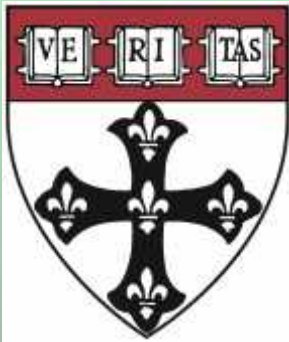


NUTRITION TRANSITION IN INDIA: THE PANDEMIC OF CARDIOMETABOLIC DISORDERS

Shilpa N Bhupathiraju, PhD
Research Associate, Department of
Nutrition,
Harvard School of Public Health, Boston, MA



Defining Nutrition Transition in India

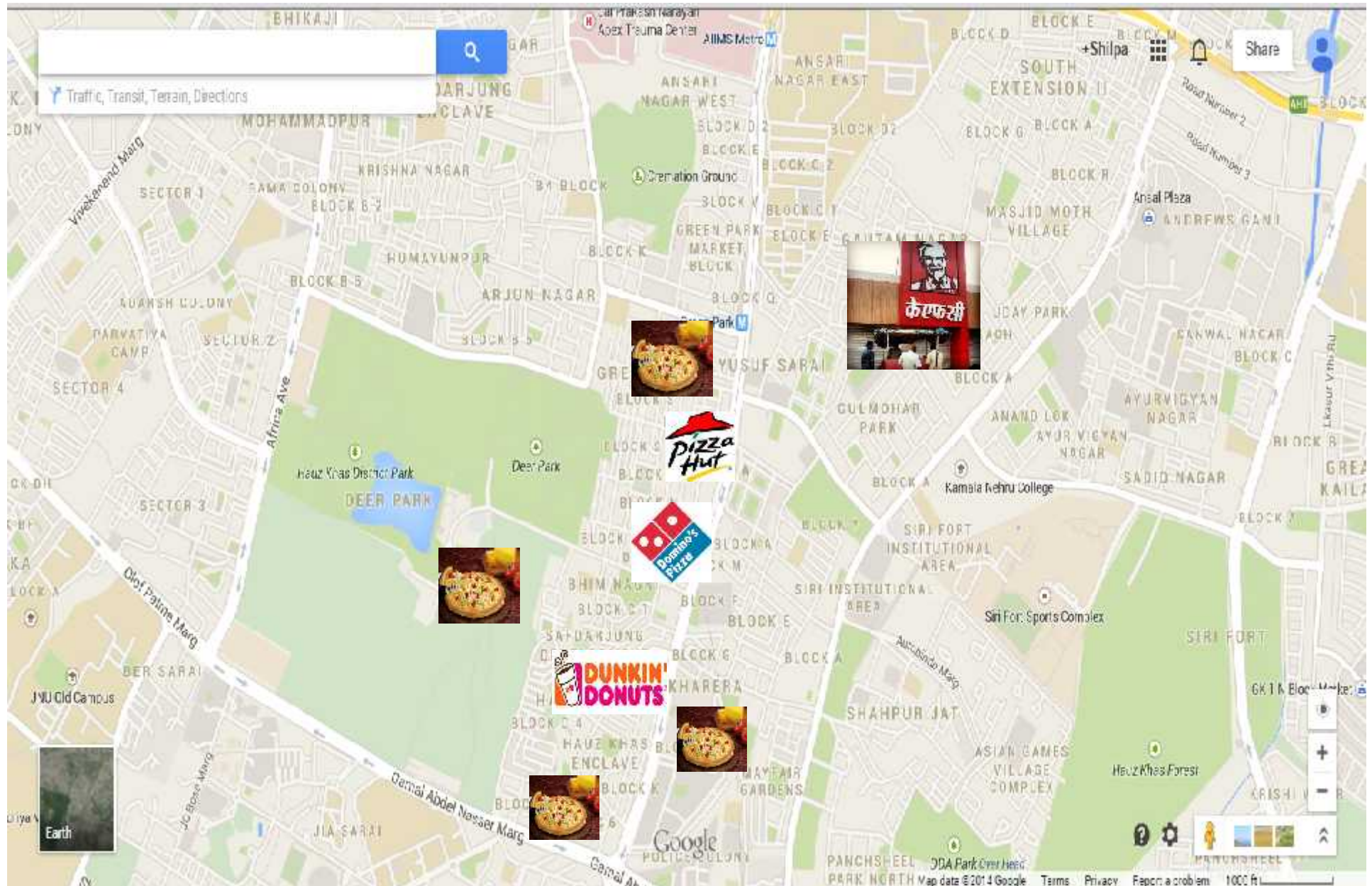


Westernization of the traditional diet



Easy access to a variety of processed foods and fast foods

FAST FOOD NATION



Defining Nutrition Transition in India

Westernization of the traditional diet



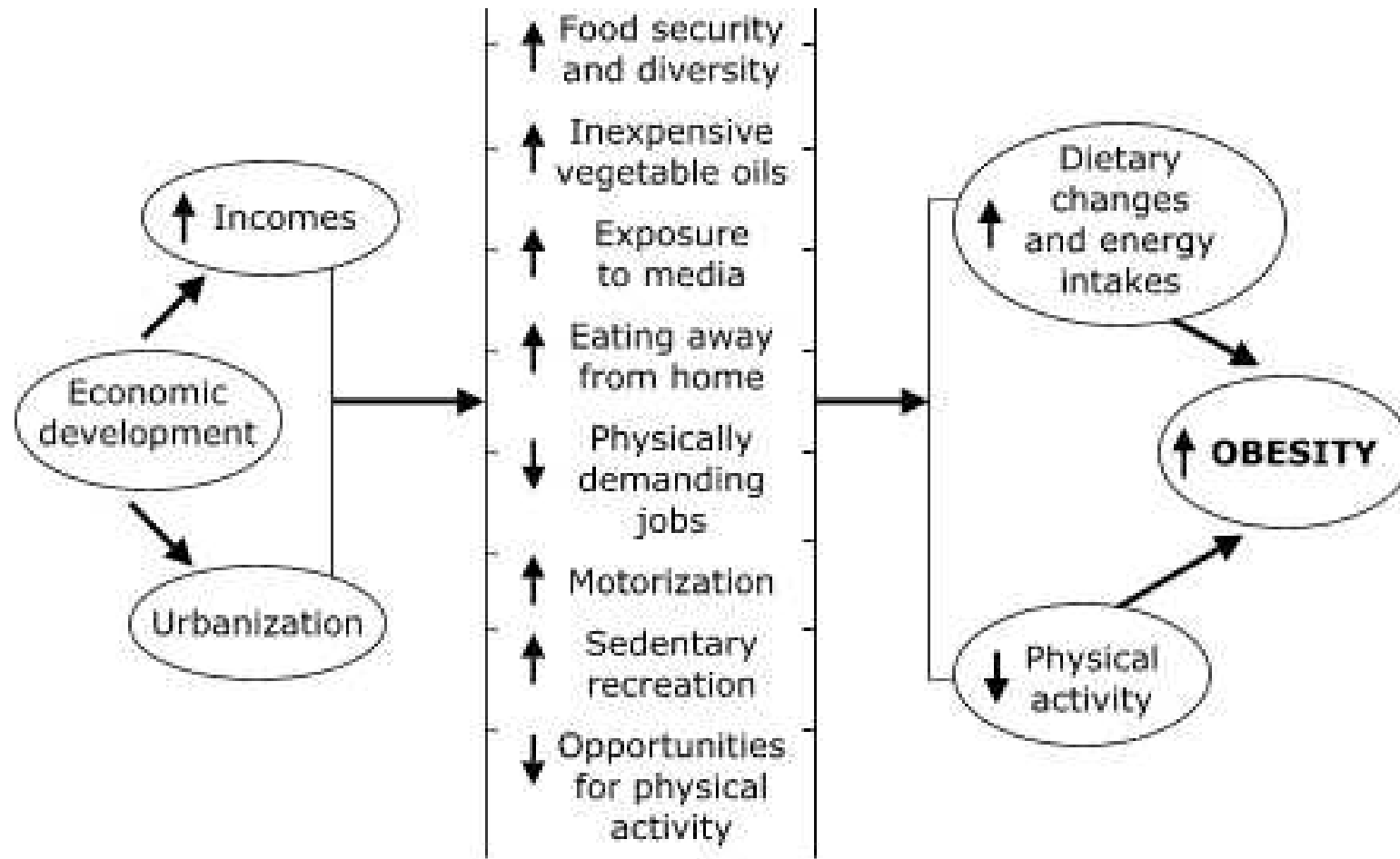
Easy access to a variety of processed foods and fast foods



Shift back to a healthier diet and lifestyle



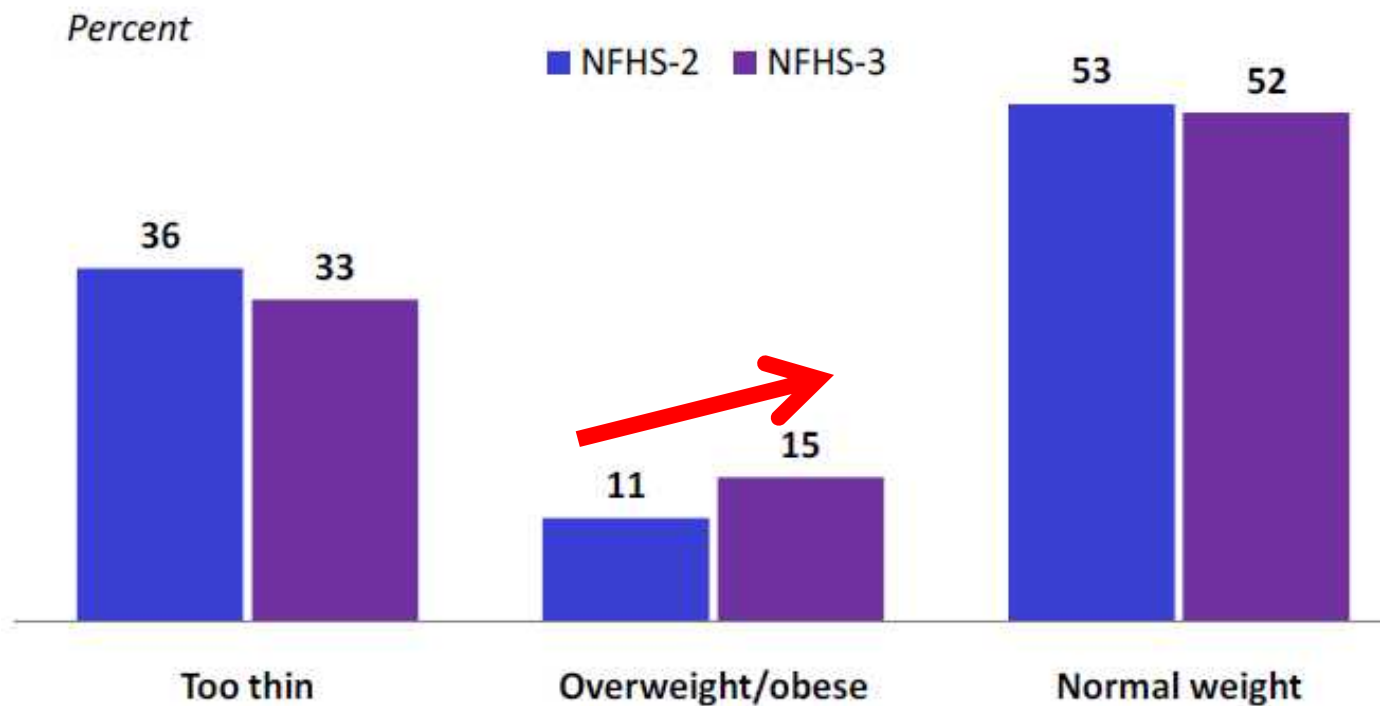
Possible causes of the nutrition transition



