

# **NUTRITION NORMS IN MDM AND FOOD SAFETY & PERSONAL HYGIENE**

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# HEALTH AND NUTRITION

## HEALTH

“... is a state of complete physical, mental, and social well being and not merely absence of disease or infirmity”


..... WHO

## NUTRITION

“ ... is a process of ingestion of food, digestion, absorption, assimilation, and utilization of various nutrients”.

## MALNUTRITION

“ ... is a pathological state, which results from ingestion of one or more nutrients, either in excess or deficient quantities over a period of time”.



*Regardless of who the Father of a  
disease is, but Surely its Mother is  
'IMPROPER DIET'*

*Chinese Proverb*

# *Who are vulnerable for undernutrition?*

- **Infants and Young Children (<5 years)**
- **School age and Adolescents**
- **Pregnant & Lactating Women**
- **Elderly**
- **Socio-economically deprived Groups**
  - **Schedule Castes**
  - **Schedule Tribes**
  - **Urban Slum communities**

# WHAT ARE THE NUTRITIONAL PROBLEMS IN INDIA?

## ❖ Macronutrient Malnutrition

### Protein energy malnutrition

a) Clinical PEM →

b) Sub-clinical PEM →

1. Kwashiorkor
2. Marasmus
3. Marasmic Kwashiorkor

## ❖ Micronutrient Deficiency

a) Vitamin A Deficiencies (VAD)

b) Iron Deficiency Anaemia (IDA)

c) Iodine Deficiency Disorders (IDD)

d) Zinc Deficiency

e) Becomplex vitamins and mineral deficiencies

## ❖ Diet related Non-communicable diseases

- Overweight & Obesity
- Insulin Resistance
- Diabetes
- Cardiovascular diseases
- Cancers

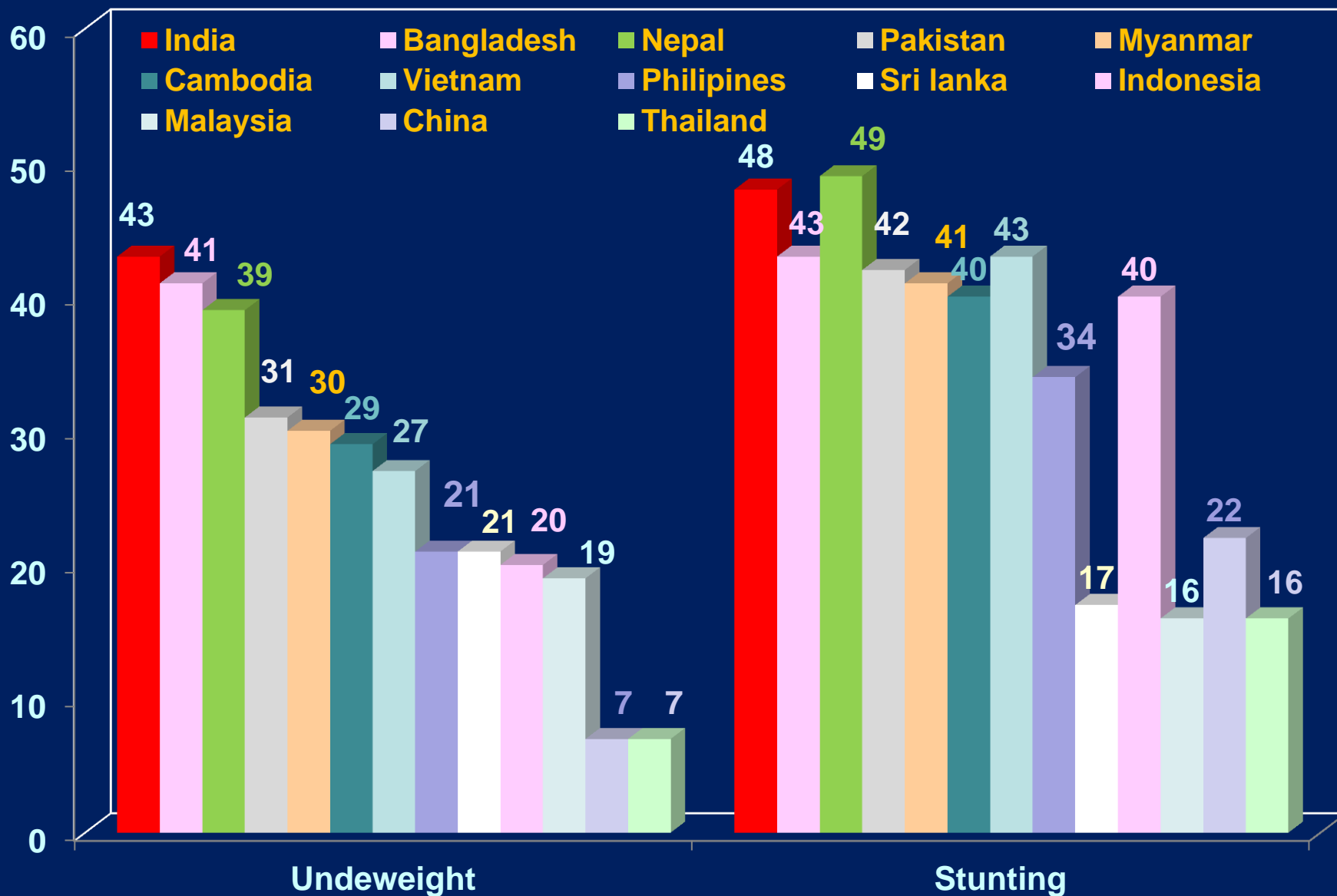


**Kwashiorkor**



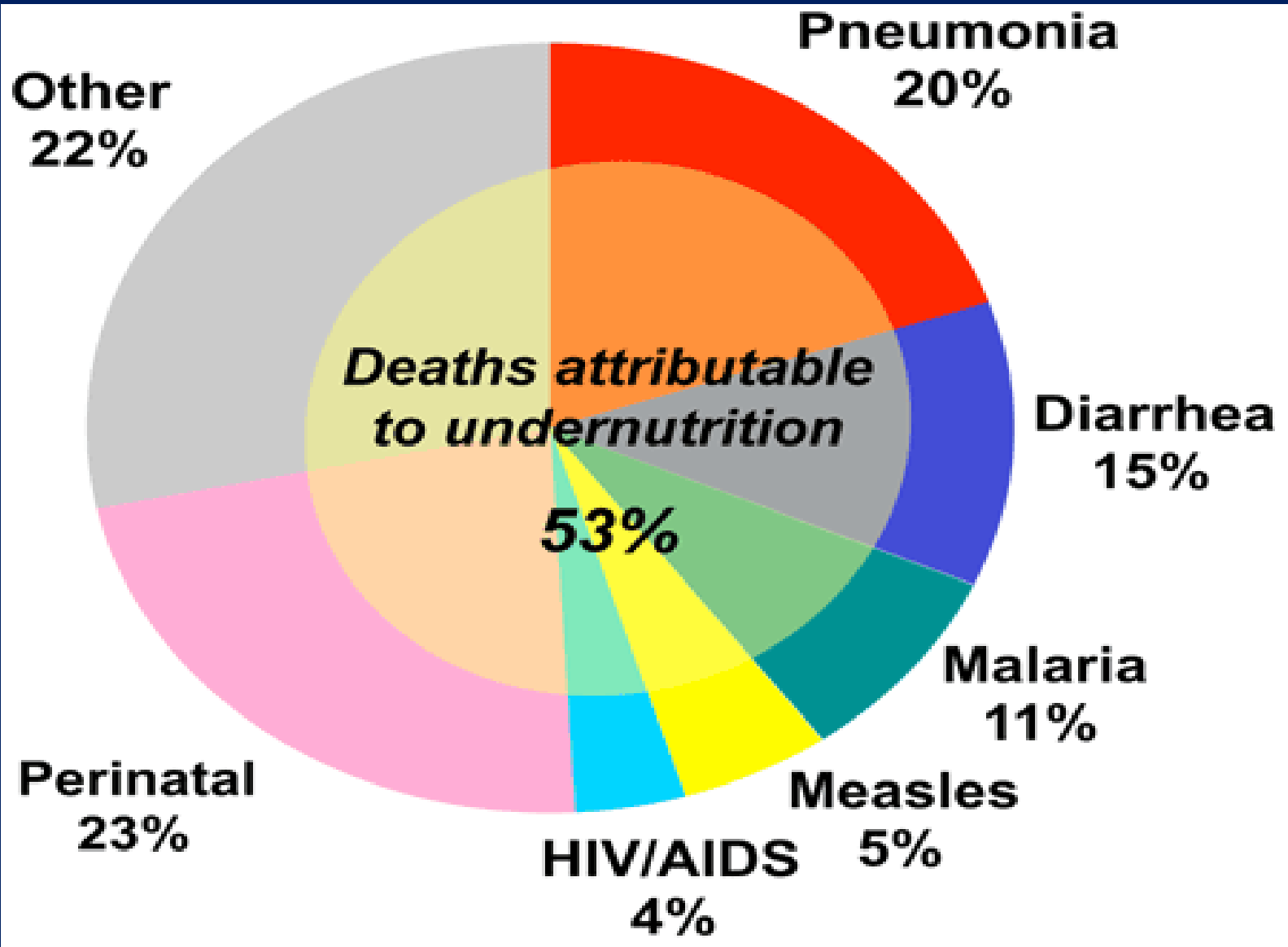
**Marasmus**

# Prevalence of undernutrition among <5 year children in South Asia



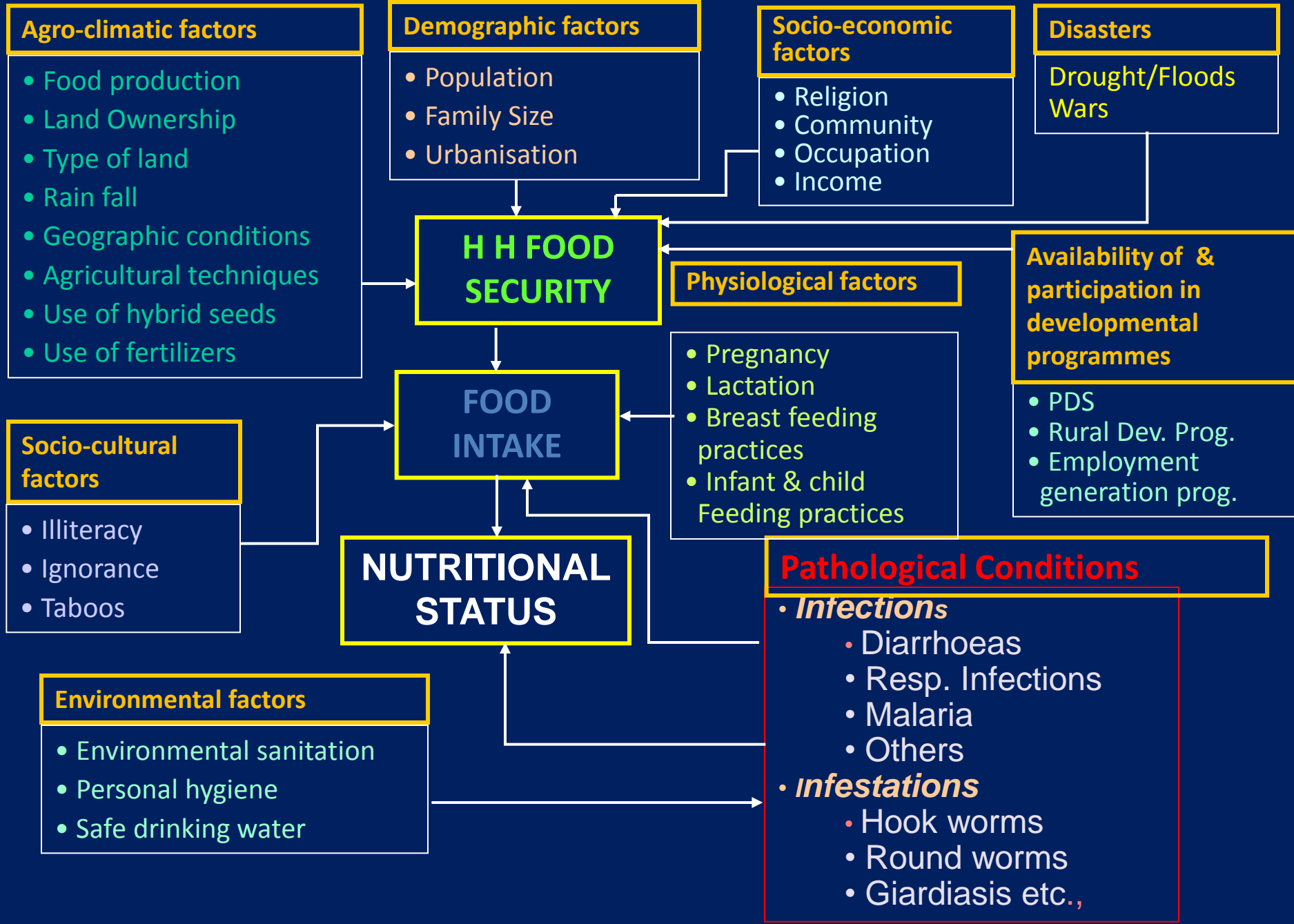
Source: J. Pediatr Child Health 2010; 46: 497-503.

# CONSEQUENCES OF UNDERNUTRITION



Source: WHO 2002; Lancet-2003

# DETERMINANTS OF NUTRITIONAL STATUS





# HOW FOODS AND NUTRIENTS USEFUL FOR BODY?

## ... *Growth*

Increase in Physical mass (Cell size & number)  
Example: weight, height etc.

## ... *Development*

Functional Capability

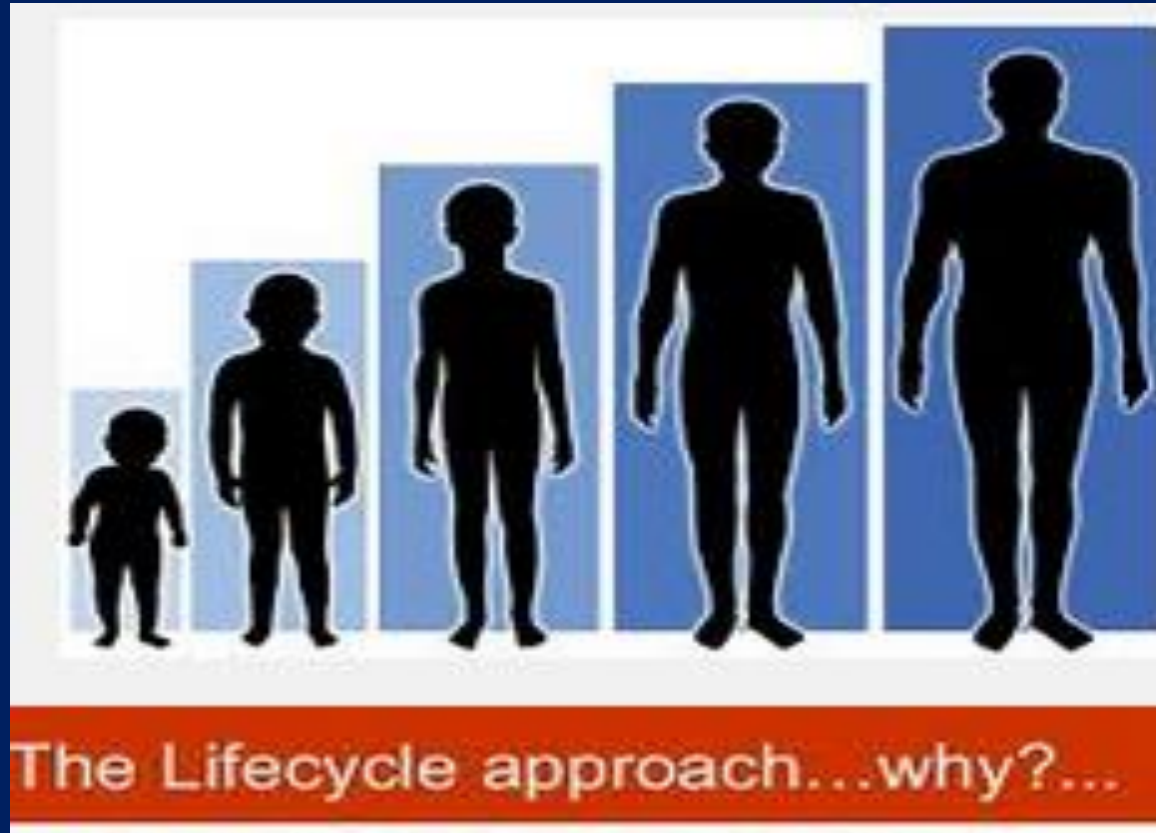
Example: Mental ability, Cognition, memory etc.

## ... *Maintenance*

Body Processes

Example: Cell repair

# Diet through life



# Macronutrients

(Required in large quantities)

- ❖ **Proteins** : 60-70% Energy
- ❖ **Fats** : 20-25% Energy
- ❖ **Carbohydrates** : 10-15% Energy

# Micronutrients

(Required in small amounts and important for regulation of metabolism and utilization of macronutrients)

❖ Vitamins

❖ Minerals

# By Function

- Energy Rich Foods
- Body Building Foods
- Protective Foods

# Energy Rich Foods

## Major Nutrients - Carbohydrates & Fats

- Food Stuffs

- Whole grain cereals and Millets
- Vegetable oils, ghee & butter
- Nuts & Oilseeds
- Sugars

- Other Nutrients

- Protein, fiber, minerals, calcium, iron & B-complex vitamins
- Fat soluble vitamins, essential fatty acids
- Proteins, vitamins & minerals
- Nil

# Body Building Foods

## Major Nutrients - Proteins

- Food Stuffs

- Pulses, Nuts & Oilseeds
- Milk & Milk Products
- Meat, Fish & Poultry

- Other Nutrients

- B-complex vitamins, invisible fat & fiber
- Calcium, Vitamin A, Riboflavin & Vitamin B-12
- B-complex vitamins, iron, iodine & fat

# Protective Foods

## Major Nutrients – Vitamins & Minerals

- Food Stuffs

- Green leafy vegetables
- Other vegetables & fruits
- Eggs, milk & milk products and flesh foods

- Other Nutrients

- Antioxidants, fiber & Other carotenoids
- Fiber & antioxidants
- Protein & fat



# ENERGY REQUIREMENTS FOR ADULTS

<b>Activity level</b>	<b>Adult Man</b>	<b>Adult Woman</b>
<b>Sedentary</b>	<b>2320</b>	<b>1900</b>
<b>Moderate</b>	<b>2730</b>	<b>2230</b>
<b>Heavy</b>	<b>3490</b>	<b>2850</b>

# ENERGY REQUIREMENTS FOR CHILDREN AND ADOLESCENTS

AGE (Yrs)	Kcal/day	AGE (Yrs)	Kcal/day	AGE (Yrs)	Kcal/day
1-3	1060	10-12: Boys	2190	13-15: Girls	2330
4-6	1350	10-12: Girls	2010	16-17: Boys	3020
7-9	1690	13-15: Boys	2750	16-17: Boys	2440

# Protein Requirements for Children and Adolescents

Group		RDA (g/day)	Group	RDA (g/day)
Adult Man		60	Children	
Adult Woman		55	1-3yr	16.7
Pregnant Woman		78	4-6yr	20.1
Lactating Woman		74	7-9yr	29.5
		(g/Kg/d)	Adolescents	
Infants	0-6 m	1.16	10-12 yr Boys	39.9
	6-12 m	1.69	Girls	40.4
			13-15 yr- Boys	54.3
			Girls	51.9
			16-18yr – Boys	61.5
			Girls	55.5

# Fat Requirements for Children and Adolescents

Group		RDA (g/day)	Group	RDA (g/day)
Adult Man		25	Children	
Adult Woman		20	1-3yr	27
Pregnant Woman		30	4-6yr	25
Lactating Woman		30	7-9yr	30
		(g/Kg/d)	Adolescents	
Infants	0-6 m	-	10-12 yr Boys	35
	6-12 m	19	Girls	35
			13-15 yr- Boys	45
			Girls	40
			16-18yr – Boys	50
			Girls	35

# Iron Requirements for Children and Adolescents

Group		RDA (mg/day)	Group	RDA (mg/day)
Adult Man		17	Children	
Adult Woman		21	1-3yr	9
Pregnant Woman		35	4-6yr	13
Lactating Woman		21	7-9yr	16
		(g/Kg/d)	Adolescents	
Infants	0-6 m	-	10-12 yr Boys	21
	6-12 m	5	Girls	27
			13-15 yr- Boys	32
			Girls	27
			16-18yr – Boys	28
			Girls	26

# Calcium Requirements for Children and Adolescents

Group		RDA (mg/day)	Group	RDA (mg/day)
Adult Man		600	Children	
Adult Woman		600	1-3yr	600
Pregnant Woman		1200	4-6yr	600
Lactating Woman		1200	7-9yr	600
		mg/day	Adolescents	
Infants	0-6 m	500	10-12 yr Boys	800
	6-12 m	500	Girls	800
			13-15 yr- Boys	800
			Girls	800
			16-18yr – Boys	800
			Girls	800

# What is a Balanced Diet?

- A balanced diet can be defined as one, which contains the various groups of food stuffs such as energy yielding foods (carbohydrates, fats), body-building foods (protein), and protective foods (vitamins, minerals) in required amounts and proper proportions.
- So that an individual is assured of obtaining the adequate amounts of all the nutrients for proper maintenance of health and nutritional status.
- The components of a balanced diet will differ according to age, gender, physical activity and physiological status like children, adolescents, pregnancy, lactation etc.

# HEALTHY BALANCED DIET

## Fruit & Vegetables

They contain vitamins and minerals, and plant chemicals called phytochemicals.

## Breads, Rice & Potatoes

They are rich in vitamins and minerals, and the wholegrain varieties contain plenty of fibre.

## Meat, Fish, Eggs & Beans

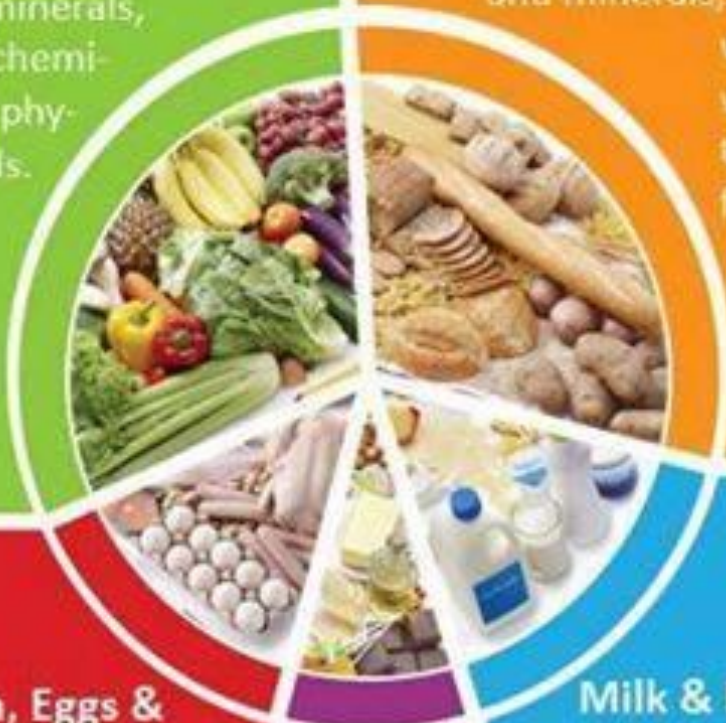
They provide nutrients that are vital for health and maintenance of your body.

## Foods & Drinks

Such as herbs, vitamins, minerals.

## Milk & Dairy Foods

They can keep bones strong and prevent high blood pressure.





