

**TIME TRENDS IN SUGAR, SALT AND FAT CONSUMPTION AND CHRONIC DISEASE EPIDEMIC IN INDIA: IS THERE A NEED FOR INTERVENTION**



**at ILSI-India Seminar on Recent Developments in Food Science and Technology for Better Nutrition**

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- **Sugar, Salt and Fat are the three crucial components of food that affect the overall taste and health.**
- **It is well evident from the scientific research away back that excessive intake of high sugar, salt and fat (HSSF) through diet show adverse effect on human health.**
- **Changes in the world food economy are reflected in shifting increased consumption of energy-dense diets high in sugar (refined carbohydrates), salt and fat.**
- **These patterns are combined with a decline in energy expenditure that is associated with a sedentary lifestyle and the phasing out of physically demanding manual tasks in the workplace.**
- **Because of changes in dietary habits and lifestyle patterns, non communicable diseases (NCDs) such as obesity, type 2 diabetes, cardiovascular disease (CVD), hypertension and stroke, and gastrointestinal and reproductive cancers are increasing in epidemic proportions.**



- **Human beings has the ability to synthesize energy from simple sugars present naturally in foods.**
- **Most of the dietary sugars are converted to a major fuel 'glucose' used by all cells in the body.**
- **Levels of glucose in the blood may vary, when low will impair the brain and cause permanent mental deterioration.**
- **In many developing countries like India, with increasing urbanization, mechanization of jobs and transportation and physical inactivity, availability of processed and fast foods, consuming more “energy-dense, nutrient-poor” diets (sugar and sweets), there is an evidence of increased NCD incidence.**



- **Salt (Sodium) is one of the essential nutrients and is tightly regulated by the human body.**
- **Sodium is an essential element for the normal functioning of human body.**
- **It plays a crucial role as the major Cation in extracellular fluid, and helps in maintaining the osmolarity and fluid balance through the sodium potassium pump.**
- **Under normal health conditions, majority of sodium is excreted (93%) through urine and small quantity may lost through sweat and feces.**
- **Therefore, total body sodium can determine blood volume and thus blood pressure.**
- **There is enough evidence that high levels of sodium intake are associated with an increased risk of blood pressure.**
- **The joint report of WHO/FAO on 'Diet, Nutrition, and Prevention of Chronic Diseases (WHO, 2003)' recommended to limit salt intake <5 g/day.**

- **If an elevation is observed in the BP levels during a period of high dietary sodium or reduces during a period of low dietary sodium, the individual is called to be Salt Sensitive.**
- **Many population-based intervention studies have demonstrated that when salt intake is reduced, there was a reduction in population BP levels.**
- **Research suggests that lower sodium intake would result in the decreased risk of cardiovascular disease and incident stroke.**
- **Assessment and monitoring of dietary sodium concentrations plays a crucial role in planning and development of an intervention strategies for risk reduction.**
- **The International study of Salt and Blood Pressure (INTERSALT), showed a modest association between higher levels of sodium intake and higher blood pressure.**
- **Government of India, in the NCD India frame work, a goal of 30% reduction in mean intake of salt/sodium at population level.**





**Dietary fat (lipids) provides energy and essential fatty acids, serves as a vehicle for fat-soluble vitamins and facilitates their absorption.**

**Since fat provides high energy value (9Kcal/g) as compared to carbohydrates or proteins (4Kcal /g), therefore, the fat content of a diet contributes significantly to its caloric density.**

**Fat enhances texture, taste and flavor of food, reduces its gastric emptying and thereby affects satiety, which are being exploited by the food restaurants.**

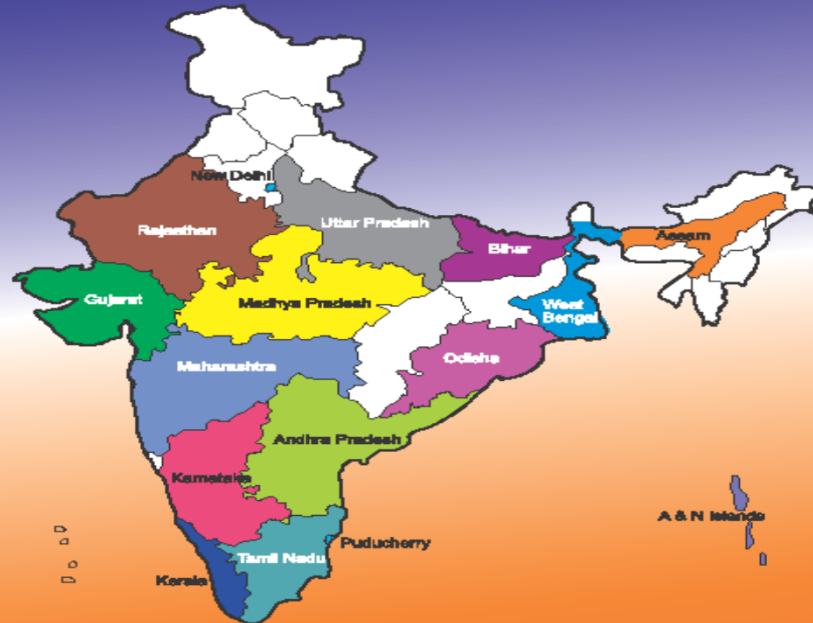
**In the body, fatty acids used for generation of cellular energy and biosynthesis of membrane lipids and lipid mediators, are essential in development of central nervous system, modulate lipoprotein metabolism and risk for diet-related non-communicable diseases (DR-NCDs).**

**The composition of dietary fat is the primary determinant of the main blood lipid risk factors for cardiovascular disease such as serum total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol and triglycerides.**

- **It is evident that saturated fatty acids increase serum cholesterol and dietary polyunsaturated fatty acids lower serum cholesterol contrarily.**
- **These leads to high disability and premature deaths in both developing and developed countries, placing additional burden on the national economy.**
- **Therefore, regular monitoring of consumption of sugar, salt and fat among population groups in India is very important to take an important and immediate measures to reduce the risk of getting non-communicable diseases.**
- **General population studies on consumption of diets high in fat, especially saturated fat have shown increased risk of cancer, diabetes and heart disease.**
- **Saturated fats (Dairy products, meat and eggs etc.) are considered to show adverse effect on health if consumed in large amounts.**
- **Therefore, it is essential to assess consumption levels of sugar and sugar sweetened beverages, salt and fats among various population groups to enable planner and implementers to develop intervention strategies to maintain sugar consumption levels at desirable limits.**

## NATIONAL NUTRITION MONITORING BUREAU

(Established 1972)



NATIONAL INSTITUTE OF NUTRITION  
Indian Council of Medical Research  
Hyderabad - 500 007, INDIA

2014

**NNMB surveys estimated consumption levels of sugars, salts and fats in the states of.....**

- **ANDHRA PRADESH**
- **KARNATAKA**
- **KERALA**
- **TAMIL NADU**
- **MAHARASHTRA**
- **MADHYA PRADESH**
- **ORISSA**
- **UTTAR PRADESH**
- **GUJARAT AND**
- **WEST BENGAL**

## **Study Design and Methodology**

**NNMB studies are cross sectional longitudinal community based studies.**

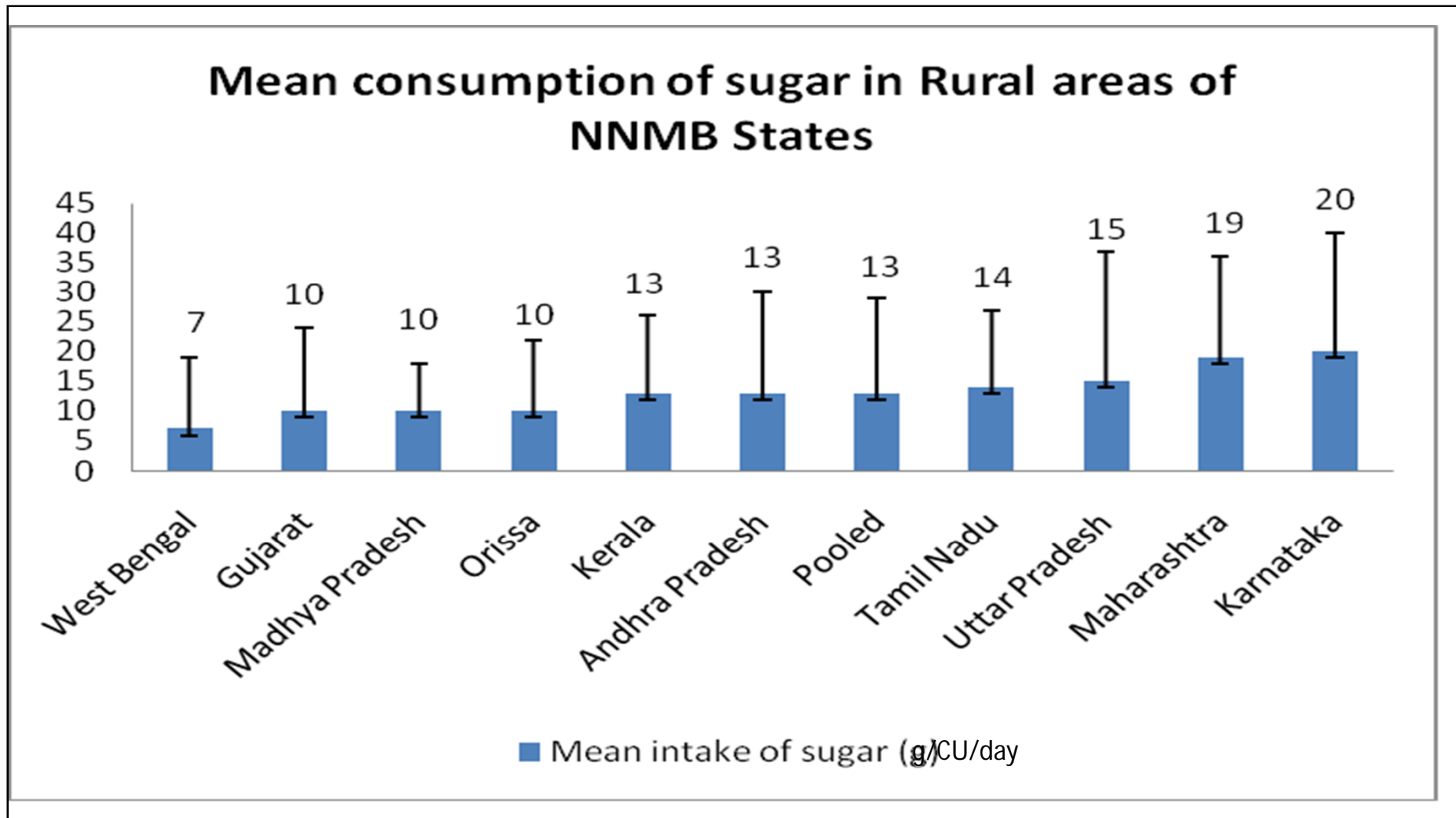
**NNMB rural and tribal surveys were carried out in 120 villages in each states and 24 hour recall diet surveys were carried out in 1200HHS in each states.**