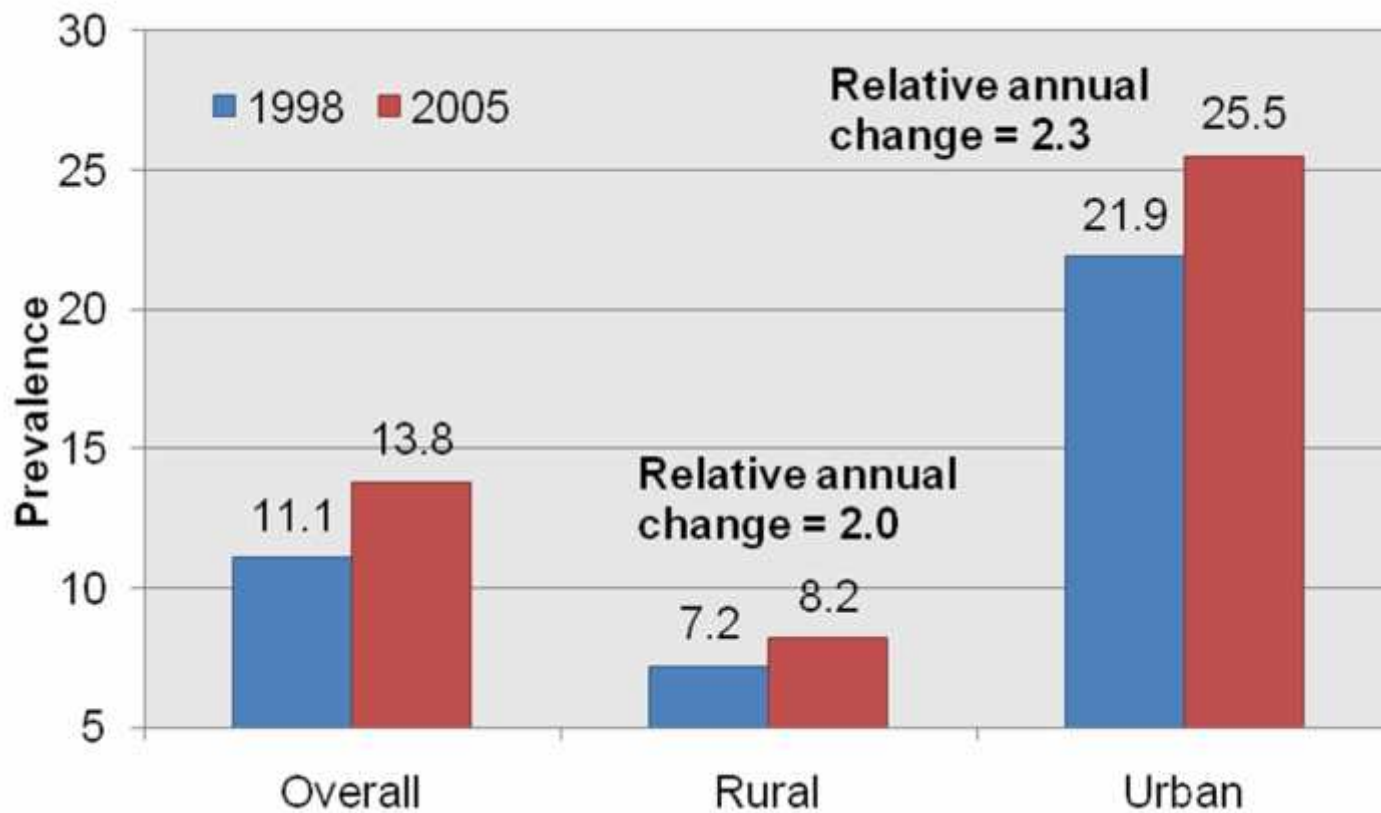
Adapted from Martorell and Stein, 2001 and Popkin, 1994.

THE DOUBLE BURDEN OF DISEASE

Trends in Malnutrition Among Ever-married Women 15-49 Years



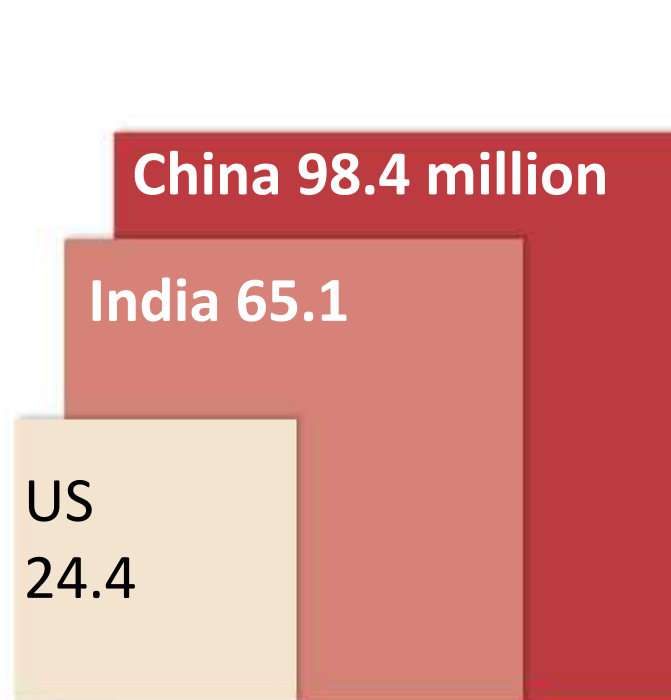
Age-standardized Rates and Trends among Women (18-49 y) who are Overweight or Obese



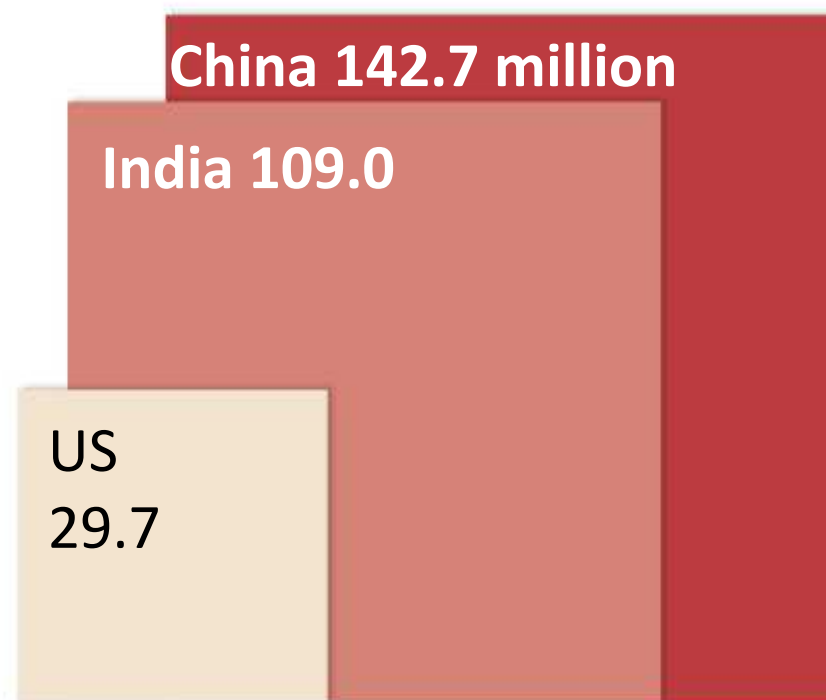
Source: Popkin et al, Nutr Rev, 2012, 70(1):3-21.