**Poor diet is the 4th biggest  
global risk factor for disease**

# Nutrient Intakes of 7-9 year Rural Children in India

<b>Nutrients</b>	<b>Actual Intake (Median)</b>	<b>Requirement (RDA)</b>	<b>Deficit (%)</b>
Protein (g)	33.4	29.5	No deficit
Total fat (g)	17.1	30.0	-43.0
Energy (Kcal)	1241	1690	-26.6
Calcium (mg)	226	600	-62.3
Iron (mg)	8.6	16.0	-46.3
Vitamin A (µg)	79	600	-86.8
Thiamine (mg)	0.8	0.8	No deficit
Riboflavin (mg)	0.5	1.0	-50.0
Niacin (mg)	9.4	13.0	-27.7
Vitamin C (mg)	19	40.0	-52.5
Folic acid (µg)	86.9	120	-27.6

# Nutrient Intakes of 10-12 years Rural Children in India

<b>Nutrients</b>	<b>Actual Intake (Median)</b>	<b>Requirement (RDA)</b>	<b>Deficit (%)</b>
Protein (g)	36.3	40	-9.7
Total fat (g)	17.6	35	-49.9
Energy (Kcal)	1368	2100	-34.8
Calcium (mg)	239	800	-70.1
Iron (mg)	9.6	24	-59.4
Vitamin A (µg)	84	600	-86.0
Thiamine (mg)	0.9	1.5	-14.1
Riboflavin (mg)	0.6	1.25	-56.1
Niacin (mg)	10.6	14	-24.4
Vitamin C (mg)	21.5	40	-46.3
Folic acid (µg)	93.7	140	-33.1

# Nutrient Intakes of 7-12 years Rural Children in India

<b>Nutrients</b>	<b>Actual Intake (Median)</b>	<b>Requirement (RDA)</b>	<b>Deficit (%)</b>
Protein (g)	34.9	35.1	No deficit
Total fat (g)	17	33	-46.6
Energy (Kcal)	1307	1905	-30.9
Calcium (mg)	233	704	-66.4
Iron (mg)	9.1	20.1	-53.1
Vitamin A ( $\mu\text{g}$ )	82	600	-86.4
Thiamine (mg)	0.9	0.9	No deficit
Riboflavin (mg)	0.5	1.1	-53.1
Niacin (mg)	10.0	13.5	-26.0
Vitamin C (mg)	20	40	-50.0
Folic acid ( $\mu\text{g}$ )	90.5	130.4	-30.4

## PROTEIN AND CALORIE ADEQUACY STATUS (P+ C+) BY AGE GROUP

State	1-3	4-6	7-9	10-12		13-15		16-17		Men	Women
				B	G	B	G	B	G		
<b>Kerala</b>	13.9	13.9	13.6	7.3	12.2	11.9	14.3	16.2	25.4	53.0	60.0
<b>Tamil Nadu</b>	20.4	9.2	6.8	7.0	8.9	8.7	19.4	21.6	60.5	59.8	76.9
<b>Karnataka</b>	34.3	18.2	26.7	22.7	17.4	23.5	28.6	38.9	38.1	59.1	79.4
<b>A.P</b>	41.3	46.3	47.2	34.2	50.8	44.3	47.7	60.7	66.1	72.8	76.3
<b>Maharashtra</b>	36.0	41.8	47.1	42.4	48.4	49.4	50.3	60.9	67.6	65.6	72.8
<b>Gujarat</b>	54.7	42.6	46.8	32.9	47.3	26.5	44.6	36.7	72.1	65.6	86.3
<b>M.P</b>	22.7	19.8	21.3	14.8	16.6	16.5	16.4	21.3	50.0	36.5	62.2
<b>Orissa</b>	24.6	14.5	17.2	18.2	26.9	27.0	57.9	59.8	80.2	83.2	89.3
<b>W Bengal</b>	34.9	57.5	53.3	57.1	66.0	74.5	64.1	63.0	65.0	82.4	82.1
<b>Pooled</b>	30.1	29.4	31.5	25.6	32.8	30.7	38.9	44.2	61.0	65.2	73.2

# Distribution (%) of Households According to Dietary Energy Adequacy Status of Adults Vs Children

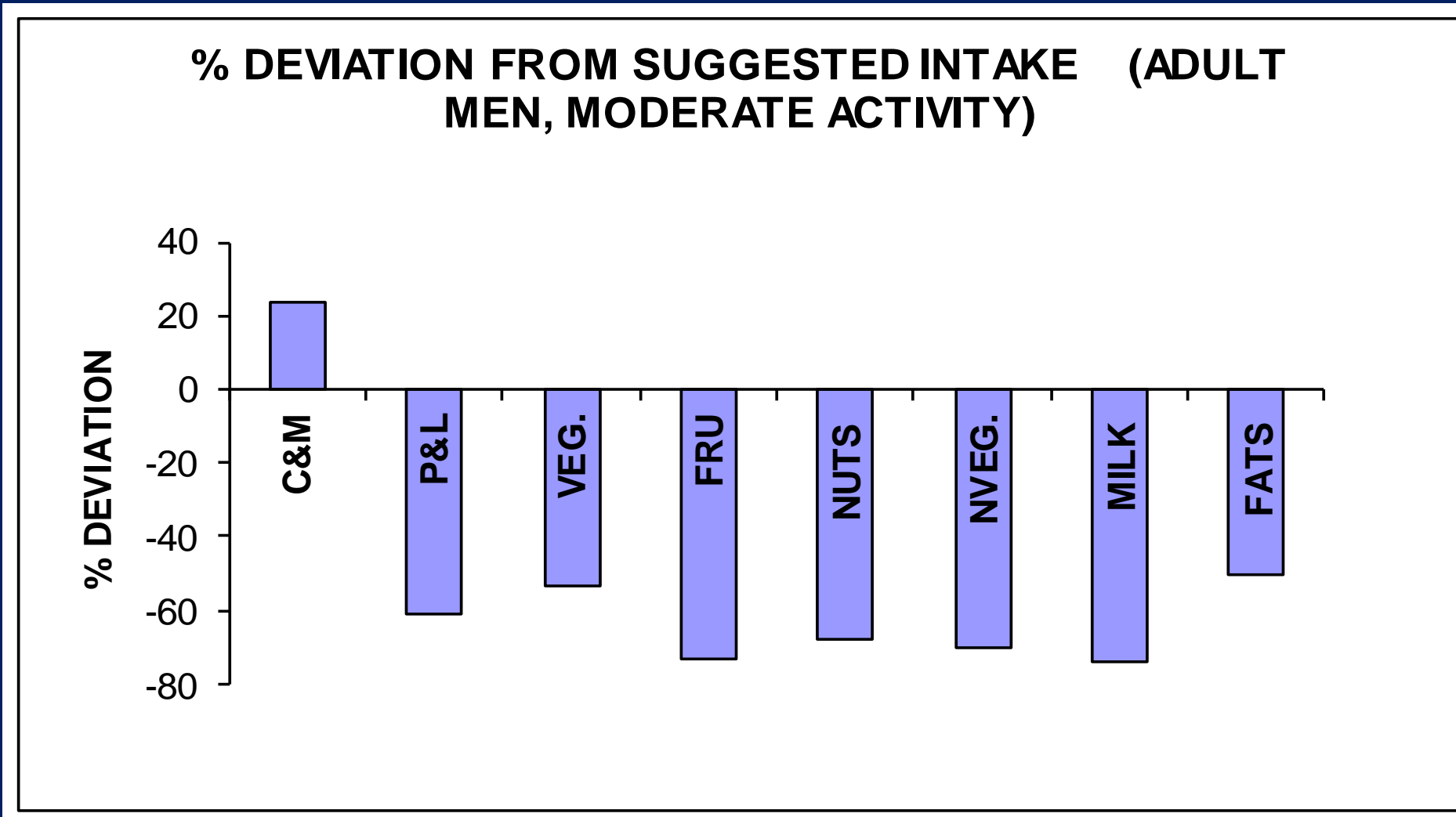
DIETARY ENERGY INTAKE			AGE GROUP						
ADULT MALE	ADULT FEMALE	CHILD	PRE- SCHOOL			SCHOOL AGE		ADOLESCENT	
			75-79	2001	2006	2001	2006	2001	2006
+	+	+	31.1	31.1	22.1	47.3	27.9	61.6	43.2
+	+	-	21.4	42.9	51.8	27.4	45.4	13.2	27.0
+	-	+	2.3	1.4	0.5	1.4	00.6	2.1	1.4
+	-	-	6.5	4.2	3.8	2.2	3.6	1.4	2.8
-	+	+	3.8	2.9	2.0	4.7	3.0	7.3	5.7
-	+	-	8.4	9.3	10.6	8.8	10.3	6.2	8.6
-	-	+	3.4	1.0	1.3	1.2	0.6	2.2	1.3
-	-	-	19.1	7.2	7.5	7.0	8.6	6.0	10.0
<b>ENERGY INADEQUACY</b>			<b>55.4</b>	<b>63.6</b>	<b>73.7</b>	<b>45.4</b>	<b>67.9</b>	<b>26.8</b>	<b>48.4</b>

Source: NNMB

+ : Adequate - : Inadequate ;  $\chi^2 : 308.6 , p < 0.001$

# How diversified is our diet? gaps

## Intake of cereals and millets among rural population



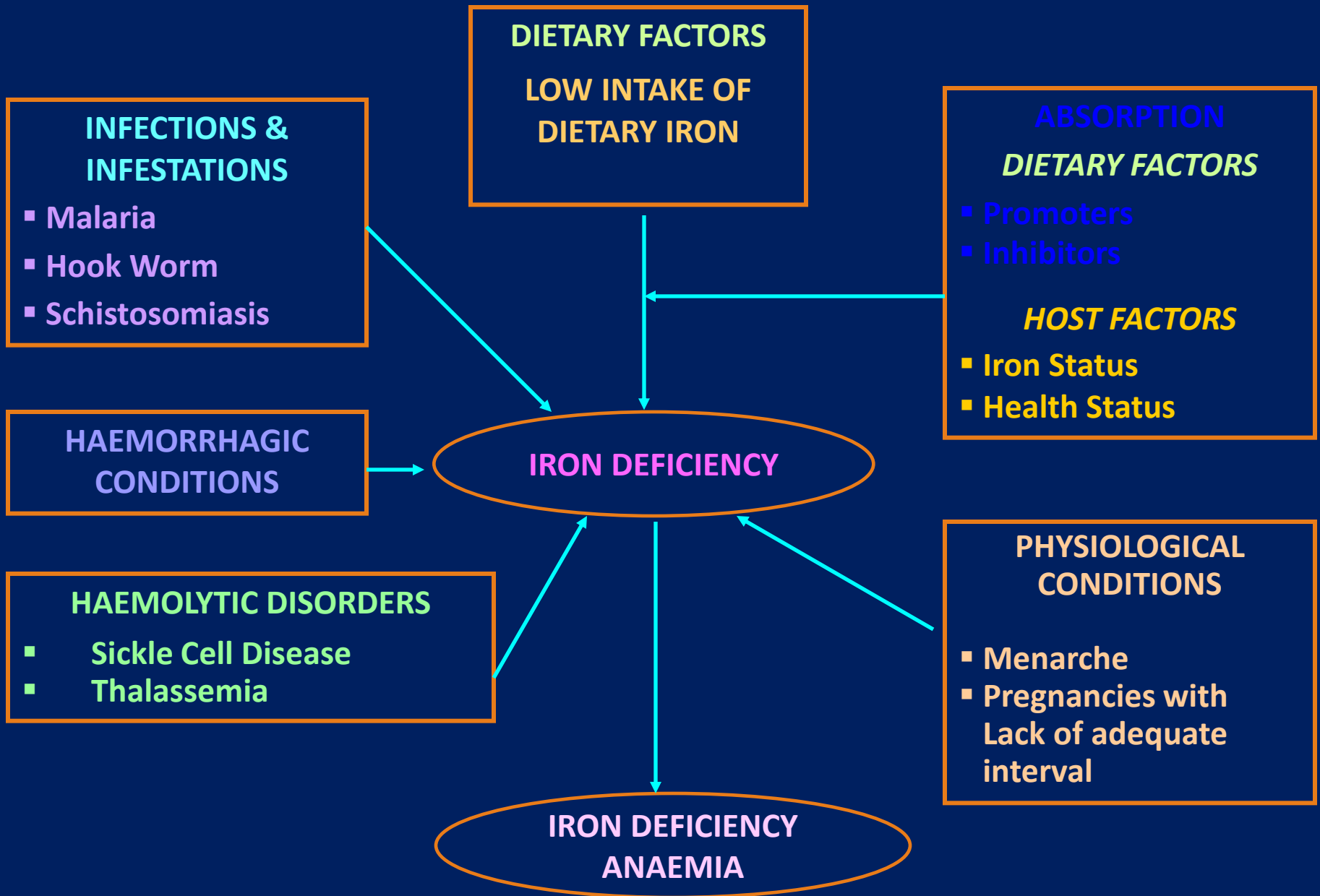
# Definition of Anemia

<b>AGE / PHYSIOLOGICAL GROUP</b>	<b>Gender</b>	<b>Hb (g/dl)</b>
<b>6 months – 6 Years</b>	<b>Boys &amp; Girls</b>	<b>&lt;11</b>
<b>6 – 14 Years</b>	<b>Boys &amp; Girls</b>	<b>&lt;12</b>
<b>≥ 14 Years</b>	<b>Men</b>	<b>&lt;13</b>
	<b>Women</b>	<b>&lt;12</b>
<b>Pregnant Women</b>		<b>&lt;11</b>

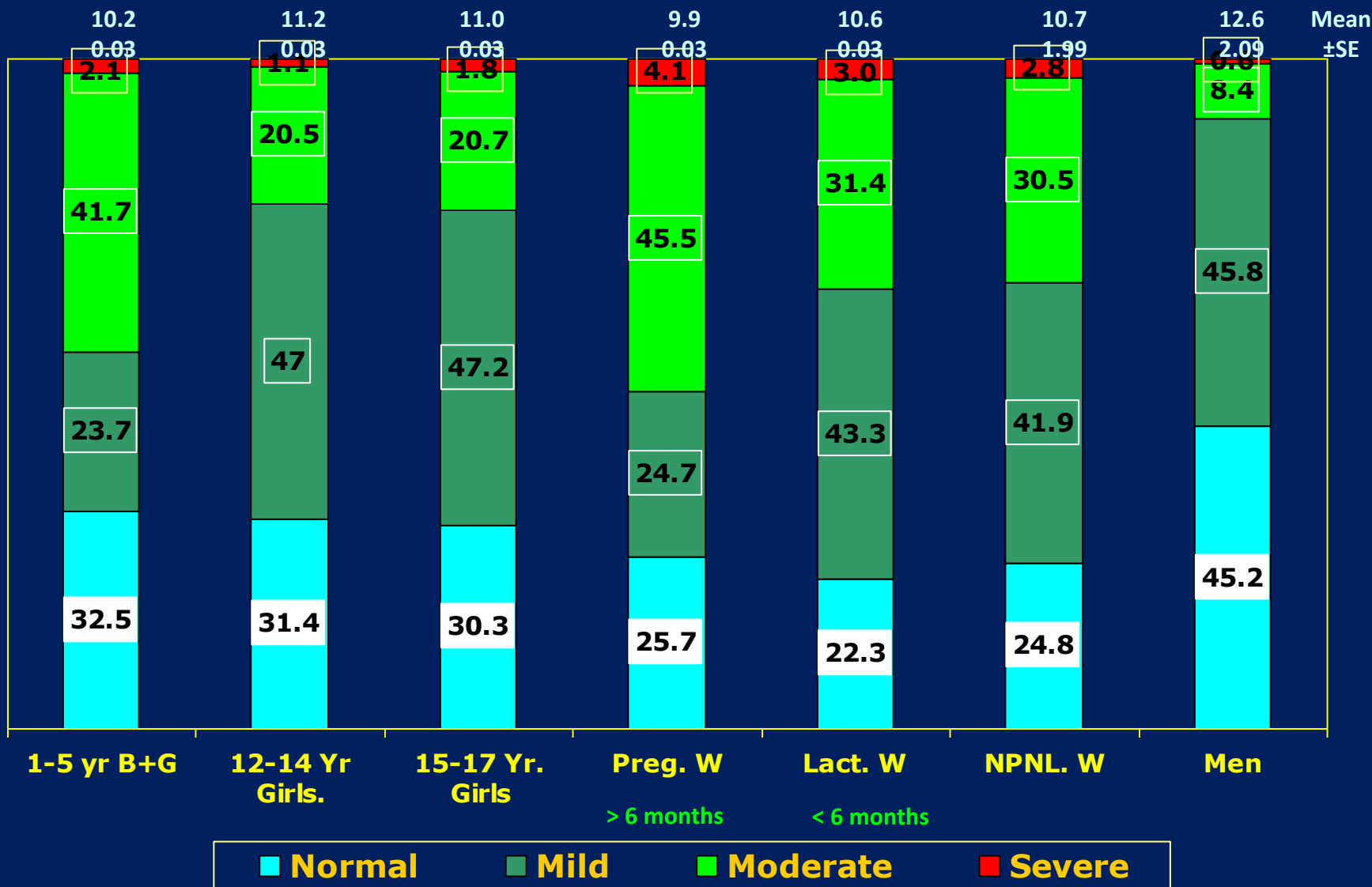
WHO, Nutritional Anemia - TRS No. 405, Geneva 1968.



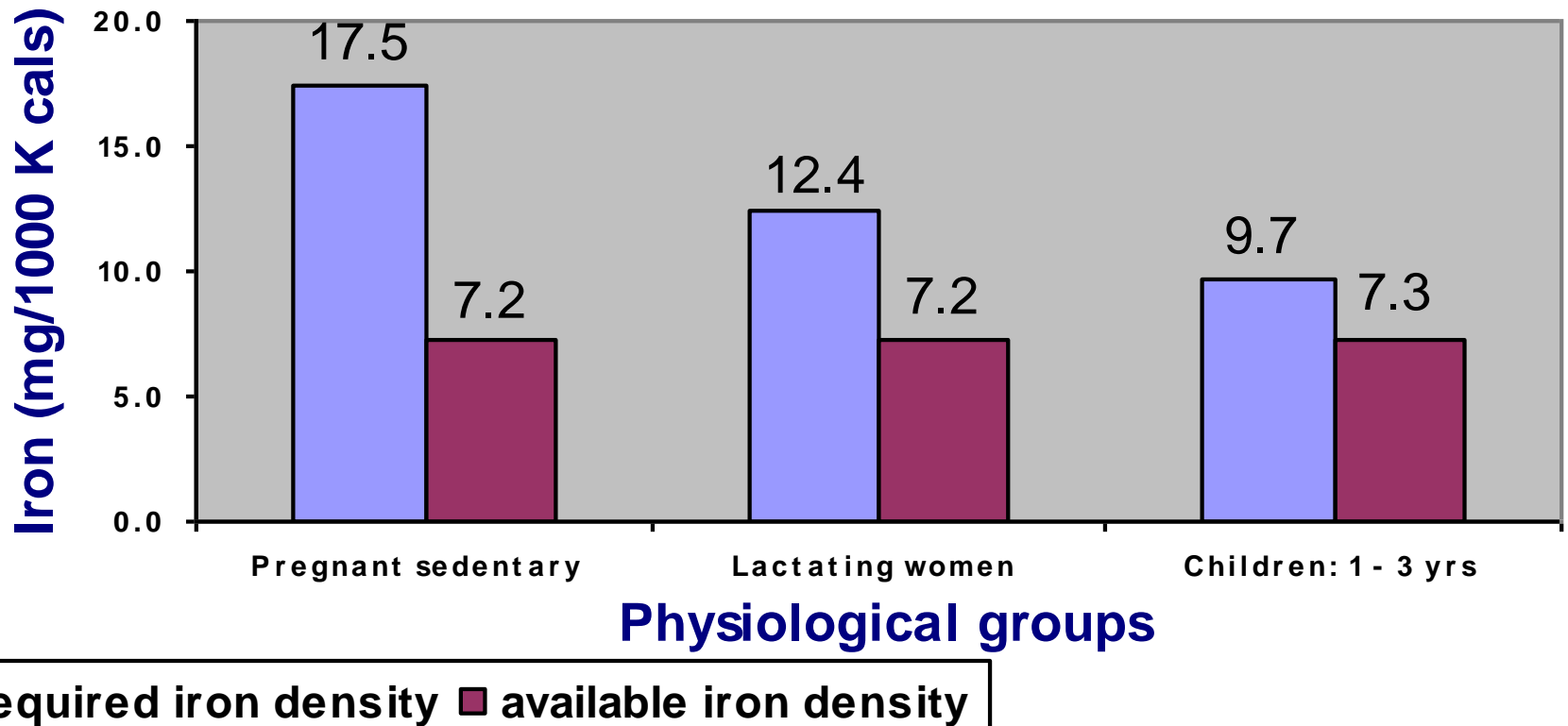
# AETIOLOGY OF IDA



# Prevalence (%) of Anaemia by Age, Gender & Physiological Groups

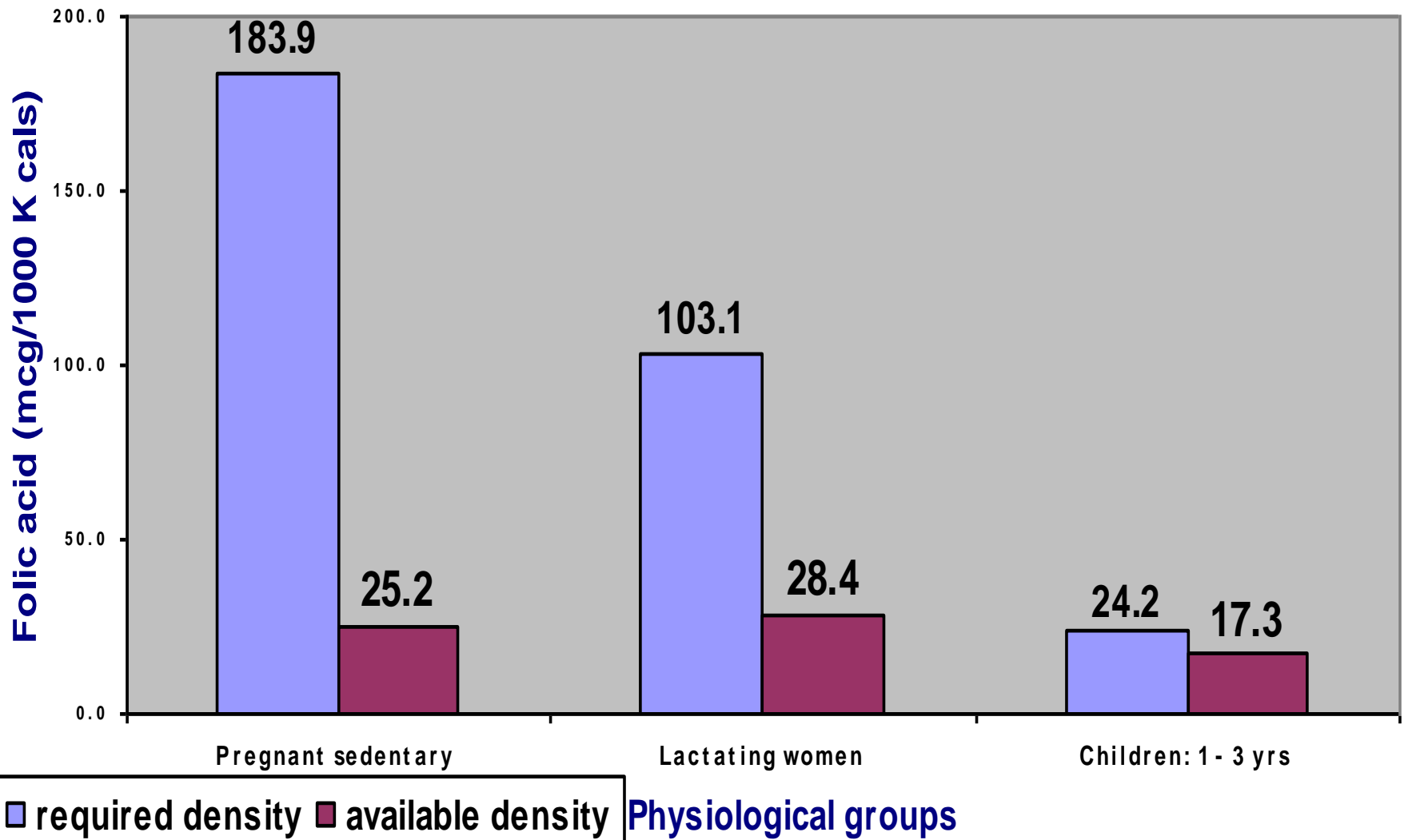


## IRON DENSITY TO MEET RDA



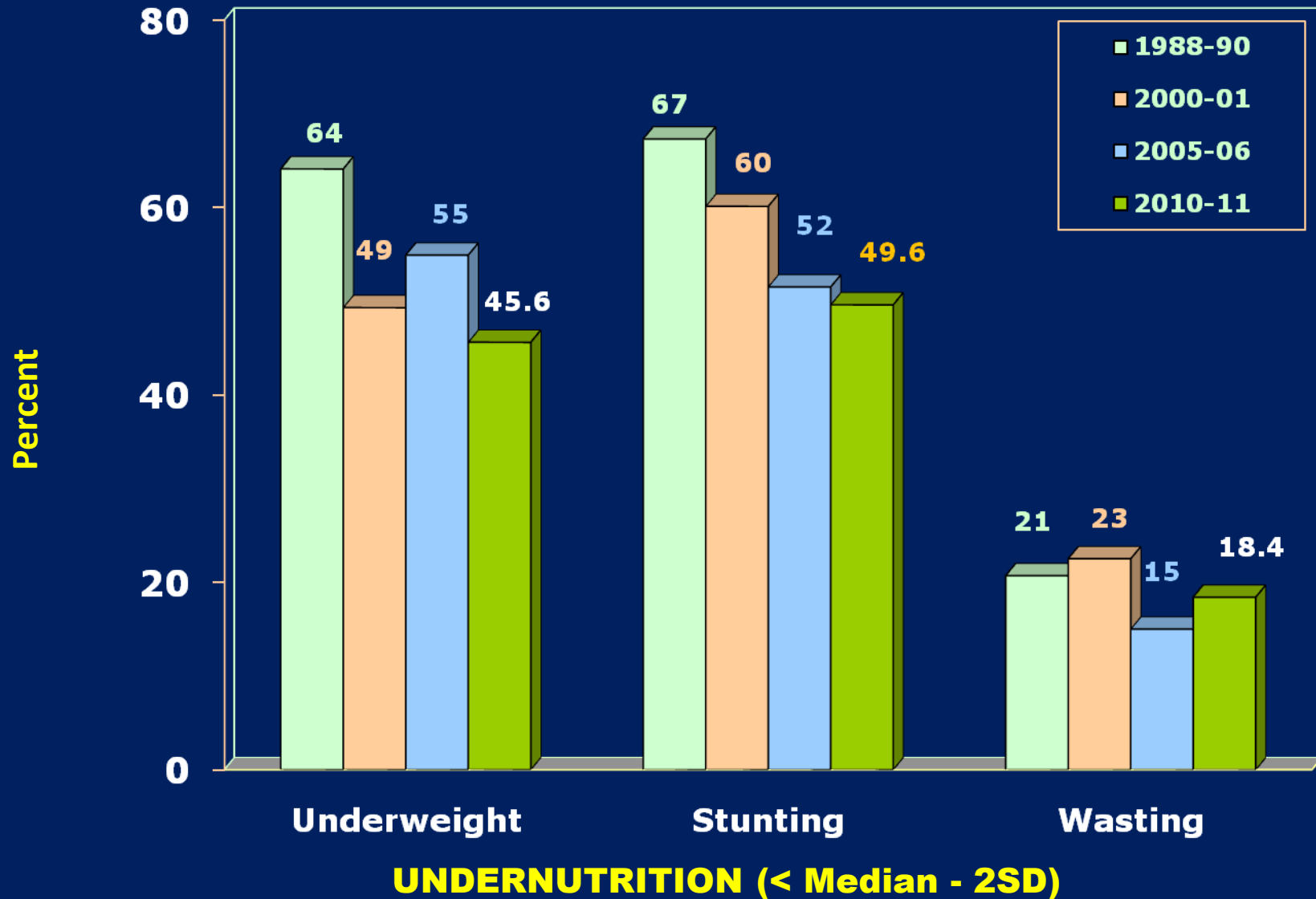
**Computed from NNMB data, rural survey, 2001**