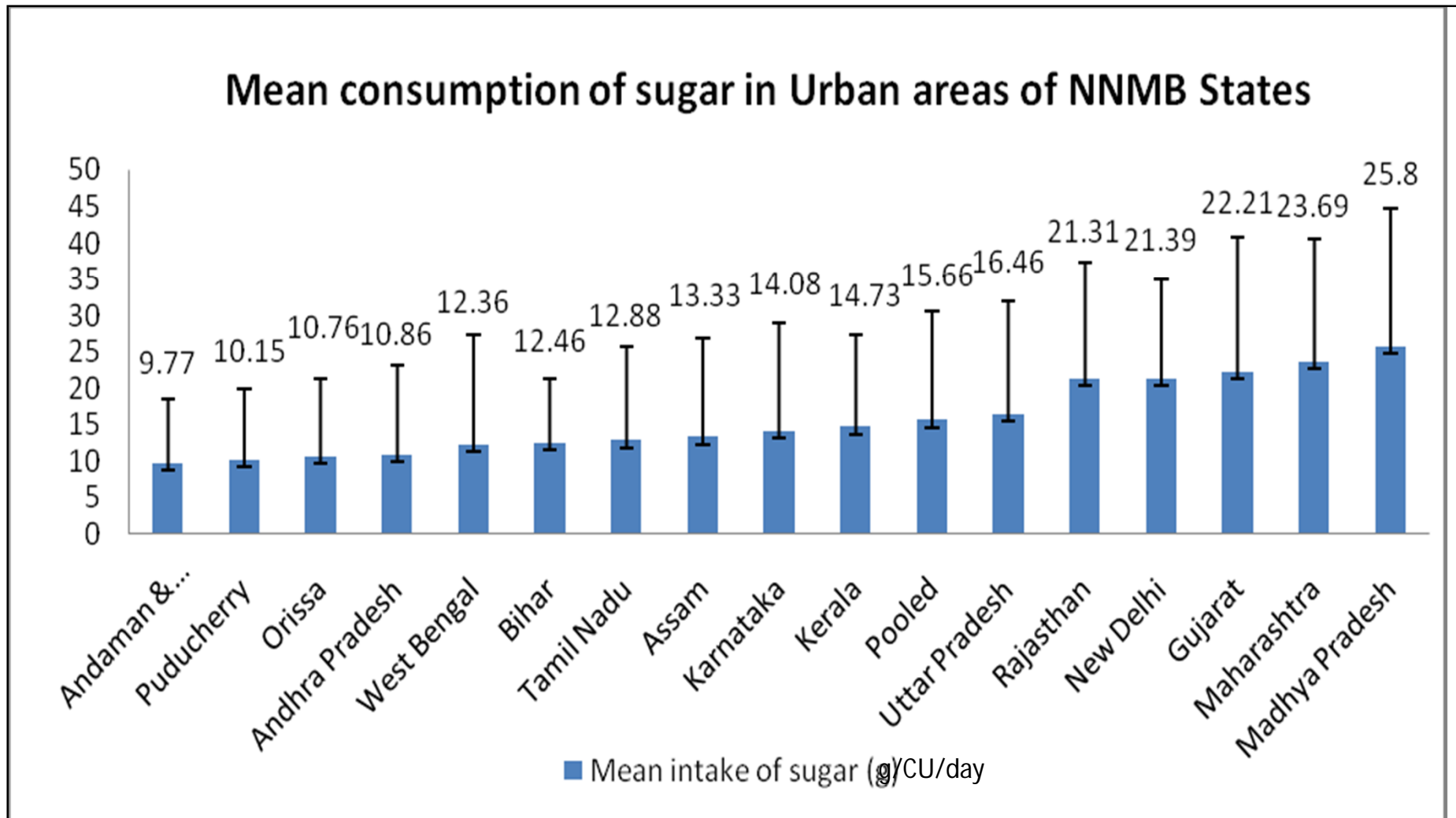
**NNMB urban nutrition surveys were carried out in select five cities ( $\geq 1$  lakh population). About 900HHs, 24 hour recall diet surveys were covered from each state, and covered 16 states.**

**Visible dietary fats, added salt and sugars were collected through 24 hour recall diet surveys.**

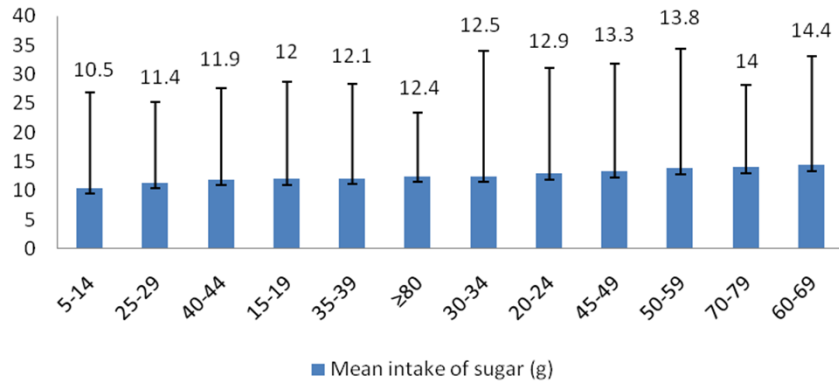
**For the purpose, NNMB data 24hour recall dietary data was obtained and analysed the data for consumption levels of sugar, salt and fats for various population groups in different time periods.**

# RESULTS

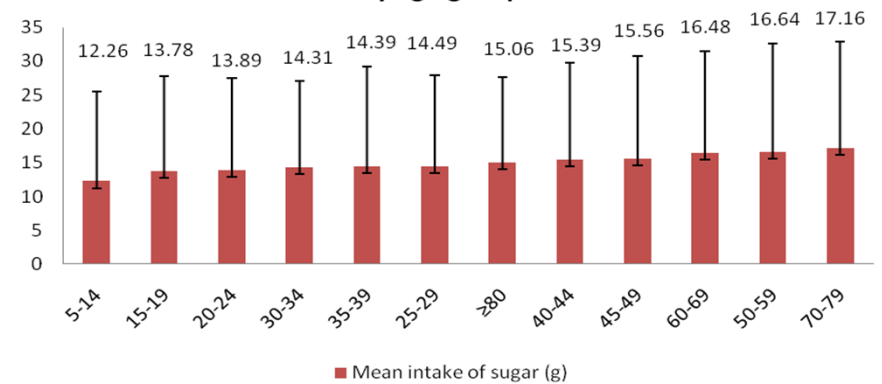




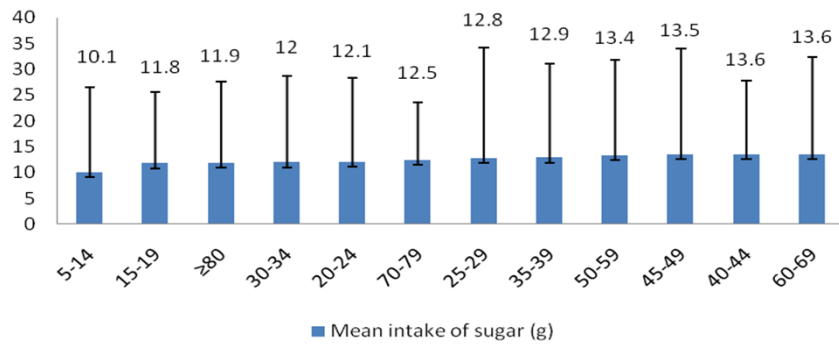
**Mean consumption of sugar by rural male population by age groups**



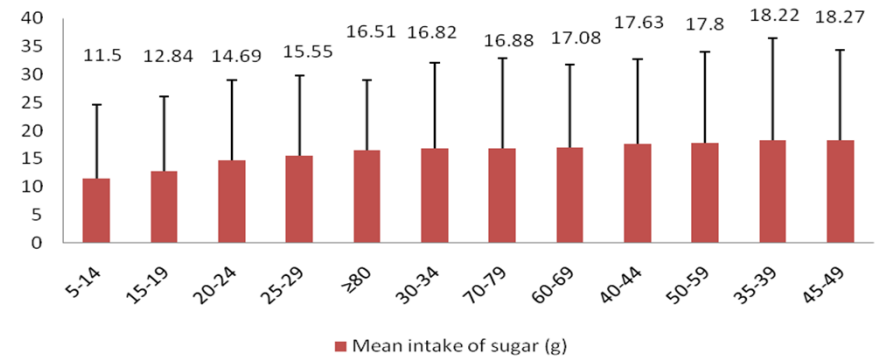
**Mean consumption of sugar by urban male population by age groups**



**Mean consumption of sugar by rural female population by age groups**



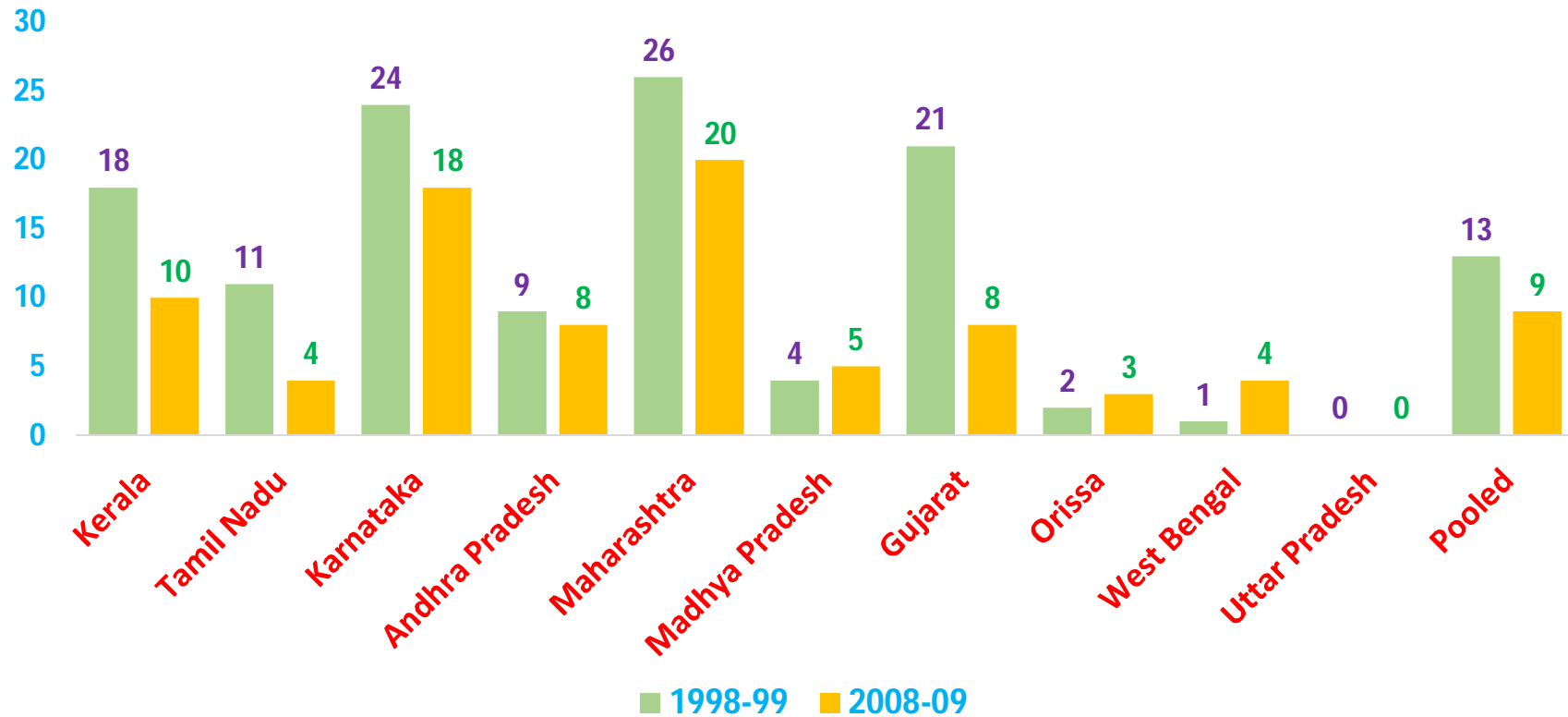
**Mean consumption of sugar by urban female population by age groups**

