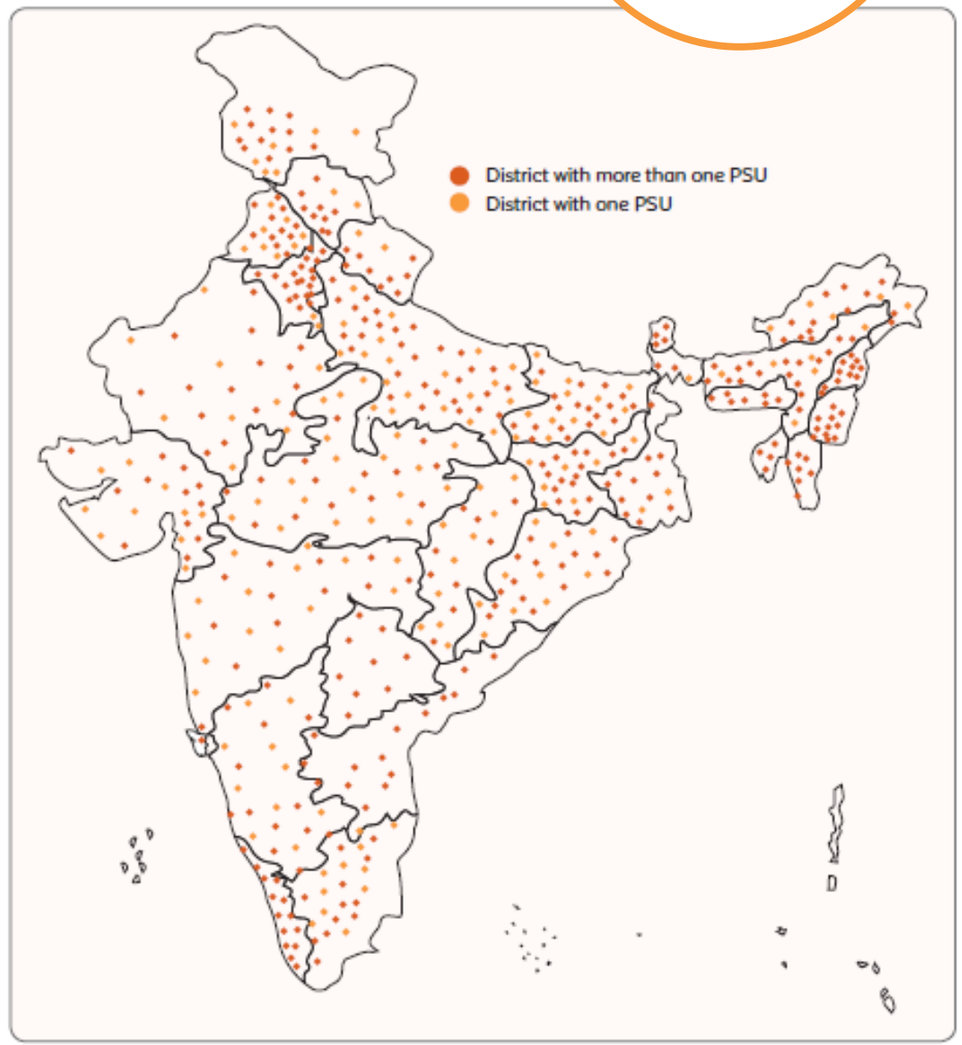
*Soumya Swaminathan, et al. (2019), The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. https://doi.org/10.1016/S2352-4642(19)30273-1

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



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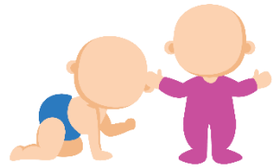
Anthropometry data

	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 (1-4 years)		
		• Waist circumference	

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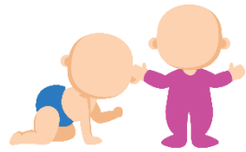
Biochemical indicators - micronutrient deficiencies and NCDs

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

Third Level

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

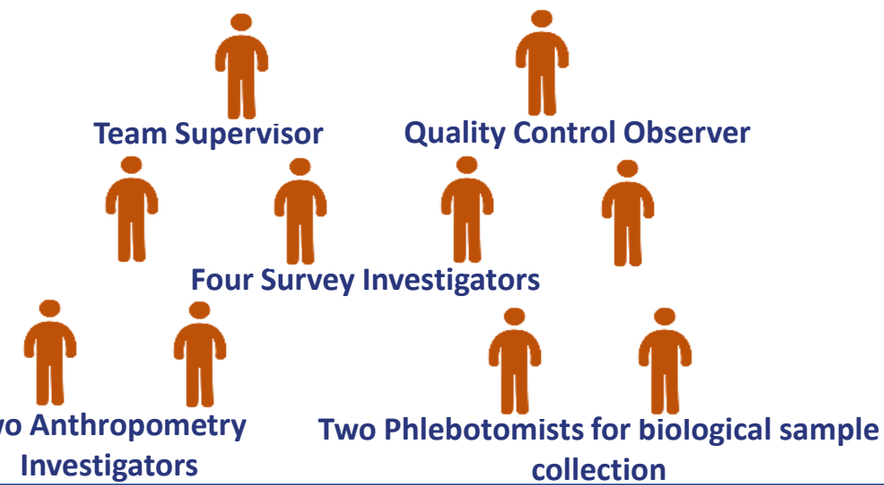
Second Level

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

First Level

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

Team Composition for data collection



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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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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 Tamil

CNNS covered 100 PSUs for data collection in Tamil Nadu

Achieved following sample size by age groups:

	0-4 years	5-9 years	10-19 years	Total
Household and anthropometry data	1,906	1,899	1,861	**5,666**
Biological sample	507	556	577	**1,640**

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Period of data collection in Tamil Nadu

CNNS data collection period: May 4, 2018 to August 10, 2018

- CNNS collected data during the summer season of 2018, while
- NFHS collected data during the winter season through early monsoon season of 2015

Survey	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CNNS 2018					May to August, 2018							
NFHS 4 2015	January to July, 2015											

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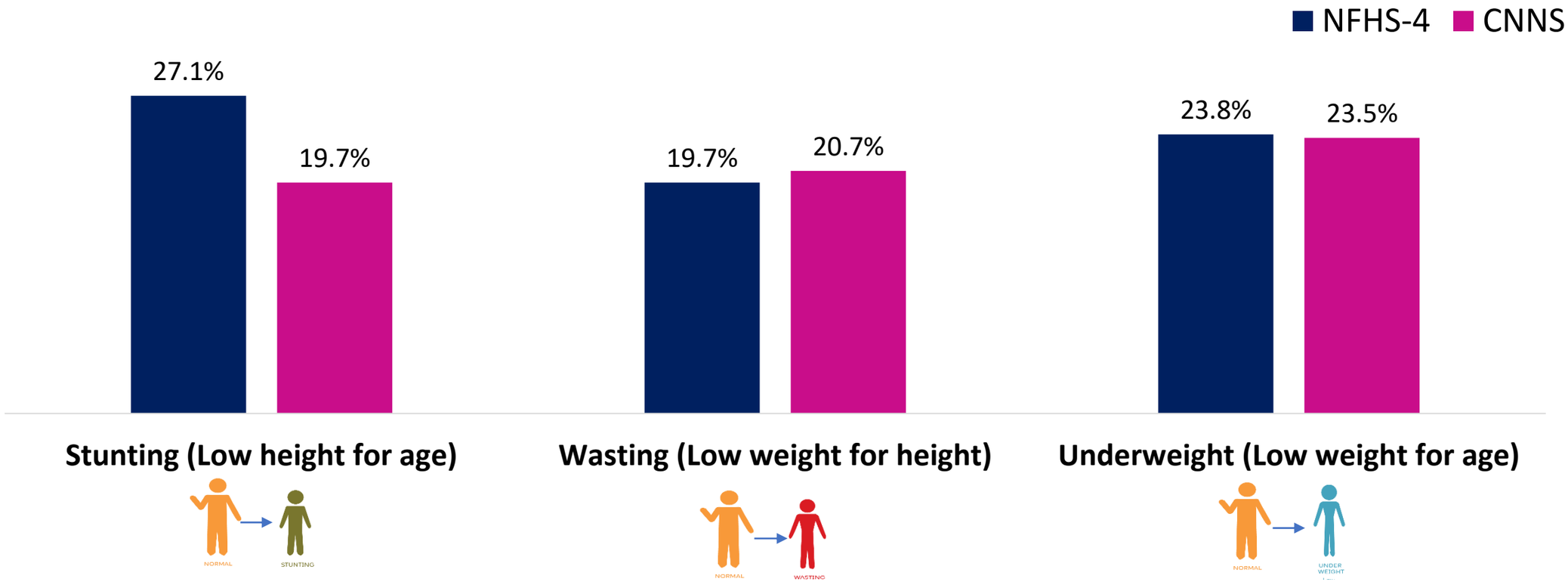
Tamil Nadu key findings: Anthropometry (1/2)

Reduction in stunting but no change in wasting and underweight in children under 5 years



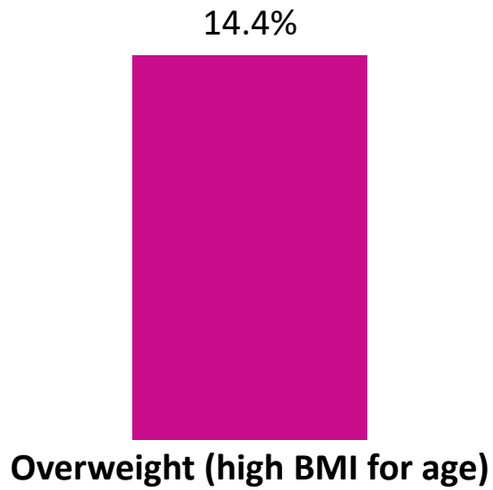
Birth to Adolescence

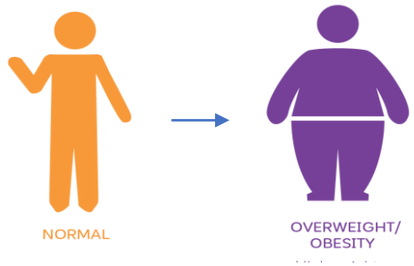
Tamil Nadu key findings: Anthropometry (2/2)

1/5 adolescents aged 10-19 years was thin for their age (BMI-Age <-2SD)

1/10 children aged 5-9 years was stunted. The school age period does not provide an opportunity for catch up growth in height.