# FOLIC ACID DENSITY TO MEET RDA

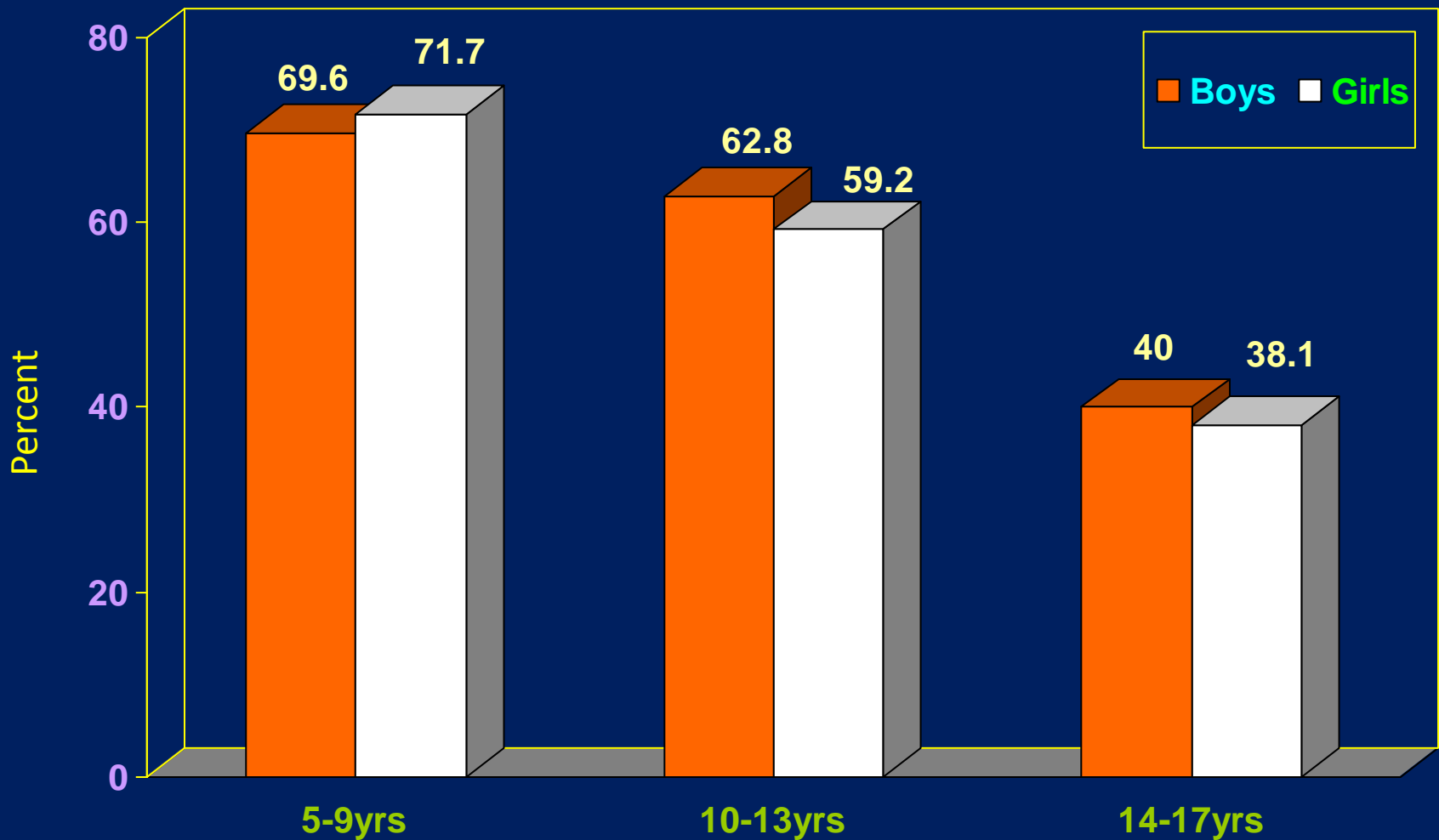


**Computed from NNMB data, rural survey, 2001**

# Time trends in the prevalence of Undernutrition among under five year Rural children in India

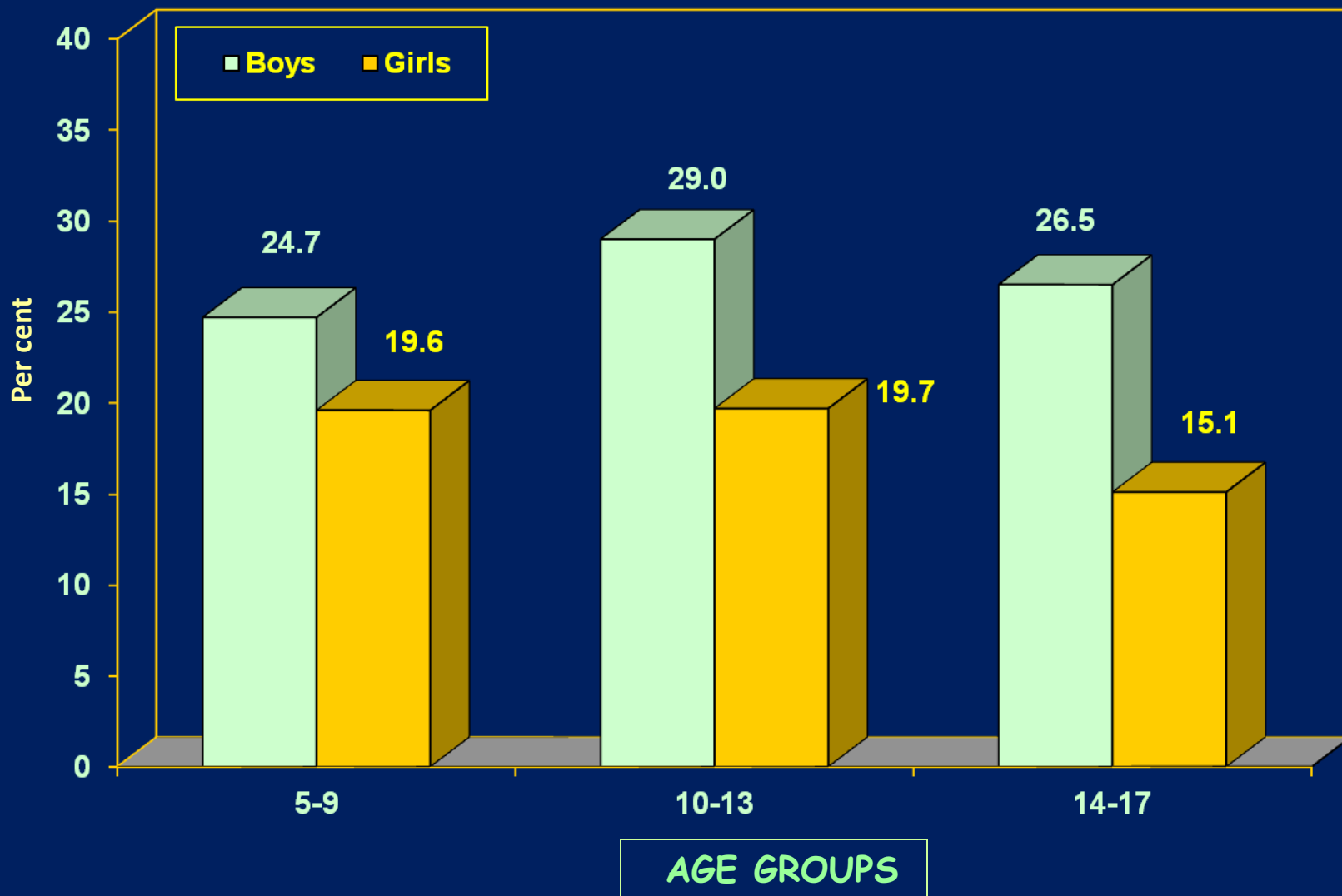


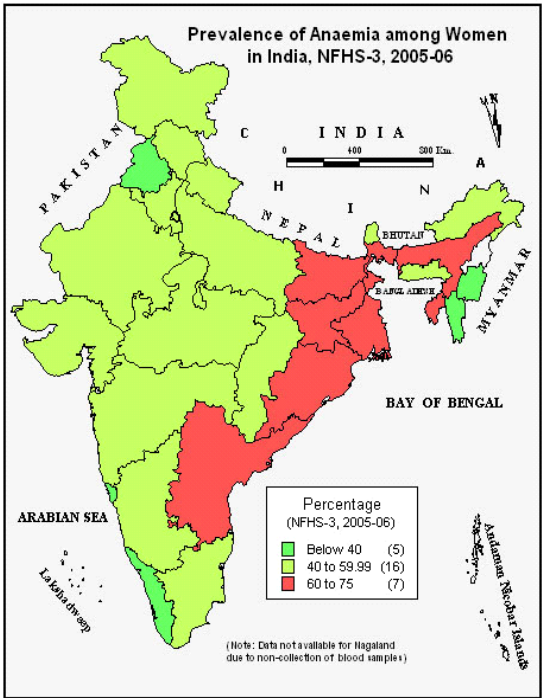
# PREVALENCE (%) OF THINNESS (<5<sup>th</sup> Centile) AMONG 5-17 YEARS BOYS AND GIRLS USING BMI AGE AND GENDER SPECIFIC CENTILES



**NNMB Tribal surveys 2008-09**

# Prevalence (%) of thinness among urban School age children and Adolescents according to BMI Z-Scores by Age and gender





# Micronutrient deficiency do not occur in isolation but rather concurrently

- Iodine
- Iron
- Zinc
- Vitamin A
- Vitamin B12
- Folic acid
- Calcium
- Vitamin D

Nutrient	Median Intake	RDA
Iron	12 mg	17 mg
Vitamin A	124 µg/CU/d	600 µg
Riboflavin	0.8 mg/CU/d	1.4 mg
Vitamin C	29 mg/CU/d	40 mg
Dietary folate	118 µg/CU/d	200 µg



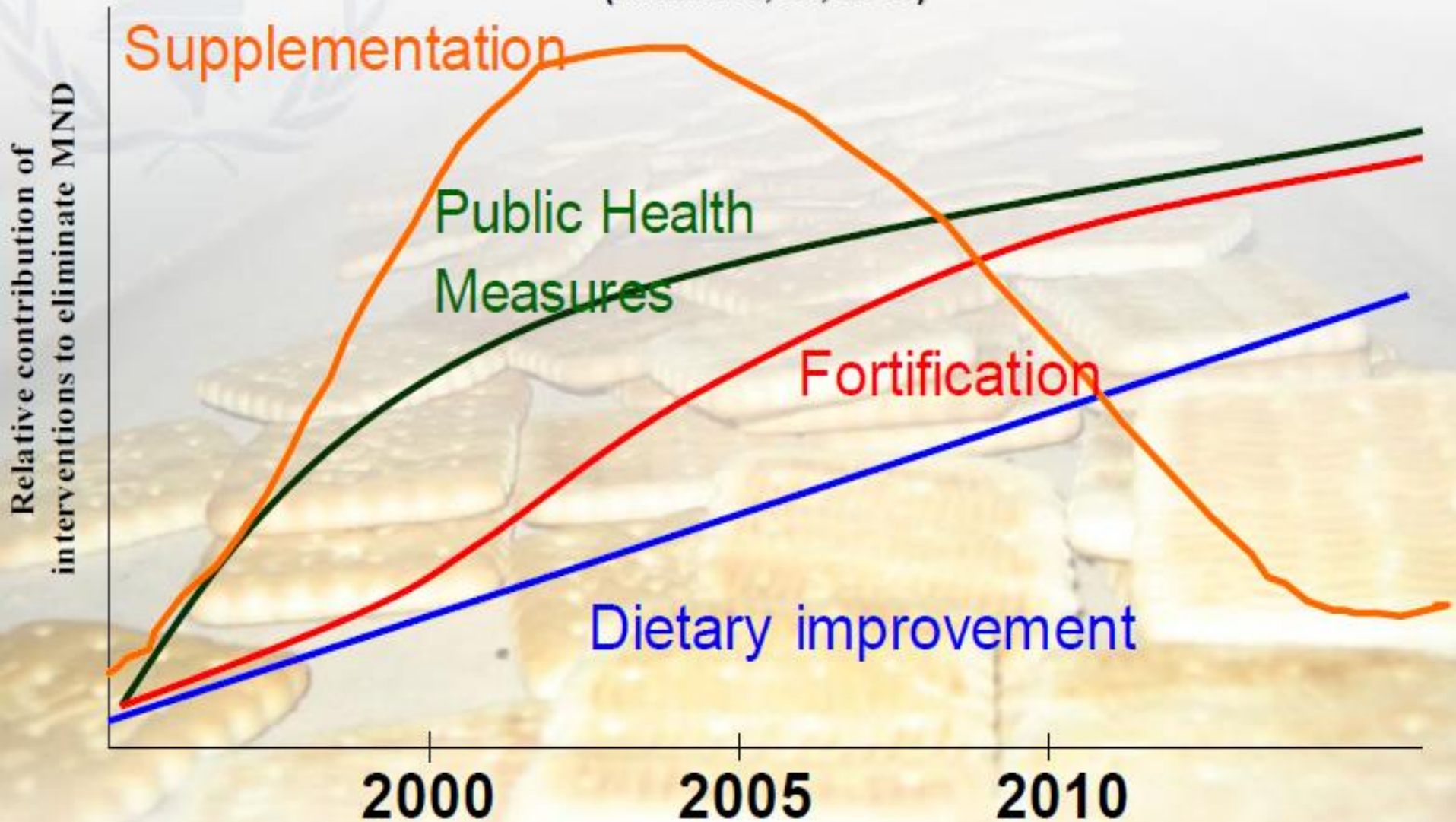
# Micronutrients (vitamins and minerals) are essential for many functions and health



They cannot be produced by the body and have to come from the diet

# Integrated Approaches to eliminate Micronutrient Deficiencies

(V.Mannar, MI, 2003)



# Three types of food fortification are in place

## Conventional fortification

- Staple foods (flour, sugar, milk, oil, rice)
- Dairy (milk, yoghurt)
- Spreads (margarine)
- Condiments (salt)



## Home fortification

- Powder
- Sachets



## Bio-fortification

- The breeding and genetic modification of plants so as to improve their nutrient content
- Agricultural products (rice, maize, sweet potato,...)



# RDA and 50 % of RDA for children, adolescents, Pregnant, and Lactating women (2010 RDA )

Micronutrient	Average RDA 6mon – 6 yrs	50% RDA used for fortification of foods	RDA		
			Pregnant women	Lactating mothers	Adolescents
Calcium mg	600 (450)	300	1000	1000	800
Iron mg	9 (15)	4.5	38	30	27
Iodine µg	100	50	200	200	120
Zinc mg	5 (10)	2.5	15	15	11
Vitamin A µg	375	187-200	600	950	600
Vitamin B2 mg	0.9	0.5	1.3	1.4	1.4
Vitamin C mg	40	20	40	40	40
Folic acid µg	90 DFE =54 Folic acid	27-30	400	150	90
Vitamin B12 µg	0.2-1	0.5	1	1	1

Values in parenthesis the existing guidelines based on previous RDA for Indians



# IRON BIOAVAILABILITY

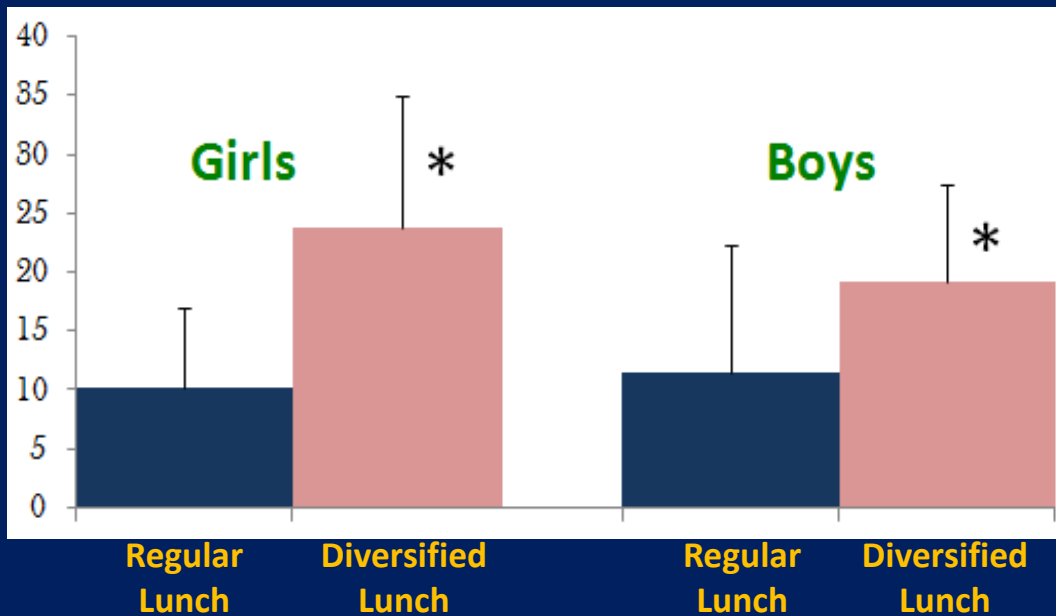
Regular meal was diversified with 100g guava among adolescents and iron absorption was estimated for both the meals using stable isotope technique.



Diversified  
with  
100 g  
Guava



Fe : AA = 1 : 5



Diversified meal found to increase iron absorption by 2 times among both the girls and boys.



# Food Safety and personal hygiene



*Mostly chronic hunger and starvation persist in large sections of the population, because of un-hygienic preparation, storage, serving and the way we eat.*

# INFECTION AND UNDERNUTRITION

*..... a Vicious Cycle*

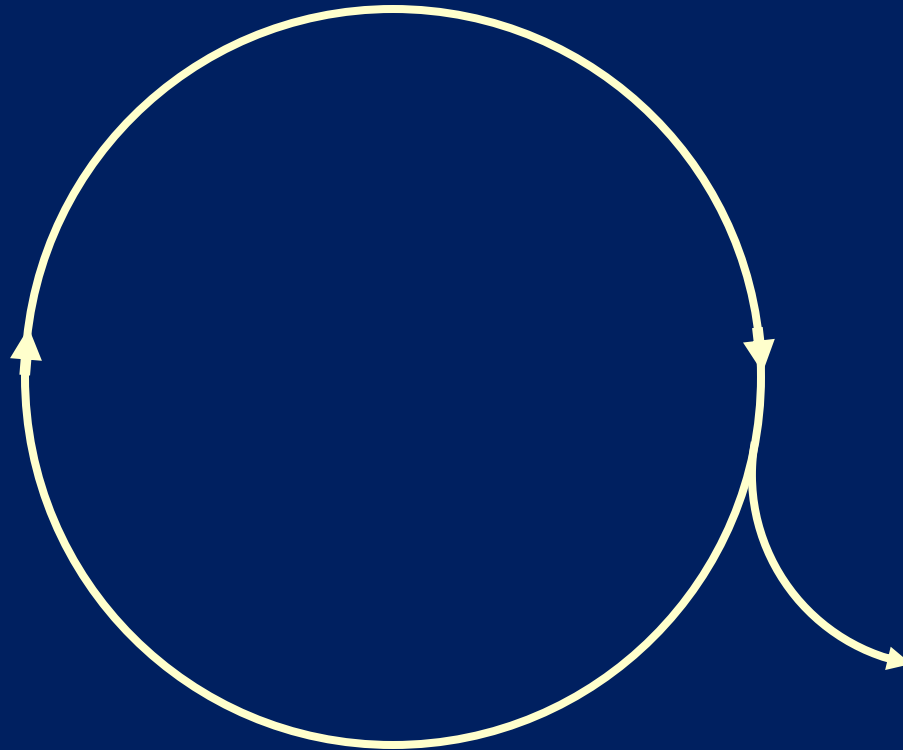
INFECTION

Lowered  
resistance/  
Frequent  
infections

Reduced  
Food intake/  
absorption

Death

UNDERNUTRITION



**Food Safety**

**Food Adulteration**

**Food Contamination**

## Definition of food safety (FAO/WHO, 2003)

It is the degree of confidence that food will not cause sickness or harm to the consumer when it is prepared, served and eaten according to its intended use

# **FOOD SAFETY SCENARIO IN INDIA**

- **The common man in India understands food safety as “ maintaining personal hygiene, cooking in clean utensils with clean water and serving hot foods“.**
- **This is essentially due to the fact that semi processed raw materials are purchased from the market and food is essentially prepared at home.**
- **Basic food safety measures are integrated in the cultural habits.**
- **Hence food safety in India can be discussed**
  - **Food Safety at household Level**
  - **Food Safety at market level (sale places)**

# Food Contaminant

*Substances that have not been intentionally added to food and present in food as a result of the various stages of its production processing, packaging, transport or holding.*

## Classification of Food Contaminants

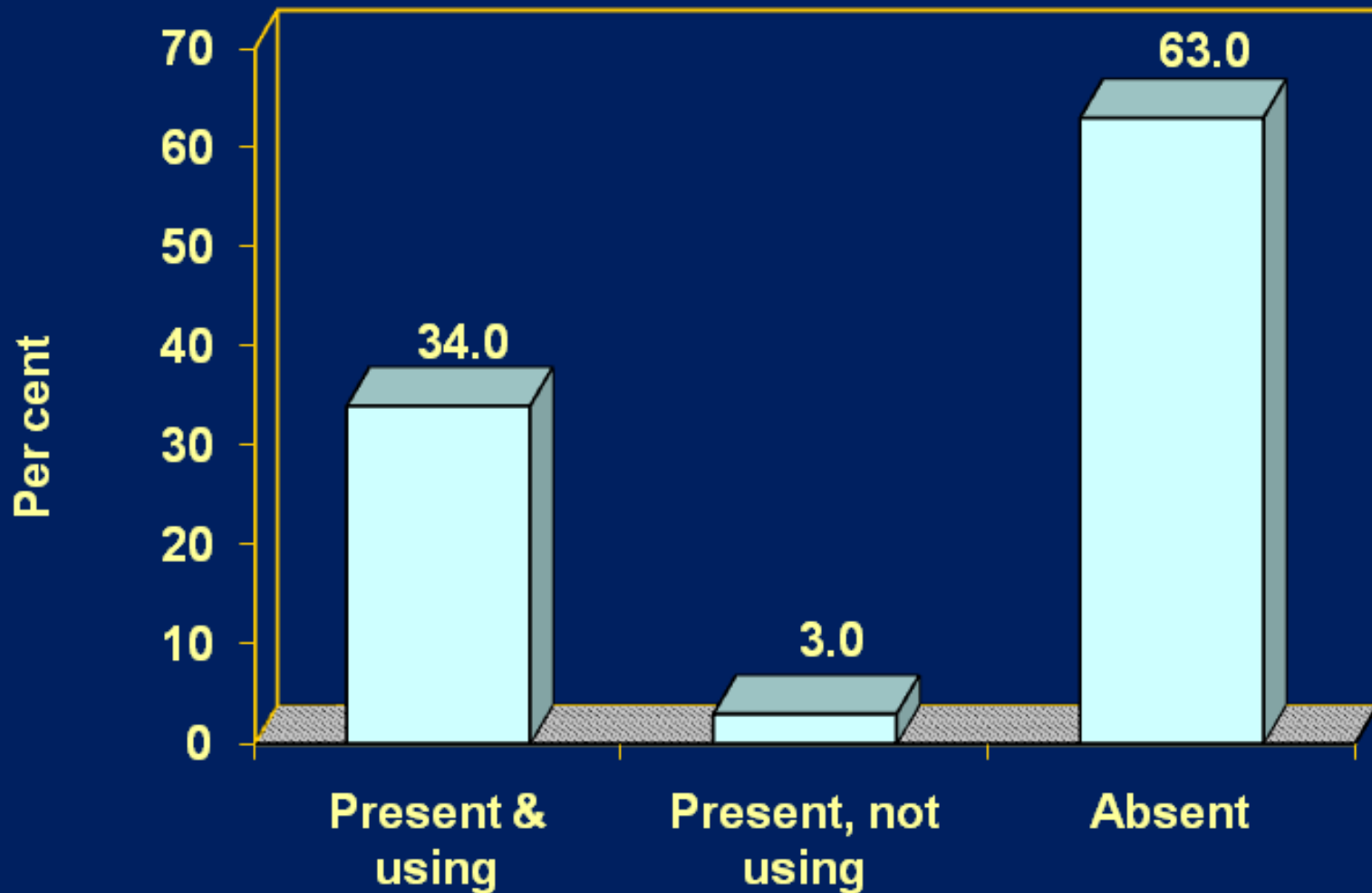
- Physical
- Chemical
- Biological

*Physical contaminants : Hair, bones, sand particles, iron filings, staples pins etc*

*Chemical Contaminants: Pesticide residues  
Toxic metals  
Veterinary Drug residues  
Poly chlorinated biphenyls  
Dioxins  
Chemicals formed during processing*