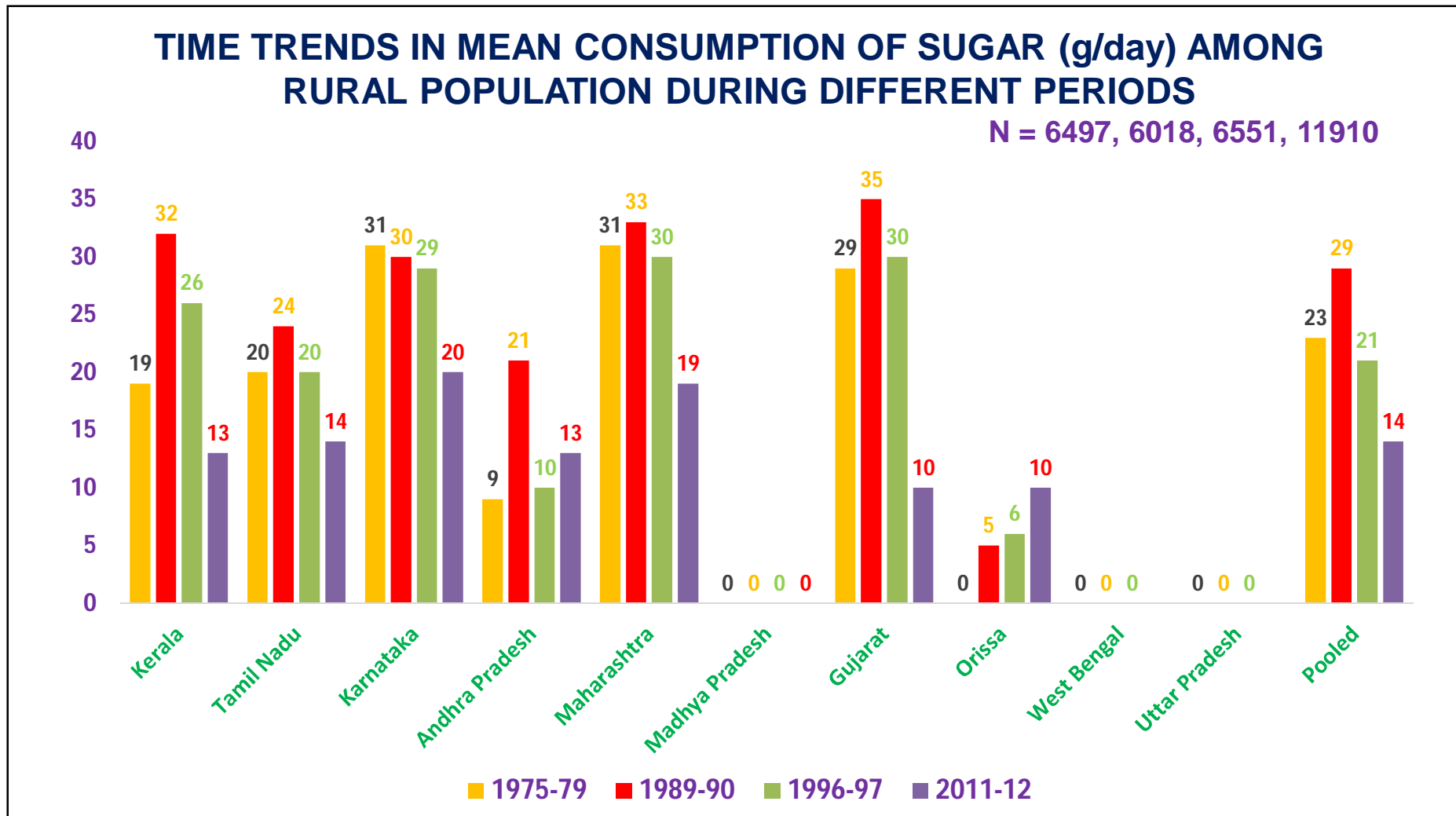




## TIME TRENDS IN MEAN CONSUMPTION OF SUGAR (g/day) AMONG TRIBAL POPULATION DURING DIFFERENT PERIODS

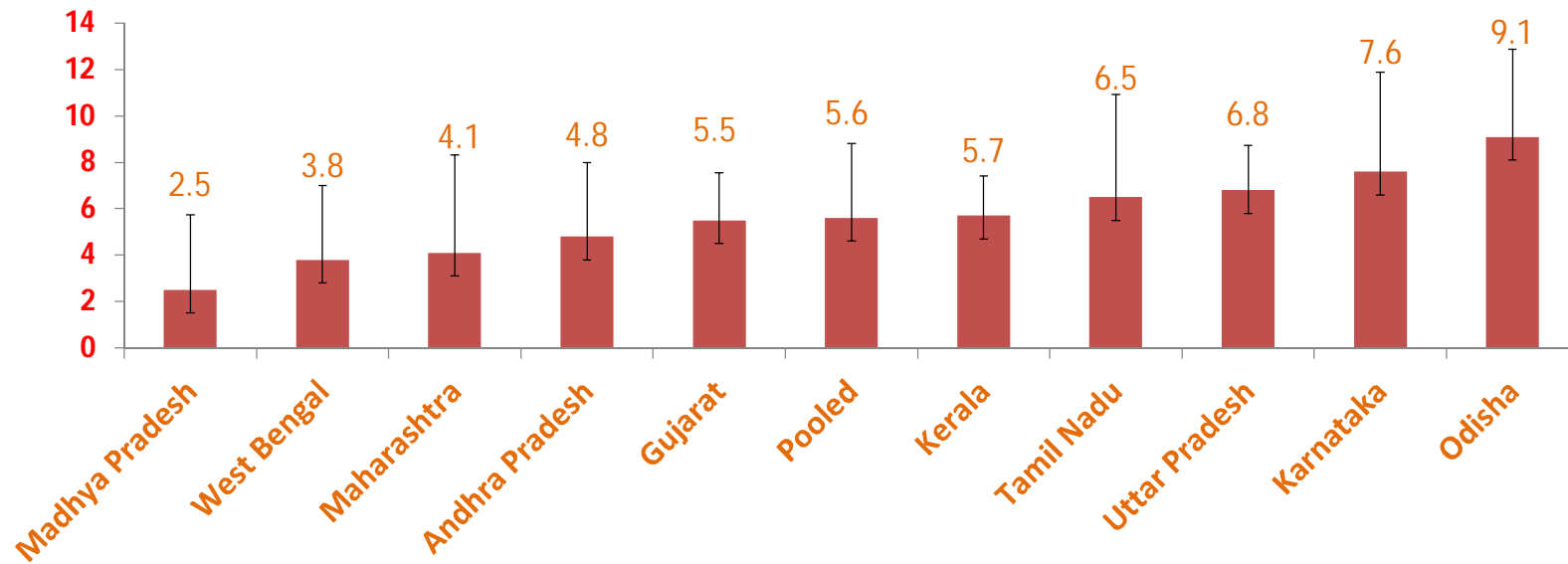
N = 8036, 10077



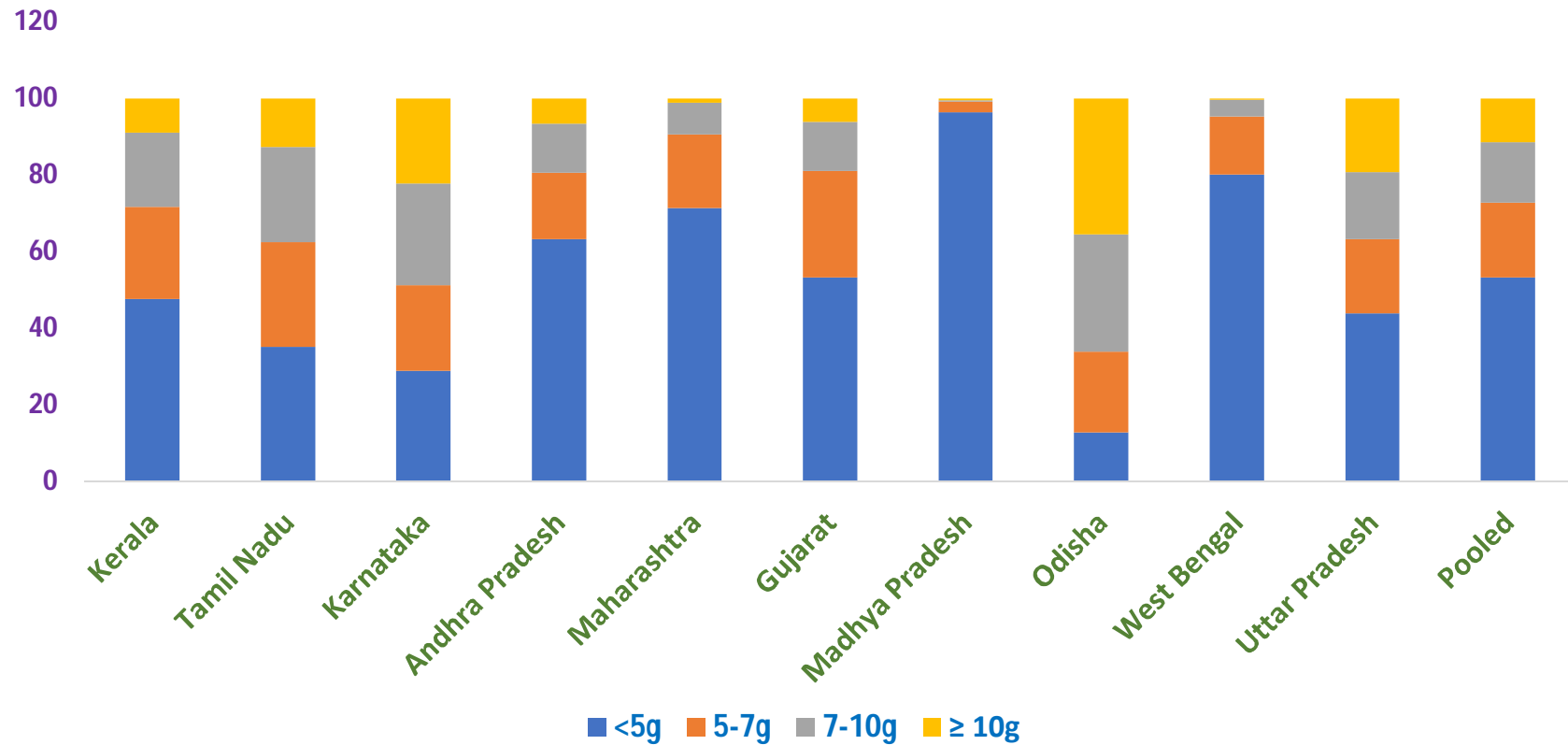


States	Urban		Rural		Tribal	
	Fat >20g/day	Sugar >30g/day	Fat >20g/day	Sugar >30g/day	Fat >20g/day	Sugar >30g/day
Kerala	40.1	9.5	15.5	4.2	5.9	1.7
Tamil Nadu	44.6	7.4	26.5	6.8	10.1	0.5
Karnataka	46.0	8.4	21.1	17.5	1.5	15.1
Andhra P	47.5	7.1	27.8	8.0	18.6	5.1
Maharashtra	74.5	28.9	26.8	14.2	21.9	22.0
Gujarat	90.6	23.4	46.3	4.1	16.5	1.2
Madhya P	77.0	37.0	19.1	2.7	2.0	0.3
Orissa	71.3	4.6	22.2	6.2	1.9	08
West Bengal	60.2	6.4	8.9	2.8	4.8	0.5
Uttar Pradesh	60.2	12.4	31.5	12.4	0	0
	65.0	13.0	24.2	7.9	9.5	5.4

**Mean salt consumption (g/CU/day) by State among rural population  
by state: NNMB surveys 2011-2012**



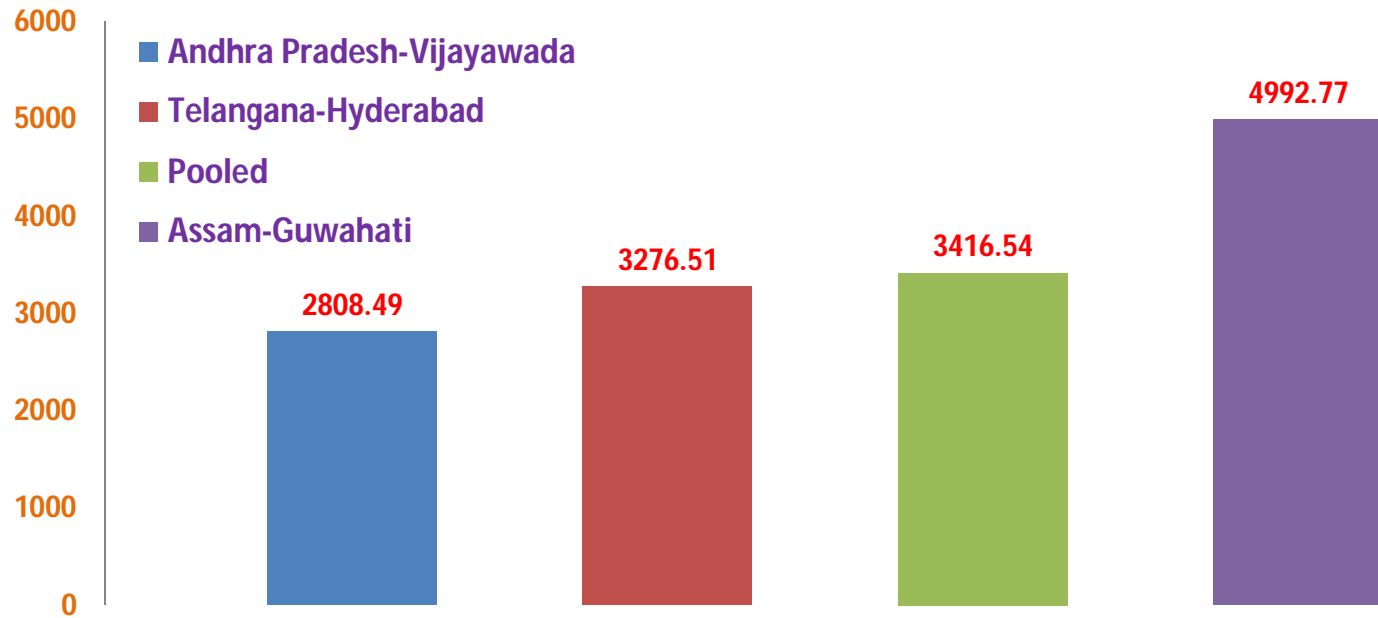
## Proportion of population consuming salt at different levels (g/CU/day)



### Mean salt (g/CU/day) consumption in different cities in India

<b>State &amp; City</b>	<b>N</b>	<b>Salt (NaCl) (g)</b>	<b>Mean Sodium (Na) as added salt (mg)</b>	<b>Mean invisible Sodium (Na) in foods (mg)</b>	<b>Total Sodium (mg)</b>
<b>Telangana-Hyderabad</b>	<b>160</b>	<b>8.4</b>	<b>3276</b>	<b>0.51</b>	<b>3276.51</b>
<b>Andhra Pradesh-Vijayawada</b>	<b>67</b>	<b>7.2</b>	<b>2808</b>	<b>0.49</b>	<b>2808.49</b>
<b>Assam - Guwahati</b>	<b>40</b>	<b>12.8</b>	<b>4992</b>	<b>0.77</b>	<b>4992.77</b>
<b>Total</b>	<b>267</b>	<b>8.8</b>	<b>3416</b>	<b>0.54</b>	<b>3416.54</b>