14% of adolescents aged 10-19 years were overweight or obese.





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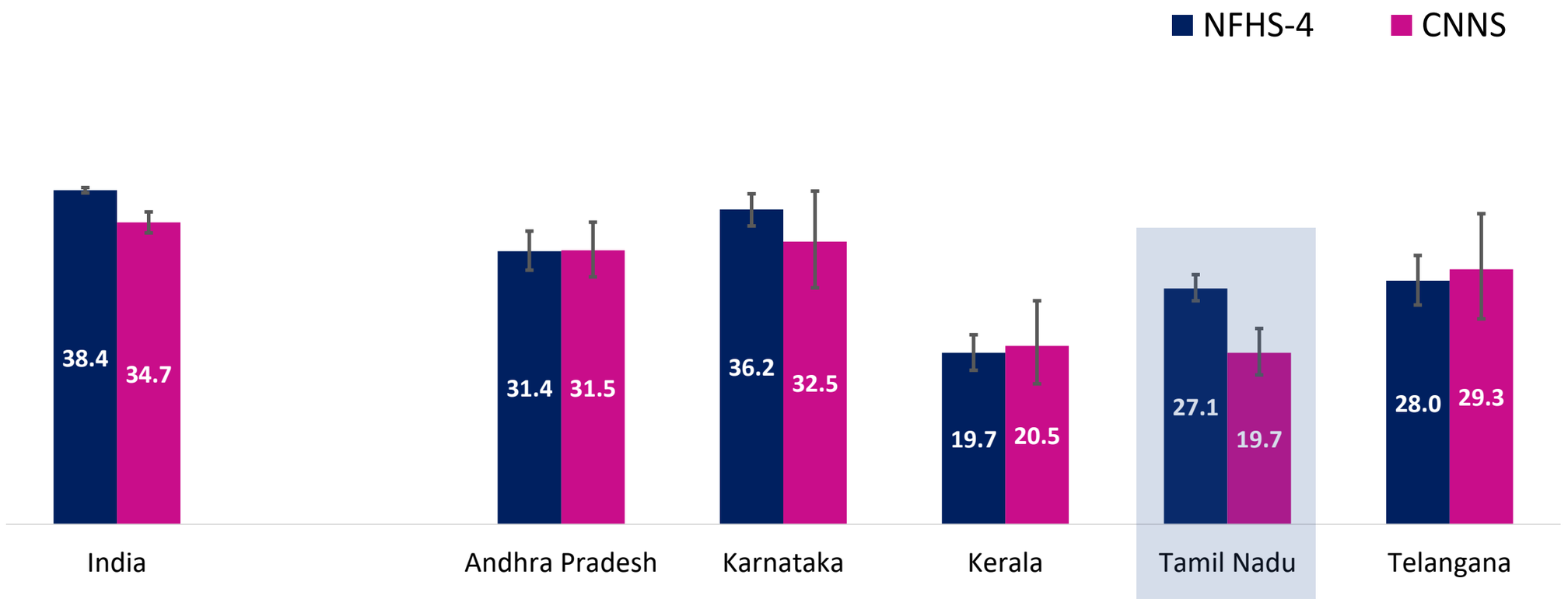
Stunting declined among children under five

Lower prevalence of stunting was observed in CNNS compared to NFHS-4 – **20%** vs **27%** in Tamil Nadu

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

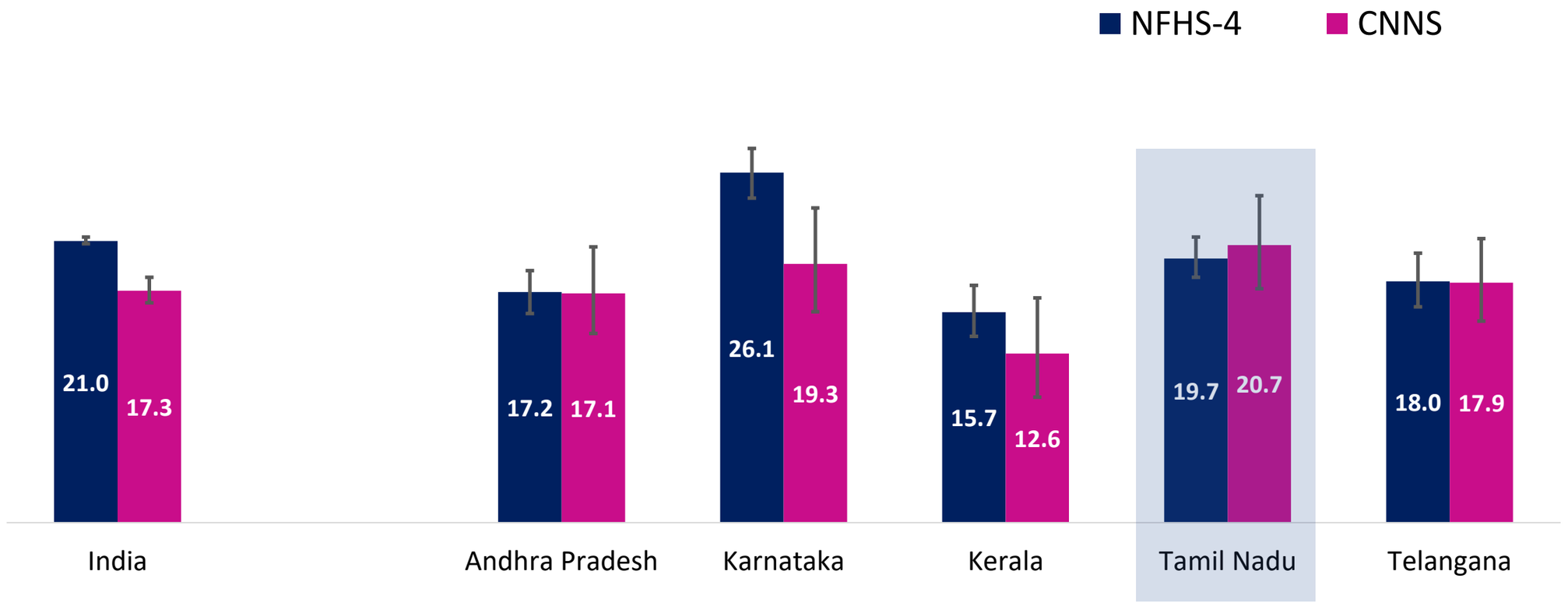


Birth to Adolescence

Wasting among children under five did not change

Prevalence of wasting unchanged in Tamil Nadu between NFHS-4 and CNNS – **20%** vs **21%**