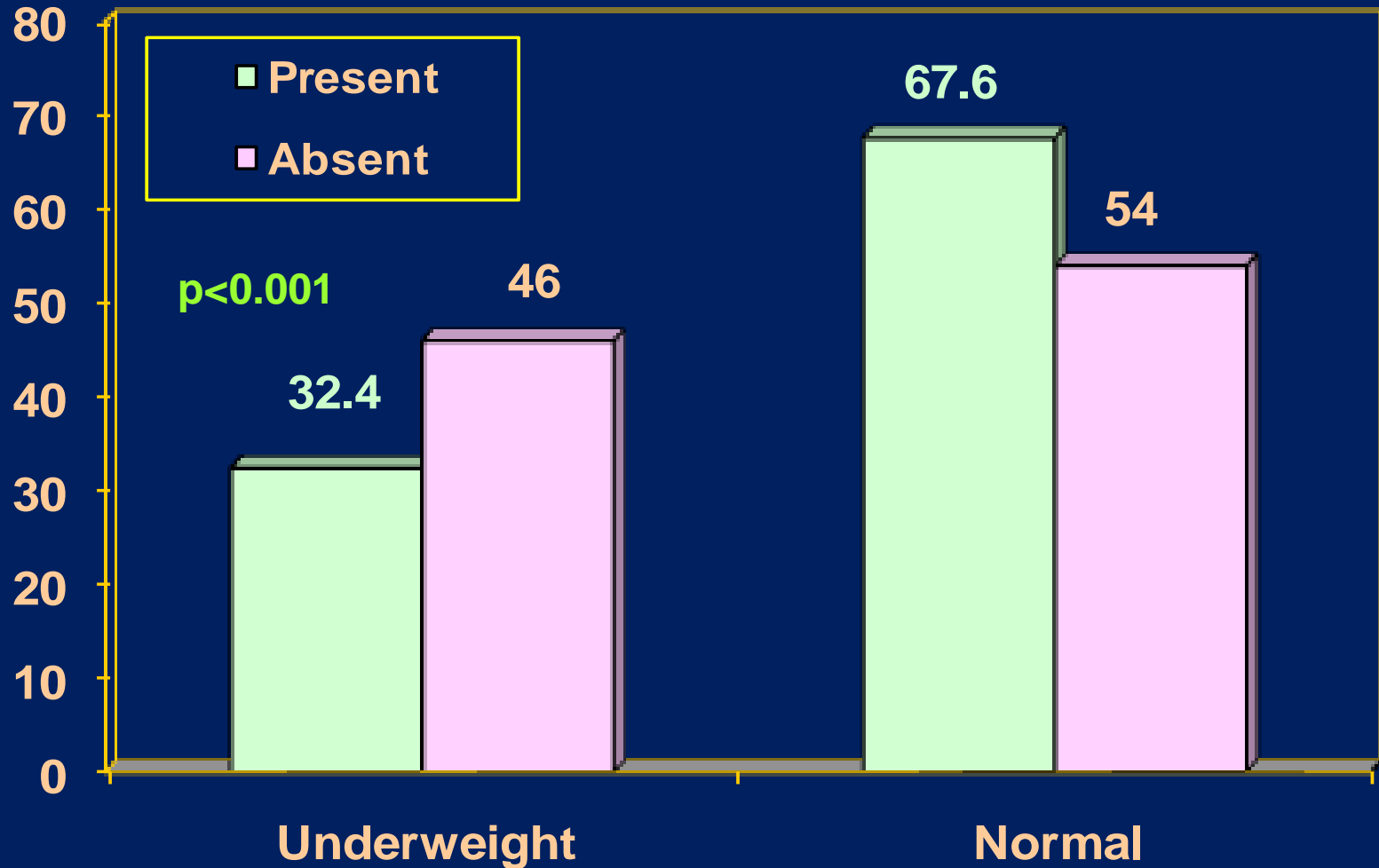
*Biological contaminants: Viruses, Bacteria, Parasites,  
Shellfish toxins, Mycotoxins*

# Distribution (%) of households by Sanitary latrine (46,000 HHs in 10 states)

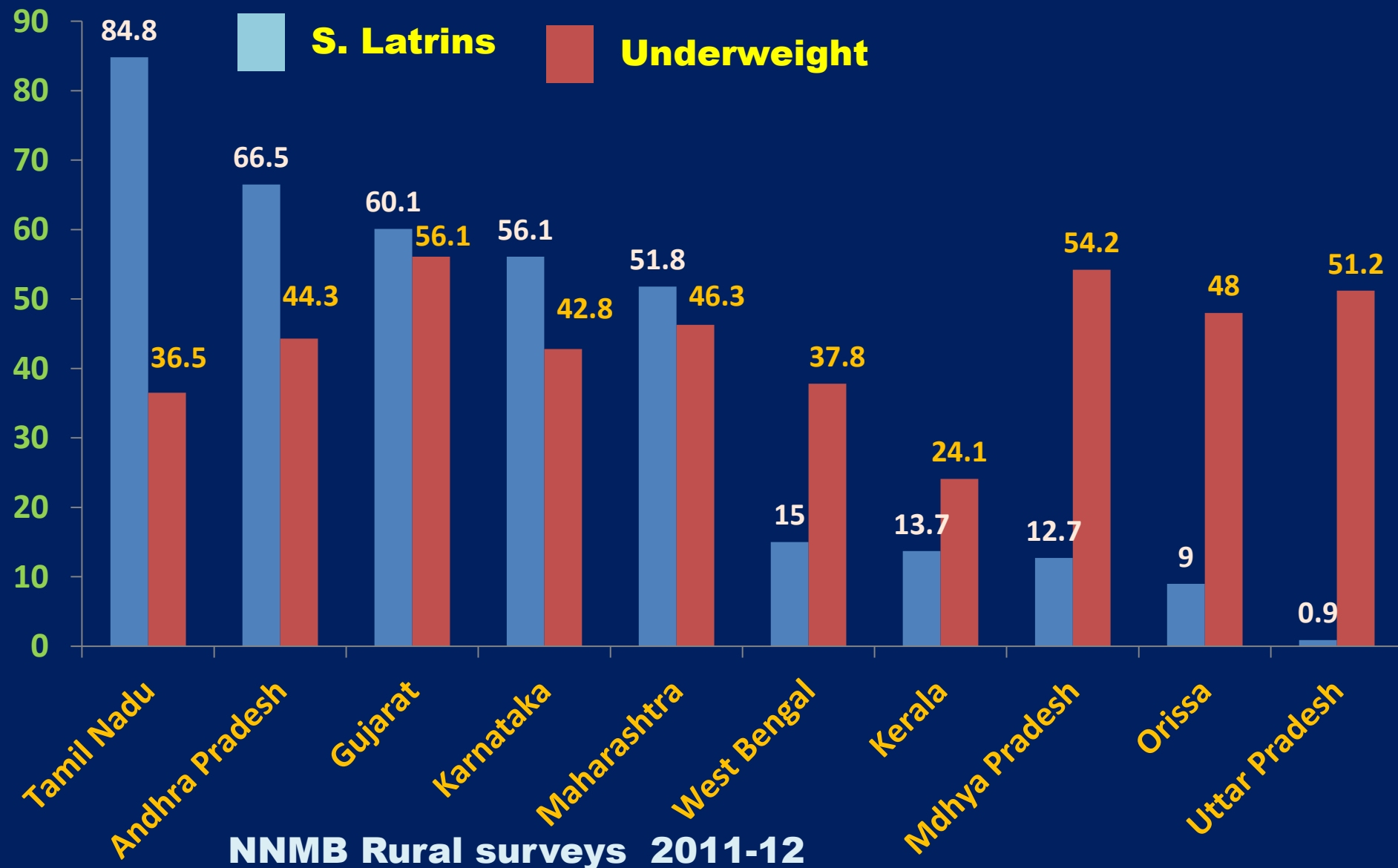




# Prevalence (%) of Undernutrition (Weight for age) among 1-5 Year Children: By Sanitary latrine



# Households (%) having safe drinking water (Tap water) in 10 major States of India



**Food preparation centres**

**Food distribution centres**

➤ **Assessment of :-**

- Sanitation and hygiene of cooking & serving premises
- Personal hygiene of food handlers
- Food material handling practices

➤ **Microbiological analysis of cooked food items**

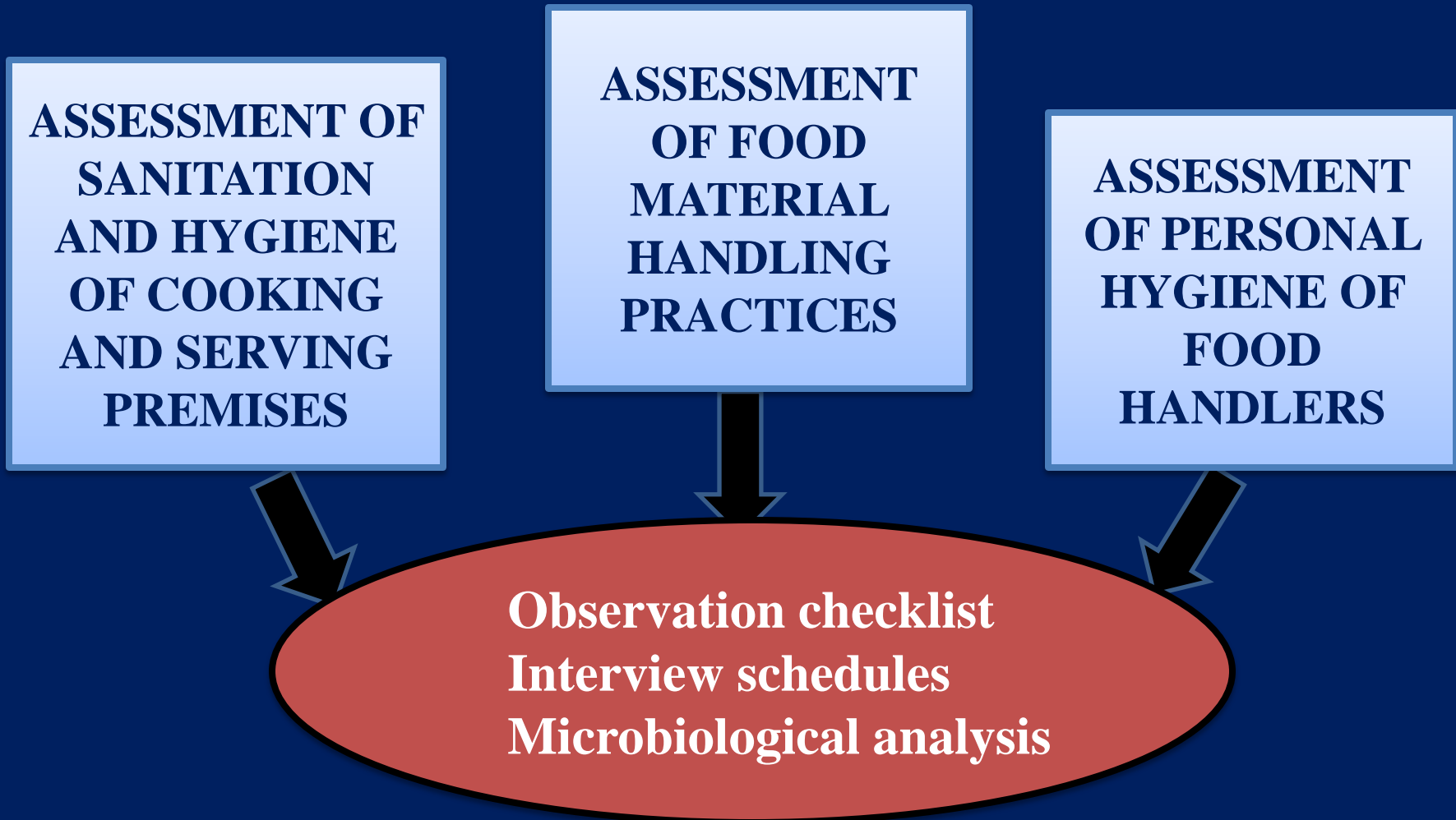
➤ **Microbiological analysis of water**

*Focus Group Discussion for studying consumer acceptability*

**Identification of CCPs for contaminated dishes**

**Data analysis and interpretation**

# *TOOLS AND TECHNIQUES*



**A three point scale was used for scoring the qualitative parameters**

# MICROBIOLOGICAL ANALYSIS

**Food samples**

**Water samples**

**Hands, equipment, utensils and surfaces samples**

- **Microbiological analysis included**
  - Total plate count (TPC)
  - Coliform count
  - Microorganisms like *E. coli*,
  - Coagulase positive *staphylococci*
  - *Bacillus cereus* in cereal preparations and
  - Yeast and mould count for the sweets
- **Standard BIS methods should be followed**

# *FOCUSED AREAS - HYGIENE NEEDED*



**Space dryness, Cleanliness, lighting and ventilation**

# Personal Hygiene of Food Handlers

**27 %**



**18 %**



**91 %**



**Microbiological analysis for surface sanitation revealed  
Hands, surfaces, equipment and utensils were  
contaminated with pathogens**

# Microbiological quality of water

Distribution Centers	Total Plate Count (cfu/ml)	Coliform/100 ml	Fecal Coliform/100 ml	E.coli/100 ml
1	$1 \times 10^1$	9	-	-
2	$1.7 \times 10^2$	1600	+	+
3	$1.7 \times 10^2$	>1800	+	-
4	$1.2 \times 10^2$	12	-	-
5	ND	27	-	-

***ND (< 1 cfu/ml) Coliform has been estimated using MPN tubes***



# Food analysis - Daily Menu of the meal

Cereal  
Preparation



+



/



Pulse  
Preparation



/



/



Vegetable  
Preparation



/



/



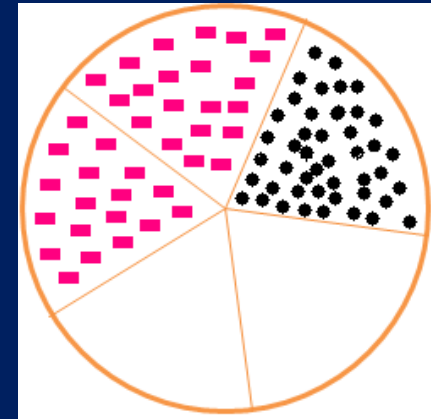
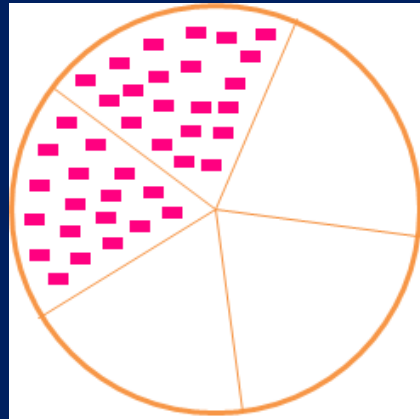
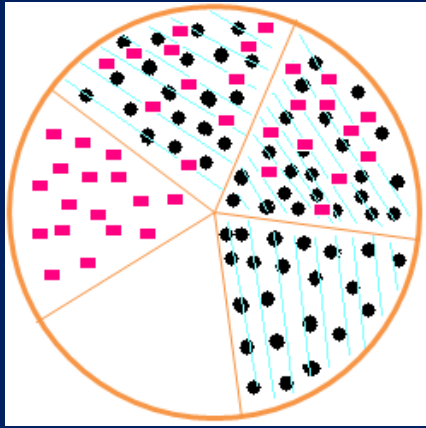
Sweet  
Preparation



/



# Foods in which pathogenic microorganisms seen (food distribution centers)



**Rice**

**Aloo Sabzi**

**Chole/chane**



Coliform count



*E. Coli*



Coagulase positive *staphylococci* count

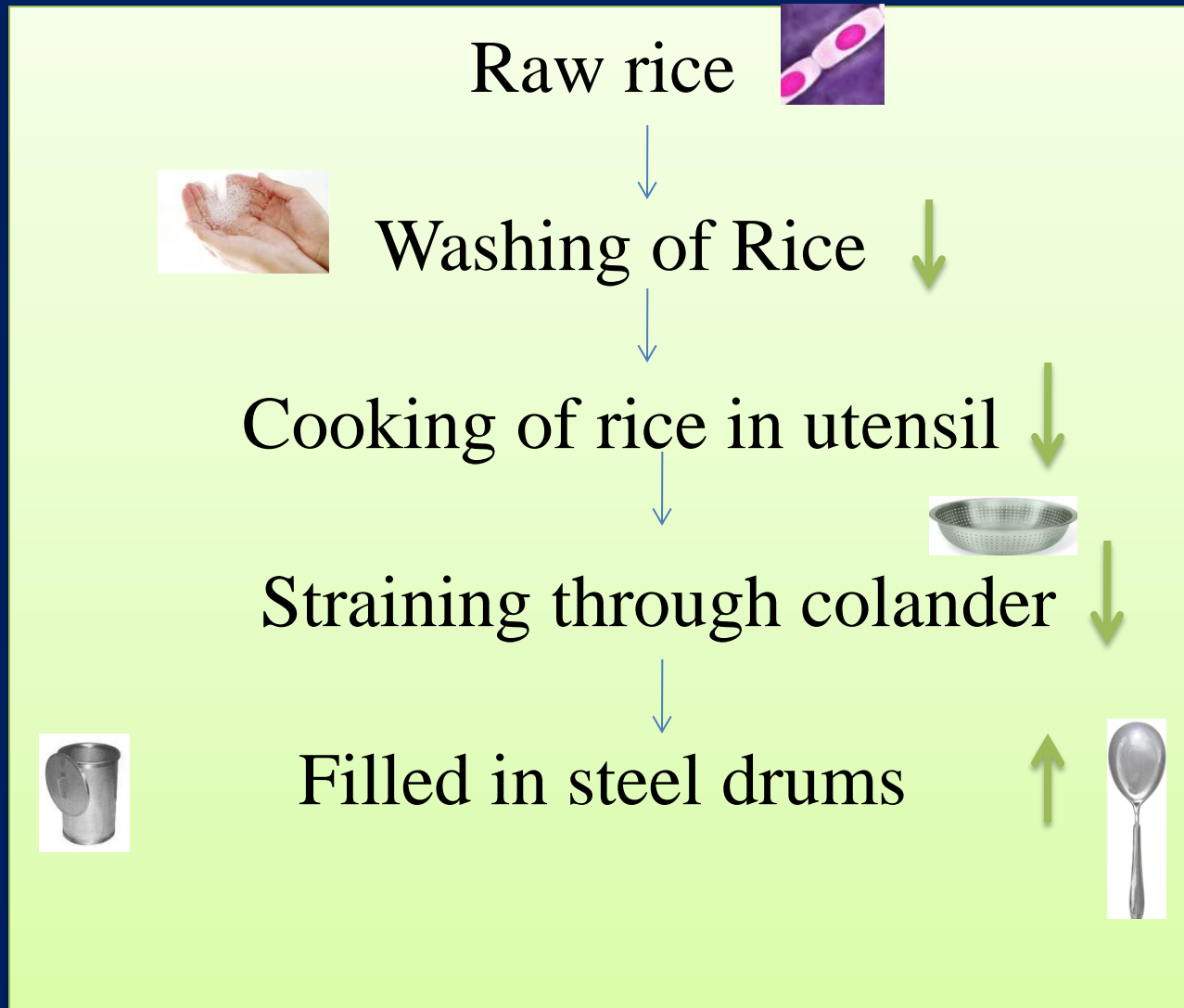


Rice, Chole and Aloo sabzi,  
Kadhi, kheer, halwa, puri,  
Rajma, Parantha

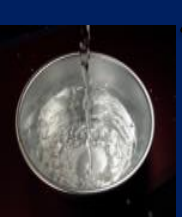


*Dal and chapatti*

# Identification of CCP's - Microbiological analysis of *Rice*



# Identification of CCP's-Microbiological analysis of *Sabzi* at each stage of production



Raw Potatoes

↓  
Peel  
↓  
Wash  
↓  
Cut  
↓  
Wash



Raw Onions

↓  
Peel  
↓  
Wash  
↓  
Cut



Soya bean

↓  
Wash  
↓  
Soak in water

→ Cooking in the utensil



↓  
Transferred to steel drums



# Objective:- Effect of washing on microbial load of vegetables

## Method:-

1. Washing was done with 3L water/kg of vegetable in a big container
2. Washed three times with peel to remove dirt and again without peel
3. Washing was done till dirt removal was assured visually.
4. At each step vegetable sample was taken and analyzed microbiologically

## Results:-

1. Raw vegetables had a high microbial load and pathogens
2. After peeling microbial load was slightly reduced but *E.coli* was detectable
3. After final washing total load was reduced and pathogens were absent
4. After repeated washings, dirt/filth had been removed and when tested, were negative for coliforms.

# HAND WASHING – A SIMPLE AND EFFECTIVE

## METHOD FOR PREVENTION OF CONTAMINATED DISEASES



Palm and fingers



Back of hands



Finger & knuckles



Thumbs



Finger tips



Wrists and forearms

### SIX STEPS IN WASHING

#### Golden rules

- Remove all jewelry and watch before hand washing. Roll the shirt to above elbow level.
- Wet and apply soap on hands and forearm up to elbow level.
- A normal, non-medicated soap is good enough.
- Dry hands either in air or by single-use sterile towel or sterile paper. Multiple-use cloth towels are not recommended
- Alcohol-based hand rub solutions may be used as an alternative. The 5 ml solution should be spread on all parts of the hands; follow Above steps; rub hands to dry.

# METHOD FOR PREVENTION OF CONTAMINATED DISEASES



**Palm and fingers**



**Back of hands**



**Finger & knuckles**

# METHOD FOR PREVENTION OF CONTAMINATED DISEASES

**STEP 4**



**Thumbs**

**STEP 5**



**Finger tips**

**STEP 6**



**Wrists and forearms**



# Summary and Recommendations

SOP should be followed in cleaning of equipment & utensils, surfaces.

Continuous education and training programme is necessary

Care may be taken in food material handling

Ensure personal hygiene to avoid contamination

**TRY TO PROVIDE ALWAYS HOT AND FRESH FOOD TO THE BENEFICIARIES**

# **SALIENT FINDINGS OF RAPID EVALUATION OF MDM IN SELECT STATES**

# Nutritional Norms of Mid Day Meal

Nutritional Content	Norm as per NPNSPE, 2004	Revised Norm as per NPNSPE, 2006
Calories	300	450
Protein	8-12	12
Micronutrients	Not prescribed	Adequate quantities of micronutrients like iron, folic acid, vitamin-A etc

# Average intake of Food stuffs by school children in MDM (g/student/day): Institutional diet survey

Food Stuffs	Primary Children		Upper Primary Children	
	MDM Norms (g)	Actual Intake (g)	MDM Norms (g)	Actual Intake (g)
Cereals (Rice)	100	76	150	93.5
Pulses (lentils, soya, Bengal gram)	20	18	30	15.8
Fat & Oils (Mustard Oil)	5	4.1	7.5	4.3
Vegetables	50	7.8	75	19.3

One of the state in North India

# Average intake of Nutrients (per/day) through MDM

Particulars	Proteins (g)	Energy (K cal)	Fat (g)	Calcium (mg)	Iron (mg)	Vitamin A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)	Free folic Acid (µg)
<b>Primary School children</b>											
<b>Through MDM</b>	<b>10.7</b>	<b>402</b>	<b>6</b>	<b>62.3</b>	<b>2.8</b>	<b>15.4</b>	<b>0.2</b>	<b>0.1</b>	<b>2.64</b>	<b>2.9</b>	<b>31.5</b>
<b>Regular Diet *</b>	<b>31</b>	<b>1248</b>	<b>12</b>	<b>159</b>	<b>7.0</b>	<b>59</b>	<b>0.7</b>	<b>0.3</b>	<b>9.1</b>	<b>15</b>	<b>33</b>
<b>ICMR RDI</b>	<b>41</b>	<b>1950</b>	<b>22</b>	<b>400</b>	<b>26</b>	<b>600</b>	<b>1.0</b>	<b>1.2</b>	<b>13</b>	<b>40</b>	<b>60</b>
<b>Upper Primary School children</b>											
<b>Through MDM</b>	<b>11.0</b>	<b>448</b>	<b>6</b>	<b>75.7</b>	<b>2.3</b>	<b>10.7</b>	<b>0.2</b>	<b>0.1</b>	<b>1.8</b>	<b>23.2</b>	<b>9.9</b>
<b>Regular diet*</b>	<b>35.1</b>	<b>1387</b>	<b>12.4</b>	<b>172</b>	<b>8.1</b>	<b>63</b>	<b>0.8</b>	<b>0.4</b>	<b>10.1</b>	<b>15.7</b>	<b>36.5</b>
<b>ICMR RDI</b>	<b>55.0</b>	<b>2080</b>	<b>24</b>	<b>600</b>	<b>26.5</b>	<b>600</b>	<b>1.05</b>	<b>1.25</b>	<b>14</b>	<b>40</b>	<b>70</b>

\* NNMB Tribal study 2008-09

# Average intake of Nutrients (per/day) through MDM

Particulars		Proteins (g)	Energy (K cal)	Fat (g)	Calcium (mg)	Iron (mg)	Vitamin A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)	Free folic Acid (µg)
<b>Institutional Level</b>												
Primary		10.7	402	6	62.3	2.8	15.4	0.2	0.10	2.64	2.9	31.5
Upper primary		11.0	448	6	75.7	2.3	10.7	0.2	0.1	1.8	23.2	9.9

# Impact of MDM Programme: Karnataka (contd.)

<b>Wt/Age % of NCHS Stds</b>	<b>MDM</b>	<b>Non - MDM</b>
<b>Grade IV (&lt; 60)</b>	<b>18.5</b>	<b>20.8</b>
<b>Grade III (60-69.9)</b>	<b>40.0</b>	<b>41.5</b>
<b>Grade II (70-79.9)</b>	<b>28.8</b>	<b>26.6</b>
<b>Grade I (80-89.9)</b>	<b>9.7</b>	<b>9.8</b>
<b>Normal (&gt; 90)</b>	<b>3.0</b>	<b>1.3</b>