Type 2 Diabetes: A Disease on the Rise

2013 cases of diabetes among
ages 20-79



2035 projected cases



Source: IDF

Nutrition Transition in India

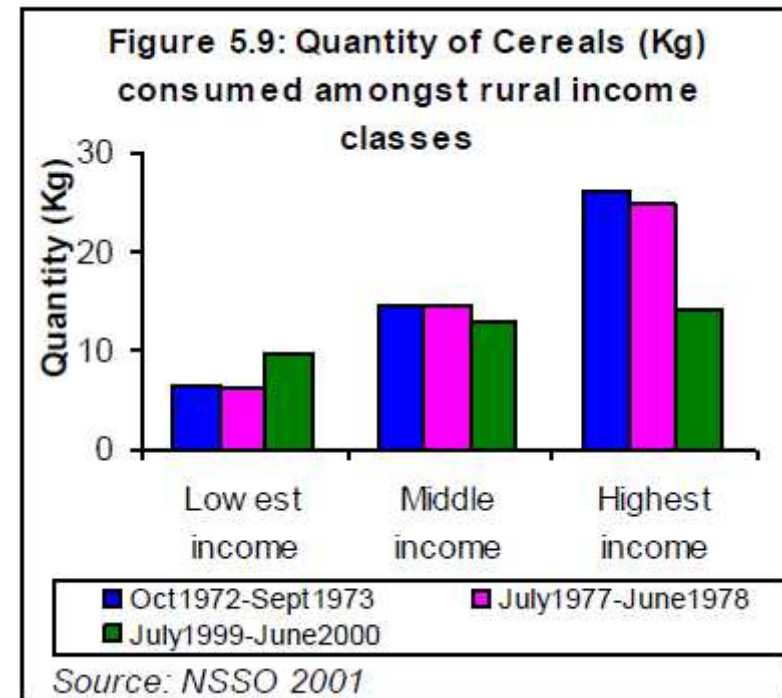
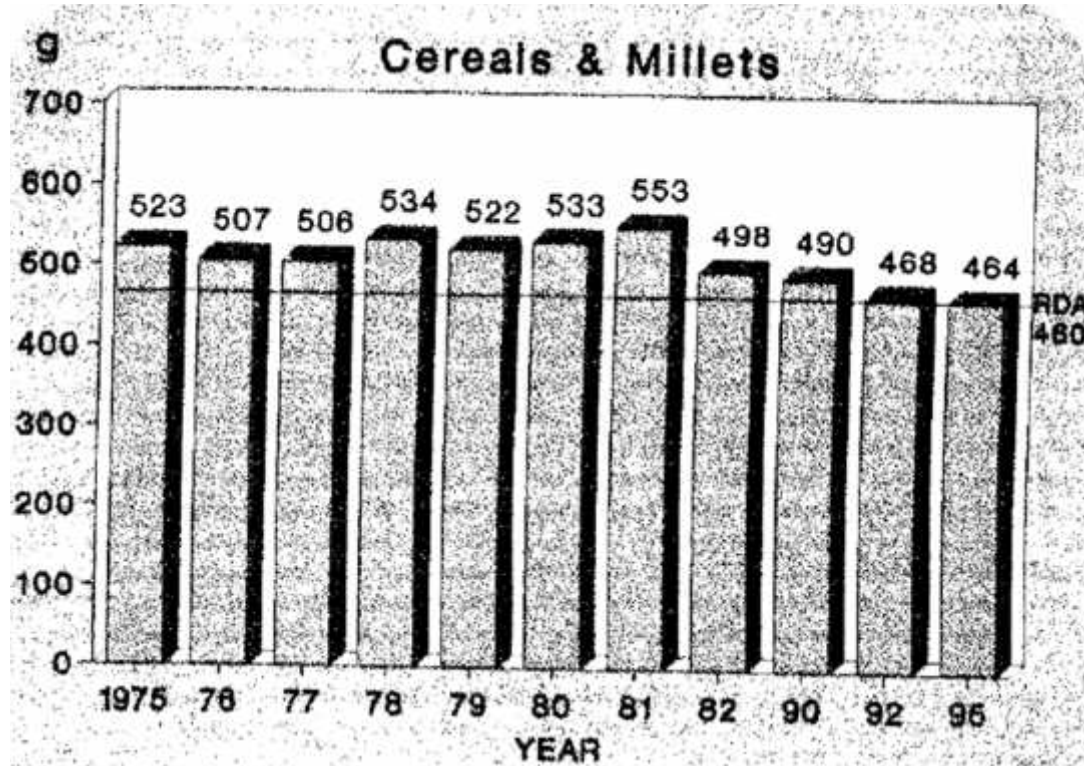
- Refined carbohydrates
- Added sugars
- Fats
- Sodium
- Animal source foods

- Coarse grains
- Legumes
- Fruits
- Vegetables



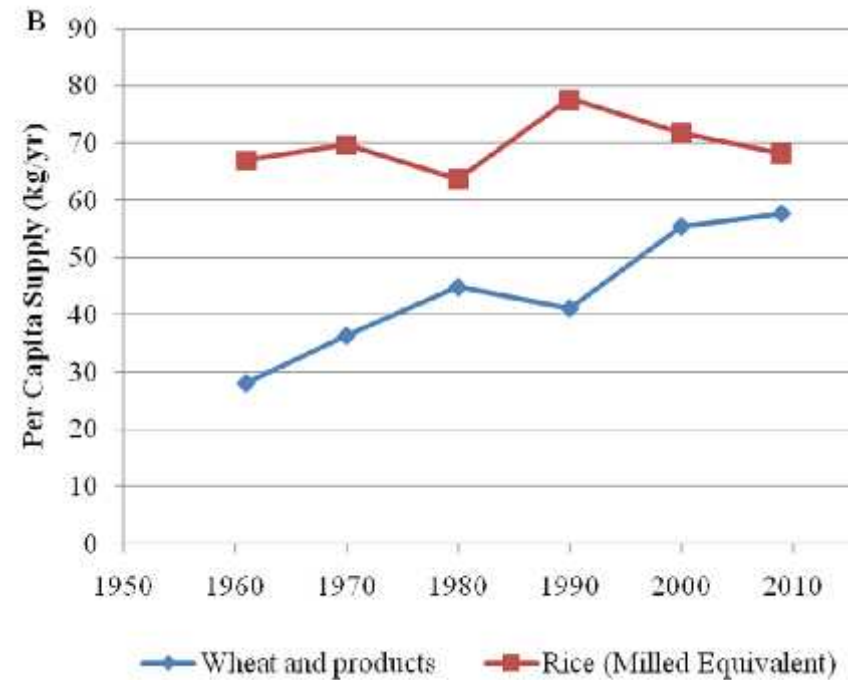
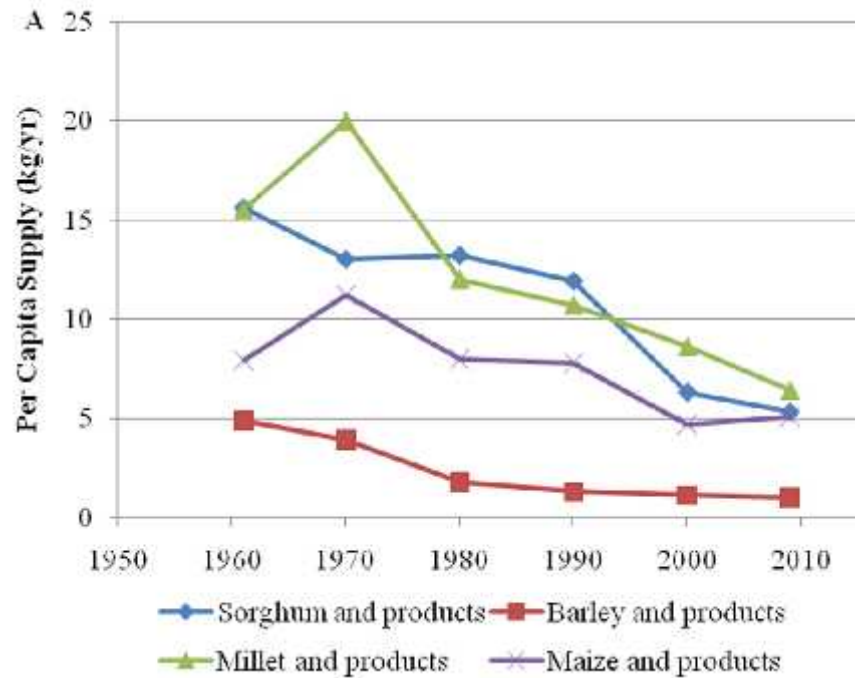
TRENDS IN CEREAL INTAKE

Trends in Cereal Intake



Consumption of cereals has declined in the past few decades despite reductions in cost. Changes depend on income level.

Trends in Cereal Intake



Reductions in consumption of traditional whole grains and increases in refined grain consumption

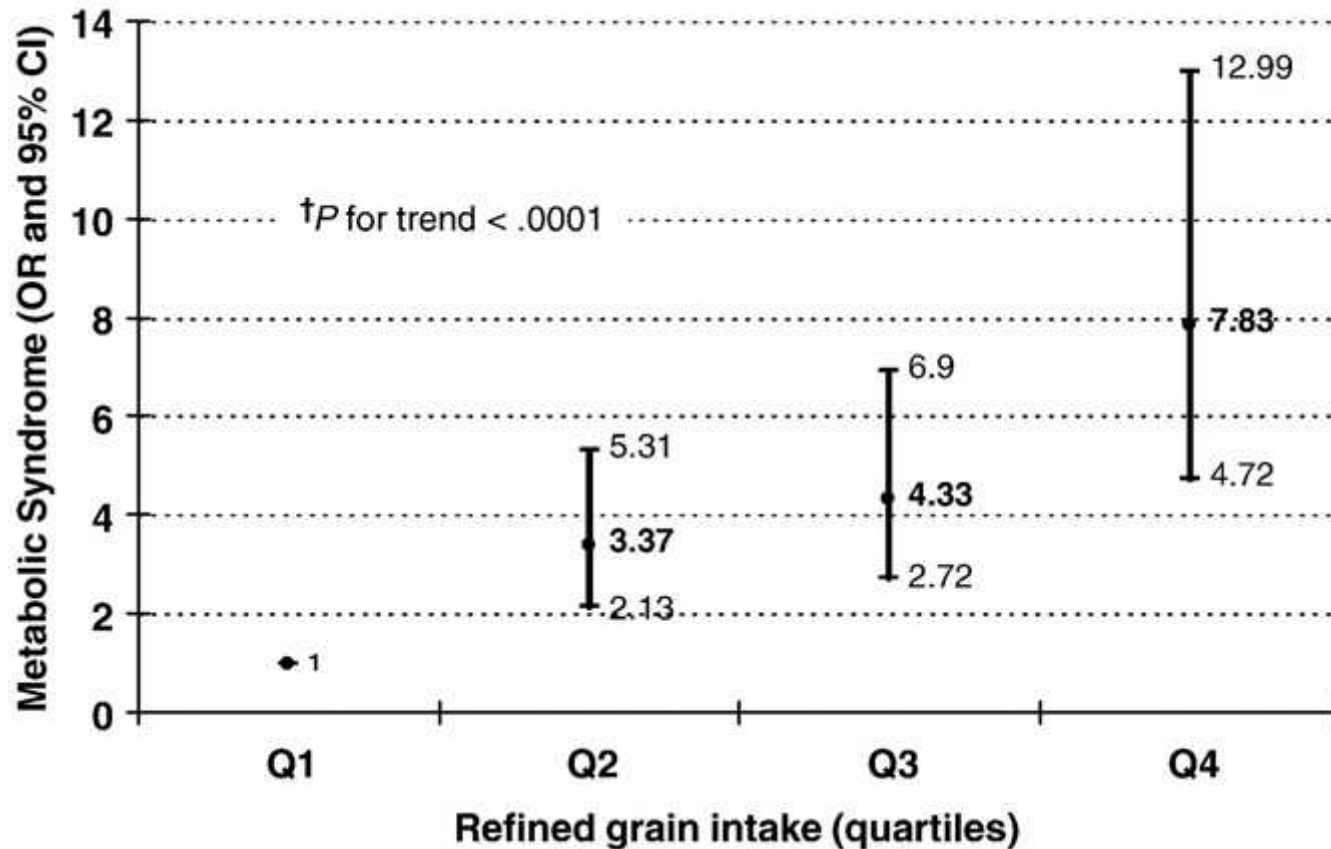
Refined grain intake and markers of glucose tolerance – The Chennai Urban Rural Epidemiology Study (CURES)

Multivariate adjusted mean (95% CI) HOMA-IR and metabolic risk factors by quartiles of refined cereal intake in 2042 participants of the CURES study