Wasting did not change significantly in any southern state except Karnataka



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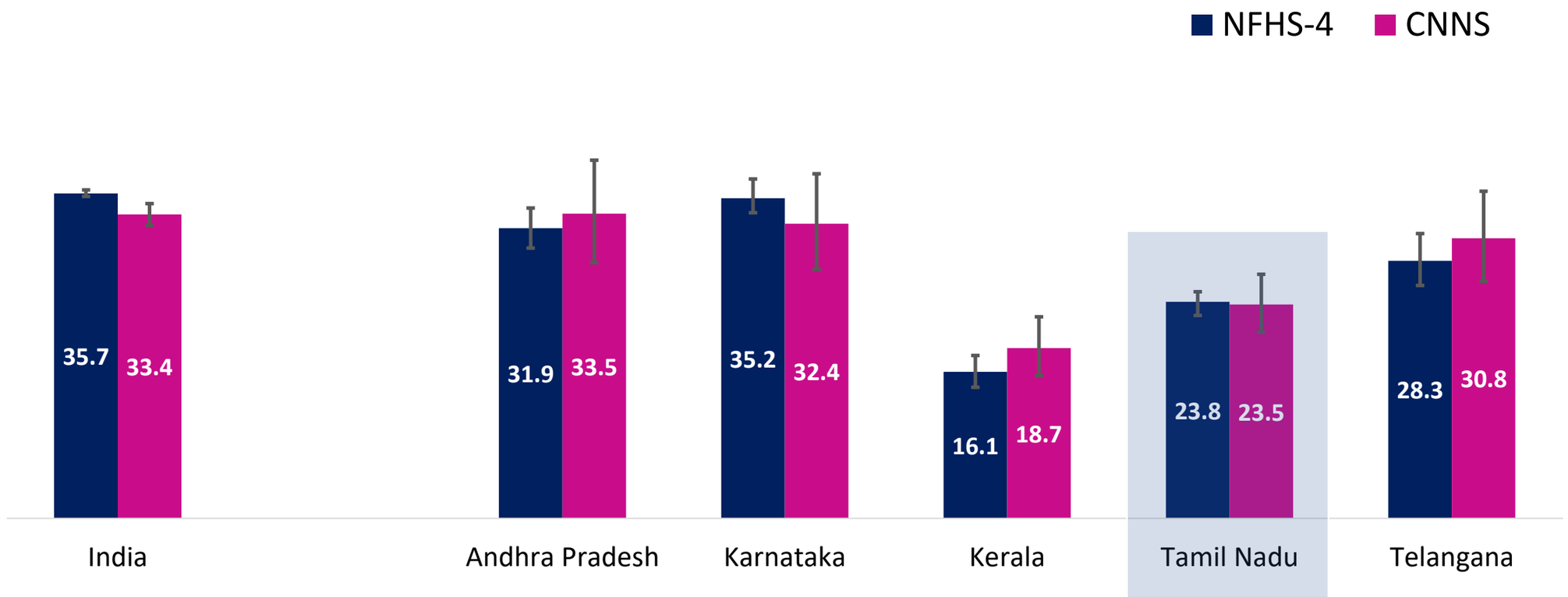
Prevalence of underweight among children under five did not change

Underweight is a composite measure of chronic and acute malnutrition

The prevalence of underweight did not change between NFHS-4 and CNNS – **24%**

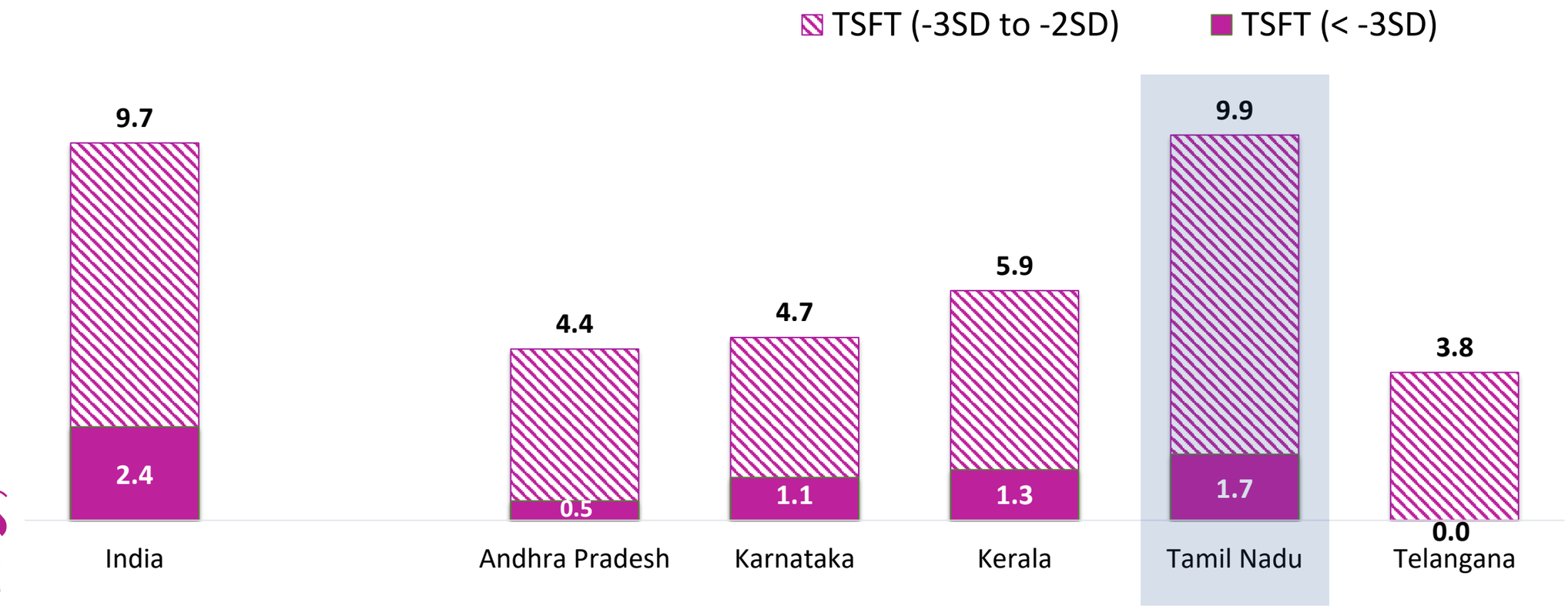
Prevalence remained nearly unchanged in all southern states



Birth to Adolescence

Triceps Skinfold Thickness (TSFT) for children under five

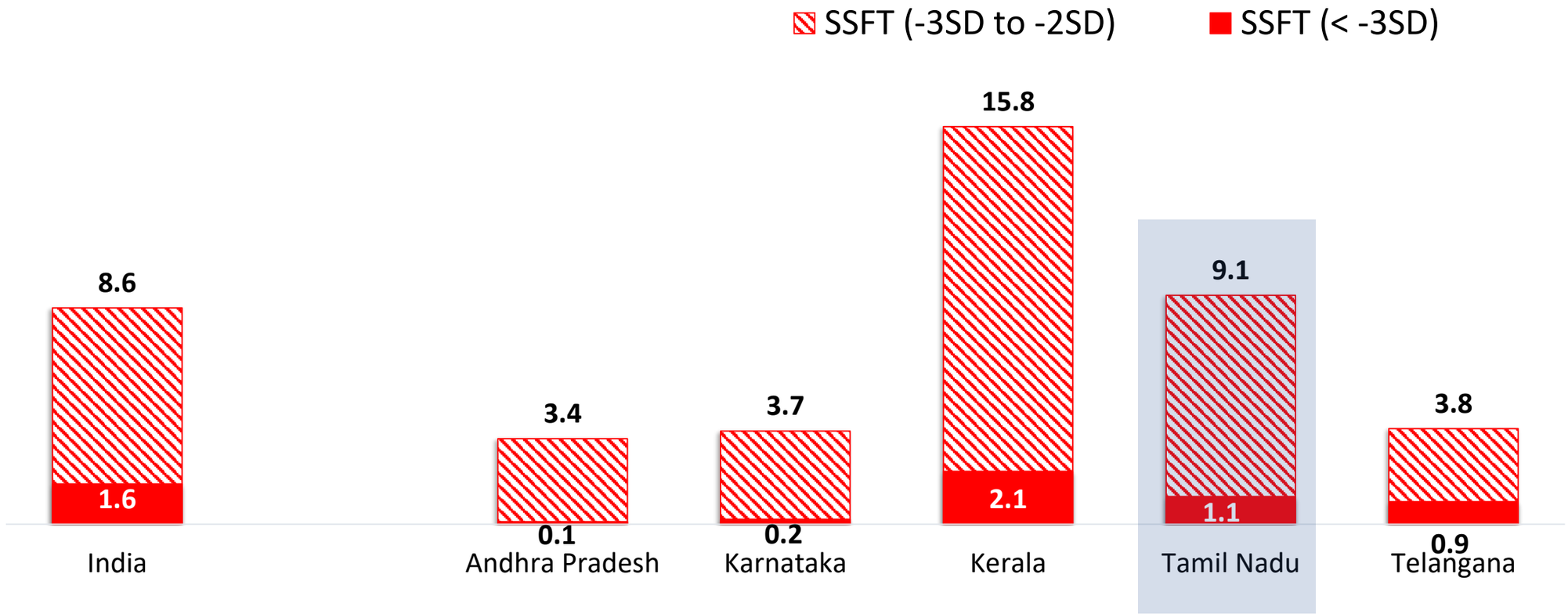
Low fat mass as reported by TSFT in Tamil Nadu was significantly higher than other southern states but was similar to national average



Birth to Adolescence

Subscapular Skinfold Thickness (SSFT) for children aged 1-4 years

Thinness as reported by SSFT in Tamil Nadu was significantly higher than Andhra Pradesh, Telangana and Karnataka; lower than Kerala and at about national level