# Impact of MDM Programme: AP

<b>Wt/Age % of NCHS Stds</b>	<b>MDM</b>	<b>Non - MDM</b>
<b>Grade IV (&lt; 60)</b>	<b>11.4</b>	<b>15.4</b>
<b>Grade III (60-69.9)</b>	<b>33.3</b>	<b>37.0</b>
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<b>Grade I (80-89.9)</b>	<b>14.9</b>	<b>11.5</b>
<b>Normal (&gt; 90)</b>	<b>2.7</b>	<b>2.8</b>

Sarma KVR et al, Asia Pac J 1995; 8 (1): 48-52



## Effect of Regularity of MDM Programme

Variables	-	No. of Feeding days	
		< 90	≥ 90
Retention Rate	-	46.3	56.2*
Drop out Rate	-	29.7	23.5*
Weight for Age (% NCHS Std.)	< 60	11.4	15.4
	≥ 90	2.8	2.7
Waterlow Classification	% Normal	61.0	59.0
	% Stunted	26.0	27.5
	% Wasted	9.3	10.0
	% Wasted & stunted	3.7	3.5

P < 0.01

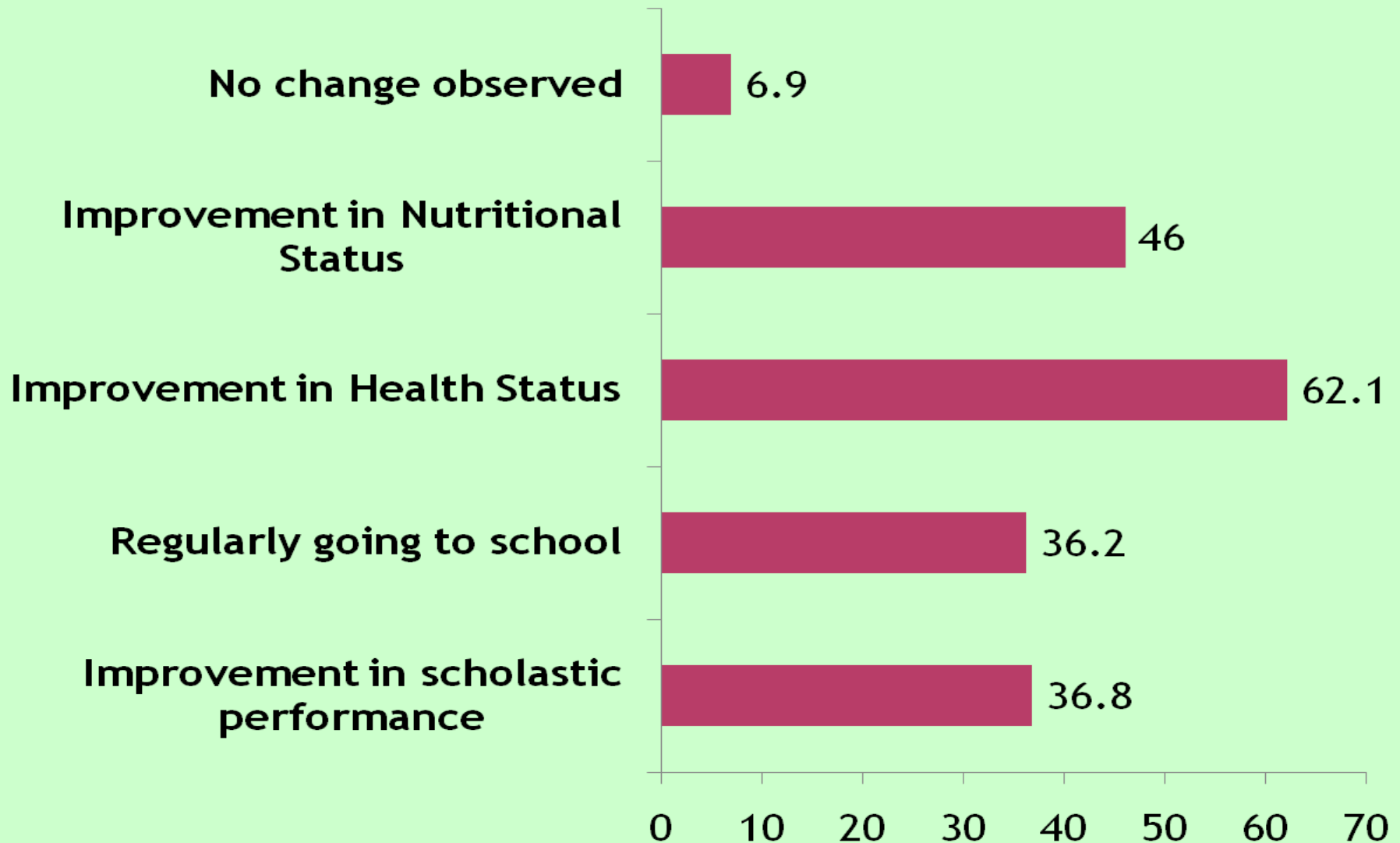
Sarma KVR et al, Asia Pac J 1995; 8 (1): 48-52

# PREVALENCE (%) NUTRITIONAL DEFICIENCY SIGNS

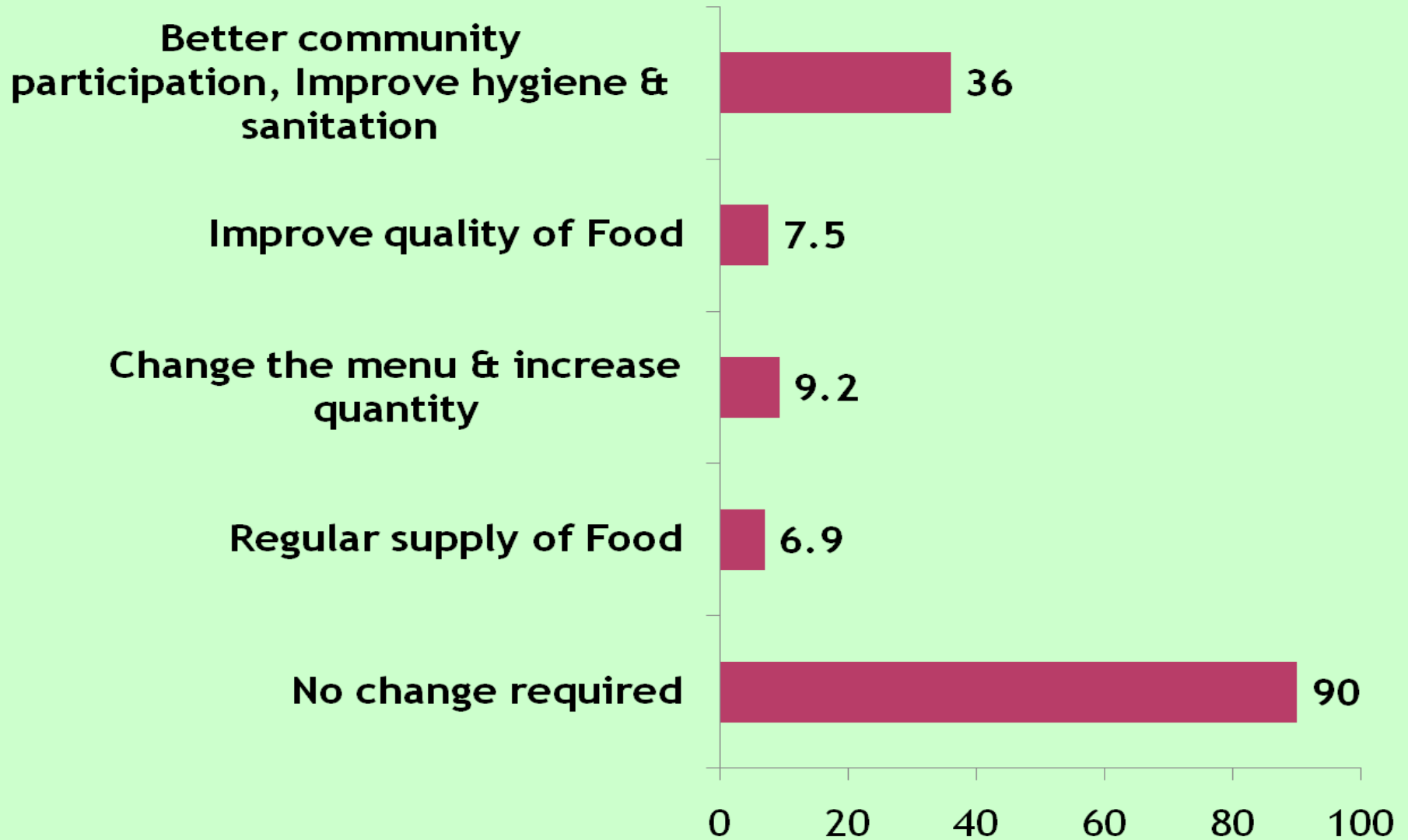
<b>Nutritional deficiency signs</b>	<b>Fategharh Sahib</b>	<b>Ludhiana</b>	<b>Pooled</b>
<b>Conjunctival Xerosis</b>	<b>1.1</b>	<b>1.5</b>	<b>1.3</b>
<b>Bitot spots</b>	<b>0</b>	<b>0.5</b>	<b>0.2</b>
<b>Angular Stomatitis</b>	<b>0.9</b>	<b>0.5</b>	<b>0.7</b>
<b>Phrynoderma</b>	<b>0.6</b>	<b>0</b>	<b>0.3</b>
<b>Dental Caries</b>	<b>14.2</b>	<b>16.1</b>	<b>15.1</b>
<b>Dental Fluorosis</b>	<b>2.0</b>	<b>0.3</b>	<b>1.2</b>
<b>Goitre I (palpable)</b>	<b>0.5</b>	<b>0.2</b>	<b>0.3</b>

**Punjab – school children**

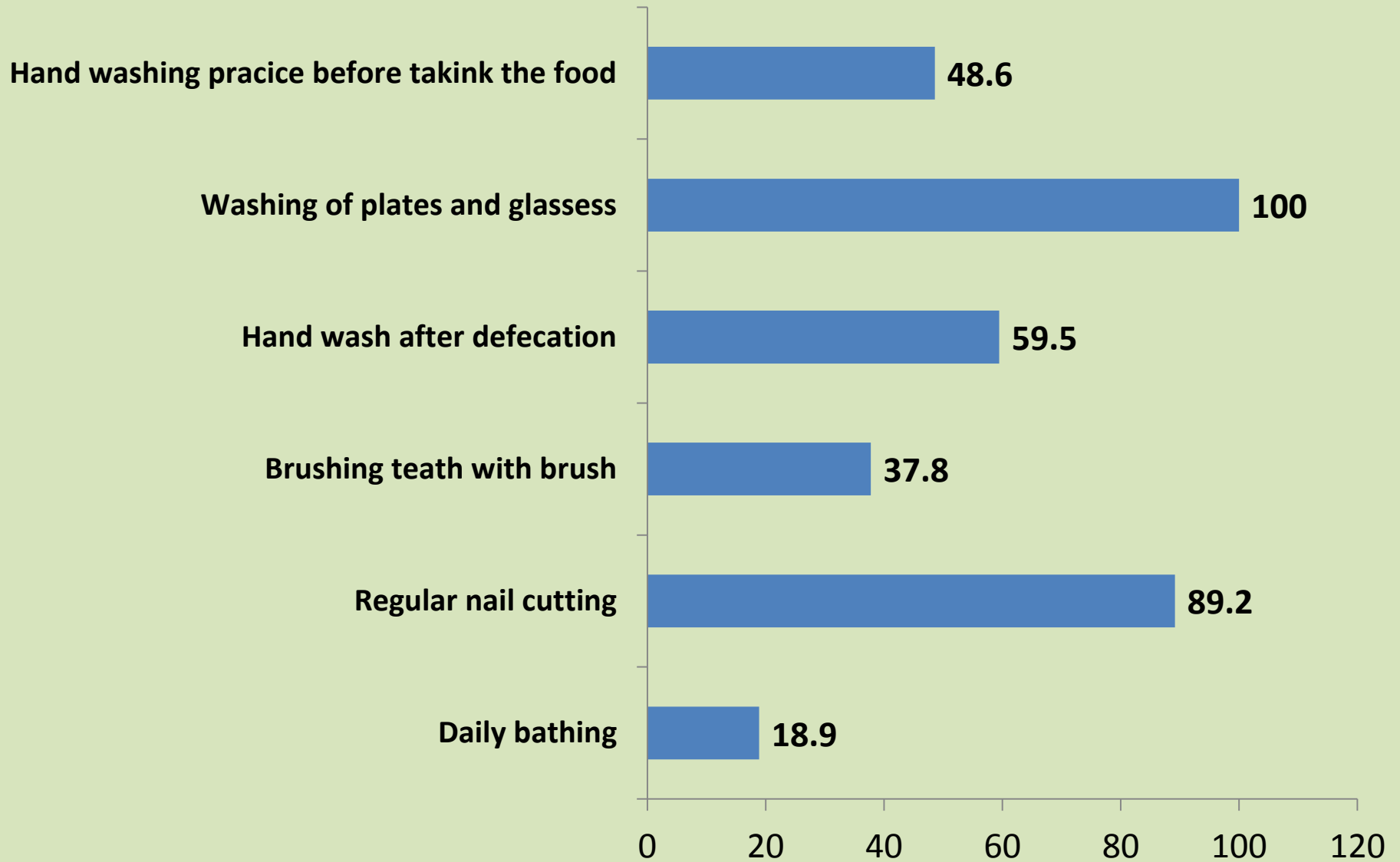
# Change observed in their children as beneficiary of MDM (Multiple responses)



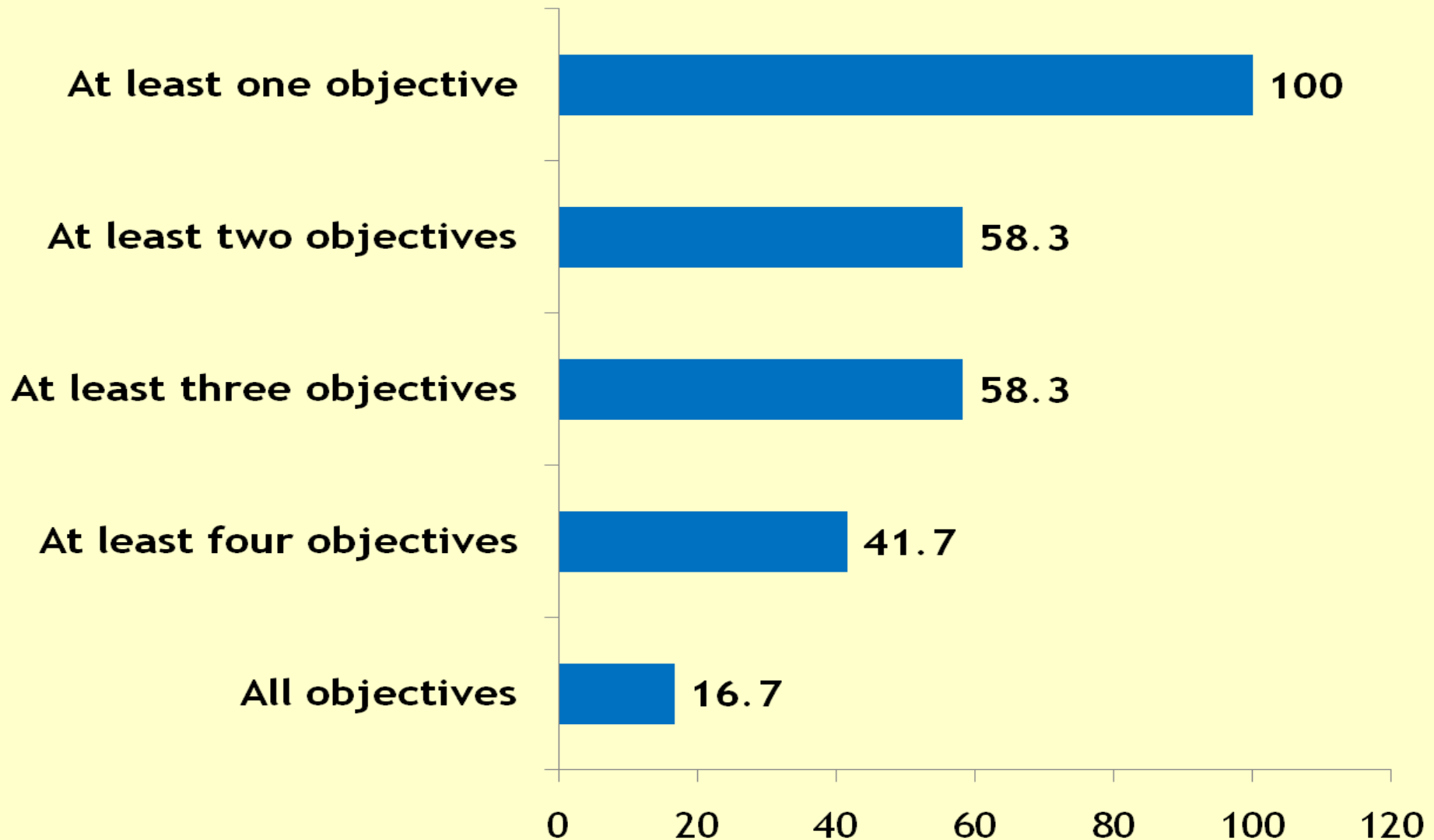
# Suggestions to strengthen the MDM



# Hygiene practices of school children



# Knowledge about the objectives of MDM programme: Functionaries



# BEST PRACTICES

- ❑ E-transfer of funds at all levels.
- ❑ RTGS no. of majority all bank accounts of schools.
- ❑ Strong Grievance redressal mechanism.
- ❑ Rigorous monitoring system - Samikshya
- ❑ Idea box
- ❑ Kitchen gardens
- ❑ Student helpline number



मध्याह्न भोजन योजना  
Mid Day Meal Scheme



Kitchen Garden



Children eat Mid day Meal in Dining Hall



Additional Water Point



Dining Hall at MS Jagarnathpur



Force & Lift Pump

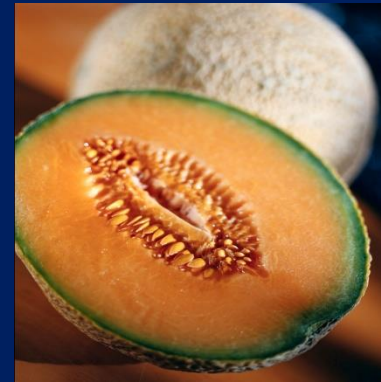
# **DIET RELATED NON- COMMUNICABLE DISEASES**

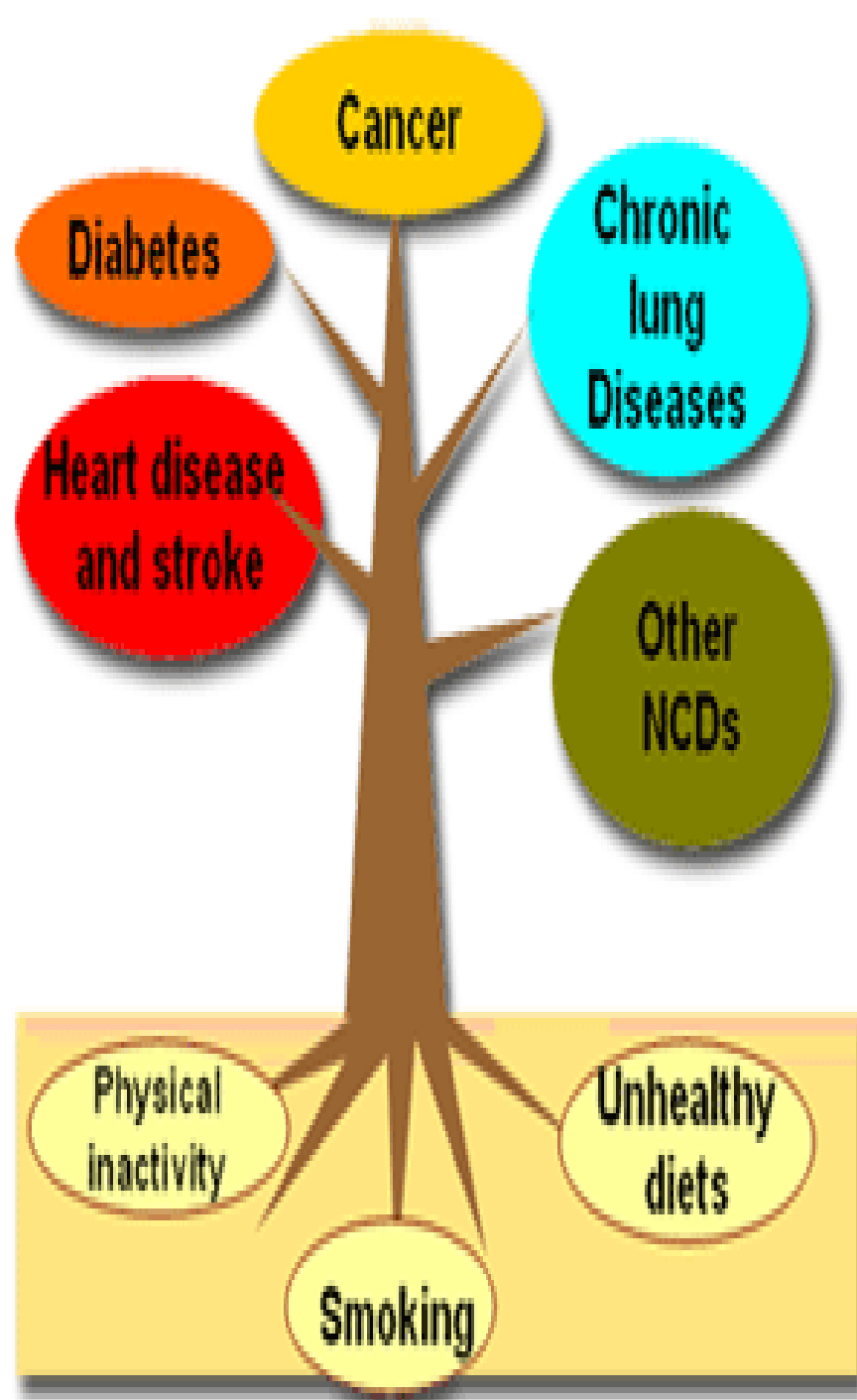


# Factors affecting Lifestyles

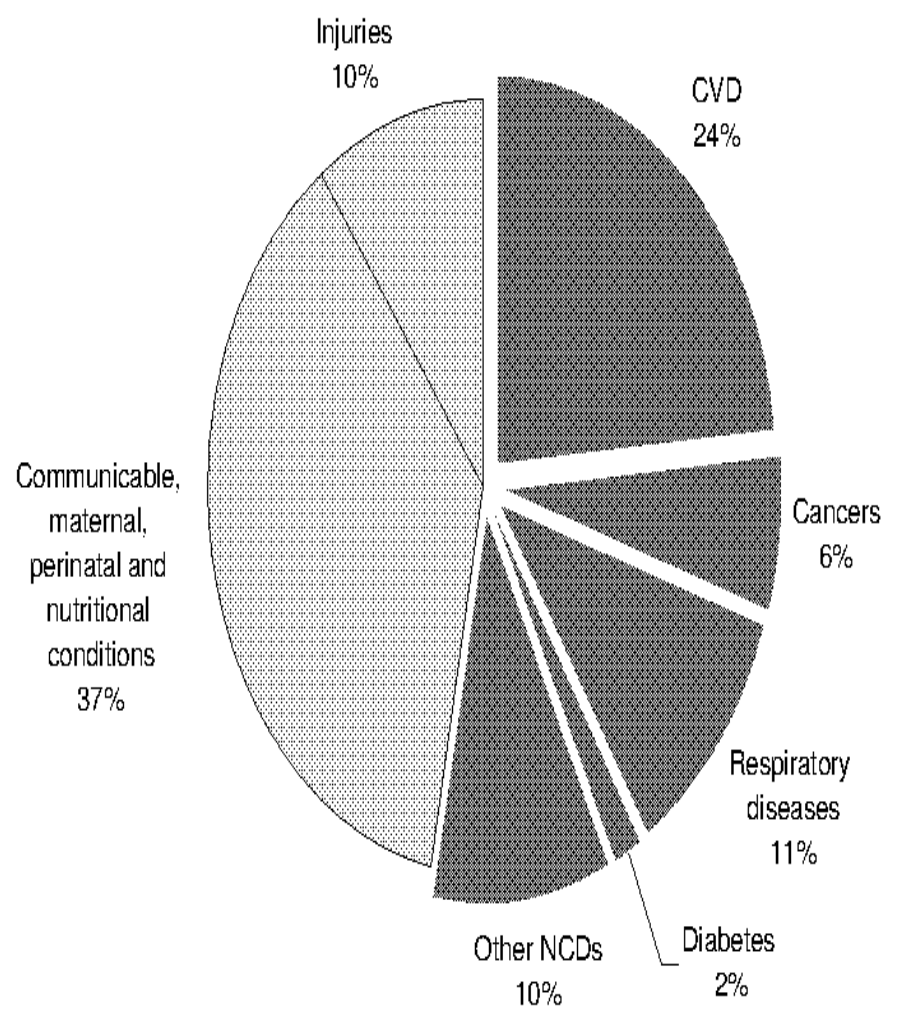
---

- The way we are born
  - The way we grow up
  - The food we eat
  - The fluids we drink
  - The way we live
  - The way we play
  - The way we move around
  - The work we do
  - The social habits
  - The way we conduct our personal lives
- 





**Proportional mortality (% of total deaths, all ages)**



**NCDs are estimated to account for 53% of all deaths.**

# Determinants → Risk Factors → NCD disease outcomes

## Socio-economic determinants

### Common Risk Factors

#### Modifiable

- Unhealthy diet
  - Obesity,
  - Dyslipidemia
- Physical inactivity
- Tobacco/alcohol consumption