## MEAN CONSUMPTION OF SODIUM (Na: mg/day) IN DIFFERENT STATES (CITIES)

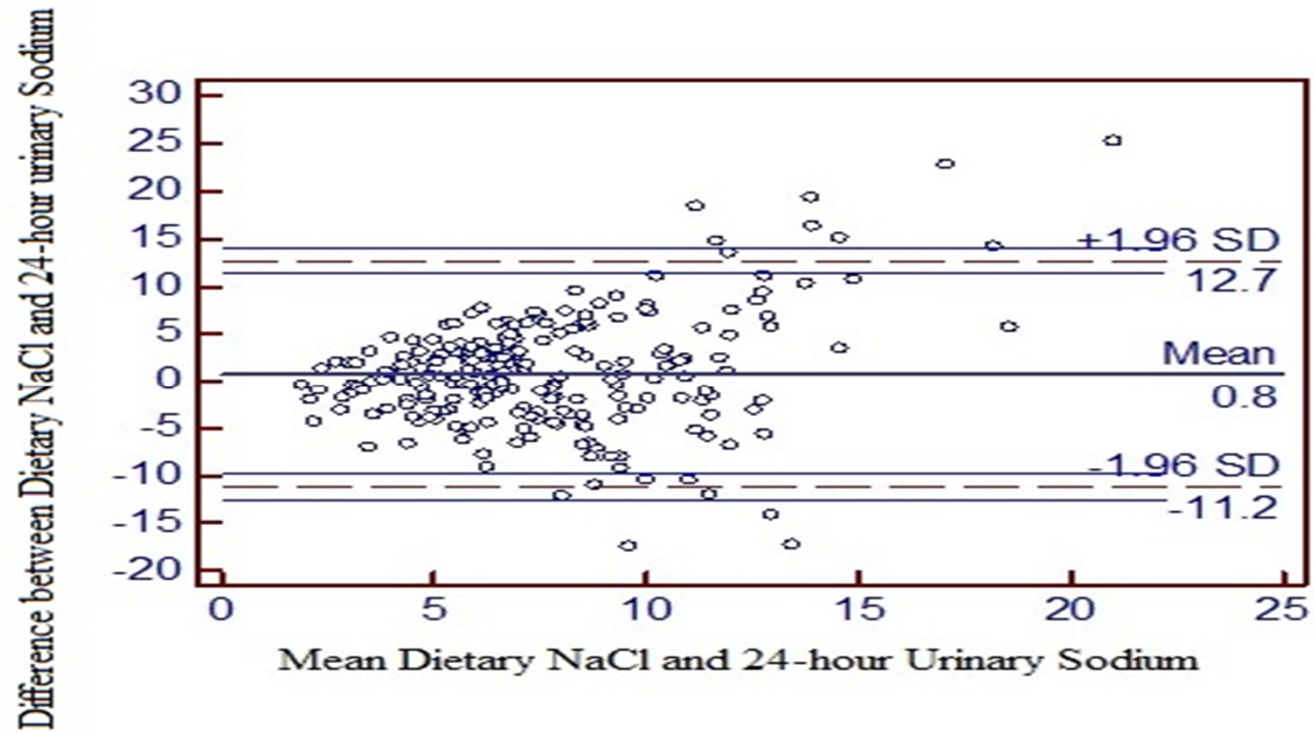


## 24 Hour dietary sodium estimation was validated with the 24 hour urinary sodium estimation

Type of Sample	Mean	SD	P value
Salt consumption Estimated from 24h urinary samples	7.3	3.69	0.015
Salt consumption Estimated from spot urinary samples	8.03	4.47	
Salt consumption Estimated from 24h urinary samples	7.3	3.69	NS
Salt consumption estimated through 24h dietary recall	8.07	5.07	
Salt consumption Estimated from spot urinary samples	8.03	4.47	NS
Salt consumption estimated through 24h dietary recall	8.07	5.07	

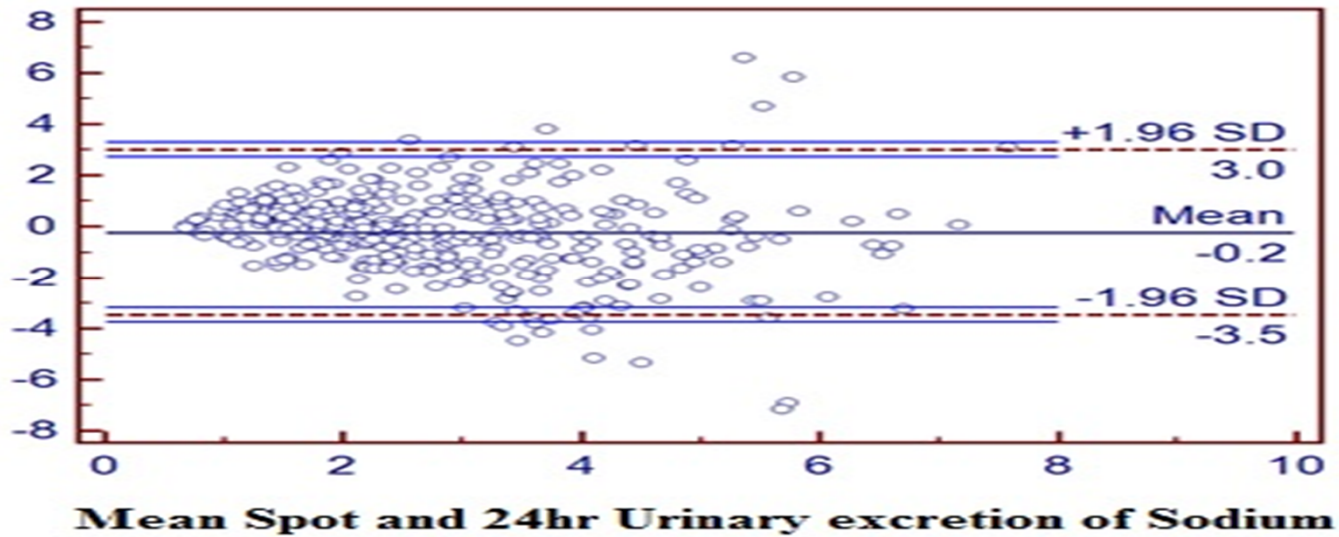


## Bland-Altman plot of dietary NaCl with 24 hour Urinary Sodium chloride equivalent

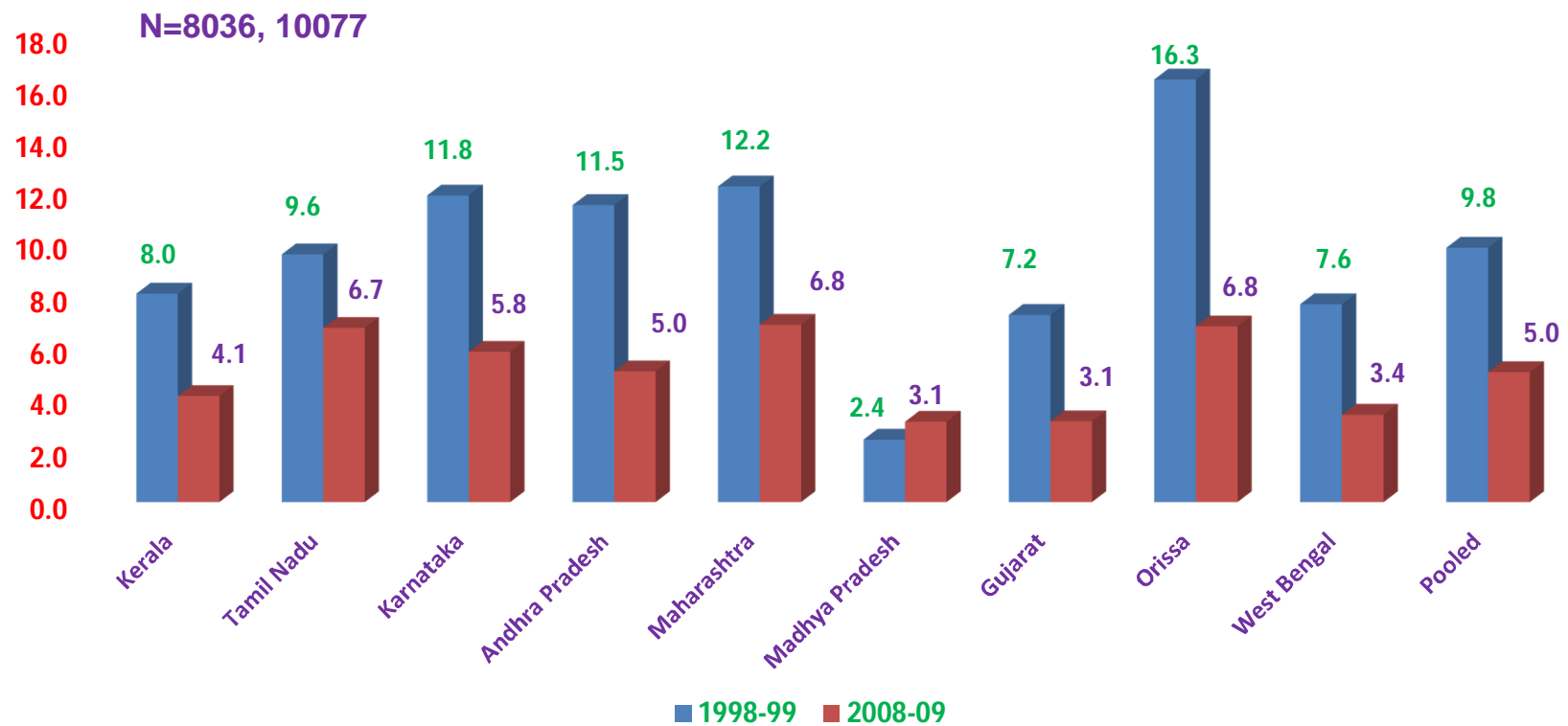


## Bland-Altman plot of 24h urinary sodium equivalent and spot Urinary Sodium chloride equivalent

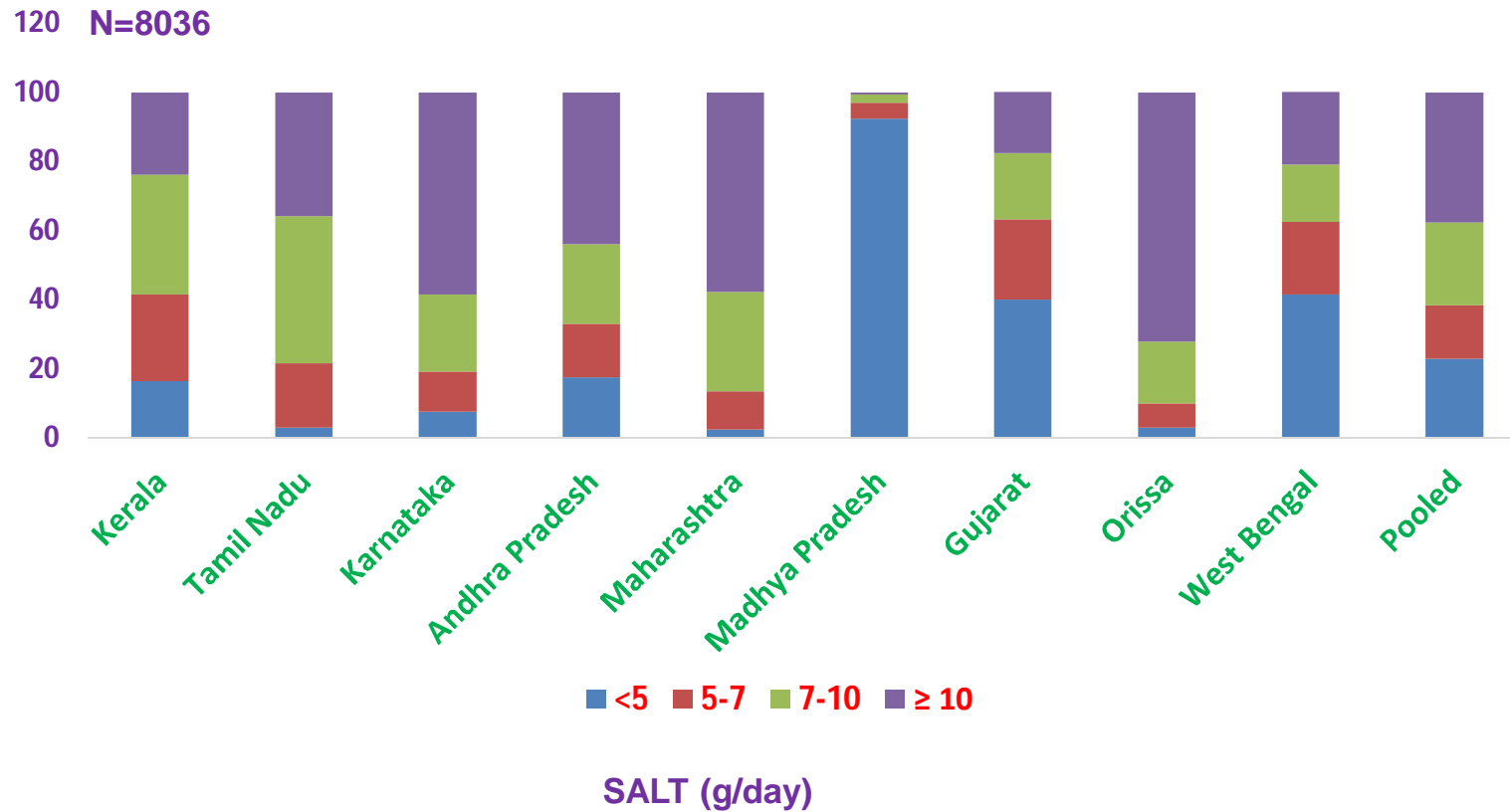
Difference between Spot and 24hr Urinary excretion of Sodium