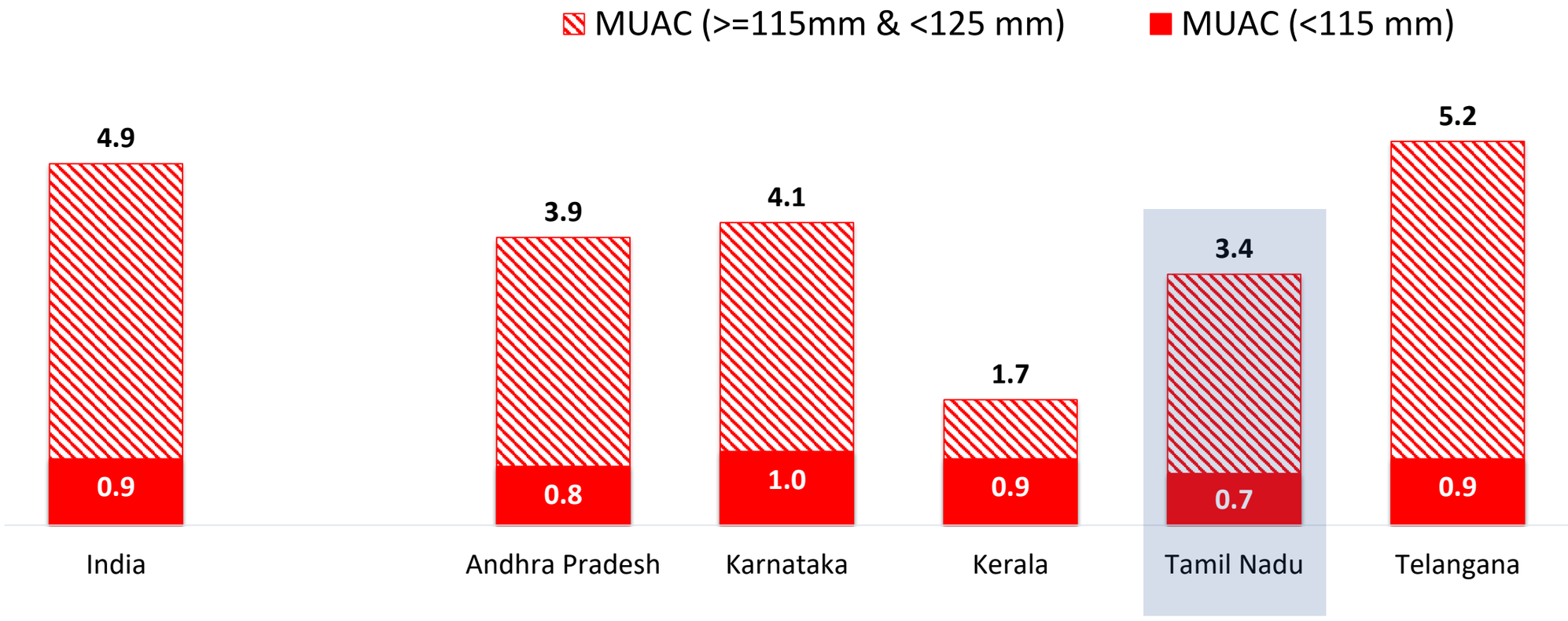


Birth to Adolescence

Mid Upper Arm Circumference (MUAC) for children aged 6-59 months

About **3%** children in Tamil Nadu had low MUAC

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

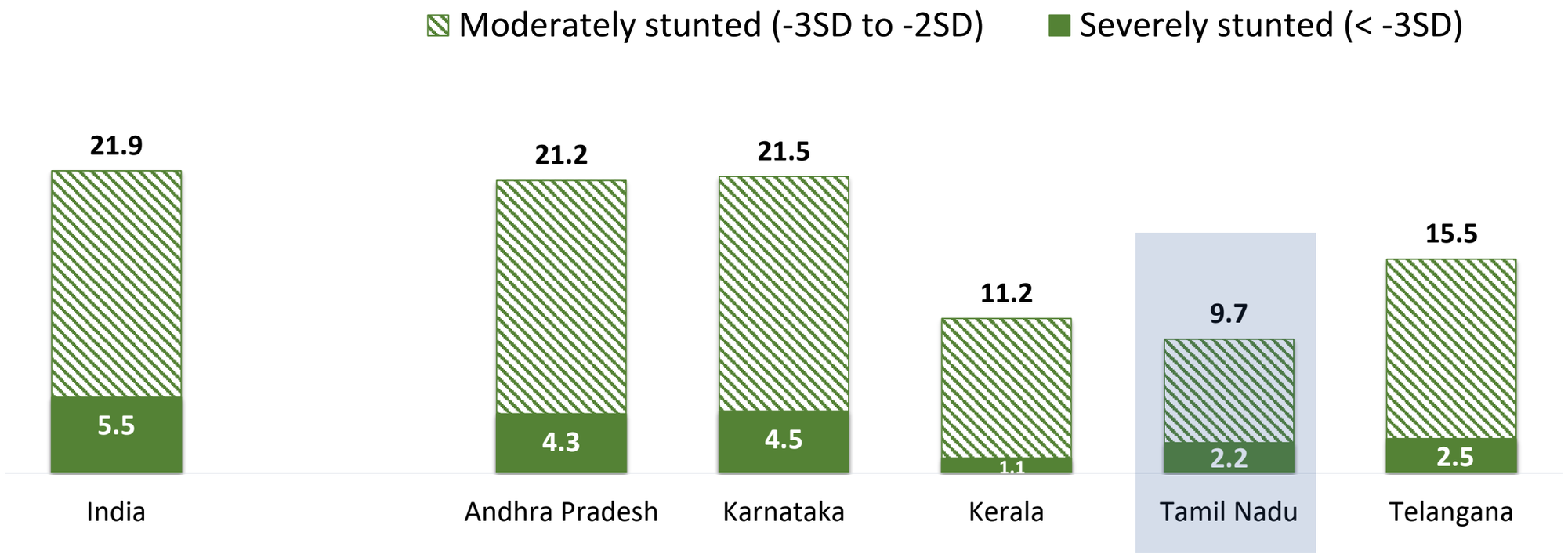


Birth to Adolescence

Stunting among school-age children (5-9 years)

1/10 of 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

Tamil Nadu had lowest prevalence of stunting among the southern states

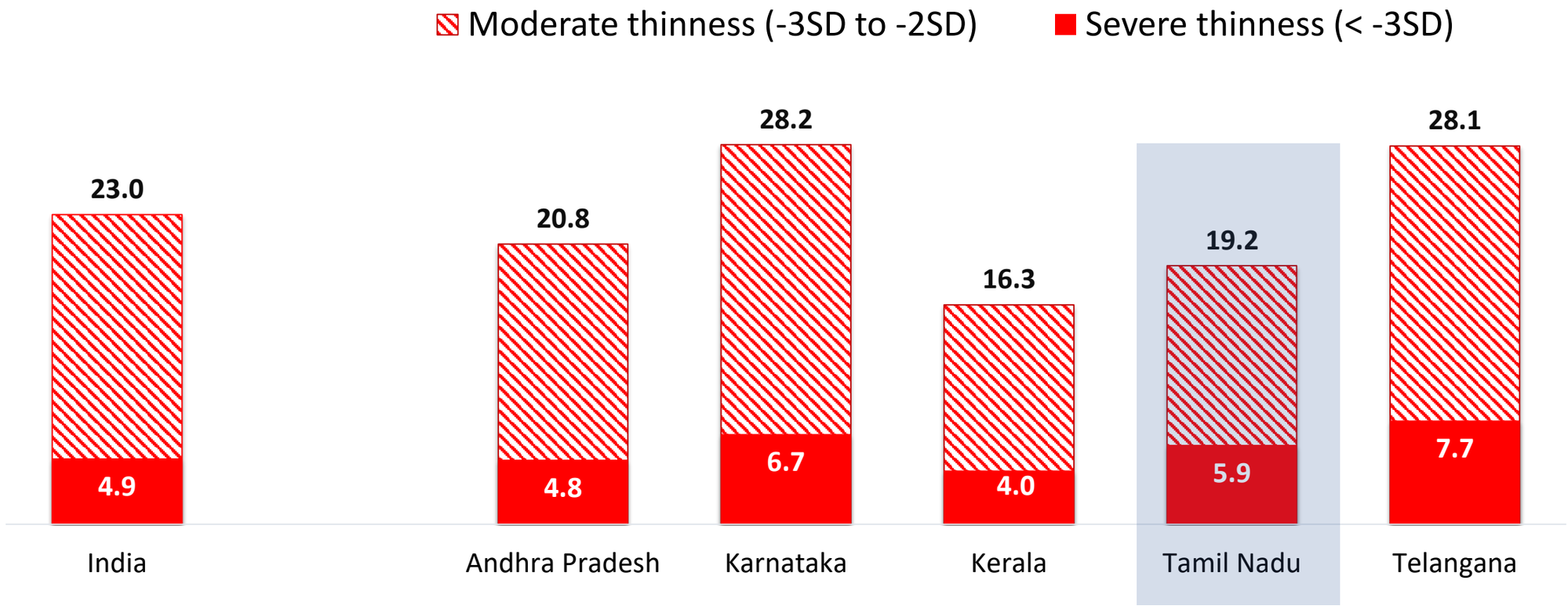


Birth to Adolescence

Thinness among school-age children (5-9 years)

1/5 children aged 5-9 years was thin

Prevalence of thinness in Tamil Nadu was slightly less than national average and among the lowest in the southern region