#### Non-modifiable

- Age
- Gender
- Genetic

### Intermediate Risk Factors

- High lipids
- High Bld Pressure
- High Bld Glucose
- Overweight/Obesity

### NCD disease outcomes

- CVD/Stroke
- Diabetes
- Chronic Resp. Dis.
- Cancers

Promotion

Prevention

Early Treatment

# Common Risk Factors

## Noncommunicable Diseases

4 Diseases, 4 Modifiable Shared Risk Factors

	Tobacco Use	Unhealthy diets	Physical Inactivity	Harmful Use of Alcohol
Cardio-vascular				
Diabetes				
Cancer				
Chronic Respiratory				

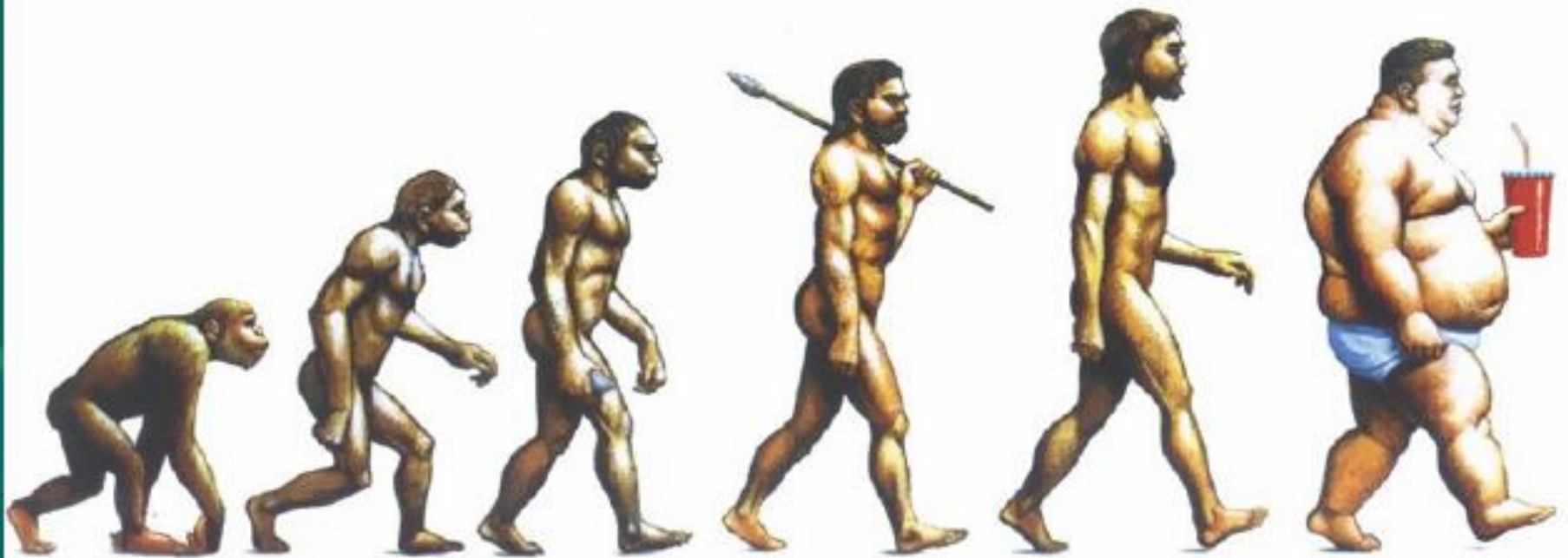


Noncommunicable Diseases  
World Health Organization  
ECOSOC High-level Segment



World Health  
Organization

# The shape of things to come

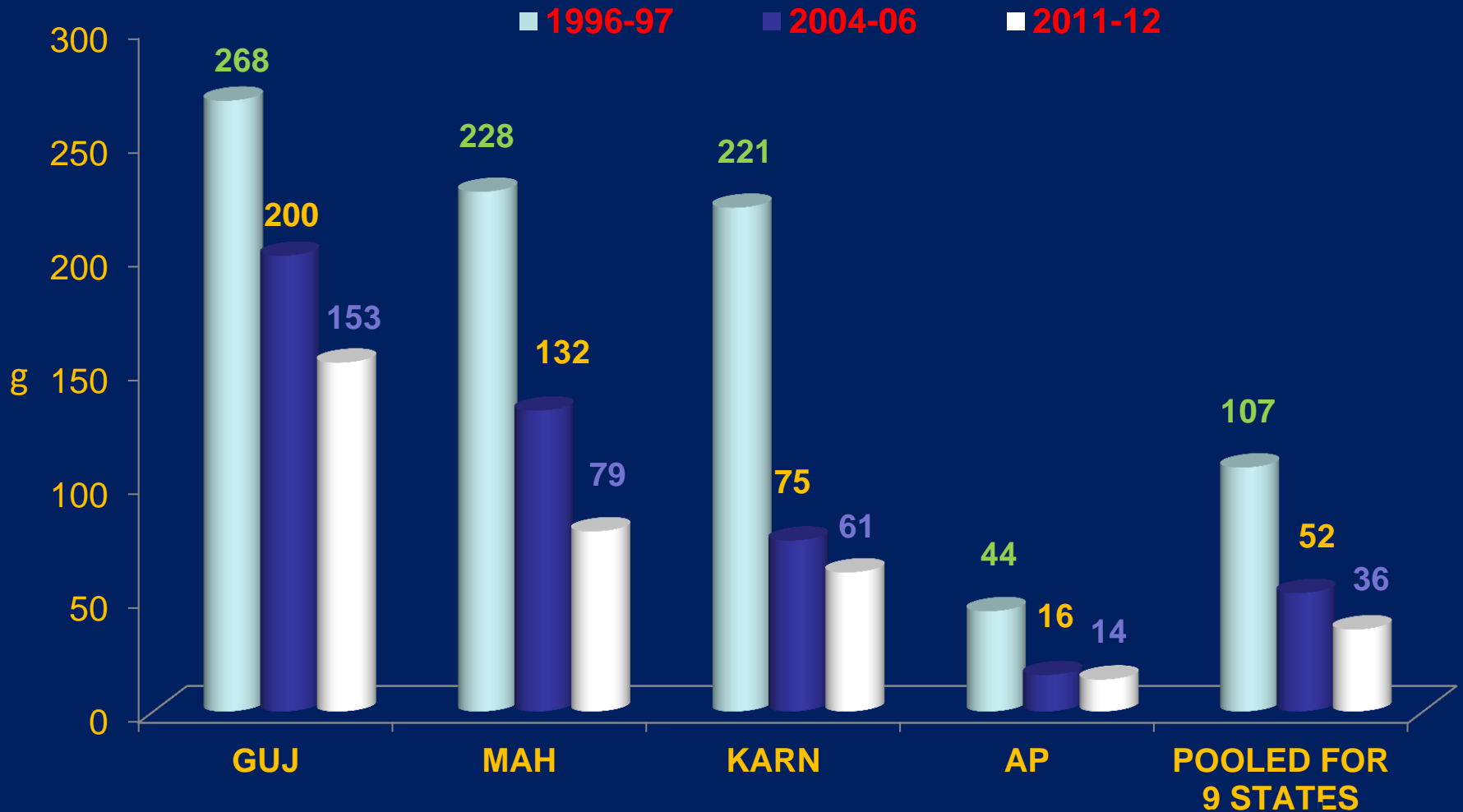


*The cover of "The Economist", Dec. 13-19, 2003.*

# Nutrition Transition

- Changes observed in the intake of legumes, vegetables milk and fats and oils, especially in animal fat consumption.
- Substitution of **millet**s by more prestigious and often **highly polished cereals** such as rice/PDS.
- Reduction in over all **cereal intakes** over a time.
- Changes observed in **dietary fat** n6/n3 ratio due to higher intake of **cheap commercial vegetable oil** (n6 fatty acids)
- Low fruit and vegetable intake in rural communities.
- Increased intake of **sugar sweetened water beverages** in semi-urban and urban areas.
- A significant reduction in physical activity **leading to overweight and obesity**.

# TIME TRENDS IN THE CONSUMPTION OF MILLETS (g/CU/day) AMONG RURAL POPULATION



# Benefits of Millets

1. Millet is alkaline and it digests easily
2. For excellent health and longevity
3. Millet will hydrate colon and prevent constipation
4. Millet acts as a pre-biotic feeding for gut microflora
5. The serotonin in millet is helpful to keep mind cool
6. It has lots of fiber and having slow glycemic index
7. High Magnesium, can help to reduce migraine and heart attacks
8. Niacin (vitamin B3) in millet can help in lowering of cholesterol
9. Millet consumption decreases triglycerides and C-reactive protein, which prevent CVDs.
10. All millet varieties show high antioxidant activity
11. Millet is gluten-free and non-allergetic in the gut
12. Millets also have high in protein content (15%), while cereals have only 6-7%.



# THE GLOBAL PROBLEM OF OBESITY (GLOBESITY)

- 1.4 billion adults overweight and more than half a billion obese (2008)
- 2.8 million people each year die as a result of being overweight or obese.
- Obesity has nearly doubled between 1980 and 2008.
- Globally, 44% of diabetes, 23% of ischemic heart disease and 7–41% of certain cancers are attributable to being overweight and obesity.
- Once it was associated with high-income countries, now it also highly prevalent in low and middle income countries.
- Obesity coexists with undernutrition in many developing countries like India, causing **'double burden of disease'**.

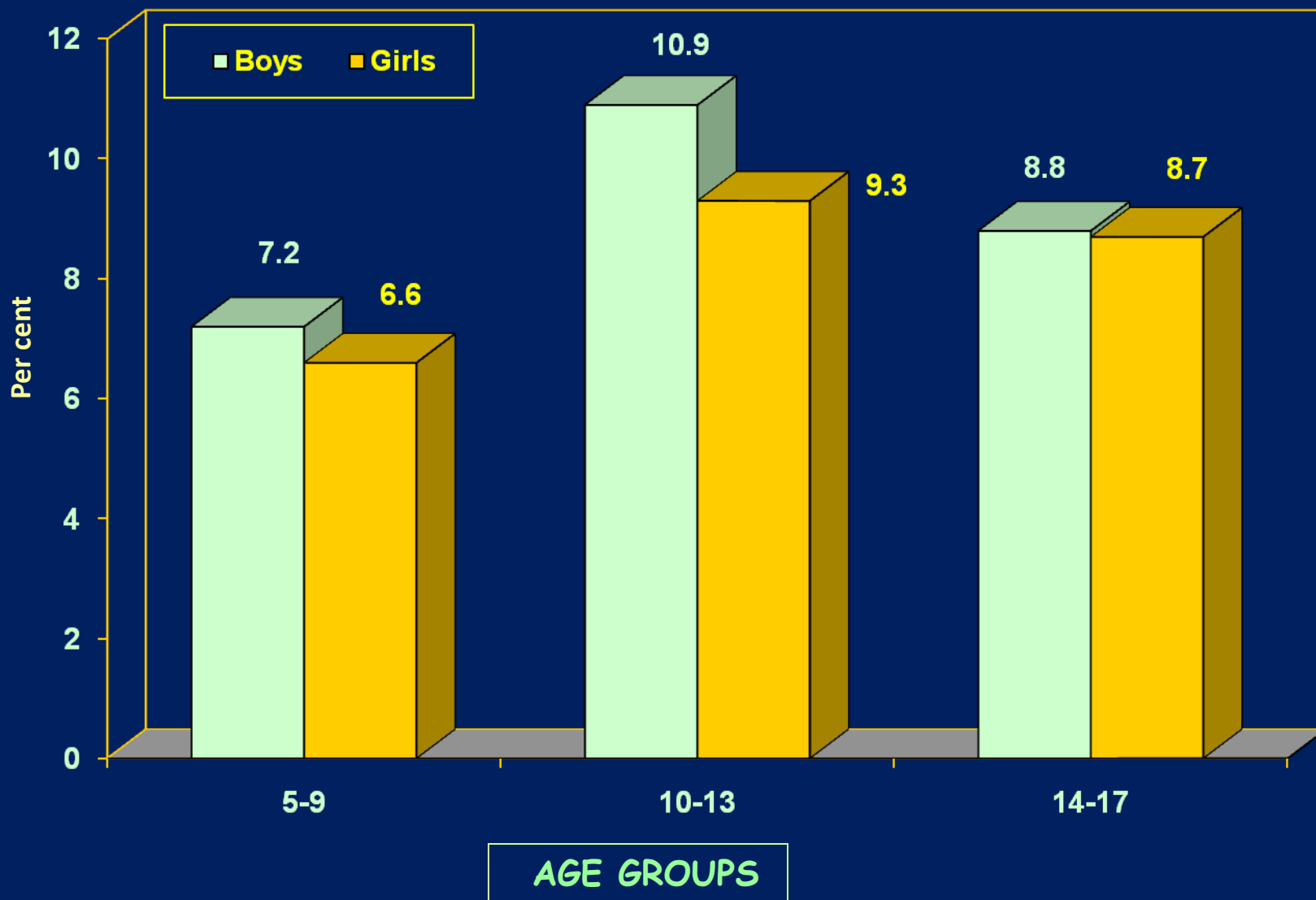
# Double Burden of Disease



## CHILDHOOD OBESITY: STUDIES CARRIED OUT IN INDIA

Author	Year	Age groups (yr)	Number of subjects	Prevalence (%)	
				Overweight	Obesity
Laxmaiah et al	2012	12-17	1090	15.6	4.3
Laxmaiah et al	2008	12-17	7850	14.3	3.6
Mohan B	2004	11- 17	2467	11.6	2.6
Khadilkar Y	2004	10 - 15	1228	19.9	5.7
Chatwal J	2004	9 - 15	2008	14.2	11.1
Subramaniam V	2003	10 - 15	707	10.0	6.0
Laxmaiah A et al	2004	12 - 17	1208	11.6	2.6
Chatterji P	2002	4 - 18	5000	29.0	6.0
Kapil U	2002	10 - 16	870	24.7	7.4
Ramchandran A	2002	13 - 18	4700	16.8	3.1
Pandey S & Vaidya R	2001	3 - 17	2439	15.1	15.3

# Prevalence (%) of overweight and obesity among urban School age Children and Adolescents according to BMI Z-Scores by Age and gender



# **Causes for Obesity Epidemic**

- **Lack of Exercise**
- **Sedentary lifestyle**
- **Diets rich in fatty foods**
- **Lack of fruits and vegetables**
- **Over consumption of soft drinks**

# Role in marketing of food & beverages for children

WHO recommend 12 marketing policies for the marketing of food & beverages for children.



# Poor Diet Can Affect Multiple Generations, Says Expert

## Express News Service

Hyderabad: Prevalence of undernutrition among women and late intake of nutritional requirements during pregnancy can not only affect the new born but can also snowball into an 'Intergeneration cycle of undernutrition' where successive generations also suffer from the consequences of undernourishment, said Dr A Lakshmi, senior deputy director, Division of Community Studies, National Institute of Nutrition (NIN).

"If a pregnant woman is undernourished, the fetus will suffer from intrauter-

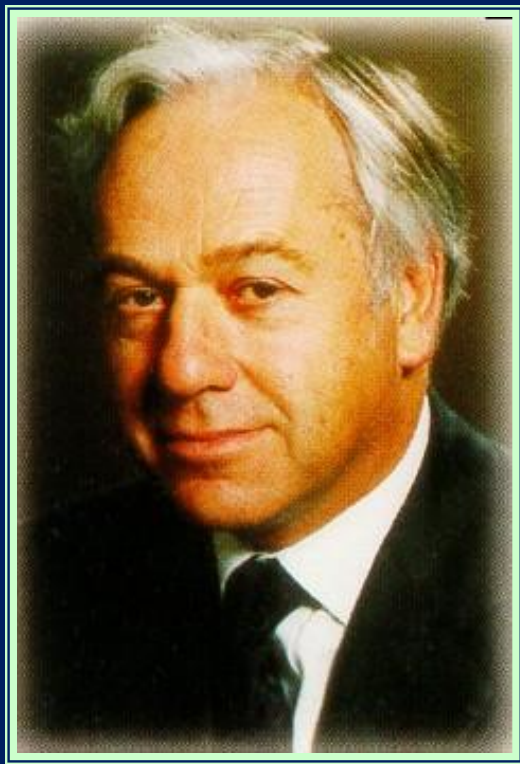
ine growth retardation and fetal programming will also be affected. After the child grows up, it becomes susceptible to early onset of adult non-communicable

**Insufficient diet of mother can cause early onset of adult non-communicable diseases in the child**

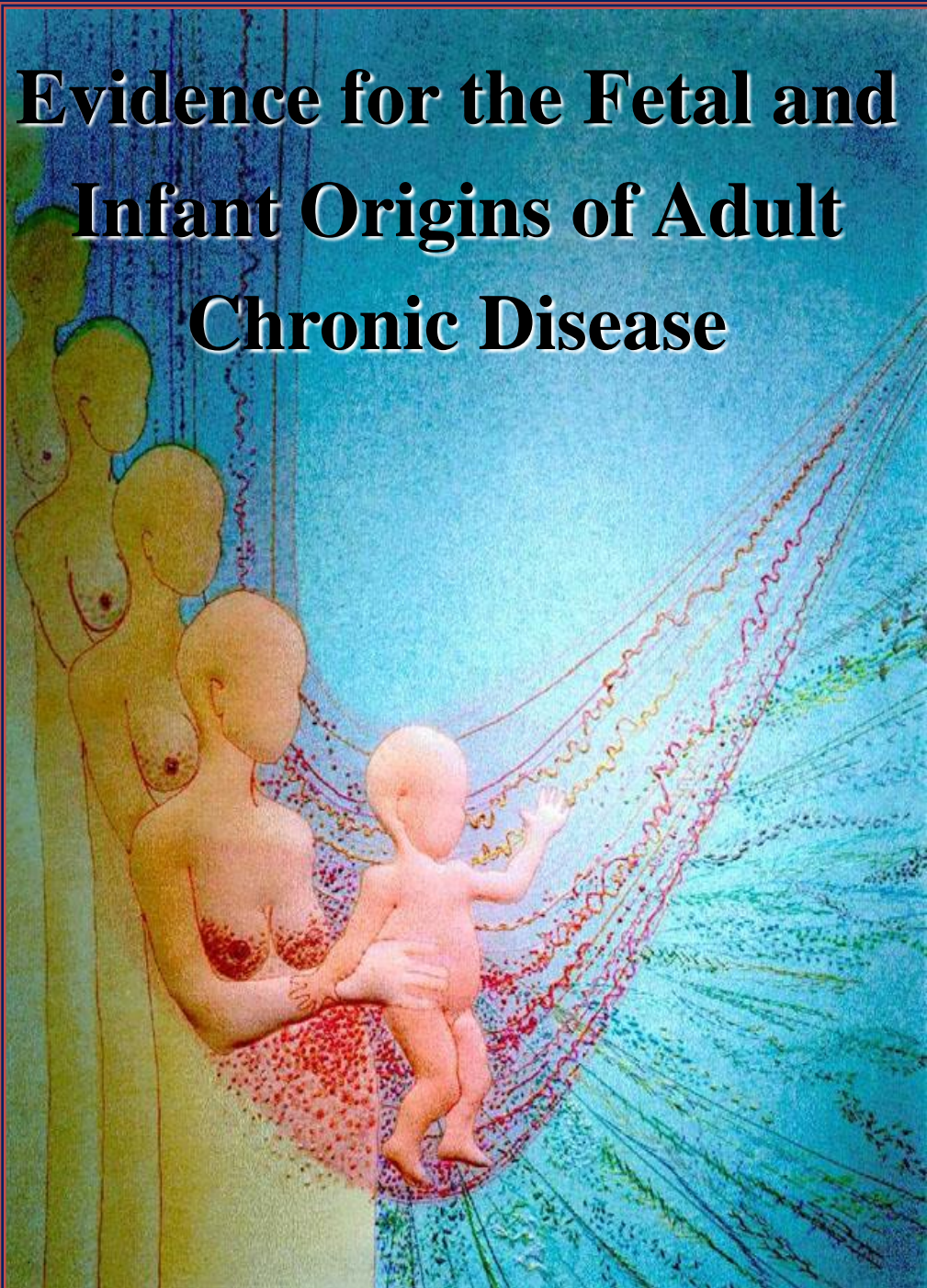
diseases like obesity, insulin drug resistance, hypertension etc. This might lead to a high rate of non-communicable diseases in India", said Dr Lakshmi

adding that about one-third of children in India are born underweight.

He pointed out that pregnant women often take nutritious food after detection of pregnancy, which happens after eight to twelve weeks and by that time major portion of fetus brain has grown. Hence nutrition intake later will help other aspects of fetal growth but not mental development, he suggested. As a solution to the problem Lakshmi advises women to take a balanced diet and improve nutrition intake even before the detection of pregnancy so they give birth to healthy child.

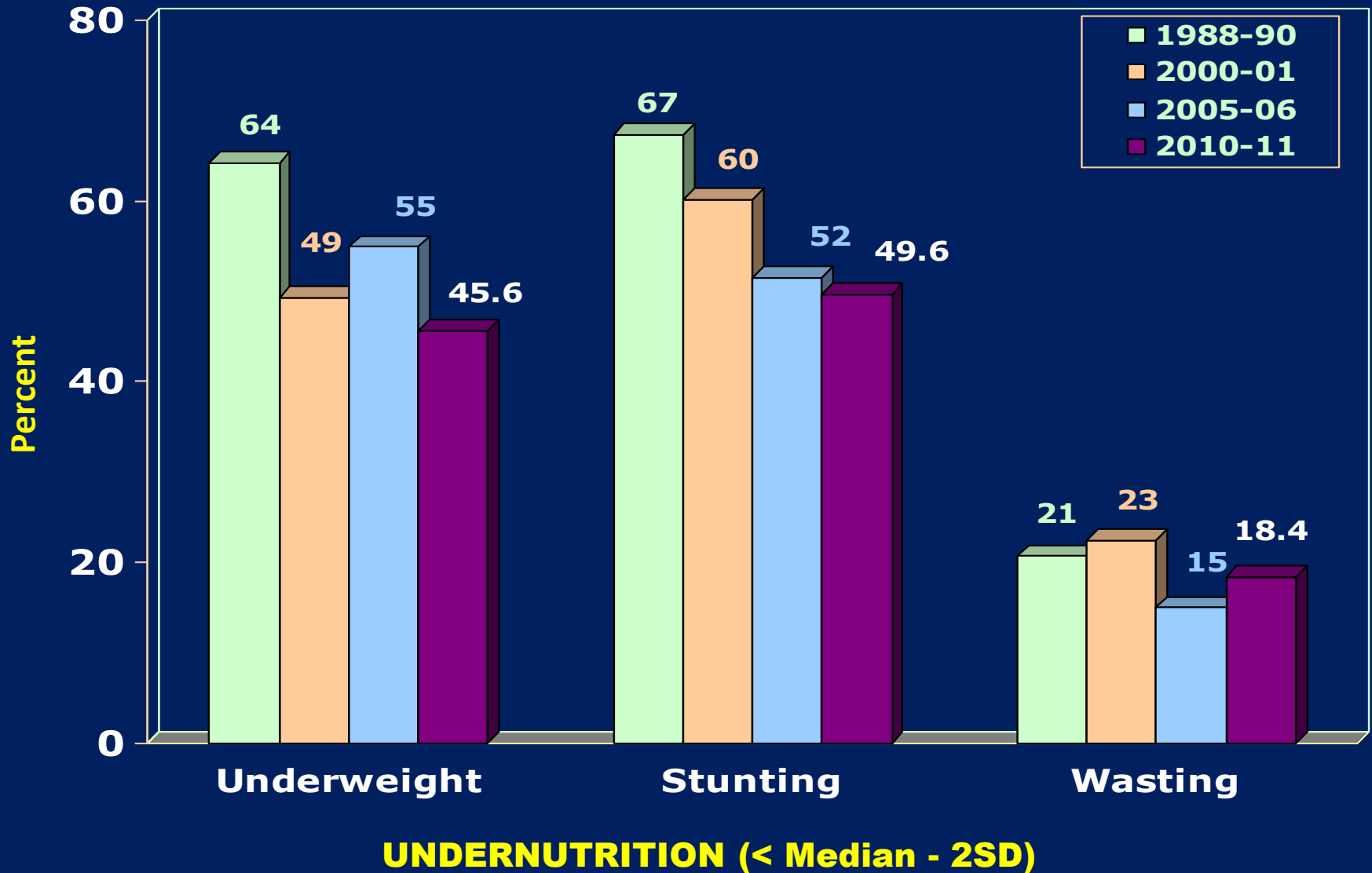


# Evidence for the Fetal and Infant Origins of Adult Chronic Disease

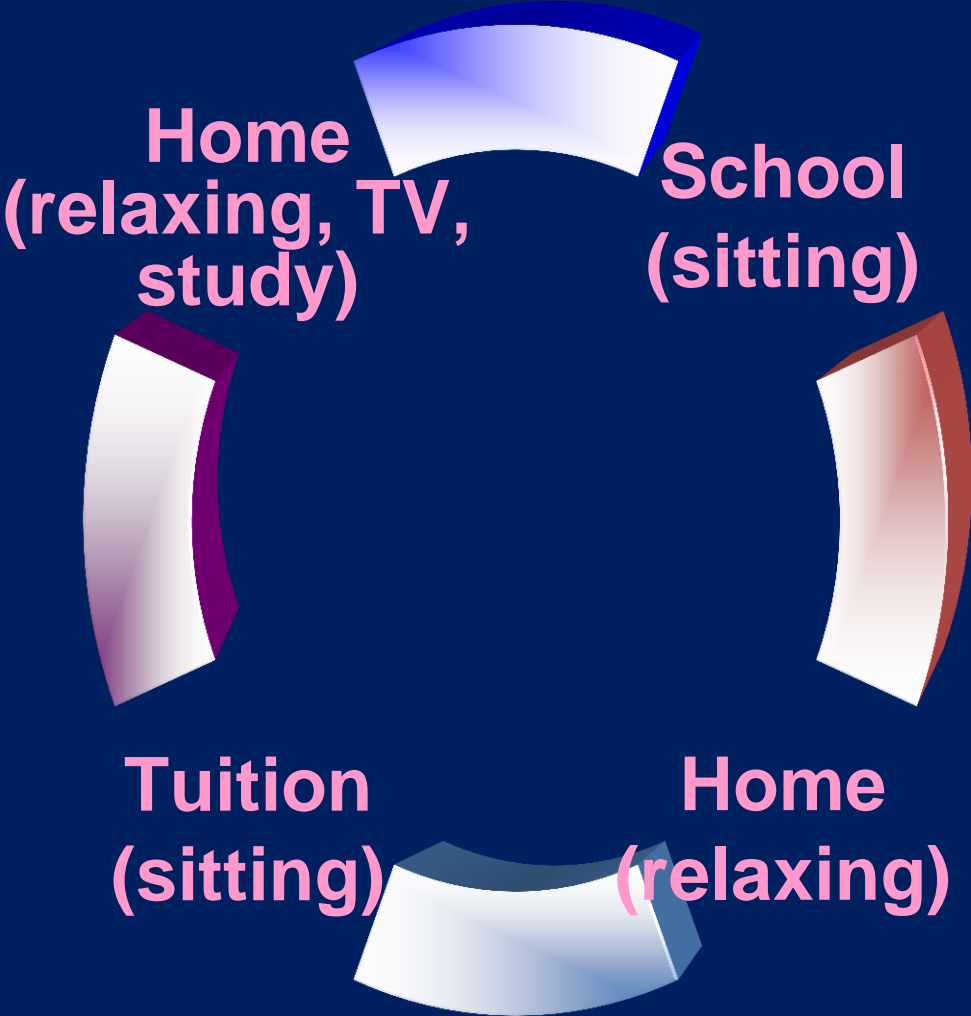




# Time trends in the prevalence of Undernutrition among under five year rural children in India



# Obesogenic Schools & Tuition Classes makes inactive environment



# Physical education at schools

According to a national study, 92 percent of elementary schools do not provide daily physical education classes for all students throughout the entire school year.