Variables	Quartile of refined grain intake				P trend ^a	% Difference between Q1 and Q4
	1 (low)	2	3	4 (high)		
n	510	511	510	511	–	
Median refined grain intake (g/d)	218.1	298.9	364.9	448.8		
HOMA-IR, μ IU/mL						
Unadjusted	1.9 (1.7-2.0)	1.9 (1.7-2.0)	2.2 (2.1-2.4)	2.5 (2.3-2.7)	.001	24.0
Multivariable ^b	1.9 (1.8-2.2)	1.9 (1.8-2.2)	2.2 (1.9-2.3)	2.2 (1.9-2.4)	.001	13.6
Weight, kg						
Unadjusted	57.7 (56.7-58.8)	58.9 (57.6-59.7)	61.7 (60.6-62.8)	63.1 (62.0-64.2)	.001	9.4
Multivariable ^b	56.1 (55.0-57.2)	58.6 (57.5-59.7)	61.2 (60.1-62.3)	62.9 (61.6-64.1)	.001	12.1
Waist circumference, cm						
Unadjusted	80.9 (79.9-81.9)	81.8 (80.7-82.8)	86.0 (85.0-87.1)	87.3 (86.3-88.3)	.001	7.3
Multivariable ^b	80.5 (79.4-81.6)	82.5 (81.5-83.6)	85.8 (84.7-86.9)	87.5 (86.3-88.8)	.001	8.0
Systolic BP, mm Hg						
Unadjusted	116.3 (114.6-117.9)	117.5 (115.9-119.1)	120.3 (118.6-121.9)	122.9 (121.3-124.6)	.001	5.4
Multivariable ^b	117.1 (115.2-118.9)	118.2 (116.5-119.9)	118.8 (117.1-120.6)	120.6 (118.5-122.6)	.001	2.9
Diastolic BP, mm Hg						
Unadjusted	72.6 (71.6-73.5)	72.9 (71.9-73.9)	74.3 (73.3-75.3)	75.6 (74.6-76.6)	.001	3.9
Multivariable ^b	73.0 (71.9-74.2)	73.3 (72.2-74.3)	74.1 (72.9-75.2)	74.3 (73.0-75.6)	.029	1.7
HDL-C, mg/dL						
Unadjusted	44.3 (43.4-45.2)	43.4 (42.5-44.3)	41.9 (41.0-42.8)	40.6 (39.7-41.5)	.001	-9.1
Multivariable ^b	44.8 (43.8-45.8)	42.8 (41.8-43.7)	42.2 (41.2-43.1)	40.7 (39.6-41.9)	.001	-10.1
Triglyceride, mg/dL						
Unadjusted	101.7 (94.8-108.7)	119.9 (113.0-126.9)	129.4 (122.5-136.4)	149.7 (142.7-156.7)	.001	32.1
Multivariable ^b	96.8 (88.4-104.6)	122.8 (115.1-130.4)	130.9 (122.9-138.8)	152.4 (143.3-161.5)	.001	36.5
LDL-C, mg/dL						
Unadjusted	110.3 (107.5-113.2)	109.6 (106.8-112.5)	110.5 (107.6-113.3)	112.9 (110.1-115.8)	.947	2.4
Multivariable ^b	112.1 (108.6-115.7)	111.2 (107.9-114.6)	110.6 (107.4-114.3)	114.6 (110.7-118.6)	.137	2.2
Fasting blood glucose, mg/dL						
Unadjusted	88.5 (86.2-90.8)	92.8 (90.5-95.1)	92.7 (90.4-95.0)	98.2 (95.8-100.5)	.001	9.9
Multivariable ^b	87.9 (84.9-90.8)	92.9 (90.2-95.6)	90.8 (87.9-93.7)	95.4 (92.2-98.7)	.007	7.9

Source: Radhika et al, Metabolism. 2009 May;58(5):675-81

Higher intakes of refined grains associated with higher odds of metabolic syndrome



Brown rice and type 2 diabetes risk: a randomized cross-over study

- 5 day trial in overweight Indians without type 2 diabetes, aged 40-59 y
- Test meals were identical except for rice and legumes (50 g)
- Effects of BR
 - ↓ Glucose IAUC (19.8%)
 - ↓ Glycemic response (22.9%)
 - ↓ % change in insulin (57%)

Source: Mohan et al, Diabetes Technol Ther. 2014, 16(5):317-25.



Global Nutrition &
Epidemiologic Transition
Initiative

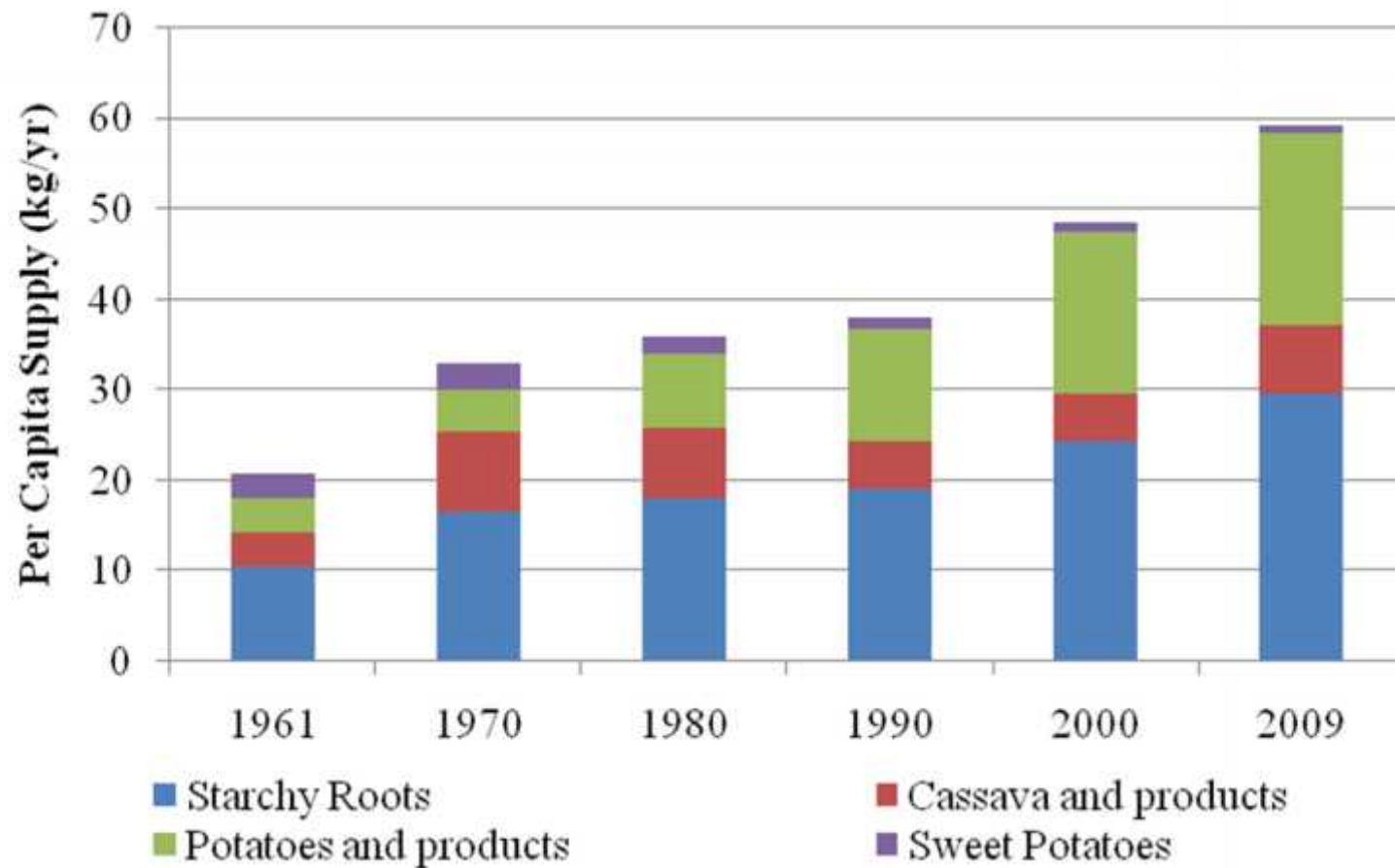


HARVARD
School of Public Health

A photograph of a grocery store potato display. The display is filled with various types of potatoes, including yellow, red, and brown-skinned varieties. Price tags are visible above the potatoes, showing prices like \$1.88, \$2.48 kg, \$2.98, and \$1. The text "TRENDS IN STARCHY ROOTS AND TUBERS" is overlaid in a semi-transparent box in the center of the image.

TRENDS IN STARCHY ROOTS AND TUBERS

Trends in Starchy Roots and Tubers



Source: FAO Food Balance Sheets data

Rocking Snack



₹ 800 crore

ESTIMATED SIZE
OF FROZEN SNACK
FOOD MARKET

30%

YEAR-ON-YEAR
JUMP IN FRIES SALES
AT McDONALD'S

50%

BURGER MEALS
SOLD AT KFC
INCLUDE A SERVING
OF FRIES

30-40%

GROWTH IN SALE
OF FROZEN FRENCH
FRIES IN MODERN
RETAIL CHAINS

French fries, due to its popularity, is leading to a reverse category creation, entering Indian homes from fast-food joints since it's easy to cook. It is also emerging as an alternative to current serious snacking for kids at home, replacing chips and noodles