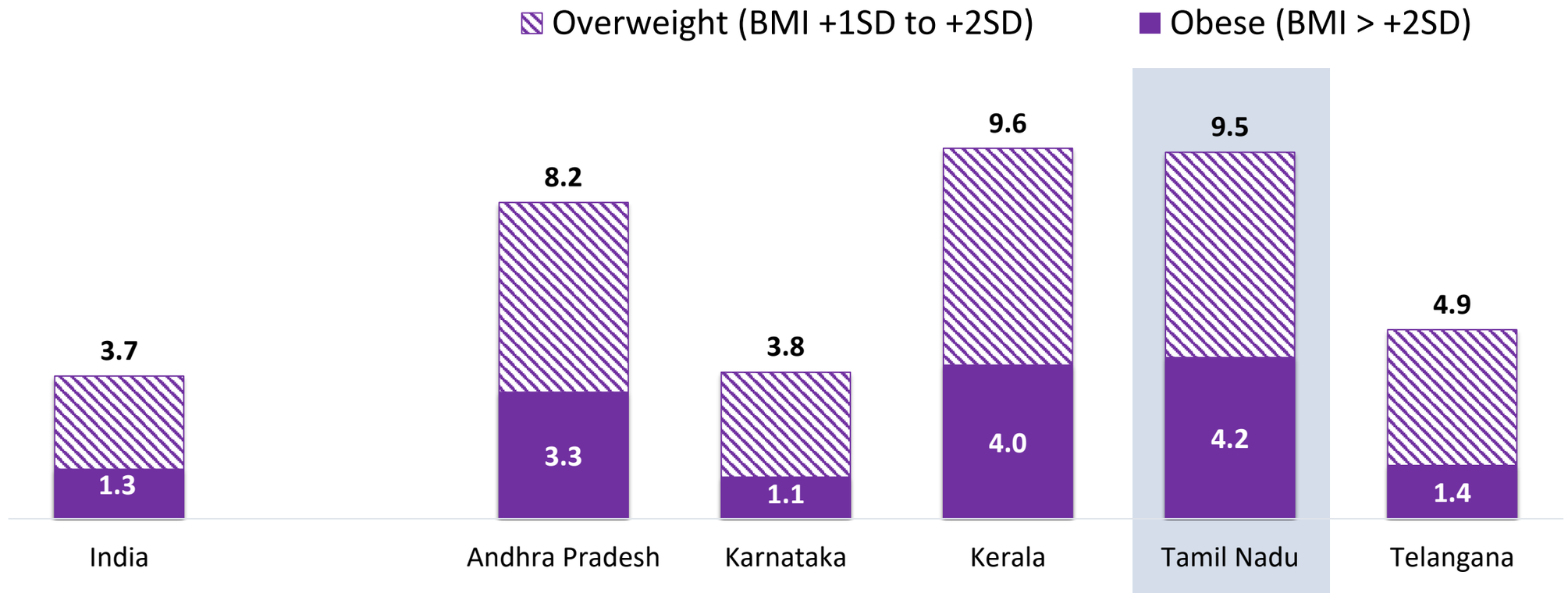
Birth to Adolescence

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 Tamil Nadu was more than double the national average

Among southern states, Tamil Nadu was one with high prevalence of overweight in this age group

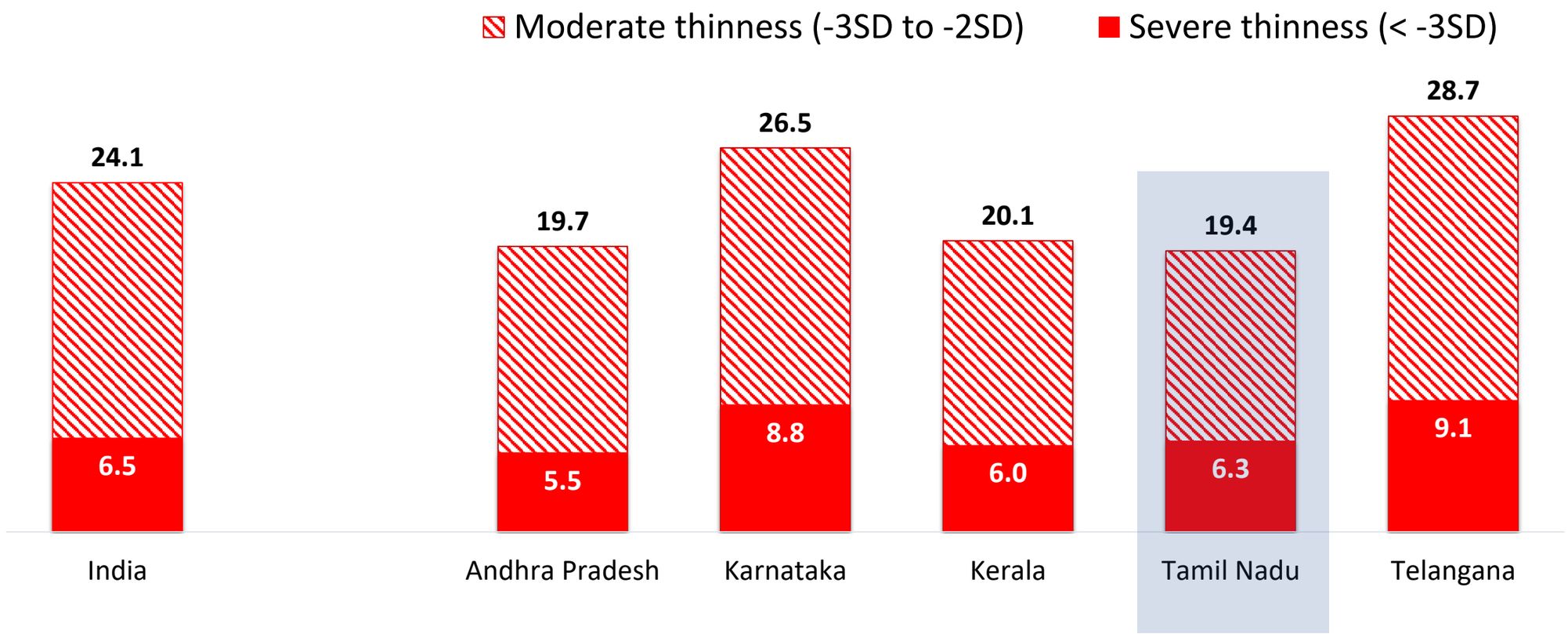


Birth to Adolescence

Thinness among adolescents aged 10-19 years substantially high

1/5 adolescents aged 10-19 years was thin in Tamil Nadu (**19%**), slightly less than national average (**24%**)

Among the southern states, Telangana (**29%**) and Karnataka (**27%**) had very high prevalence of thinness

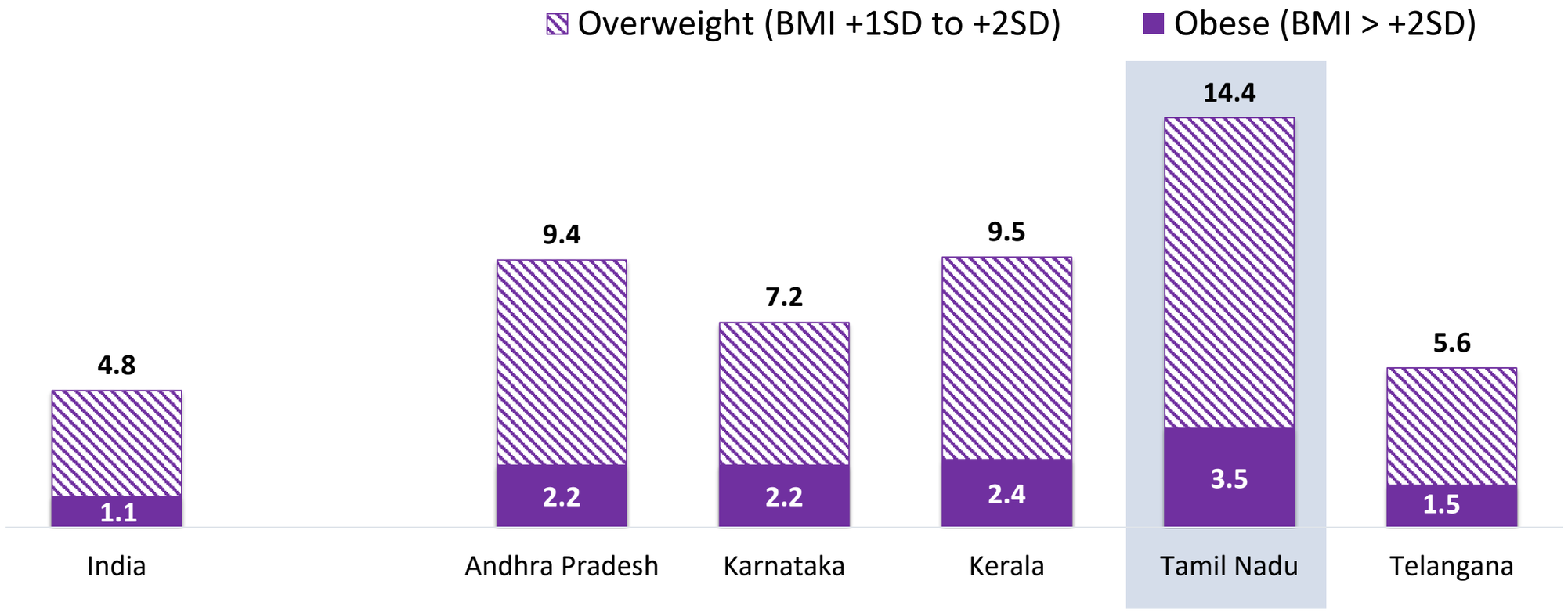


Birth to Adolescence

Prevalence of overweight among adolescents aged 10-19 years high

1/7 adolescents was overweight in Tamil Nadu (**14%**), three times higher than national average (**5%**)