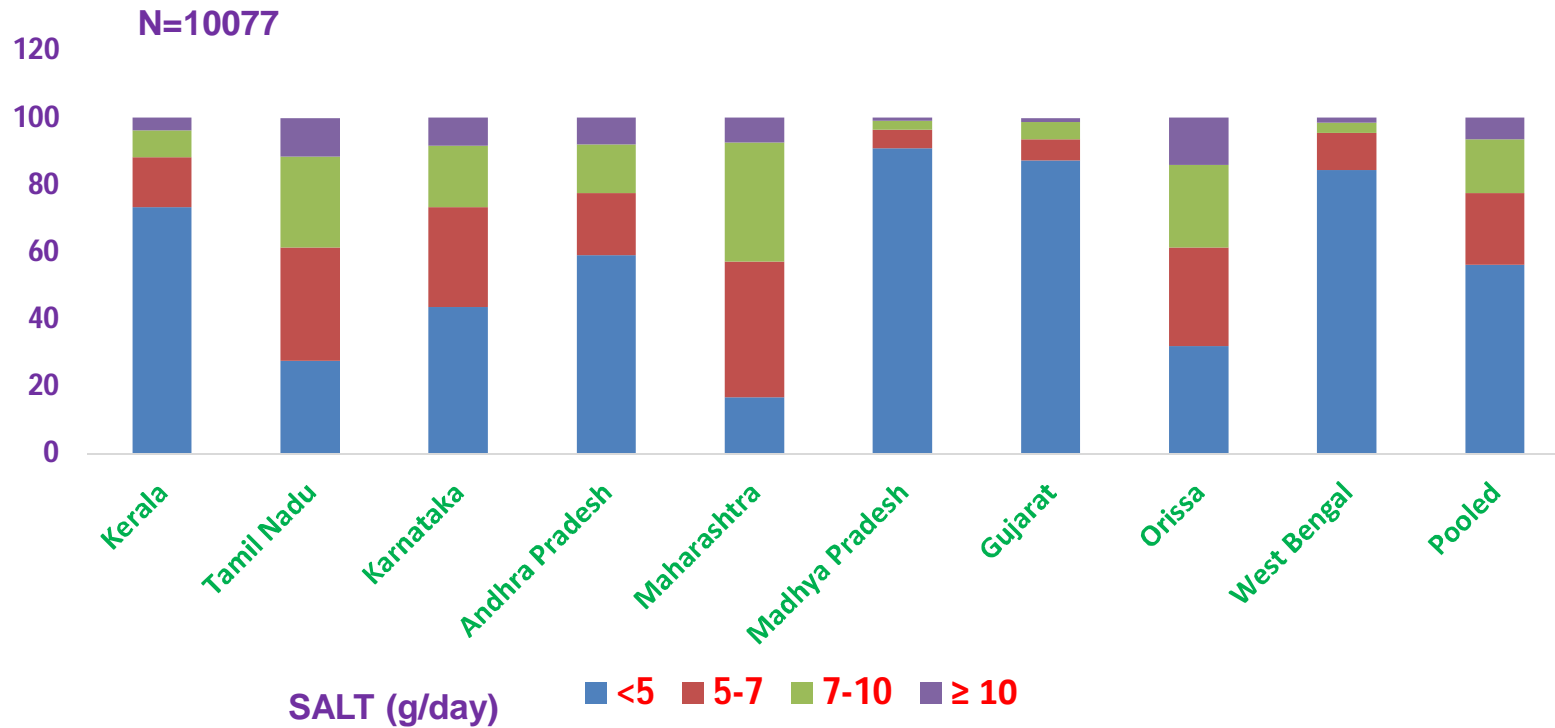
## MEAN SALT (NaCl) INTAKE (g/day) OF TRIBAL POPULATION DURING 1998-99 & 2008-09

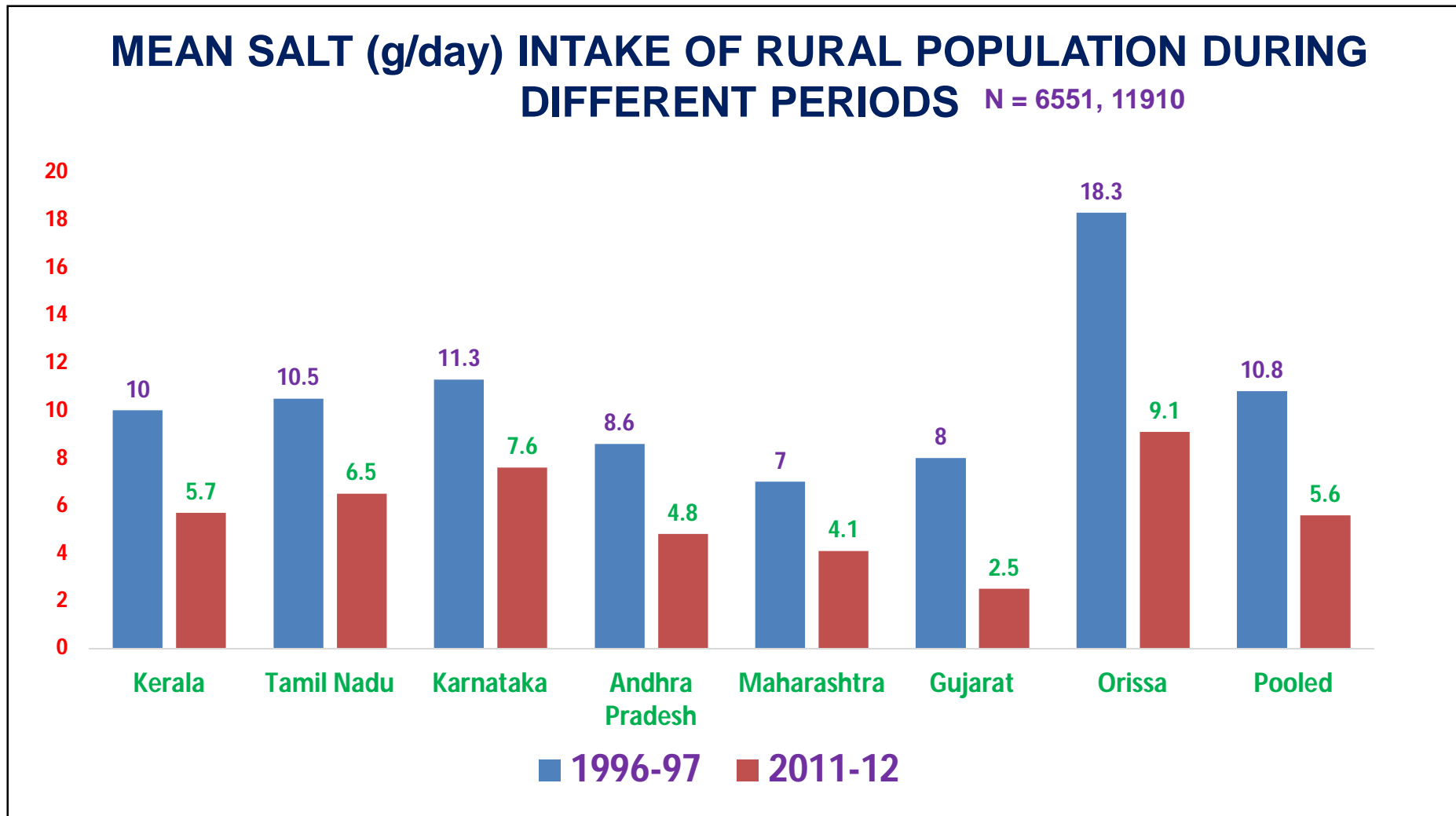


## SALT (NaCl) CONSUMPTION (g/day) OF TRIBAL POPULATION DURING THE PERIOD 1998-99



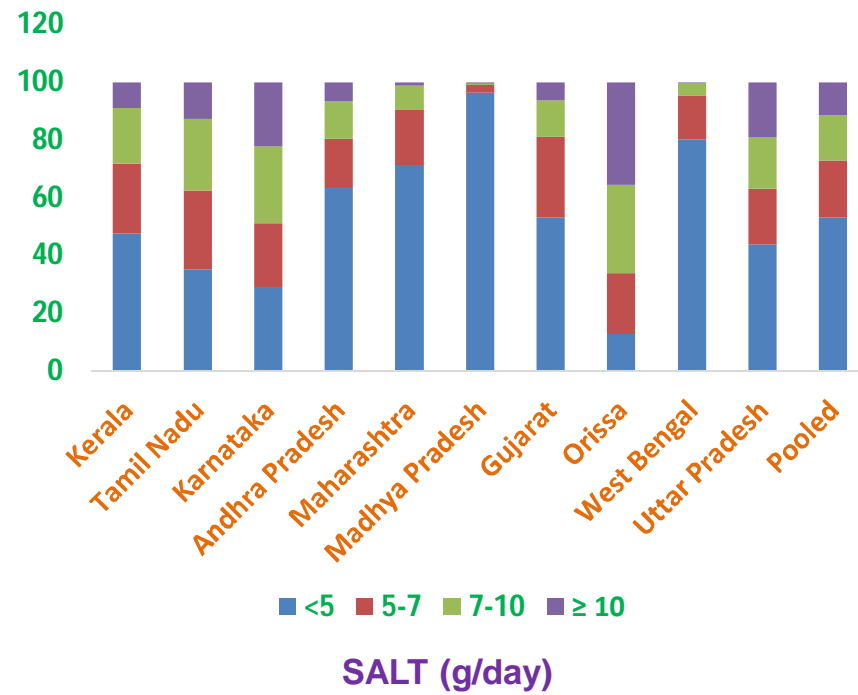
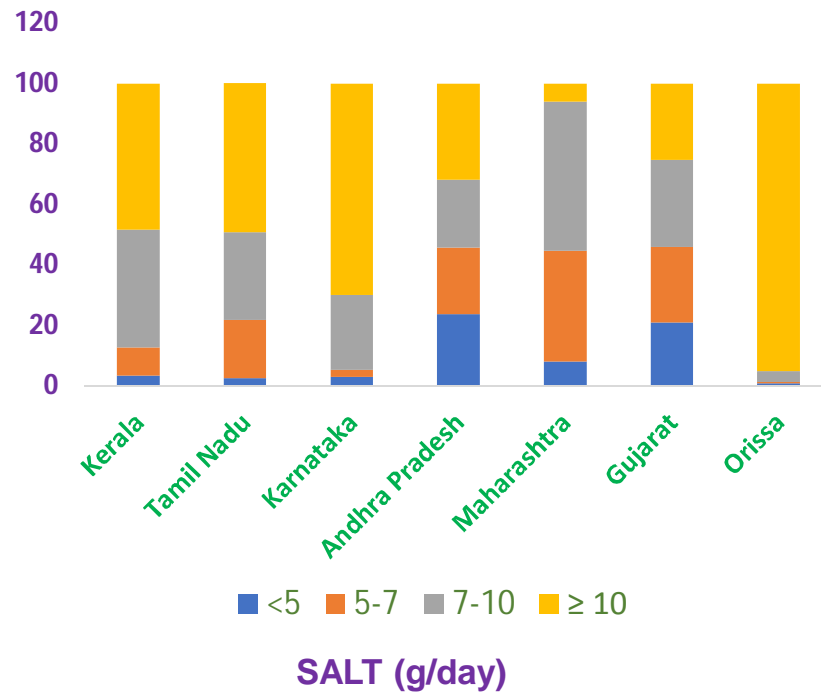
## SALT (NaCl) CONSUMPTION (g/day) OF TRIBAL POPULATION DURING THE PERIOD 2008-09