DEVENDRA CHAWLA

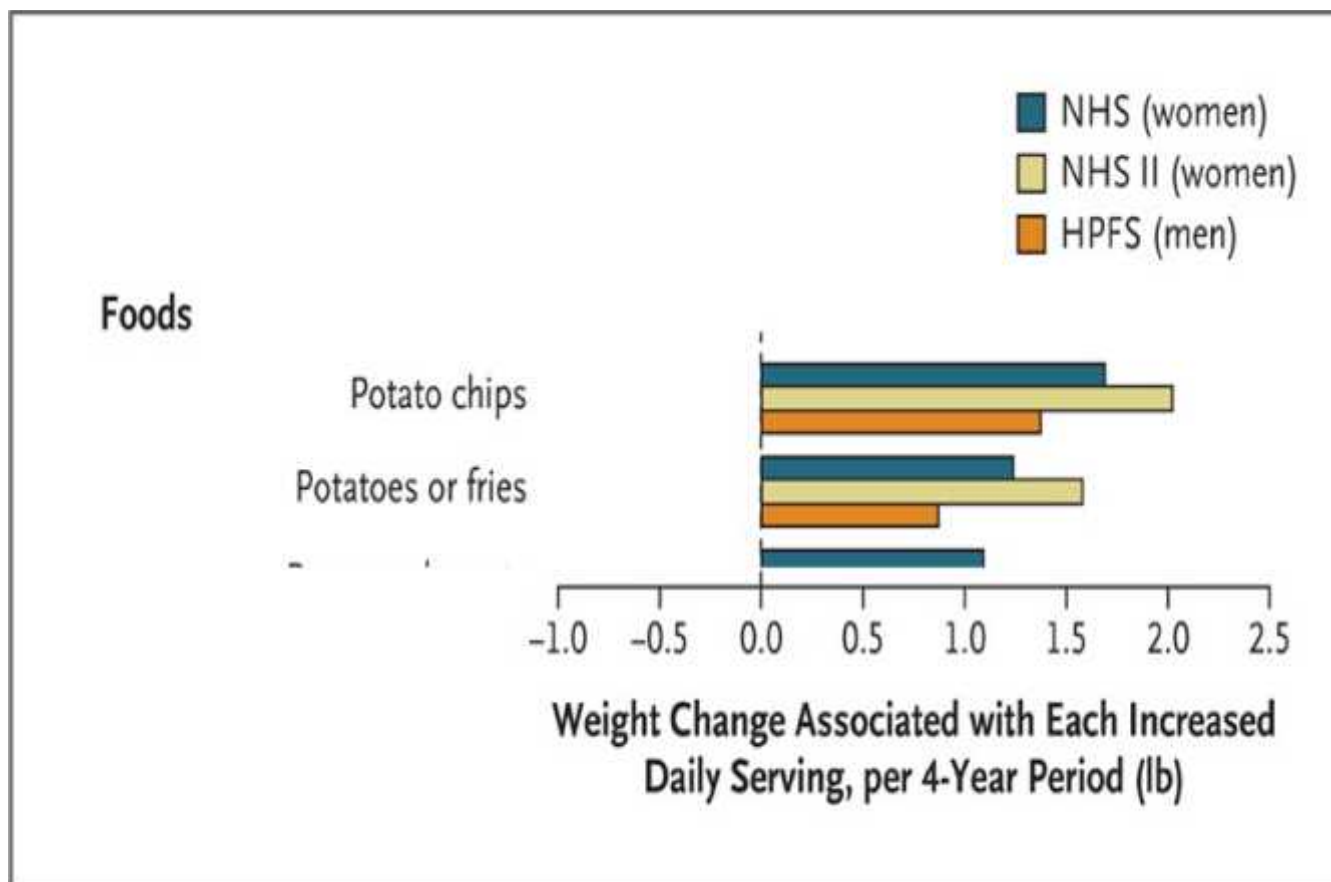
President (Food Bazaar), Future Group

French fries are now one of the largest selling snacks in modern retail and in the frozen food section.


Canadian firm McCain Foods, the world's largest maker of French fries and assorted potato snacks, says fries along with potato smiles are its fastest moving products in India.



Changes in potato consumption and subsequent weight gain



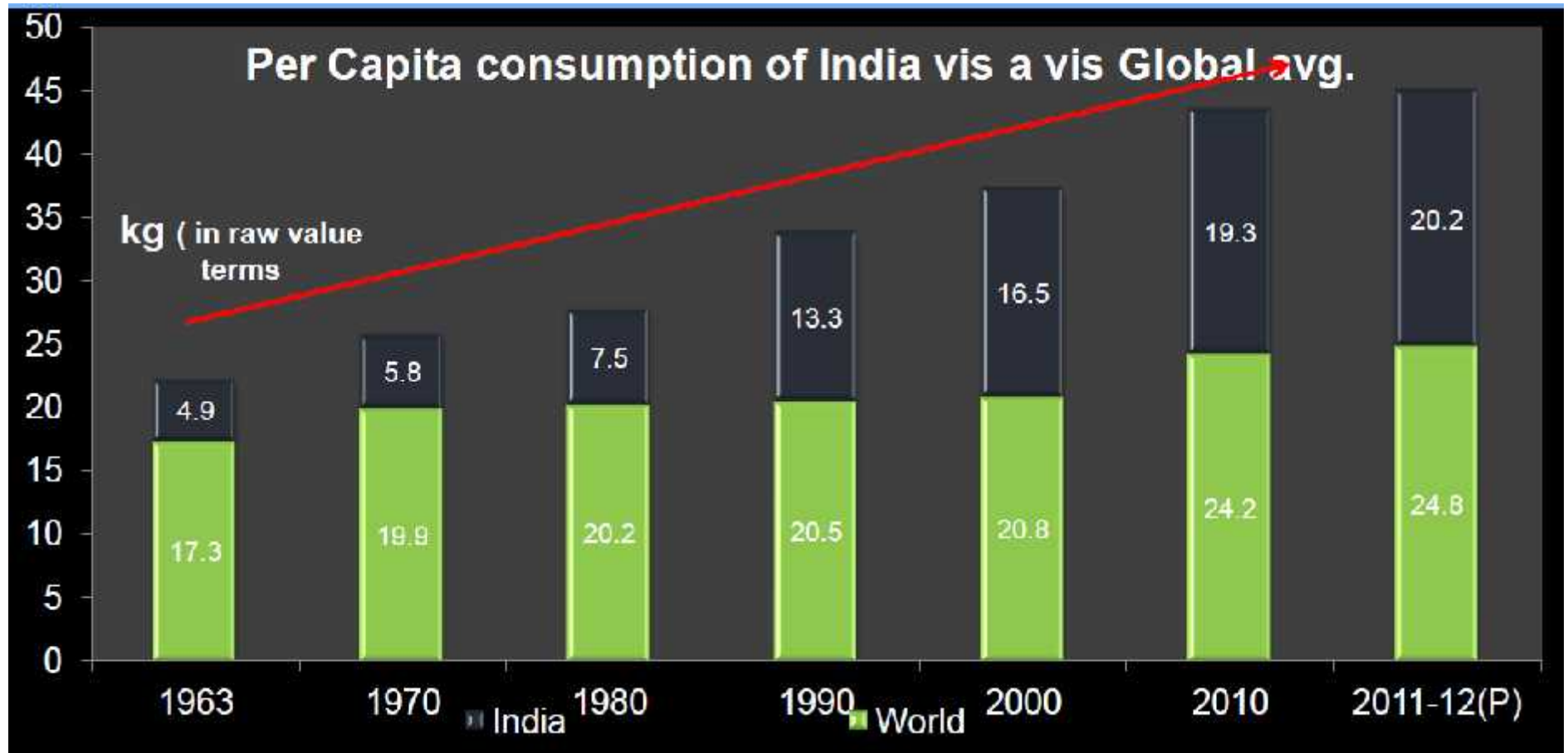
Source: Mozzafarian et al, 2011, N Engl J Med, 23;364(25):2392-404.



TRENDS IN SUGAR INTAKE

Trends in Sugar Consumption

A Sweet Tooth Nation



Source: India's Sugar Policy and the World Sugar Economy, FAO International Sugar Conference, Fiji, August 2012

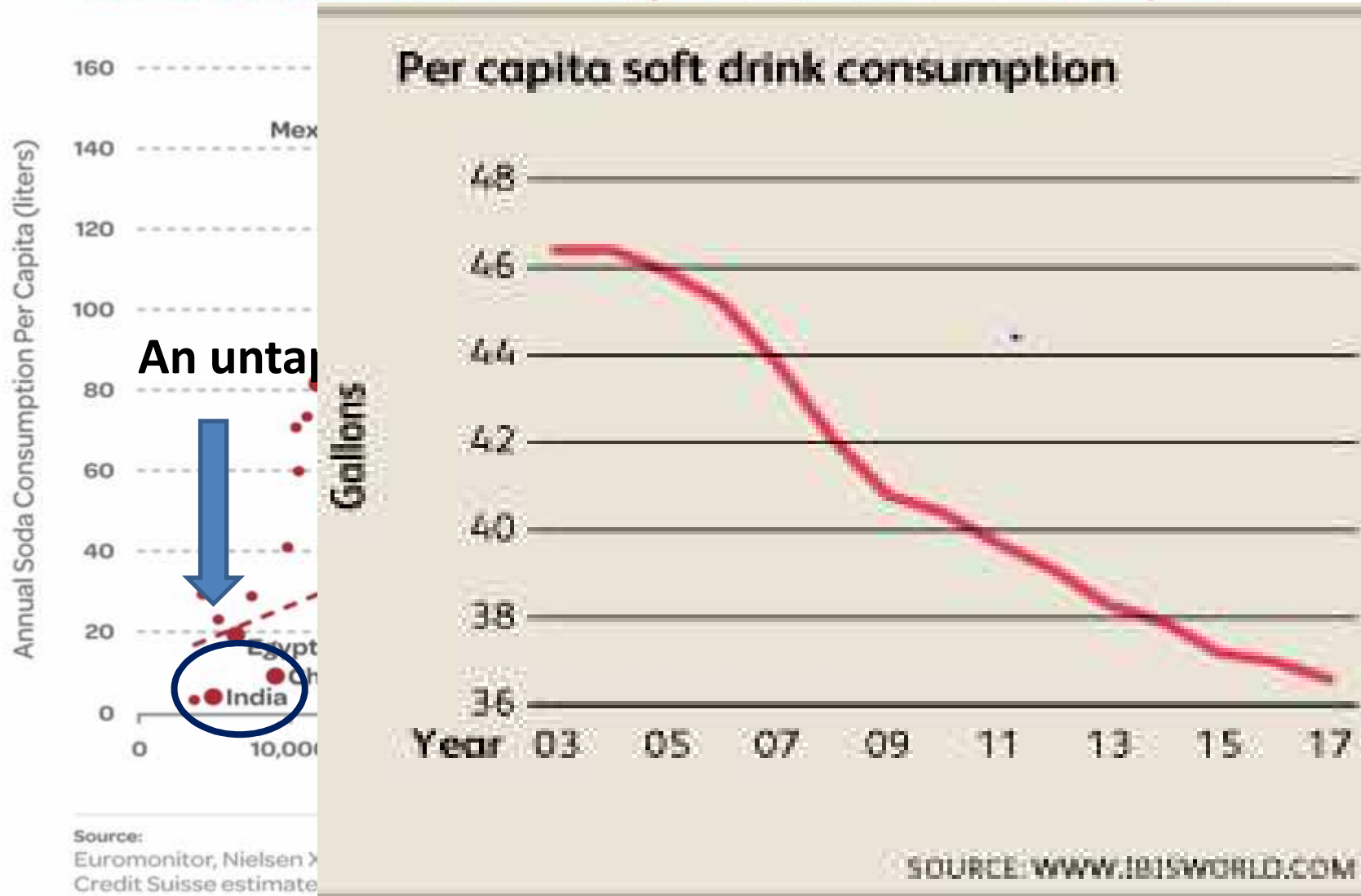
Sources of added sugar in the Indian diet