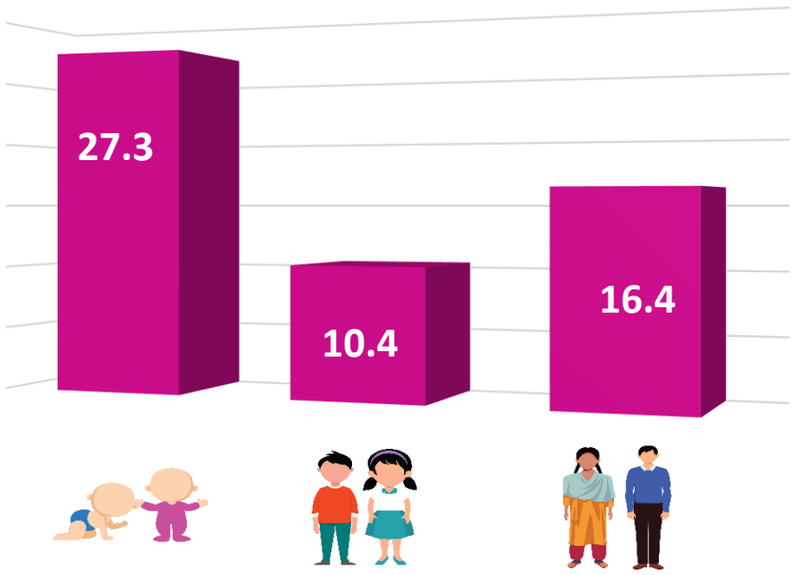
Among the southern states, Tamil Nadu had highest prevalence, also high in Kerala (**10%**) and Andhra Pradesh (**9%**)



Birth to Adolescence

Tamil Nadu key findings: Anaemia and iron deficiency

Anaemia



In Tamil Nadu, 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

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

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Prevalence of Anaemia among children and adolescents

More than **1/4** children aged 1-4 years were anaemic in Tamil Nadu (**27%**), lower than national average (**41%**)

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

Anaemia Cut Offs (WHO)

1-4 years: Hb<11.0 g/dl

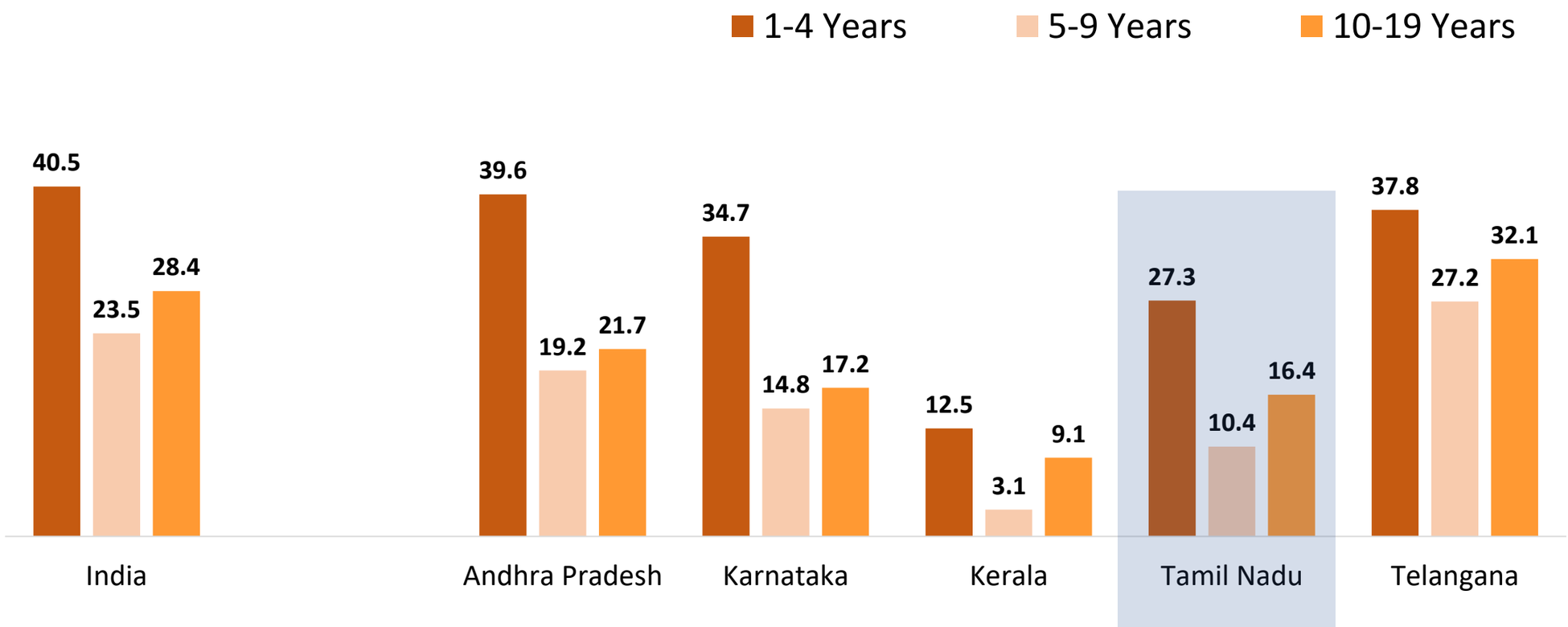
5-11 years: Hb<11.5 g/dl

12-14 years: Hb< 12 g/dl

Girls ≥15years: Hb< 12g/dl

Boys ≥15 years: Hb< 13 g/dl

(Adjusted for altitude)

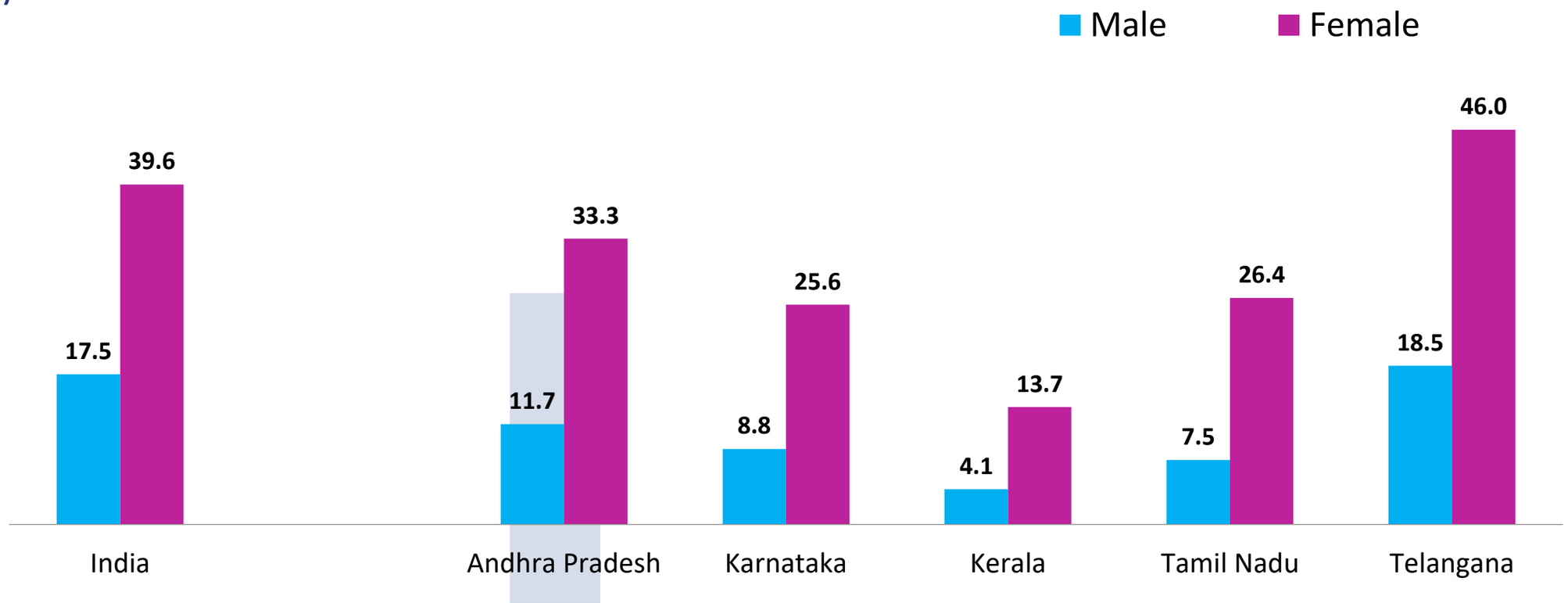


Birth to Adolescence

Prevalence of Anaemia among adolescents (10-19 years)

Overall, in the country, anaemia prevalence among adolescent girls (10-19 years) was twice that of adolescent boys

In Tamil Nadu, as in many other southern states, adolescent girls were three times more likely than adolescent boys to be anaemic