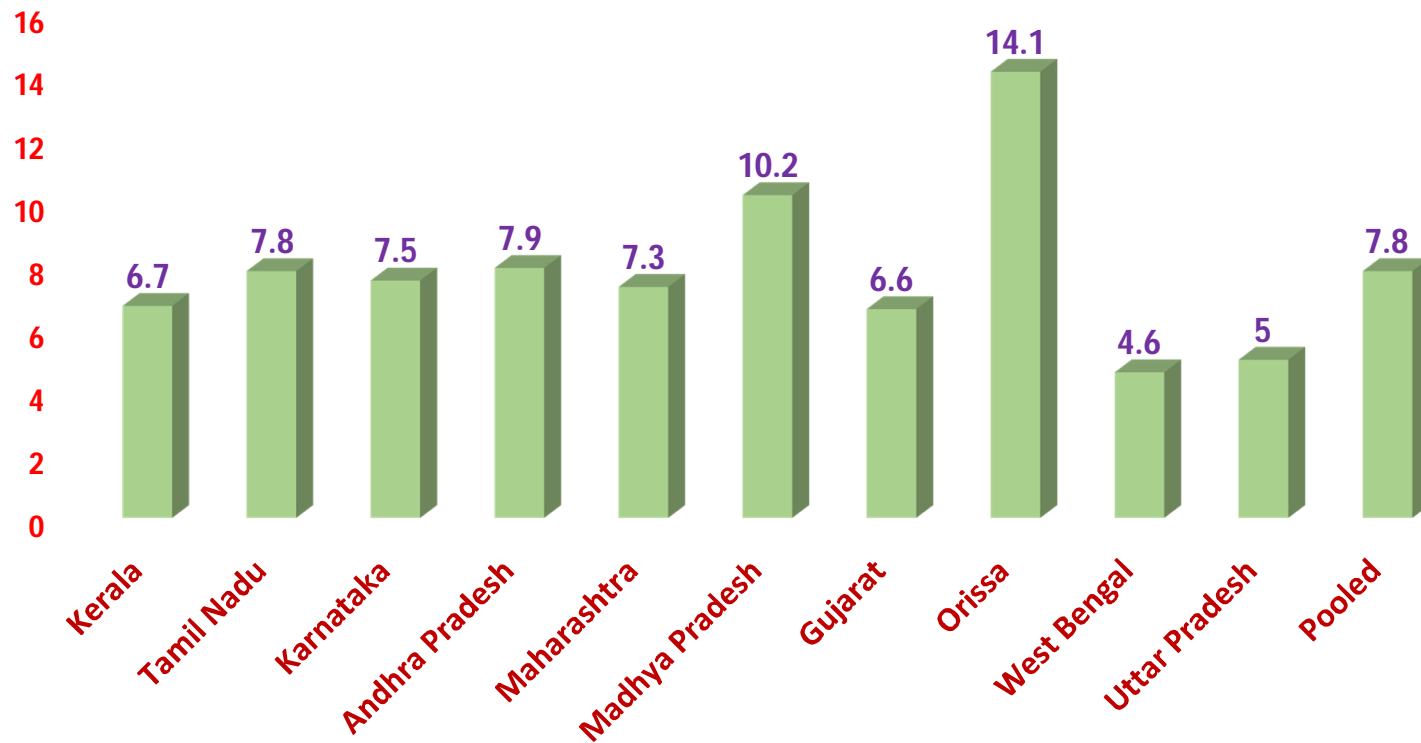
## SALT (NaCl) CONSUMPTION (g/day) PATTERN OF RURAL POPULATION DURING THE PERIOD 1996-97 and 2011-12

N = 6551, 11910



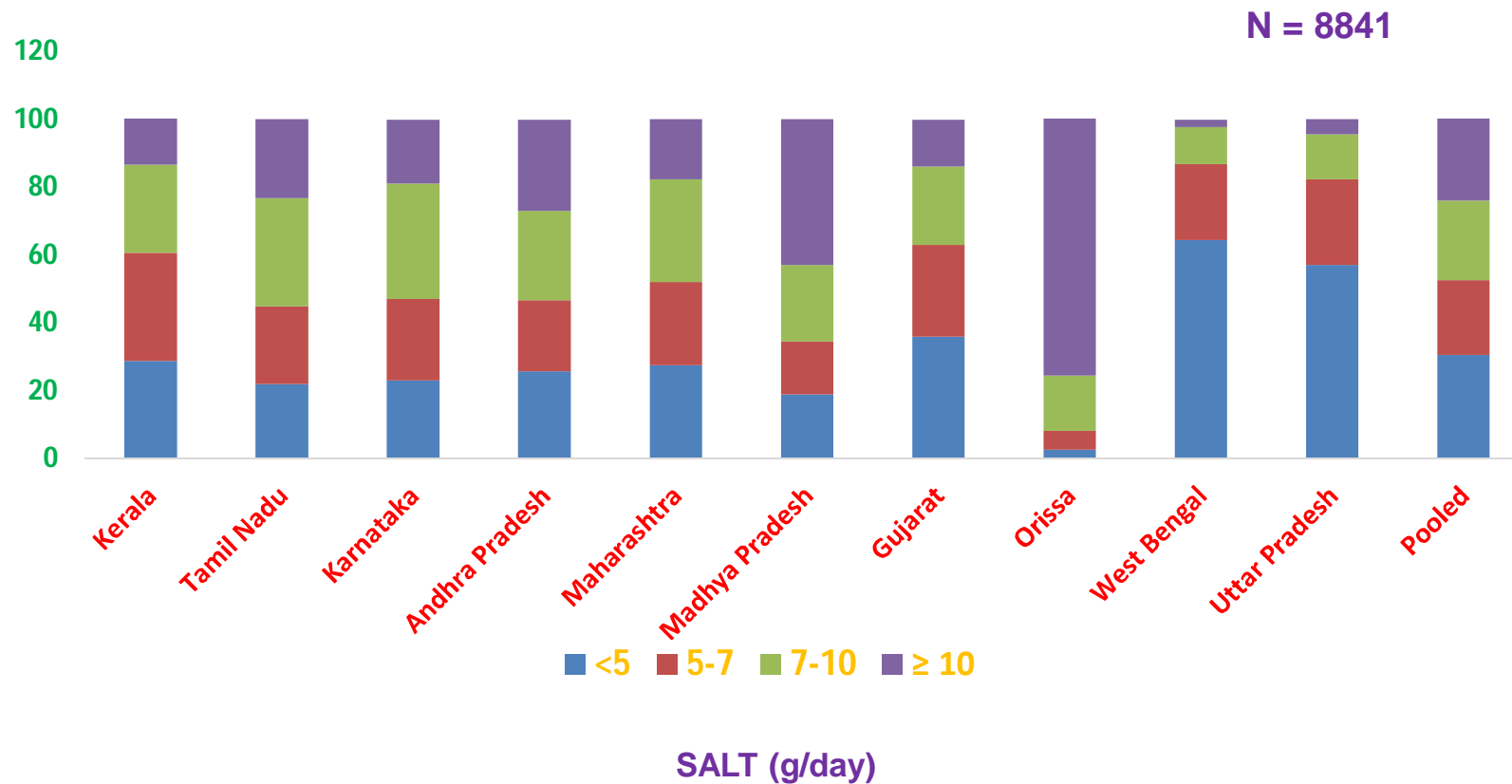
# MEAN INTAKE OF SALT (g/day) AMONG URBAN POPULATION DURING 2015-16

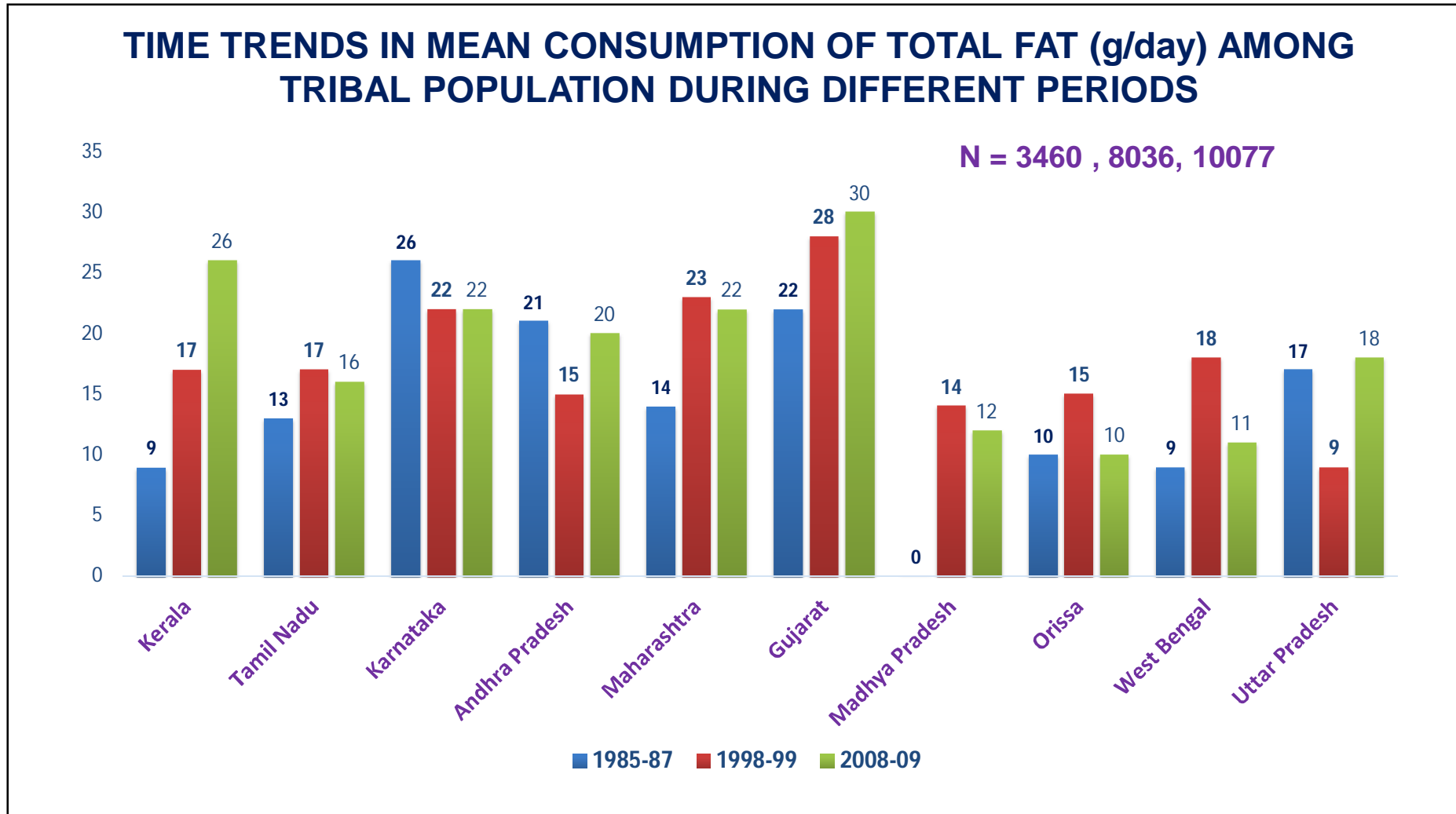
N = 8841





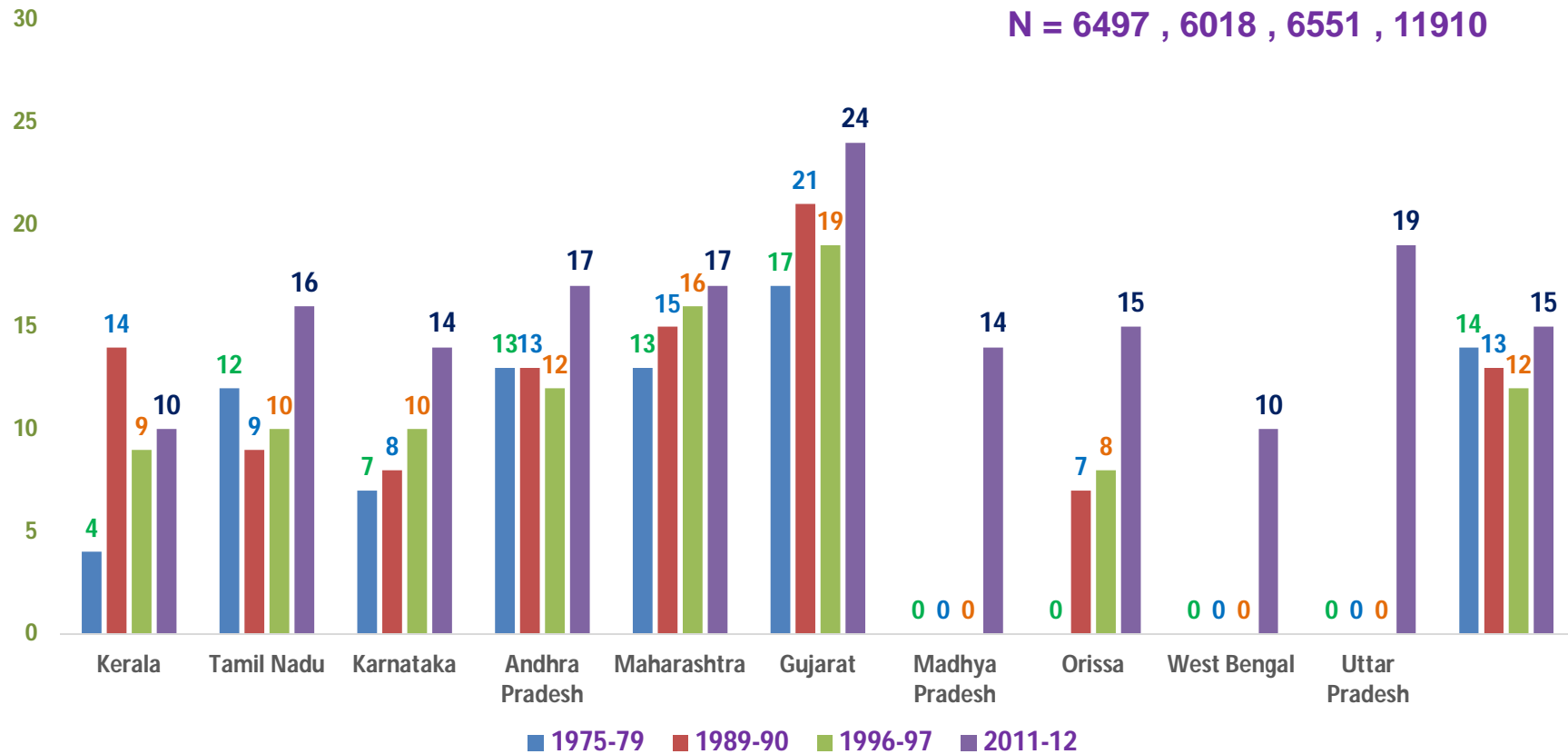
## SALT (NaCl) CONSUMPTION (g/day) OF URBAN POPULATION DURING THE PERIOD 2015-16