- Traditional sweets
- Cakes, cookies, biscuits
- Sugar-sweetened beverages



Soda consumption across the globe

Annual Global Soda Consumption Versus GDP Per Capita

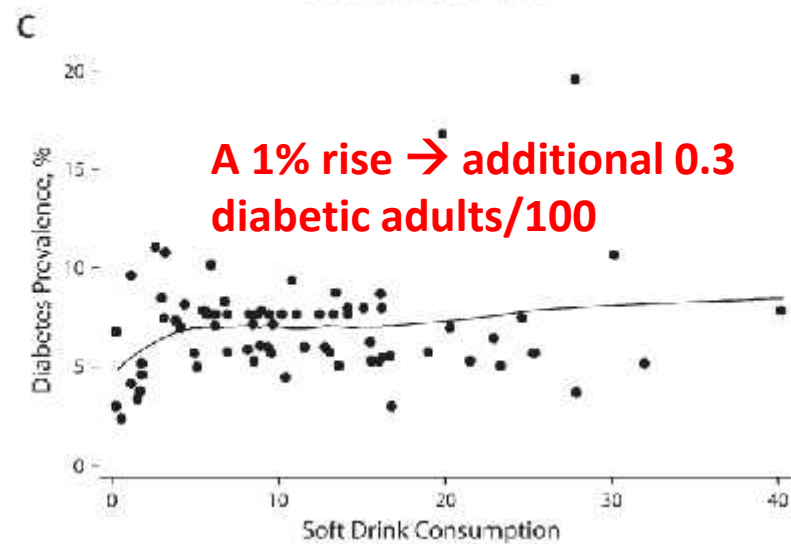
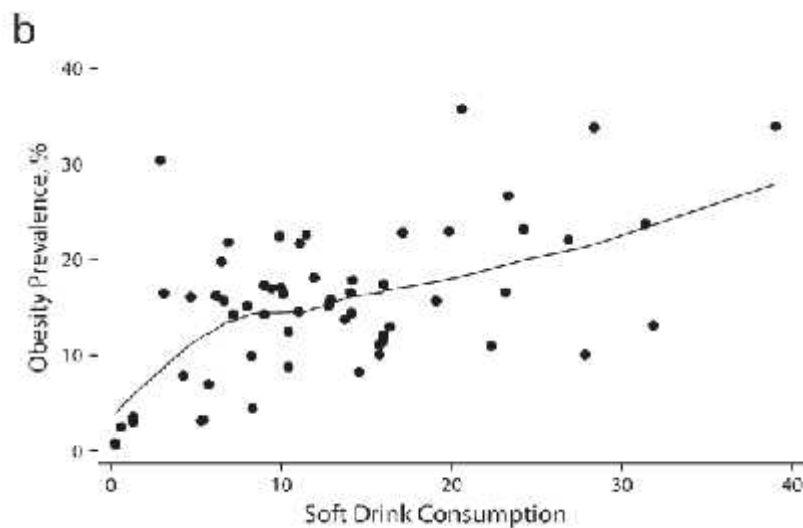
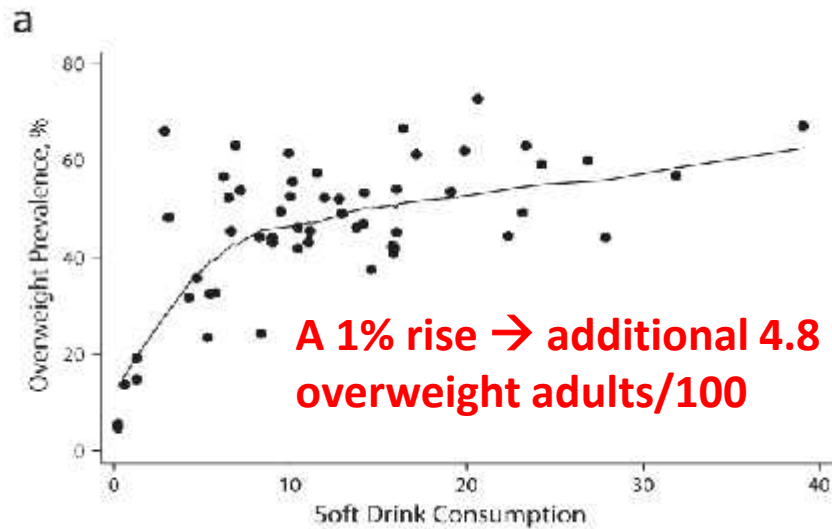


An untapped market

- Soft drink industry - \$50 bn
- Annual growth rate of 6%-7%
- Penetration into rural areas (40% sales)
 - Outlets growing exponentially since 2001
 - Expand distribution infrastructure
 - Increasing coolers in each outlet offers
 - Increasing awareness of hygiene



Soft drink consumption and global overweight, obesity, and type 2 diabetes



Data Sources:

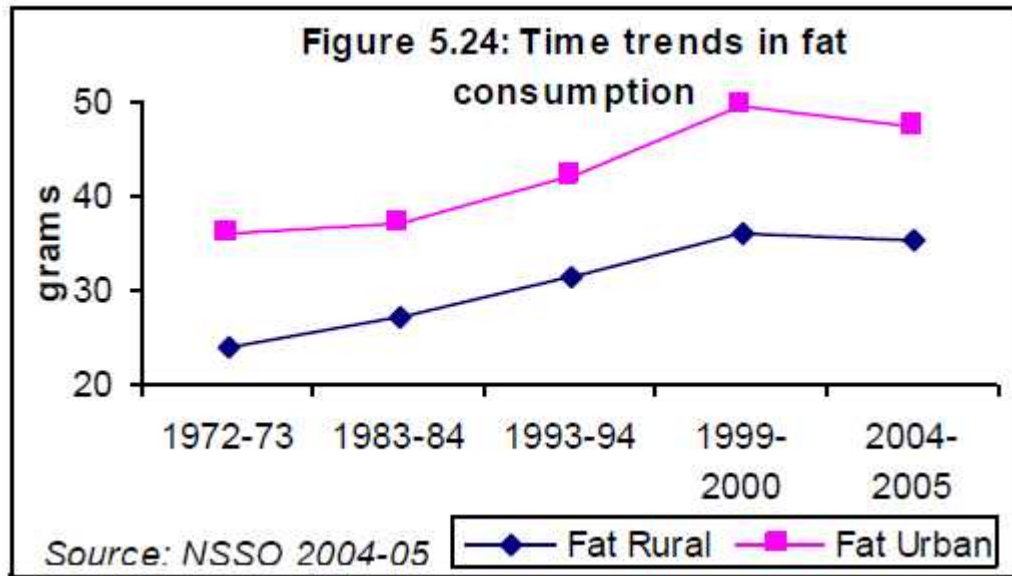
- Euromonitor Global Market Information
- WHO
- IDF

Source: Basu et al Am J Public Health. 2013;103:2071–2077

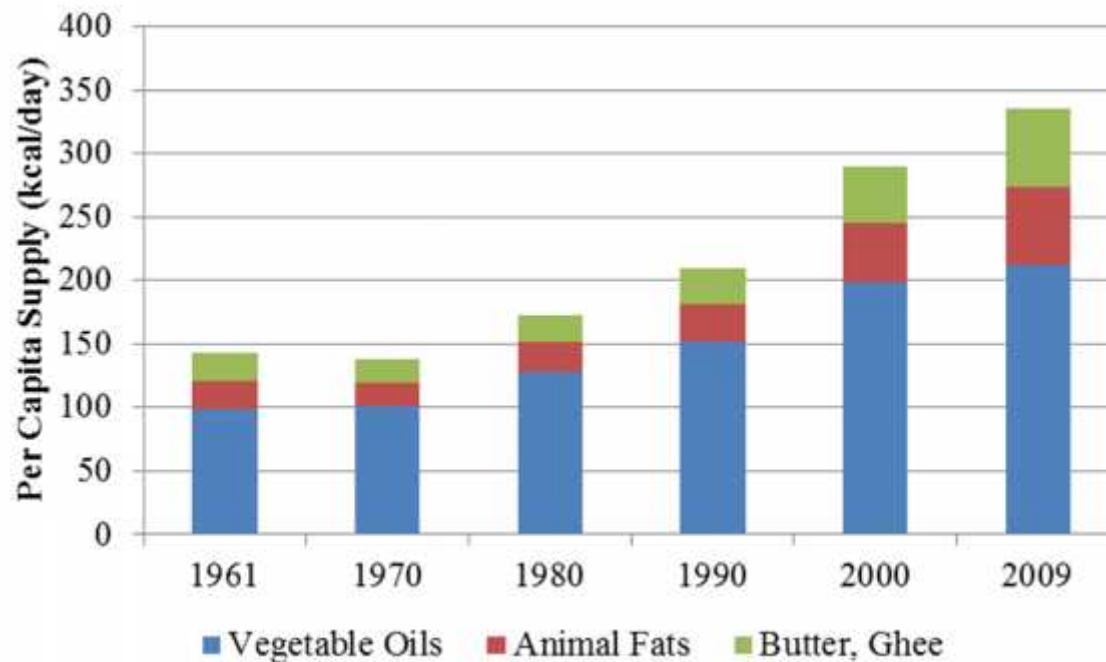
A collection of glass bottles containing yellow oils, likely olive or sunflower oil, arranged on a reflective surface. A large sunflower is in the foreground. The text "TRENDS IN FAT INTAKE" is overlaid in the center.