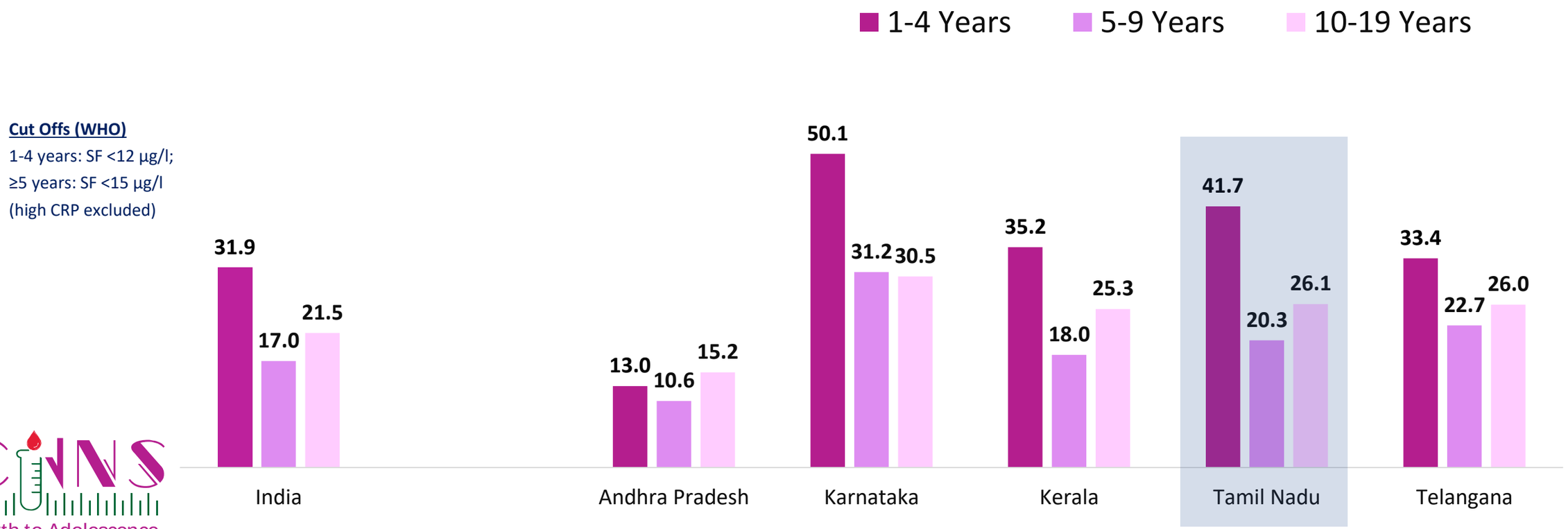


Birth to Adolescence

Iron deficiency measured by serum ferritin among children and adolescents

More than **2/5** children aged 1-4 years had iron deficiency in Tamil Nadu (**42%**), higher than the national average (**32%**); prevalence was highest among children aged 1-4 years

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



Birth to Adolescence

Tamil Nadu key findings: Vitamin A and Vitamin D deficiency

Vitamin A deficiency was moderately high (13%) in children 1-4 years indicating the need for policy review

School-age children and adolescents were found to have similar levels of Vitamin A deficiency as children aged 1-4 years

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

Adolescents aged 10-19 years were found to have higher level of Vitamin D deficiency than children aged 1-9 years

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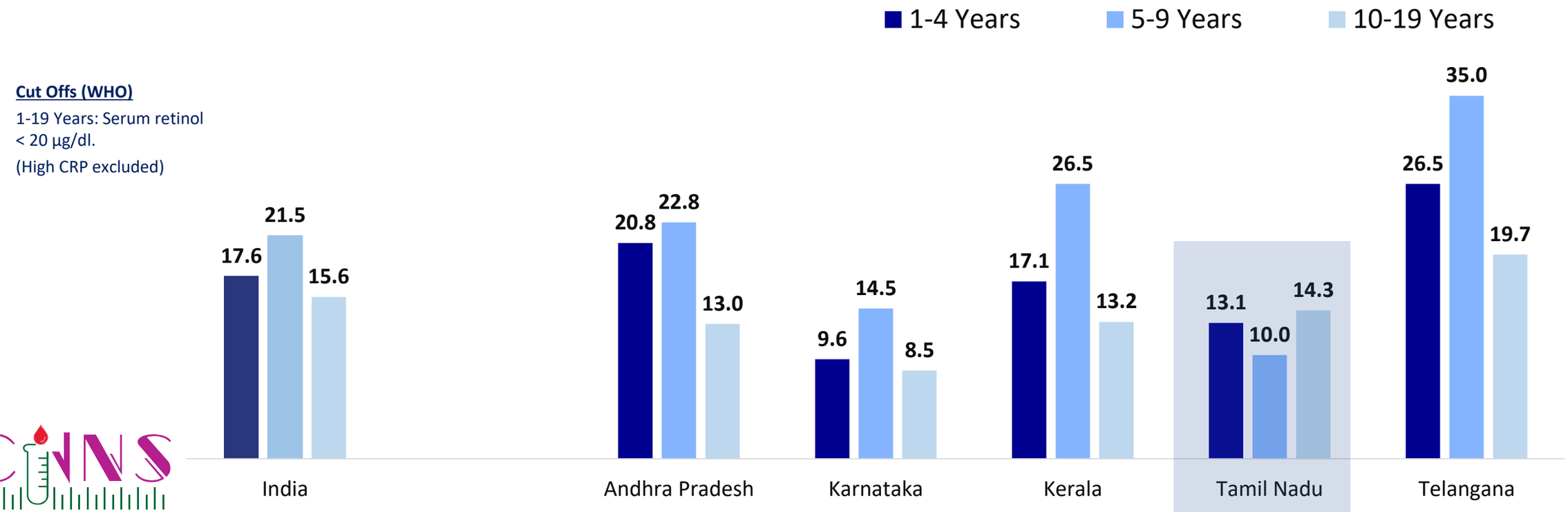
Vitamin A deficiency among children and adolescents

10-14% children and adolescents had Vitamin A deficiency in Tamil Nadu, slightly lower than national average (**18-22%**)

Among southern states, Karnataka and Tamil Nadu had lower prevalence of Vitamin A deficiency than other three states

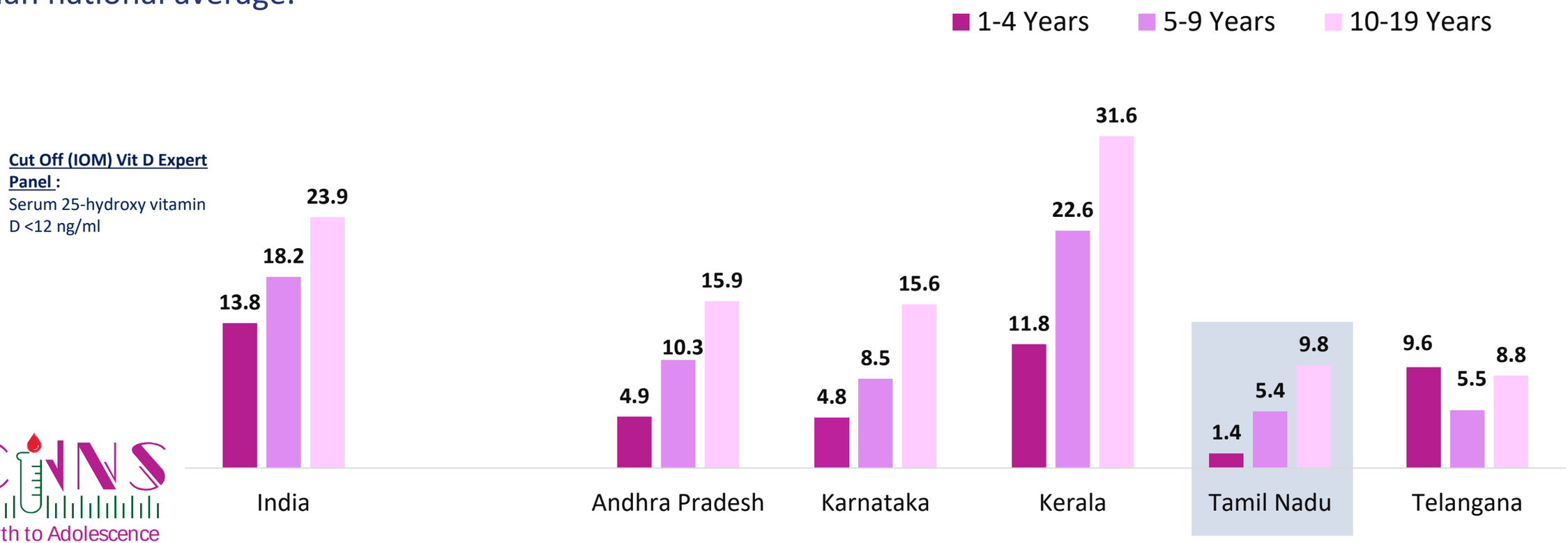


Birth to Adolescence

Vitamin D deficiency increases with age

1-10% children and adolescents had Vitamin D deficiency in Tamil Nadu, much lower than the national average (**14-24%**); Vitamin D deficiency increased sharply with age.