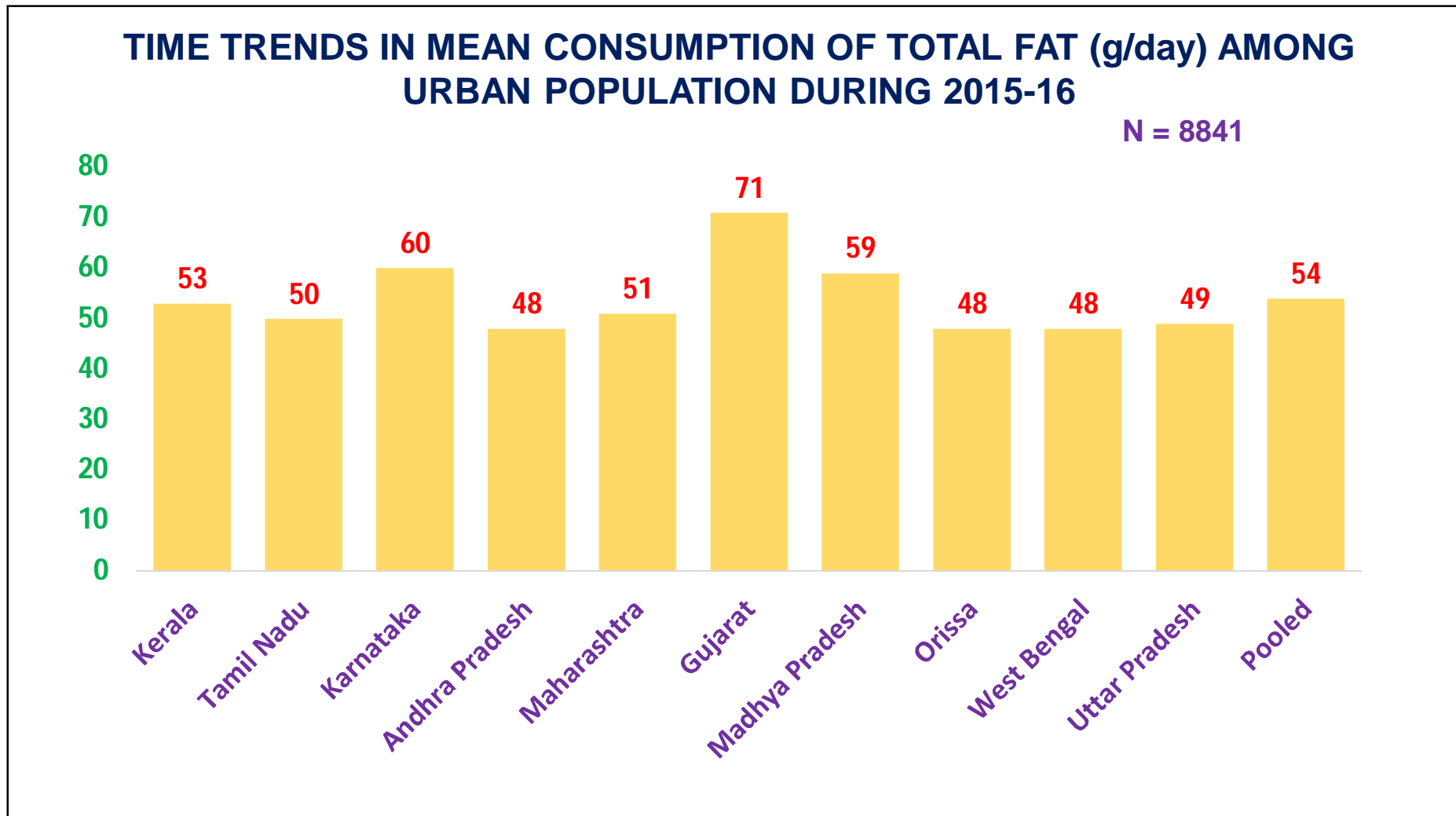




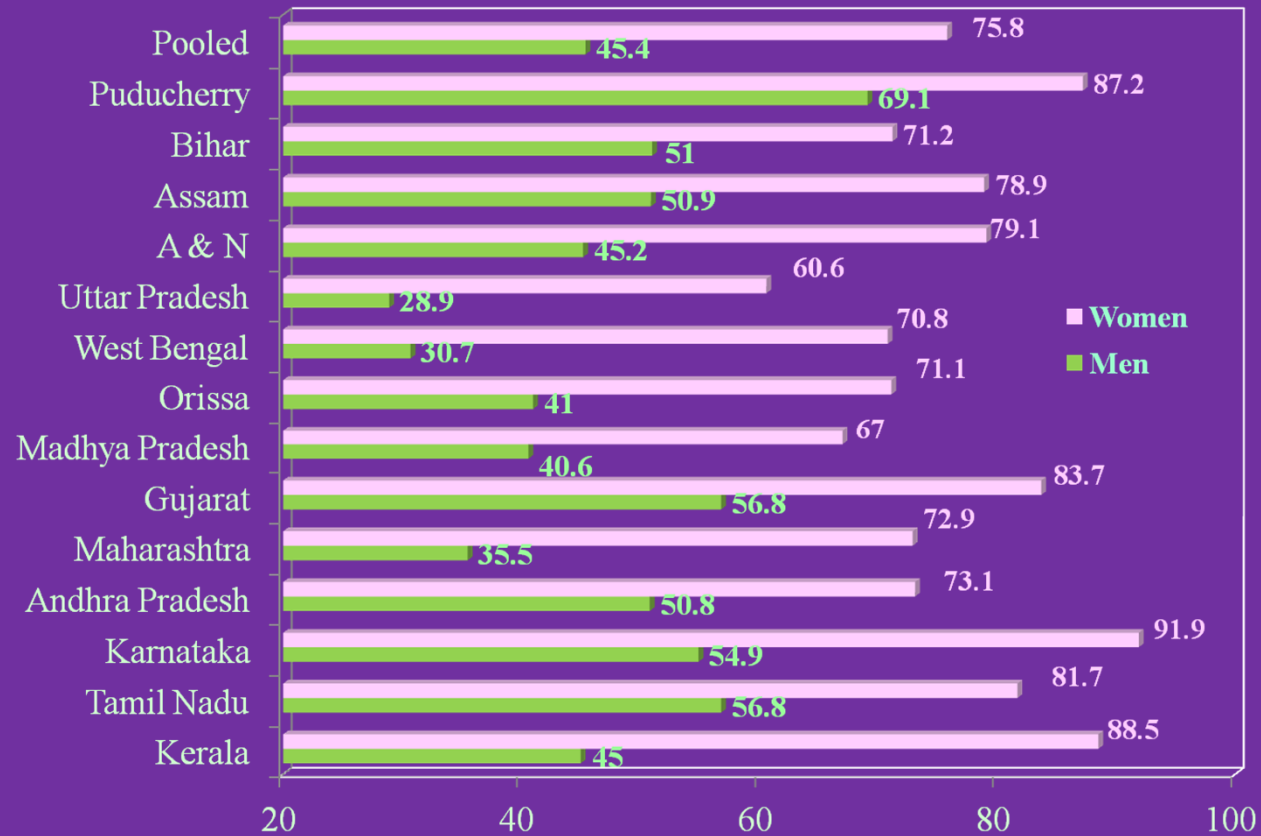
## TIME TRENDS IN MEAN CONSUMPTION OF VISIBLE FAT (g/day) AMONG RURAL POPULATION DURING DIFFERENT PERIODS

N = 6497 , 6018 , 6551 , 11910



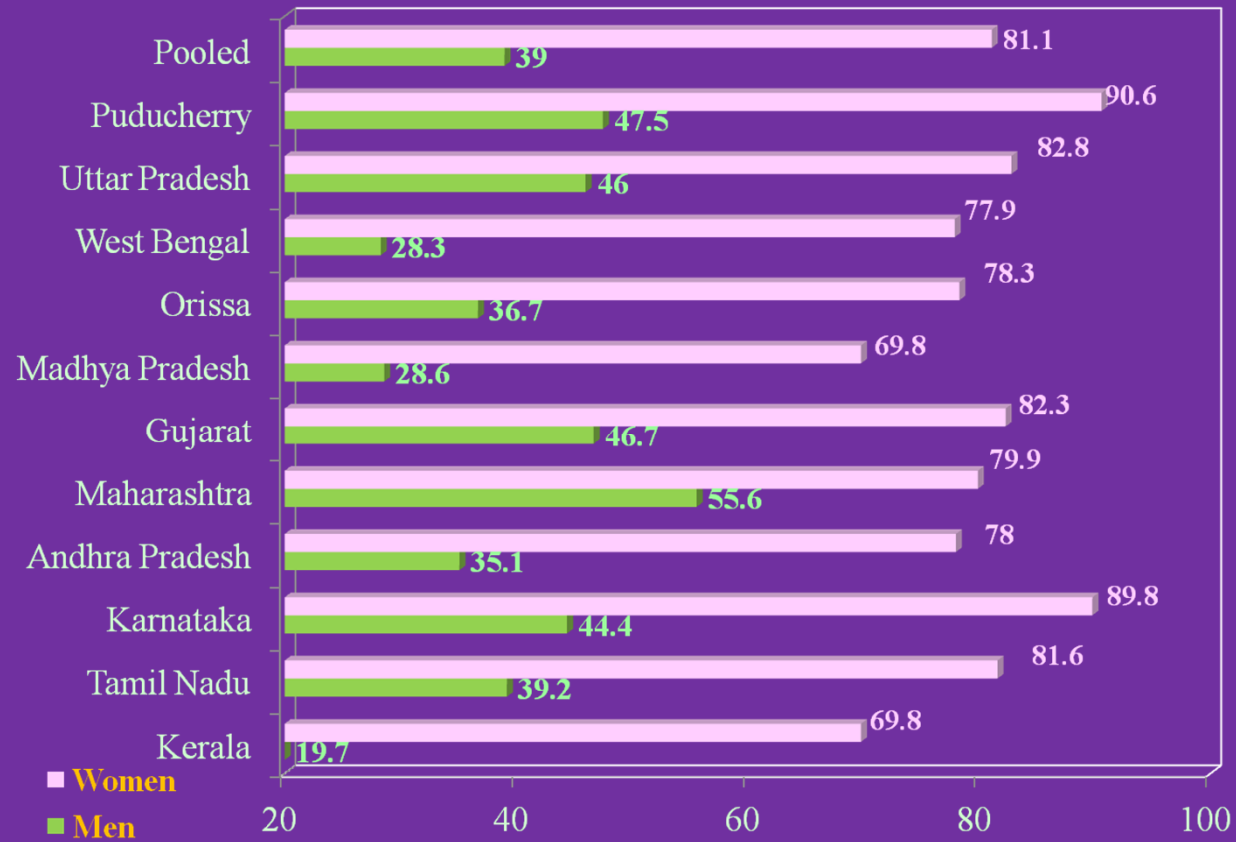


## Prevalence (%) of Total body fat % among men and women by States



NNMB urban surveys 2014

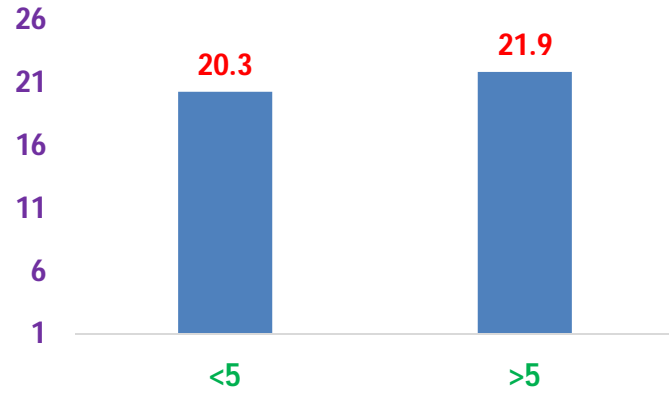
## Prevalence (%) of Total body fat % (BIA) among men and women by States: NNMB urban surveys 2014