TRENDS IN FAT INTAKE

Trends in Fat Intake

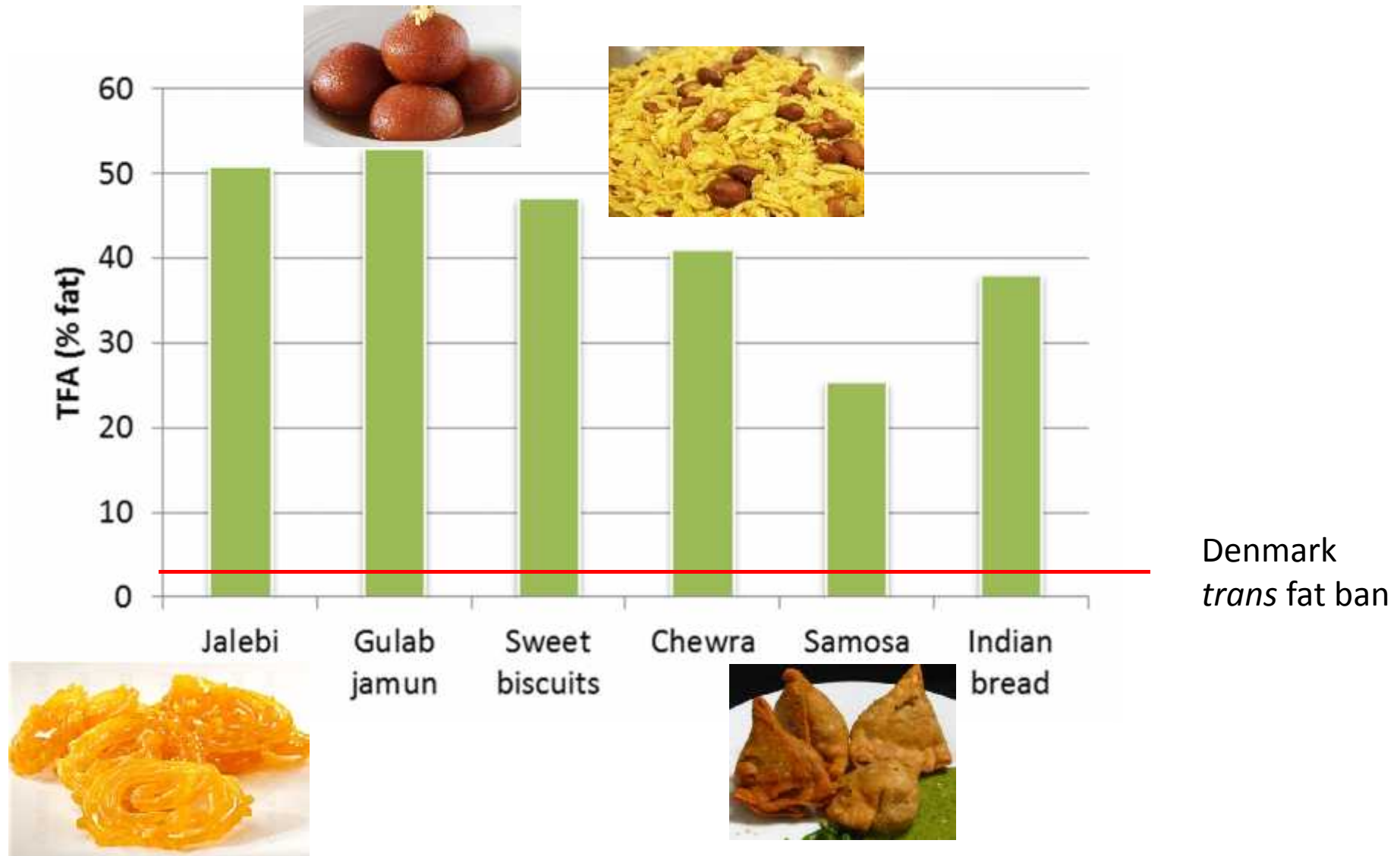


- Vegetable oil supply doubled
- Animal fats increased 3-fold
- Supply of ghee increased 4-fold



Source: FAO Food Balance Sheets data

TFA of common Indian foods



Source: Agrawal A et al, 2008, Nutrition & Food Science, Vol. 38 Iss: 6, pp.564 - 569

Regulation of trans fats in India

Current Regulations

- Foods with TFA should declare on the label “Hydrogenated vegetable fats or shortening used – contains trans fats”
- Health claim of **trans fat free** can be made when TFA is <0.2 g per serving of food
- Health claim of **saturated fat free** can be made when the SFA does not exceed 0.1 g per 100 g/100 ml of food

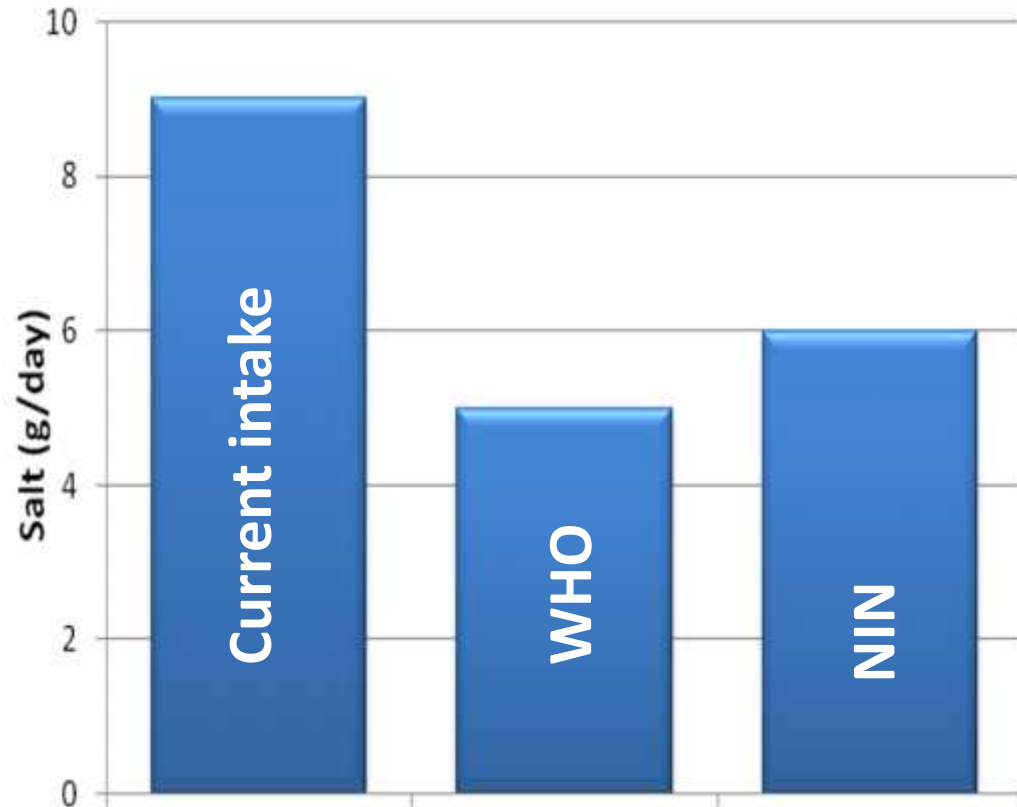
Proposed Regulations

- Level of TFA in vanaspati/PHVO be fixed at 10% maximum and brought down to 5% in 3 years

A glass salt shaker is tipped over, spilling a large amount of white salt crystals onto a wooden surface. The salt is piled up in the center, with some crystals scattered around it. The shaker is partially visible in the upper right corner, and the wooden surface has a natural grain pattern.

SALT CONSUMPTION

Dietary Salt



- Current intakes continue to be high
- Urban rural differences
- Higher with increasing income

Dietary salt intake and HTN risk in an Indian cohort

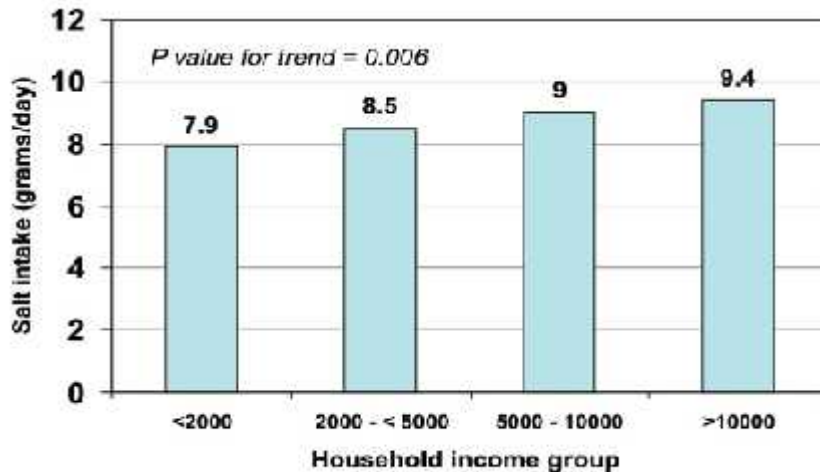


Fig. 1 : Mean dietary salt intake (g/day) by household income (n=1902).

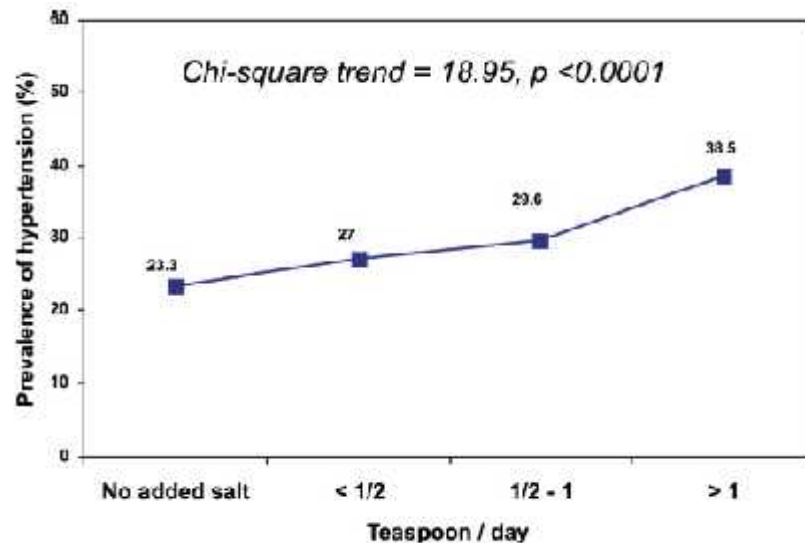
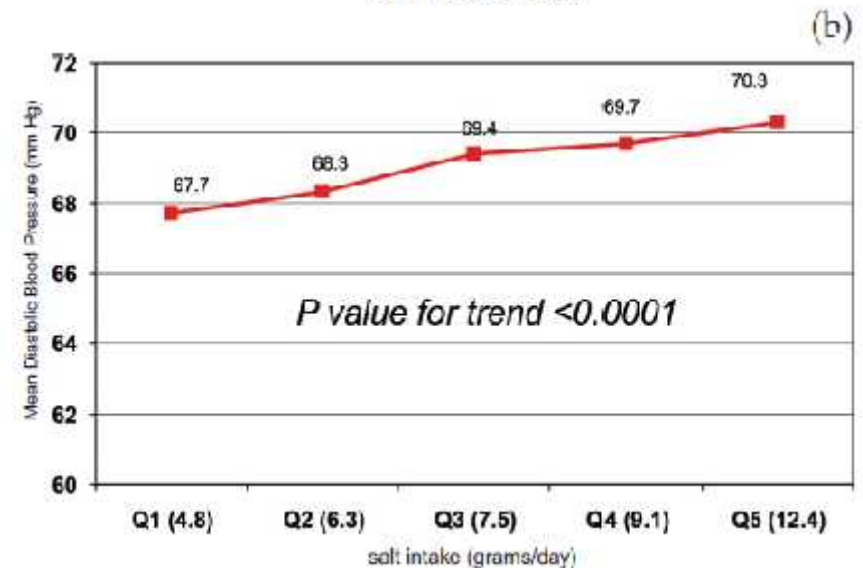
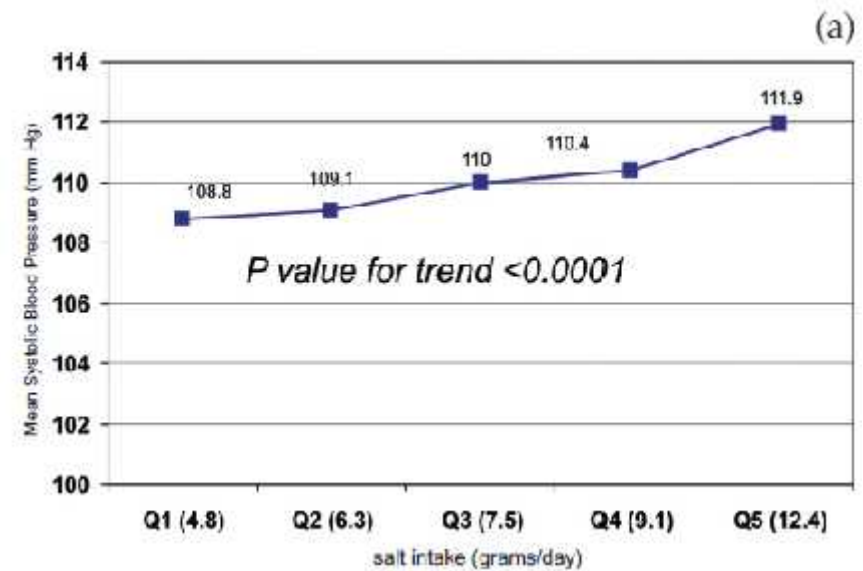








Fig. 2 : Prevalence of hypertension by salt added at the table (n=1902).