*(School Health Policies and Programs Study. Journal of School Health 2001;71(7))*



# Physical Activity at schools



Let's See why.....

**Parental Attitude**

**Urban Lifestyle**

**Peer Pressure**

**Media**

**Heredity**



# Principle Component Analysis

(Dietary pattern & Overweight)

Comp.	% variation	cum. vari.	Loading factors
1	15.0	15.0	<i>Stuffed parota/Nan &amp; butter Nan</i>
2	6.3	21.3	<b>Puffs/butter/beverages/soft drinks/</b>
3	3.6	24.9	<i>Dosa / puree / vada</i>
4	3.4	28.3	<b>Milk/coffee/Horlicks/bourn vita</b>
5	3.1	31.4	<b>Non-veg fries/curries</b>
6	2.9	34.2	<b>Bread &amp; jam</b>
7	2.5	36.7	<b>Sweets/boondh-mixture</b>
8	2.3	39.0	<b>Dal/samber/pickle/fried chips/Papad</b>
9	2.3	41.3	<b>Fried rice</b>
10	2.2	43.5	<b>Chocolates/tea/biscuits</b>
11	2.1	45.6	<b>Ghee/curd/butter milk</b>
12	2.0	47.6	<b>Plain rice/veg.curry</b>
13	1.9	49.5	<b>Pulihora rice/upma/ice-cream</b>
14	1.9	51.4	<b>Vegetable fry</b>
15	1.8	53.2	<b>Pulka</b>

# Ban junk food: cardiologists

Special Correspondent

**KURNOOL:** The Cardiologists Society of India urged the government to ban sale of fast food in school canteens in the larger interests of future generations.

In a representation to Chief Minister N. Chandrababu Naidu at informal get-together after the Independence Day function here on Friday, society State president P. Chandrasekhar said the government, parents bodies and doctors should know

what the children were consuming in school canteens.

## 'Will lead to obesity'

He said in order to appeal to taste buds of children the canteens were stacking with fast foods which were rich in cholesterol and trans fats. High fat and sodium and chemical preservatives would cause obesity which was the cause of all diseases at a young age. Also, the body suggested compulsory yoga in schools since most of the schools had no play

ground. Ban on sale of tobacco products near school was also requested by the doctors' body.

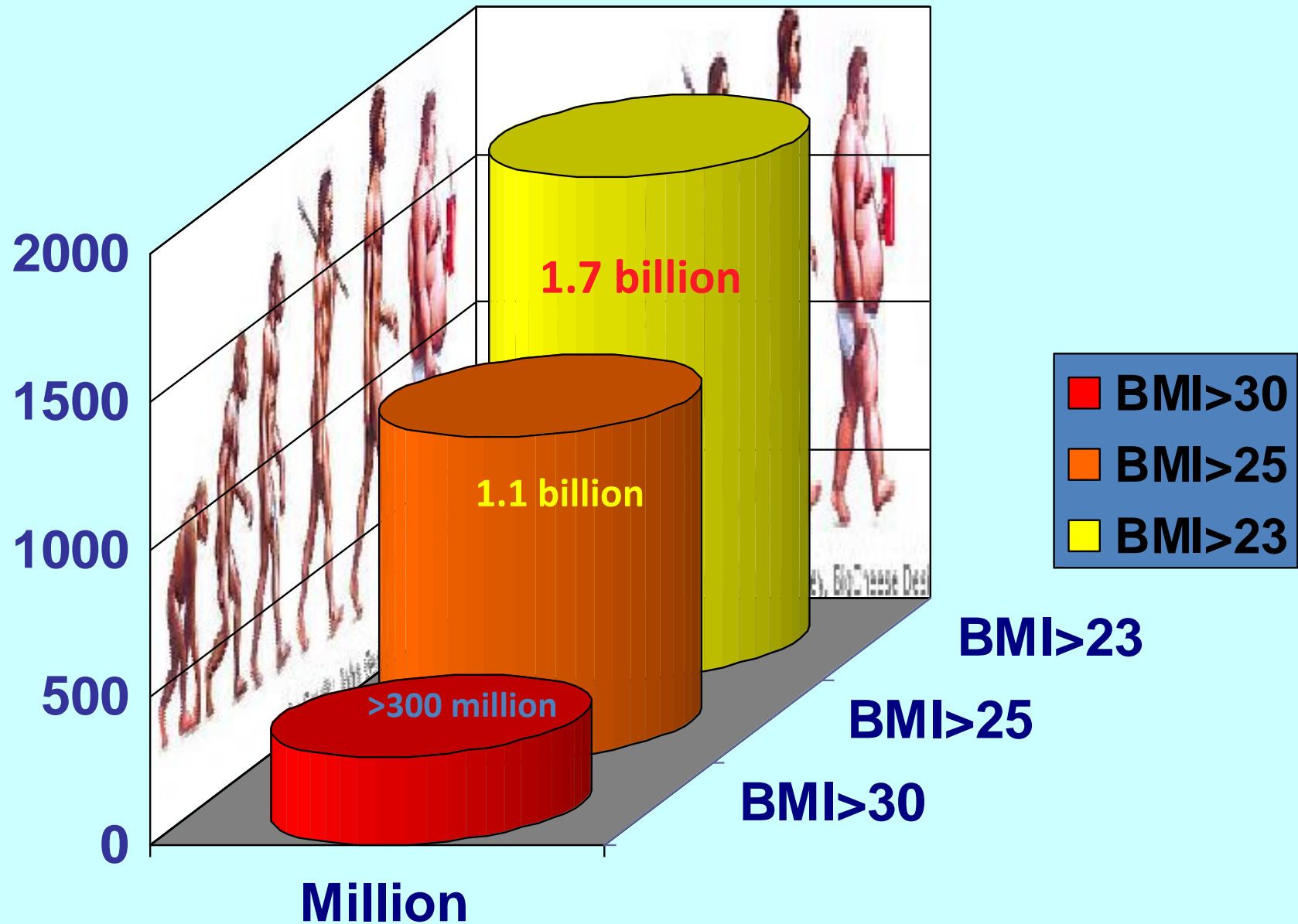
Dr. Chandrasekhar suggested that health clubs should be started in all towns as public institutions to protect people from the evil effects of sedentary life.

A ban on import of red chicken meat from the U.S. which was rejected by the US consumers was requested along with intensive care units at every 50 km to deal with emergency cases.

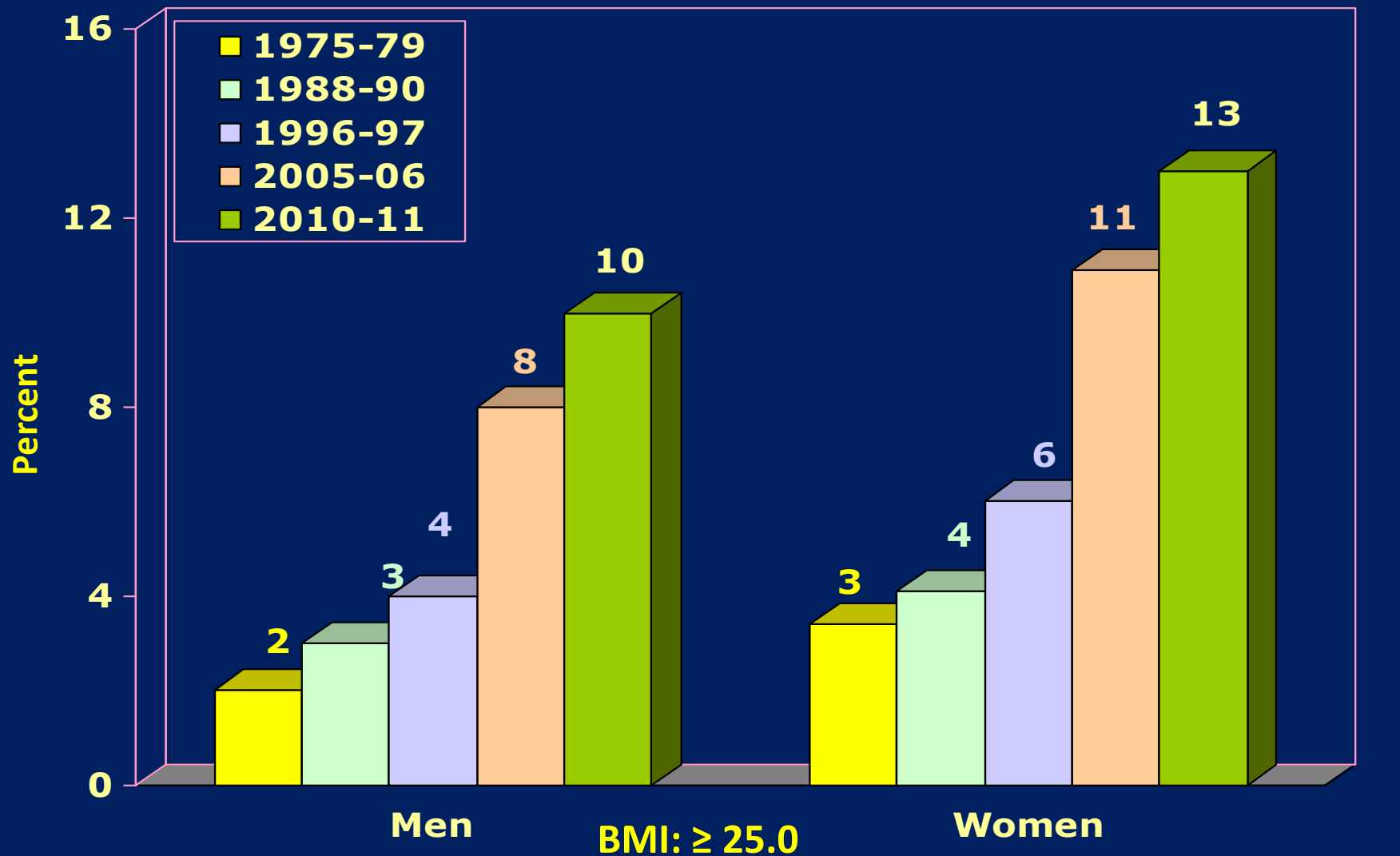


We as parents like to give our  
children many things – let obesity not  
be one of them

# ADULT OBESITY: GLOBAL EPIDEMIC



# Prevalence (%) of overweight and obesity among rural Adults and Time trends: NNMB Surveys in India



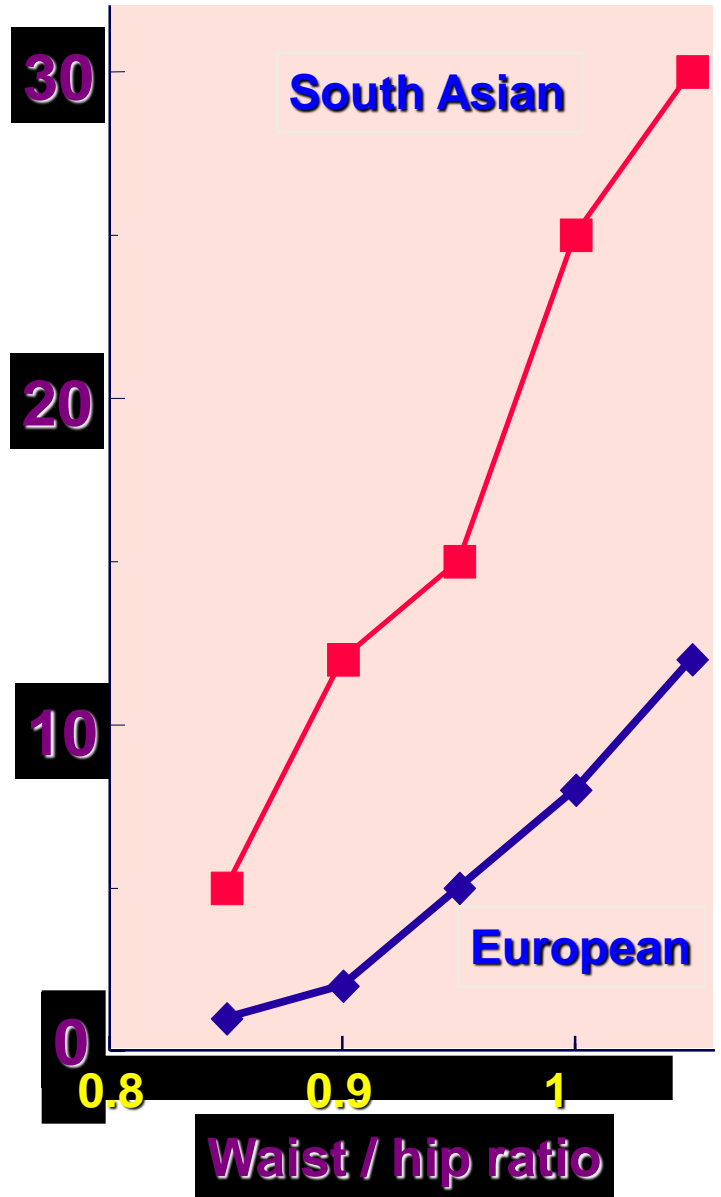
# ABDOMINAL OBESITY



Central obesity and insulin resistance: South Asian susceptibility

McKeigue et al. Lancet, 1991, 337: 382

## Diabetes prevalence %



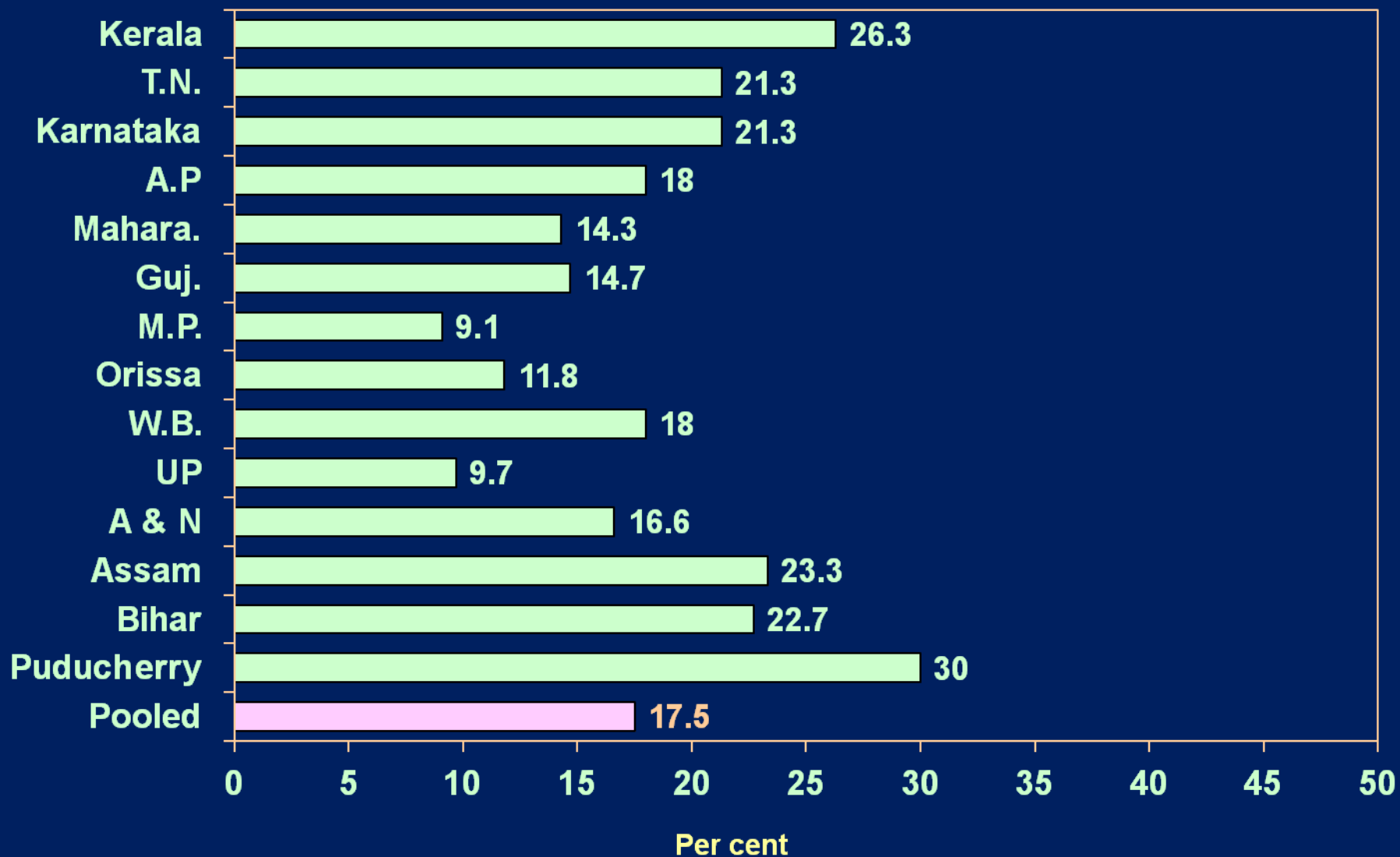
# Consequences of Overweight/obesity



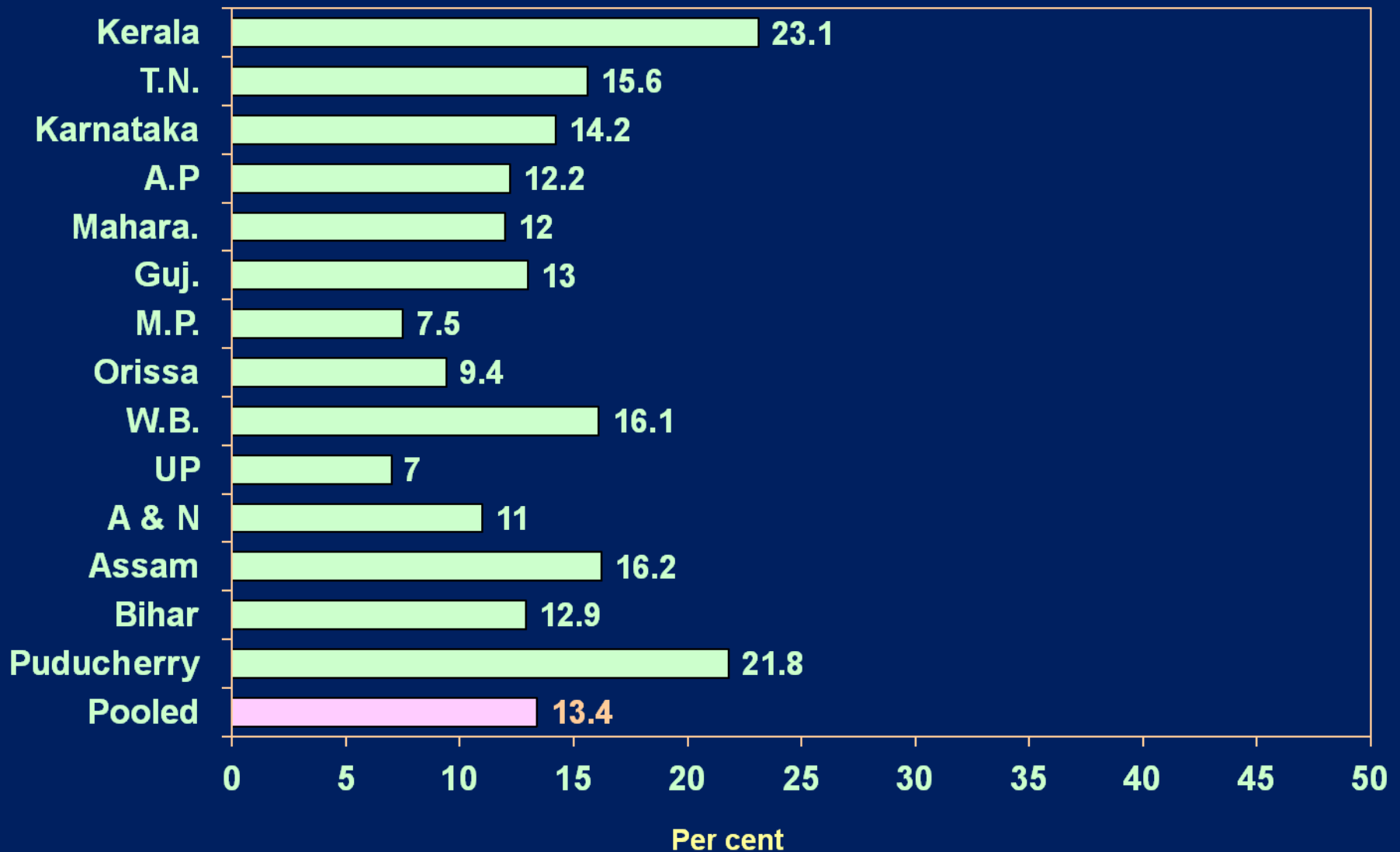
- ☞ **Diabetes**
- ☞ **Stroke**
- ☞ **Heart Disease / Hypertension**
- ☞ **Gall Bladder Disease**
- ☞ **Osteoarthritis**
- ☞ **Sleep Apnoea**
- ☞ **Cancers**
  - **Breast/Colon**