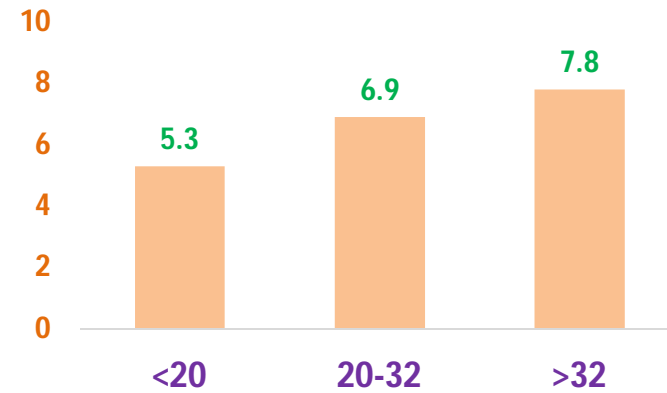
**Odds Ratios and 95% CI of Diabetes with WC/WHR/BMI (Asian cut off) and Fat%**

<b>Variable</b>	<b>Men</b>	<b>Women</b>
<b>WC</b>	<b>2.6(2.3-2.8)</b>	<b>5.0(4.4-5.6)</b>
<b>WHR</b>	<b>5.6(4.6-6.7)</b>	<b>5.1(4.2-6.1)</b>
	<b>() Indicates Confidence Interval</b>	

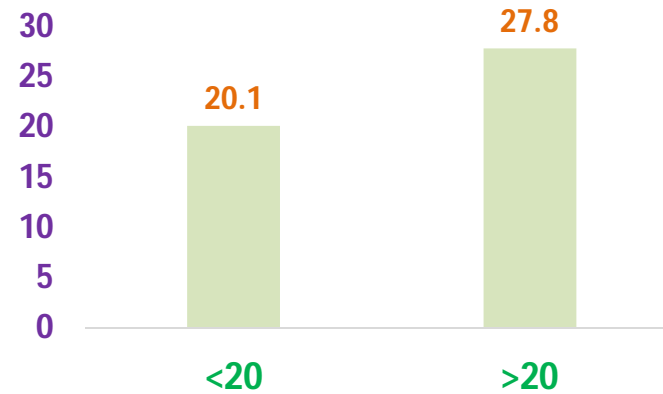
**Fig.1 Prevalence (%) of Hypertension and Salt (g/day) consumption levels**



**Fig.2 Prevalence (%) of diabetes and fat (g/day) consumption levels**

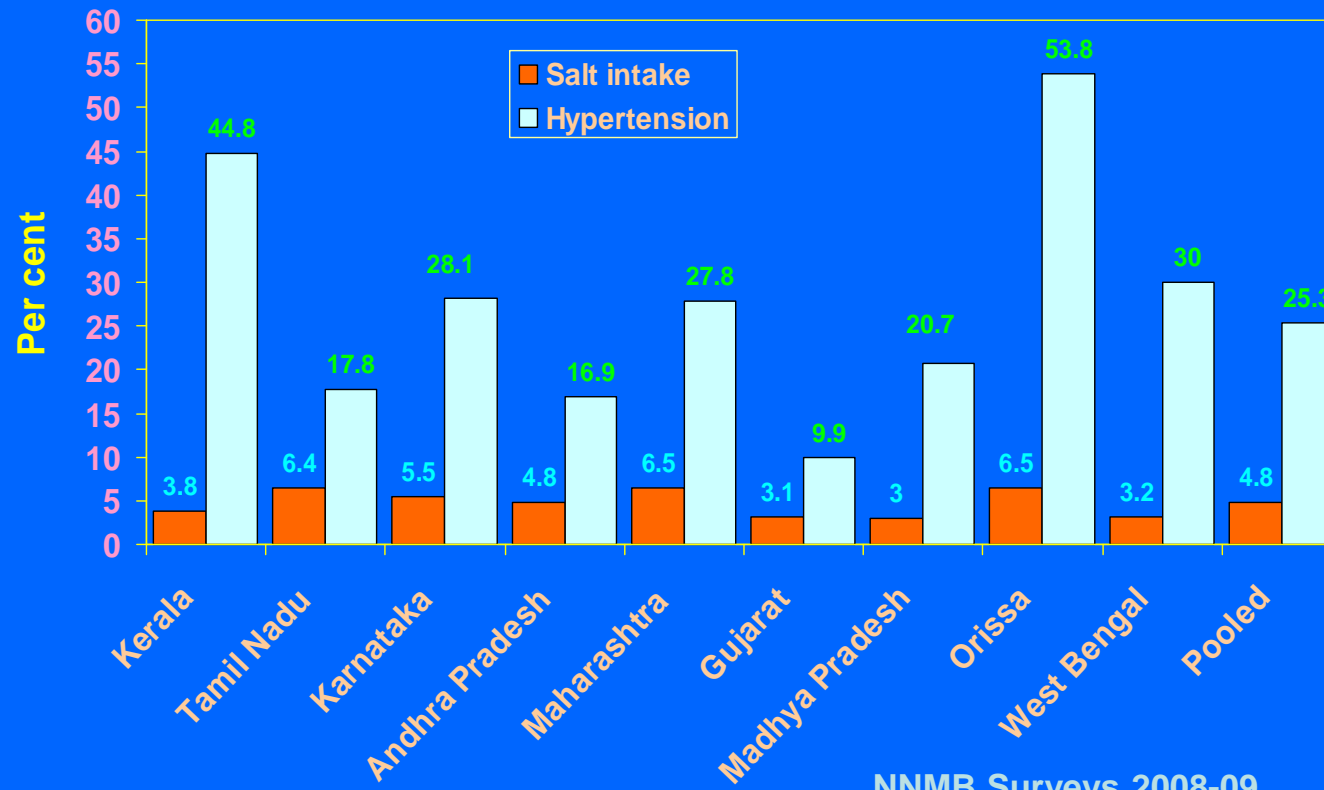


**Fig. 3 Prevalence (%) of Overweight and obesity and sugar (g/day) consumption levels**

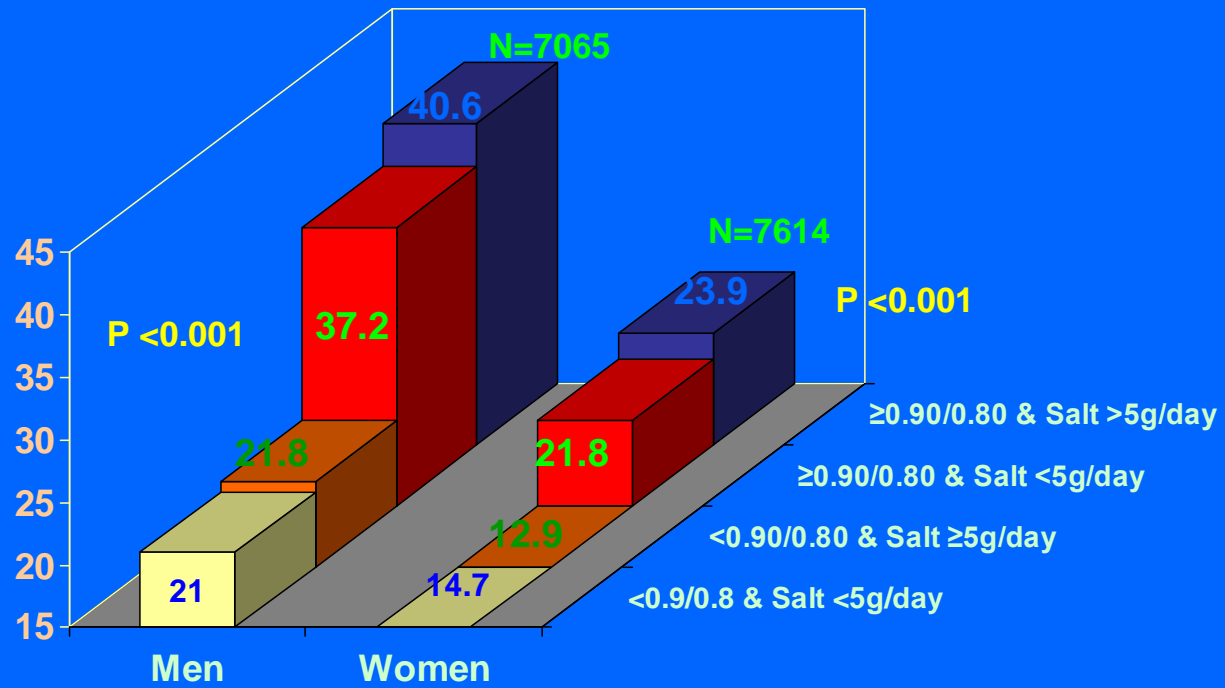




## Mean per capita salt consumption (g/day) among Tribal Adults ( $\geq 20$ years)



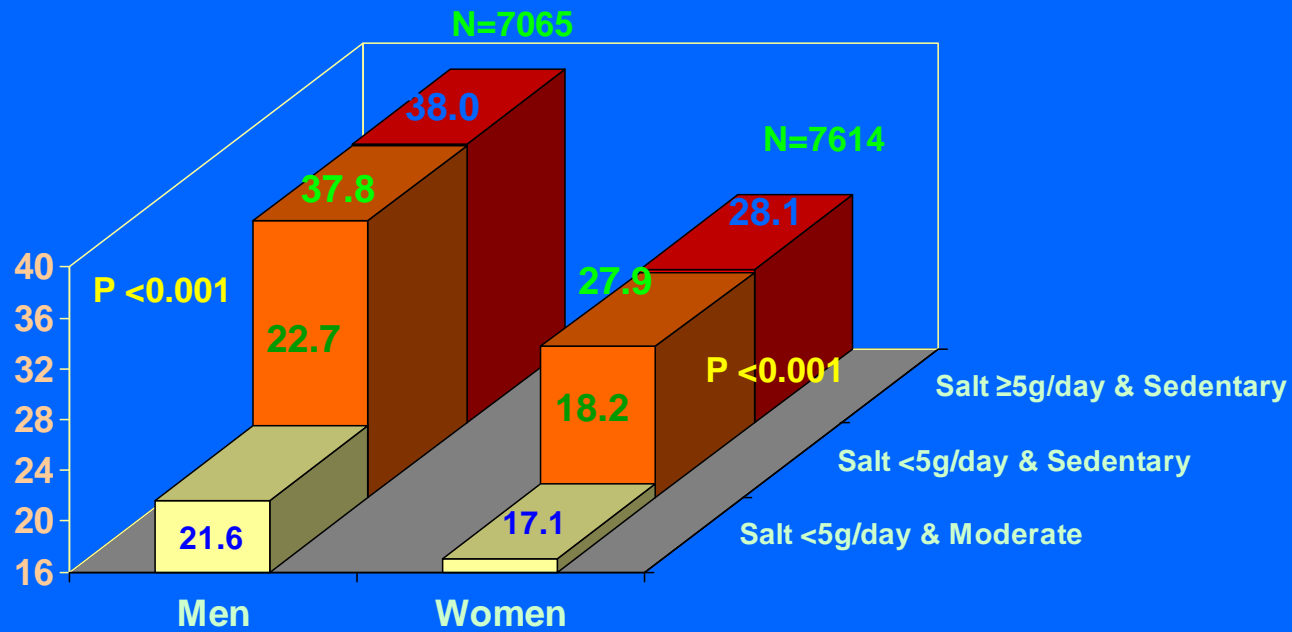
## PREVALENCE (%) OF HYPERTENSION AMONG BY ABDOMINAL OBESITY & SALT INTAKE BY GENDER



Hypertension (SBP ≥140 and /or DBP ≥ 90)

NNMB Tribal survey 2008-09

## PREVALENCE (%) OF HYPERTENSION AMONG BY ACTIVITY & SALT INTAKE BY GENDER



Hypertension (SBP  $\geq 140$  and /or DBP  $\geq 90$ )

NNMB Tribal survey 2008-09

## CONCLUSIONS

- Sugar consumption levels among rural and urban population was less than the suggested levels of ICMR (30g/CU/day).
- However, salt consumption levels among rural, tribal and urban population was higher than the suggested levels of WHO (5g/CU/day).
- Fat consumption levels significantly higher among urban population, while in case of rural and tribal population it was within the suggested levels of ICMR (20g/CU/day)
- Especially, the proportion of people, who are consuming >10g/day salt significantly decreased their proportion over a period of time.

## CONCLUSIONS

- **The high intakes of salt is significantly associated with increase of prevalence of hypertension. Similarly, high intake of sugars correlated with the high prevalence of overweight and obesity and high intake fat is significantly associated with high prevalence of diabetes.**
- **High intake of fat is also significantly associated with more body fat percent and overweight and obesity.**
- **There is a need to control the consumption of sugar, salt and fat among all the population groups, more focus may be given among urban population**

## Acknowledgements

We profusely thank all who executed, helped and cooperated during all the NNMB surveys

- Officer-in-charges, States
- Investigators of each state
- NIN colleagues, who helped CRL, NNMB
- WHO and ILSI India for supporting and guiding for the present Analysis
- Active participation of Experts today and providing very good suggestions for further improvement of the analysis and report presentation.

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**NNMB Project staff of all the states**



*Thank you*