Dietary salt in processed foods

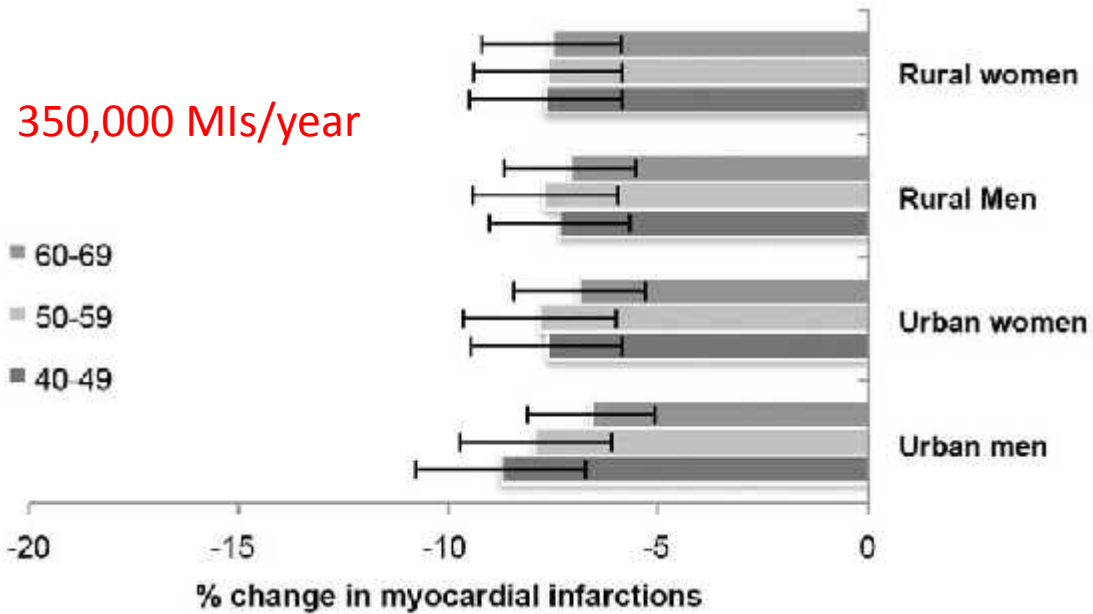
UNHAPPY MEALS TO AVOID			
NUTRITIONAL GUIDELINES			
PERSON	KILO CALORIES ¹	SALT ²	TRANS FATS ³
Adult male	2,320	6	2.6
Adult female	1,900	6	2.1
Children (10-12 yrs)	2,100	6	2.3
<small>* allowed/day **gram/day</small>			
CSE'S DANGEROUS DISCOVERY			
SAMPLE	SALT **	TRANS FATS**	
POTATO CHIPS			
Uncle Chipps Spicy Treat	3.5	0.8	
Lay's American Style Cream & Onions	1.2	0.9	
Bingo, Dyc Pudina	2.3	0.6	
INDIAN SNACKS			
Haldiram's Aloo Bhujia	3.3	2.5	
Kurkure Masala Munch	1.5	0.7	
INSTANT NOODLES			
Masala Maggi	4.2	0.6	
Top Ramen Super Noodles (Masala)	3.2	0.7	
BURGERS			
McAloo Tikki (with cheese)	2	0.3	
KFC's Veg Zinger (with cheese)	1.7	0.7	
Nirula's Subz Burger (with cheese)	1.7	0.3	
McChicken	1.1	0.4	
KFC's Chicken Zinger	1.2	0.5	
Nirula's Chicken Burger	1.2	0.3	
PIZZA			
Pizza Hut's Margherita Pan	1.4	0.1	
Domino's Margherita	0.6	0.1	
Slice of Italy's Margherita Classic	1	0.1	
FRIES			
McDonald's Fries	0.3	1.3	
KFC's Fries	0.8	1.7	
Nirula's French Fries	0.2	1.8	

STOMACH THIS!

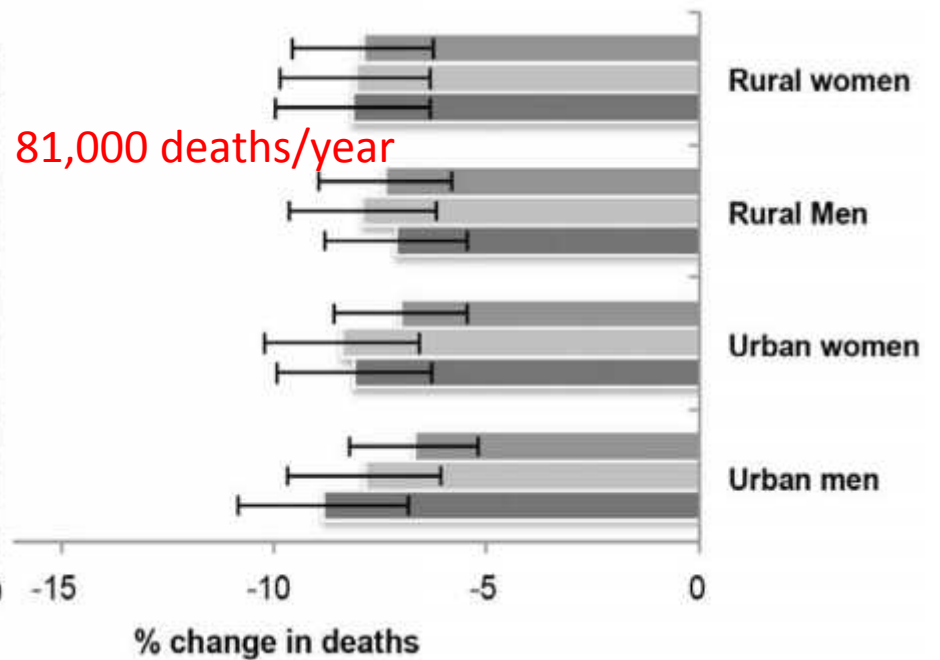
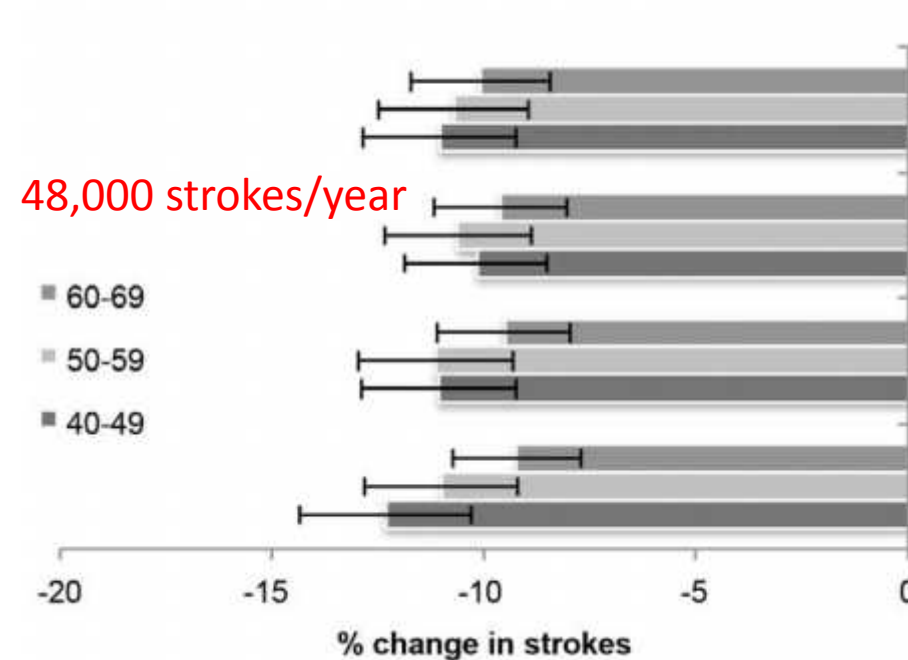
Most junk foods contain very high levels of trans fats, salts and sugar — which inevitably lead to ill health and diseases such as obesity and diabetes. For instance, a two-piece fried chicken (about 250gm) has nearly 60 gm of fats, which is recommended for the whole day, the CSE study found

Companies resort to large-scale mis-branding and mis-information; many say their products contain zero trans fats when actually the study found heavy doses of it

The younger generation is hooked on to junk food and therefore vulnerable to heart diseases in the prime of life. The CSE lab-tested 16 major brands of foods relished by people: Maggi and Top Ramen noodles, McDonald's foods, KFC's fried chicken and Haldiram's Aloo Bhujia, among others



Impact of dietary salt reduction of 3 g/d over a 30-y period on future MI, stroke, and mortality



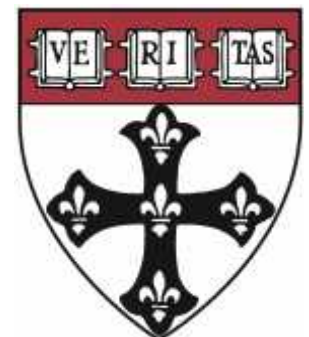
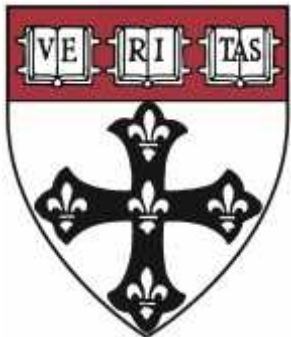
Source: Basu et al (2012) PLoS ONE 7(9): e44037.

NEXT STEPS: MULTI-PRONGED APPROACH

- Understanding the feasibility and acceptability of simple dietary interventions
- Mechanistic studies to understand the lower age of onset of type 2 diabetes
- Effect of educational campaigns
- Effect of policy changes such as soda taxes

QUESTIONS?

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