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



Birth to Adolescence

Tamil Nadu key findings: Non-communicable diseases

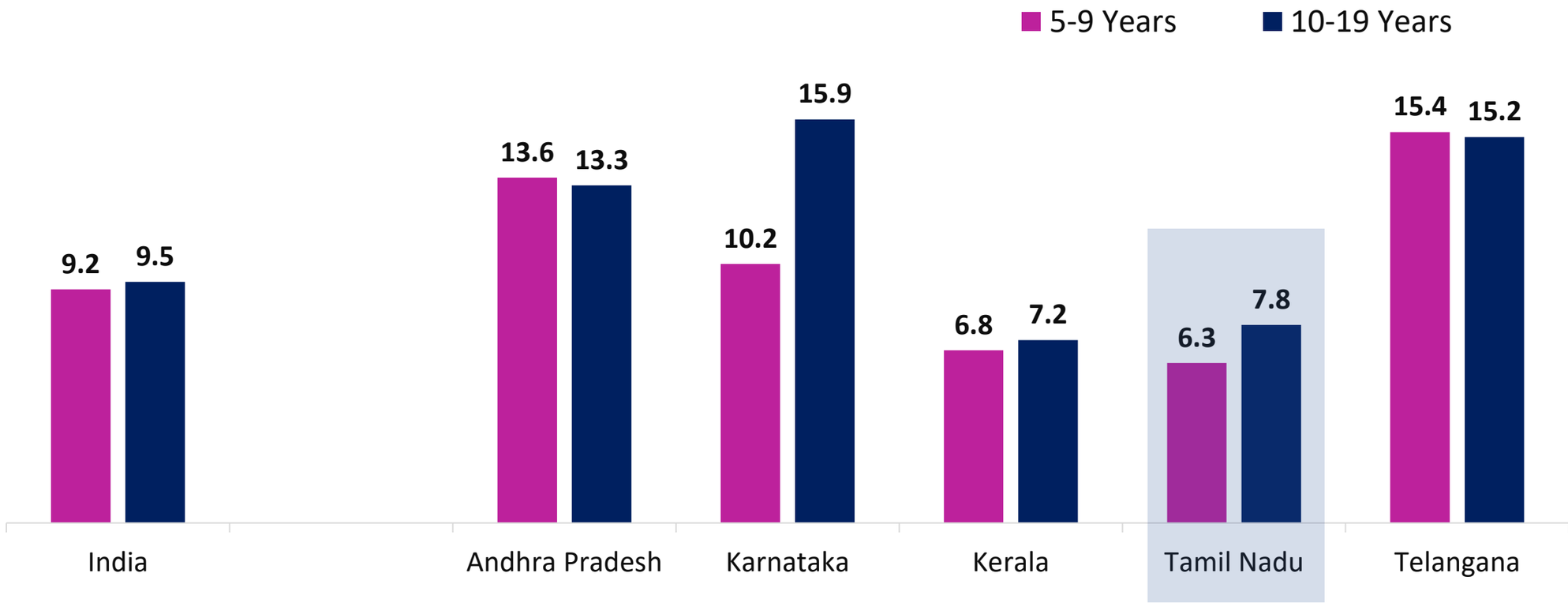
Slightly less than 10% school-age children and adolescents were found with high level of glycosylated haemoglobin (HbA1c).

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

Risk of diabetes among school-age children and adolescents

Based on Glycosylated hemoglobin (HbA1c), slightly less than **10%** children and adolescents had increased risk of diabetes in Tamil Nadu, about the same level in the country as a whole (**9-10%**)

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

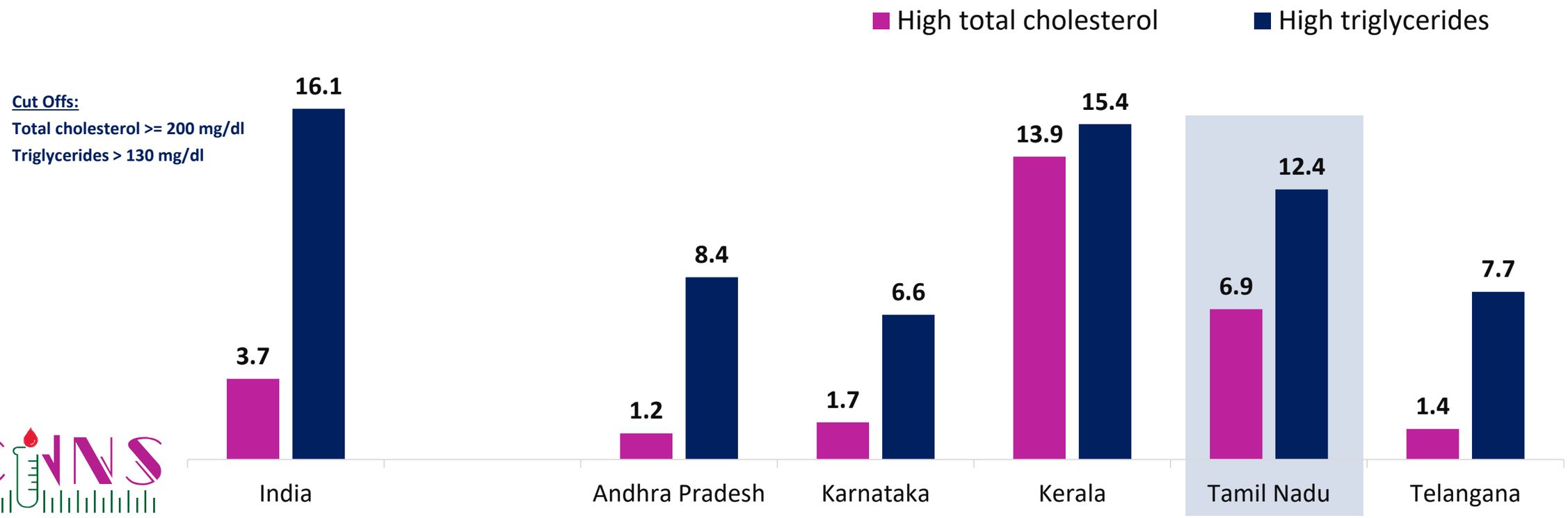


Birth to Adolescence

High total cholesterol and high triglycerides among adolescents

Elevated risk of NCDs in Tamil Nadu among adolescents – **7%** had high level of total cholesterol and **12%** with high level of triglycerides

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

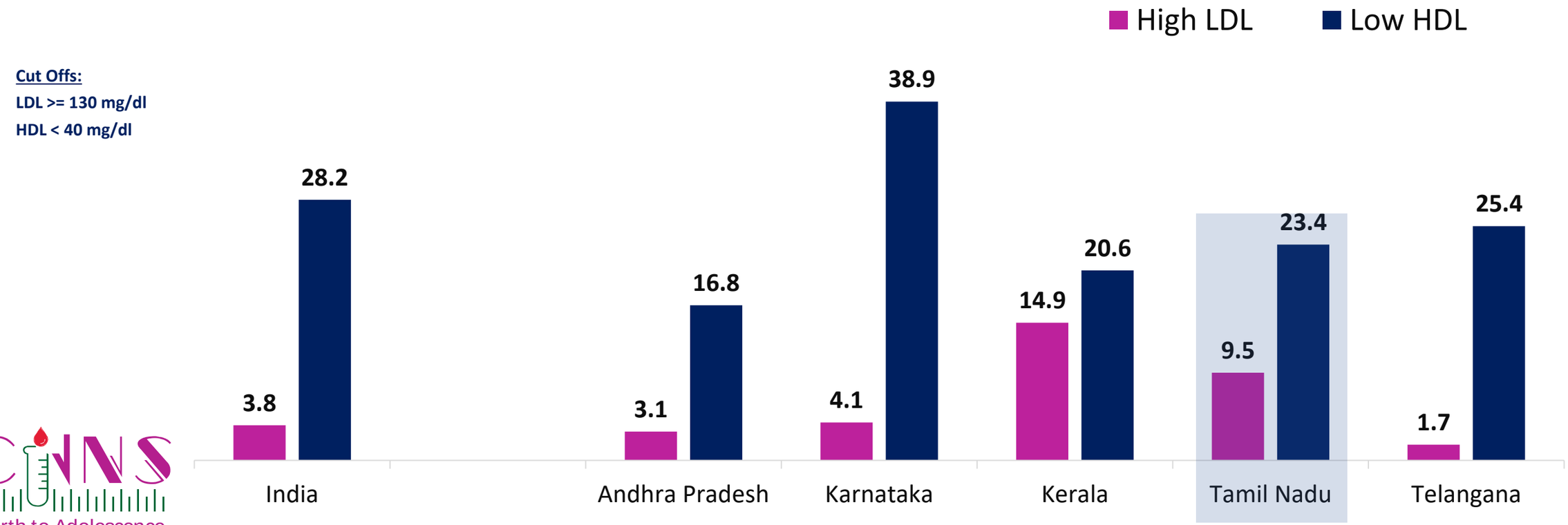


Birth to Adolescence

High LDL and low HDL among adolescents

Risk of NCDs among adolescents in Tamil Nadu was high – **1/10** had high level of LDL and **1/4** had low level of HDL

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



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.

CNNS
Birth to Adolescence

The survey was conducted with generous financial support from

Aditya and Megha Mittal

and technical support from