## Prevalence (%) of Diabetes among urban men of $\geq 18$ years by State

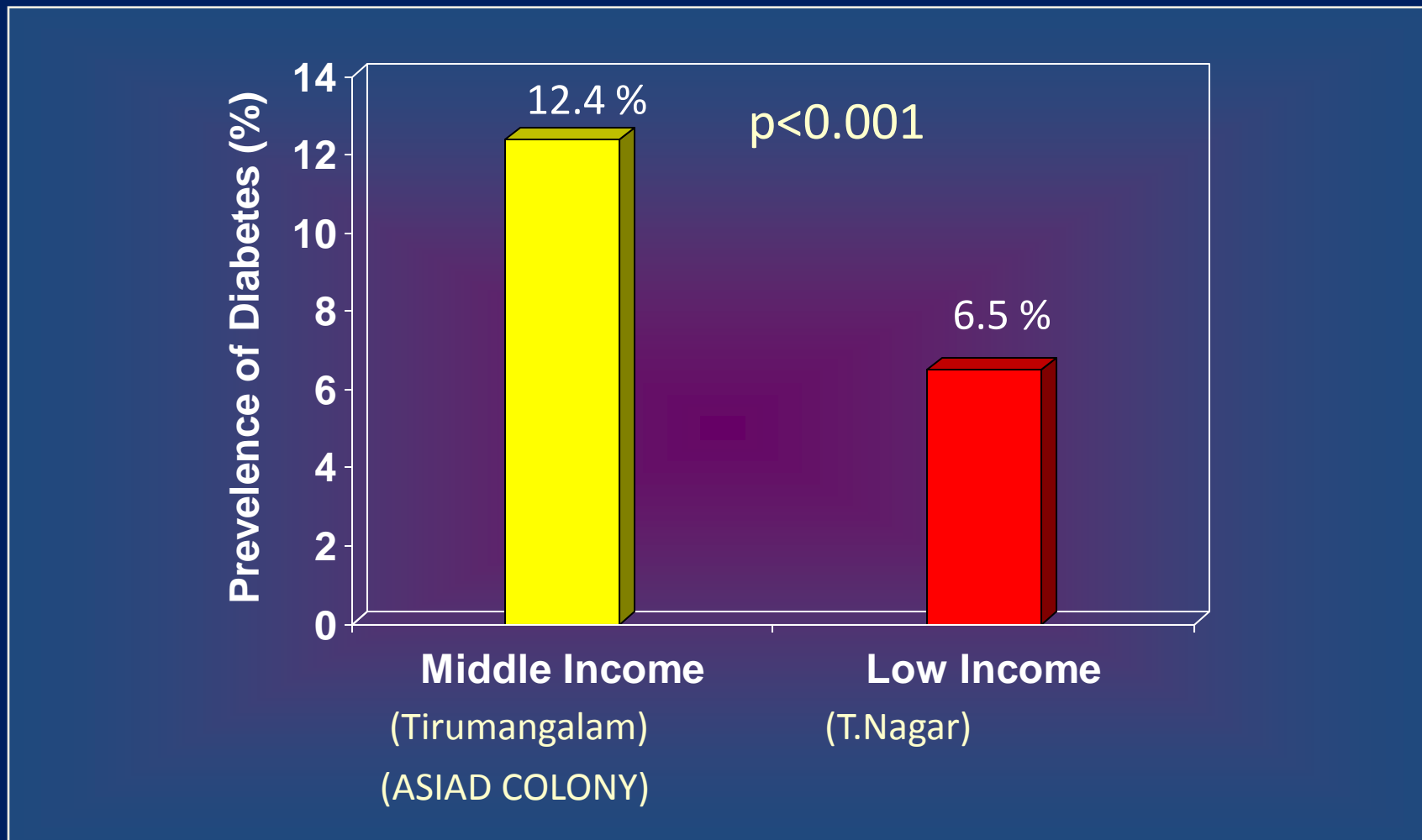


# Prevalence (%) of Diabetes among urban women of $\geq 18$ years by State



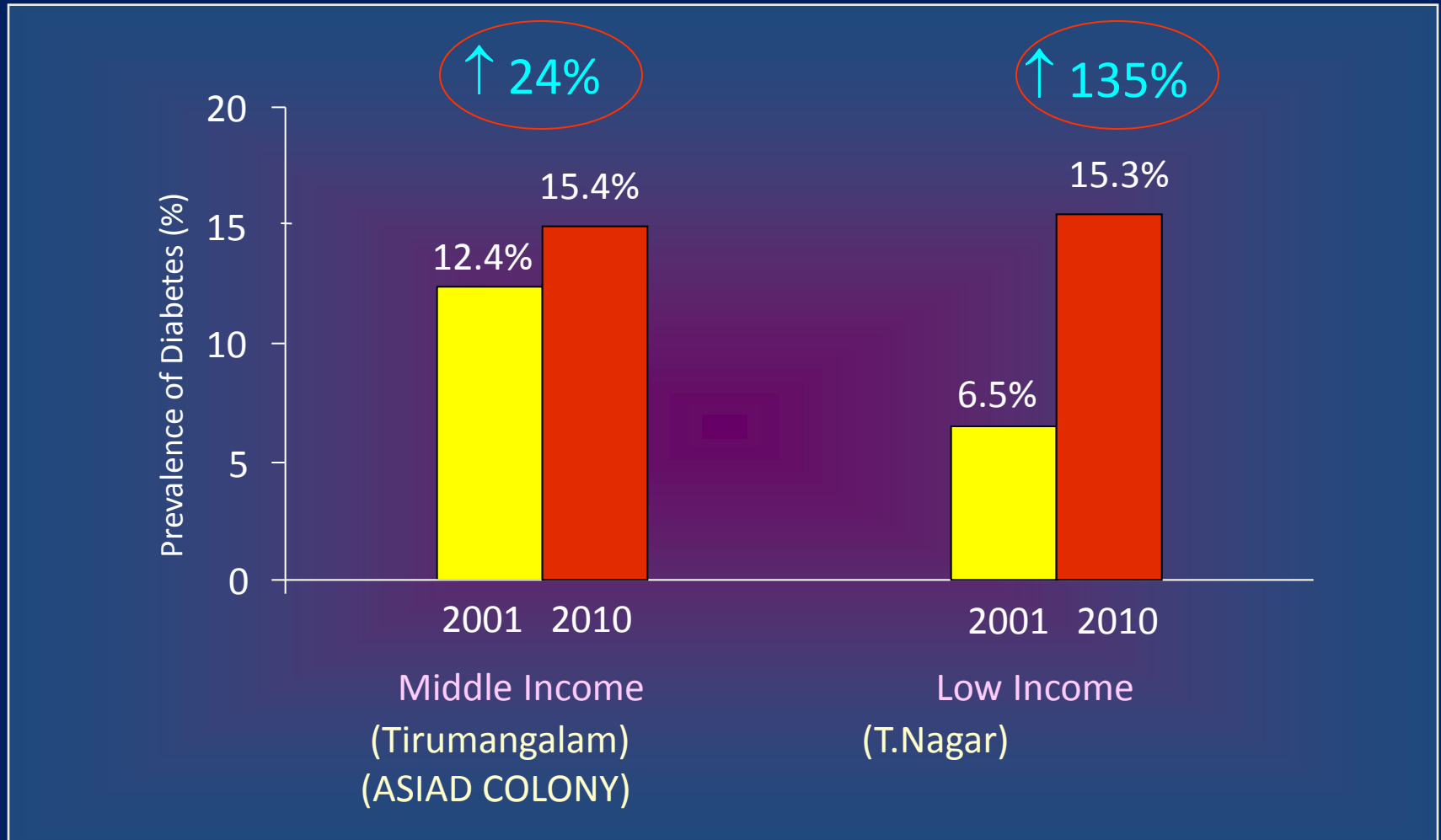
# SOCIO ECONOMIC DIFFERENCES IN DIABETES PREVALENCE [CHENNAI]

CHENNAI URBAN POPULATION STUDY (CUPS) [1998 – 2000]

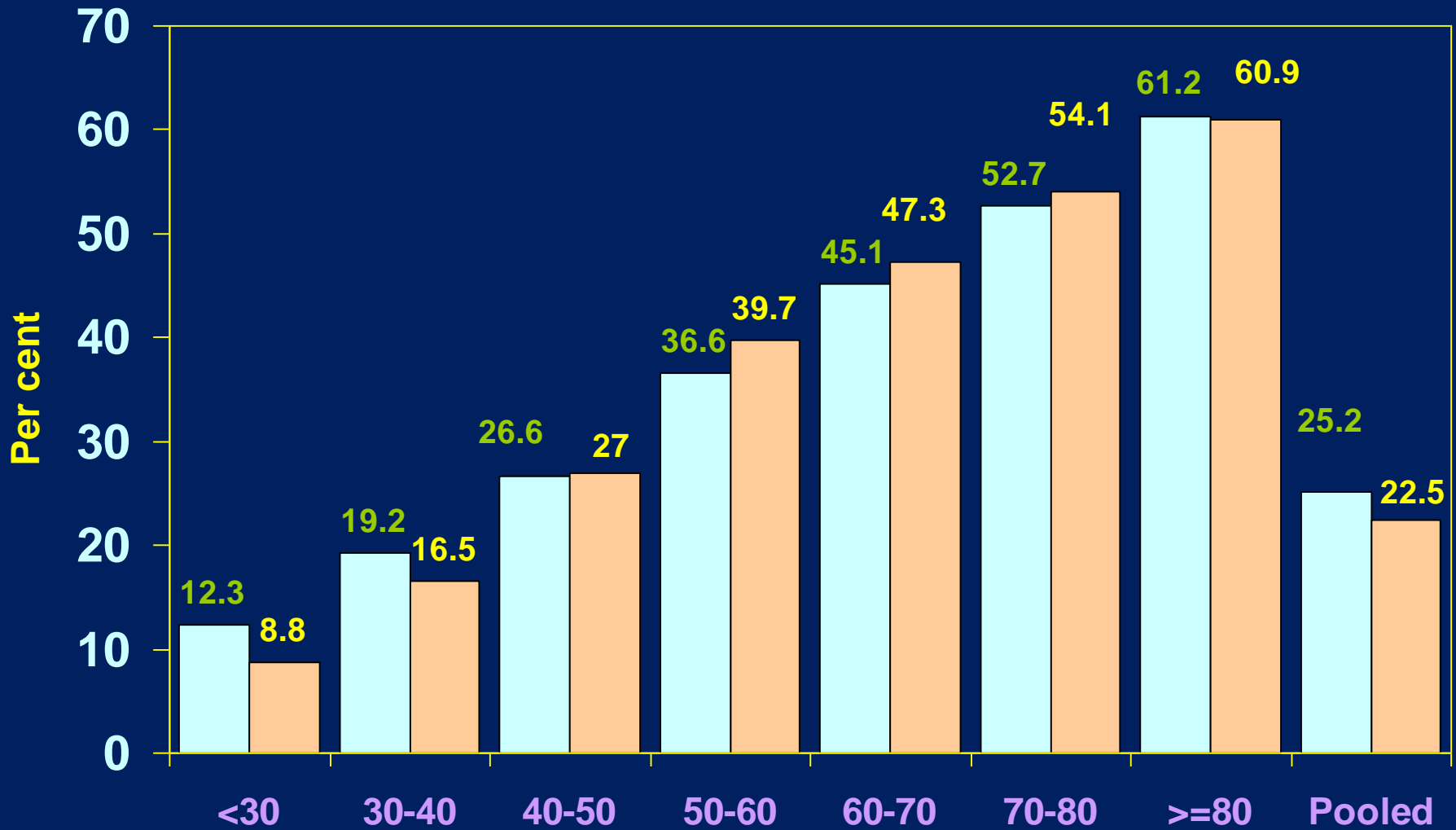




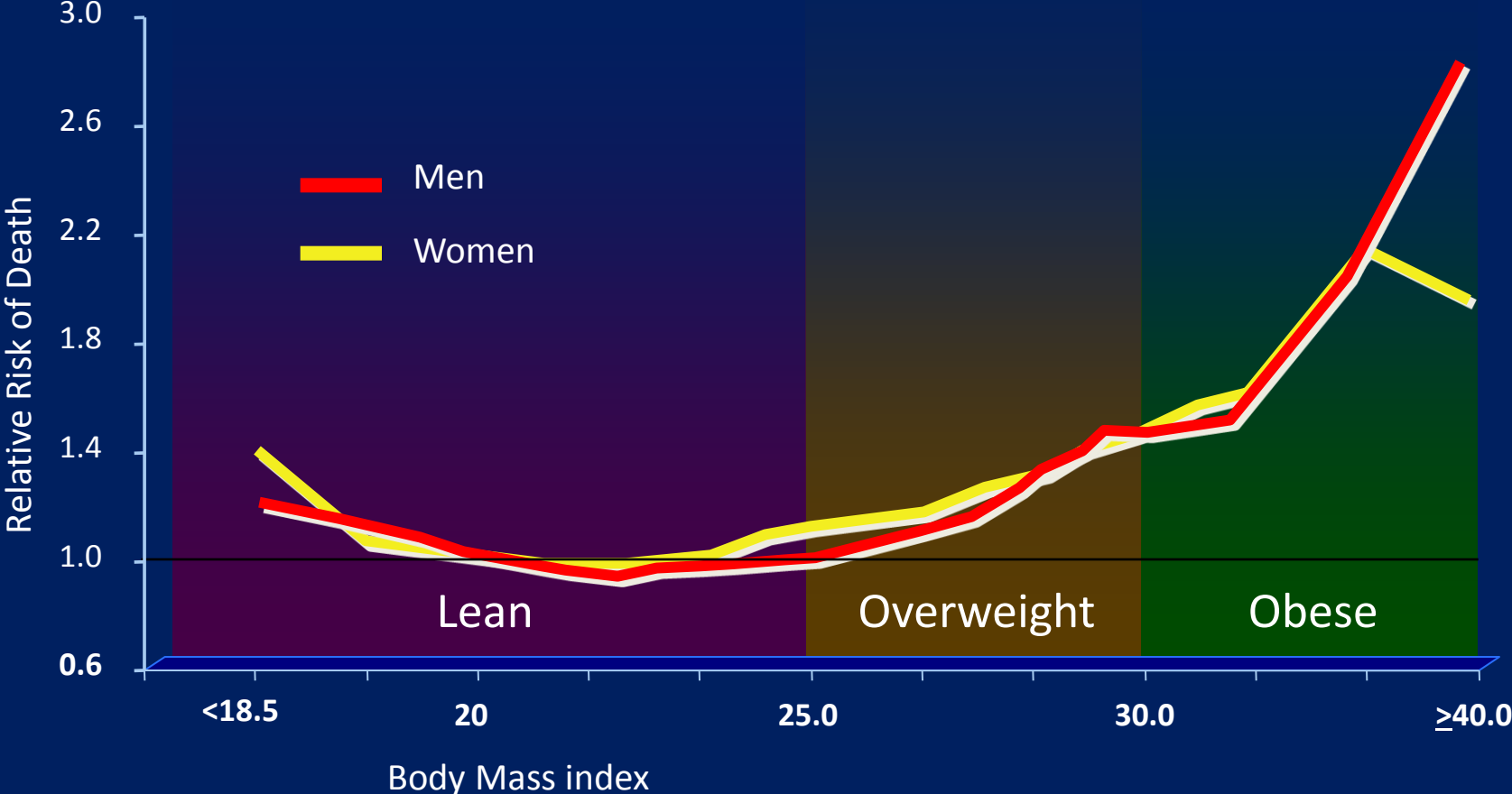
# NEW PREVALENCE RATES OF DIABETES IN THE SAME CUPS STUDY POPULATION [2008 – 2010]



# Prevalence (%) of Hypertension among Tribal Adults ( $\geq 20$ years) - By Gender and Age group



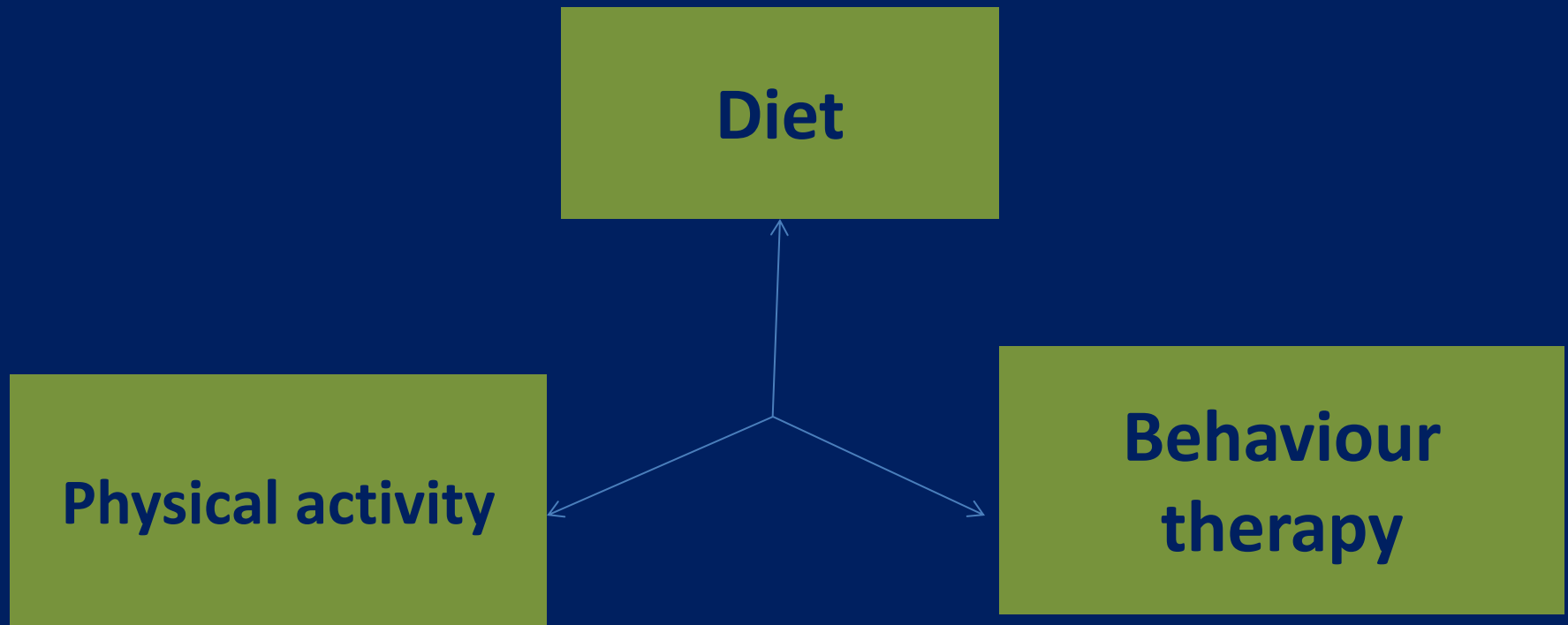
# Relationship Between BMI and Cardiovascular Disease Mortality



Source: Calle et al. *N Engl J Med* 1999;341:1097.

# PREVENTIVE STRATEGIES

# Lifestyle modification



# 2012 WHO Global Targets: Reducing Risk Factors

Premature mortality from NCDs  
25% reduction

Raised blood pressure  
25%

Tobacco smoking  
30%

Salt/  
sodium intake  
30%

Physical inactivity  
10%

Obesity  
0%


Fat intake  
15%


Alcohol  
10%


Raised cholesterol  
20%

Generic medicines and technologies  
80%

Drug therapy and counselling  
50%

 Target adopted by the World Health Assembly

 Targets with wide support

 Targets with support for further development



**Traditional food**





# TRADITIONAL DIETS

# CURRENT DIETS

BULKY  
LOW ENERGY DENSITY

PALATABLE  
ENERGY DENSE

SLOWLY DIGESTED

RAPIDLY DIGESTED

PROTEIN



PROTEIN



FAT



FAT



UNSATURATED FATS ↑

SATURATED FATS ↑

COMPLEX CARBO- ↑

REFINED FOODS ↓

HYDRATES-FIBRE

FIBRE

VITAMINS / MINERALS ↑

VITAMINS/MINERALS ↓

PHYTONUTRIENTS ↑

PHYTONUTRIENTS ↓

GLYCEMIC INDEX ↓

GLYCEMIC INDEX ↑

Na / K RATIO ↓

Na / K RATIO ↑

CALCIUM ↑

CALCIUM ↓

# WAYS TO BURN 100 CALORIES

WALKING THE DOG



26  
MINUTES

SHOPPING



38  
MINUTES

MOWING THE LAWN



20  
MINUTES

DANCE PARTY



20  
MINUTES

BIKE RIDE



23  
MINUTES

WALKING UP STAIRS



11  
MINUTES

GOLF



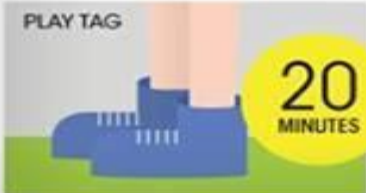
20  
MINUTES

GIVING A MASSAGE



20  
MINUTES

PLAY TAG



20  
MINUTES



Bulu Box™

burning junk food is not easy...



Junk Food	Calories	How to burn it
Slice Pizza	250 Cal	Bicycling for 1 ½ hours
	<b>250</b>	
Cheese Burger	330 Cal	Swimming for 1 hour
	<b>330</b>	
Medium French Fries	300 Cal	Jogging for 1/2 an hour
	<b>300</b>	
Junk Meal	700 Cal	Basket ball for 2 hours
	<b>700</b>	
Pastry	300 Cal	Tennis (singles) for 1 ½ hours
	<b>300</b>	
Samosa Large	160 Cal	Brisk walking for 2 km
	<b>160</b>	
Aerated Drink	80 Cal	Brisk walking for 1 km
	<b>080</b>	

# Fatty acid composition of cooking oils

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## SFA rich oils

Coconut oil ( ~ 90%)

Palm oil (~ 48 %)

Ghee (~ 65 %)

## MUFA rich oils

Olive oil (~ 70%)

Groundnut oil ( ~ 50%)

Palm oil (~ 40 %)

Rice Bran oil (~42.5%)

Ghee<sup>b</sup> (~ 27 % )

## PUFA rich oils

### n-6 PUFA :

Safflower oil (~ 75%)

Sunflower oil (~ 55%)

Corn oil (~ 55%)

Rice Bran oil (~39%)

Groundnut oil (~35%)

### n-3 PUFA:

Linseed oil<sup>a</sup> (~ 55%)

Soyabean oil<sup>a</sup> (~7%)

Mustard oil<sup>a</sup>(~10%)

Rice bran oil (~1%)

<sup>a</sup> Present in the form of  $\alpha$ -linolenic acid

<sup>b</sup>290 mg % Cholesterol

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# RECOMMENDED OIL COMBINATIONS FOR OPTIMAL HEALTH BENEFITS

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Oil combinations	Proportion
Groundnut/Sesame/RBO : Mustard	3:1
Groundnut/Sesame/RBO : Canola	2:1
Groundnut/Sesame/RBO : Soybean	2:1
Palmolein : Soybean	1:1
Safflower : Palmolein : Mustard	1:1:1

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1 **Start Here** →

2 **Check Calories**

3 **Limit these  
Nutrients**

4 **Get Enough  
of these  
Nutrients**

5 **Footnote** <

# Nutrition Facts

Serving Size 1 cup (228g)  
Servings Per Container 2

## Amount Per Serving

**Calories** 250      Calories from Fat 110

## % Daily Value\*

<b>Total Fat</b> 12g	<b>18%</b>
Saturated Fat 3g	<b>15%</b>
<i>Trans</i> Fat 3g	
<b>Cholesterol</b> 30mg	<b>10%</b>
<b>Sodium</b> 470mg	<b>20%</b>
<b>Total Carbohydrate</b> 31g	<b>10%</b>
Dietary Fiber 0g	<b>0%</b>
Sugars 5g	
<b>Protein</b> 5g	
Vitamin A	<b>4%</b>
Vitamin C	<b>2%</b>
Calcium	<b>20%</b>
Iron	<b>4%</b>

\* Percent Daily Values are based on a 2,000 calorie diet.  
Your Daily Values may be higher or lower depending on  
your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

6

## Quick Guide to % DV

• 5% or less  
is Low

• 20% or more  
is High

**You don't have to**

EAT LESS

**You just have to**



**EAT RIGHT**

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# Veggies on the table. Who's in?

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#experienceit





Jennifer Leigh  
Medicinal Nutrition

let food  
be thy medicine  
and medicine  
thy food  
- Hippocrates

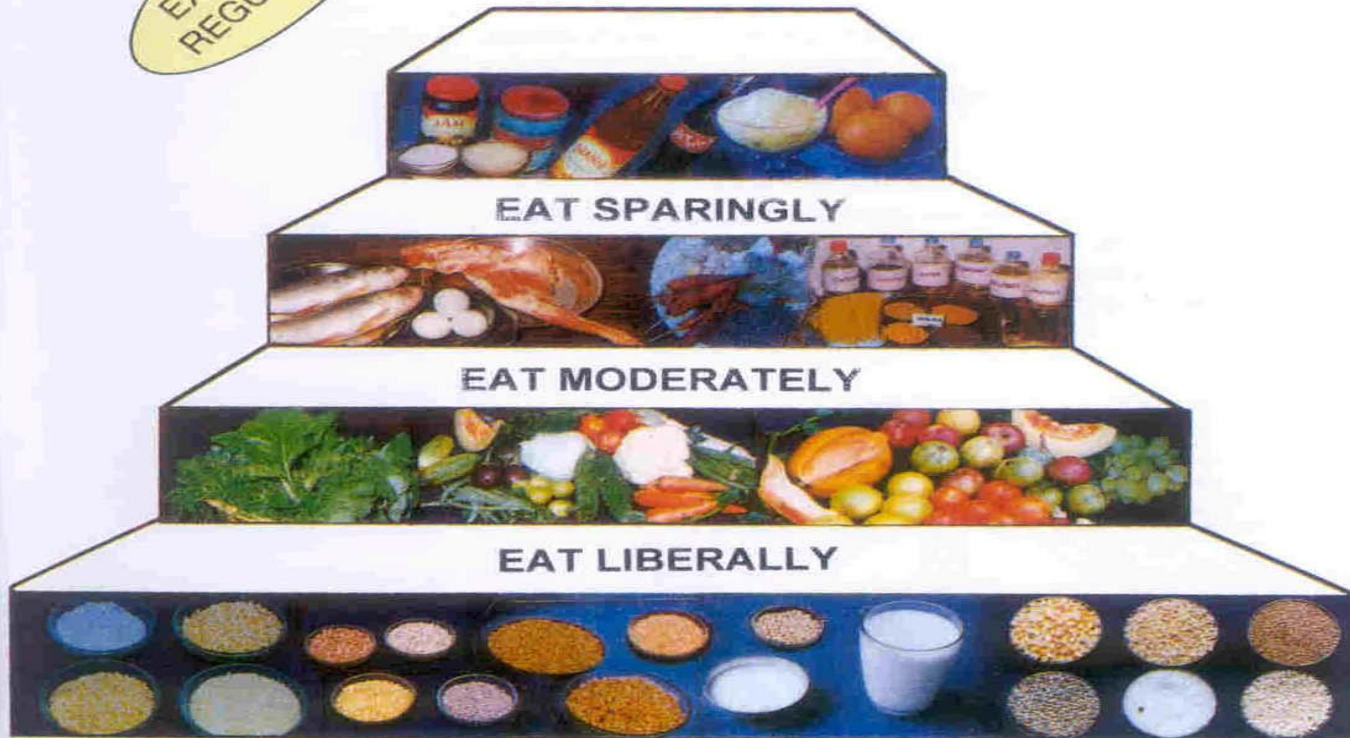
[MedicinalNutrition.com](http://MedicinalNutrition.com)



# DIETARY GUIDELINES FOR INDIANS

FOUNDATION TO NUTRITION AND HEALTH

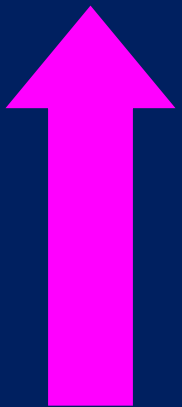
EXERCISE  
REGULARLY



EAT ADEQUATELY

# ACTIONABLE POINTS ARE:

- Fats
- Sugars
- Salt
- Fruit and vegetables
- Physical activity
- Drink plenty of water



## **ACKNOWLEDGEMENTS**

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**Technical and support staff of DCS**

**Project staff of NNMB**



**THANKS**

***Journey has just begun.  
Miles to go...***