Effect of Climate Change on Food and Nutrition Security

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The Food and Agricultural Organization (FAO) states that food security emerges when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Food security has three important and closely related components, which are availability of food, access to food, and absorption of food

Average Household Intake of foodstuffs (g/per CU/day): Time trends – States* Pooled

STATES	Period of Survey				RDI (Dietary Guidelines: 2011)
	1975-79	1988-90	1996-97	2011-12	
Cereals & Millets	505	469	450	368	375
Pulses & Legumes	34	32	27	33	75
Green Leafy Veg.	8	9	15	16	100
Other Veg.	54	49	47	48	200
Roots & Tubers	56	41	44	50	200
Milk & Milk Prod.	116	92	86	95	300
Fats & Oils	14	13	12	16	25
Sugar & Jaggery	23	29	21	14	20

*KER, TN, KAR, AP, MR, GUJ, ORI (7 States)

Source: NNMB, Tech Rep 26, 2012

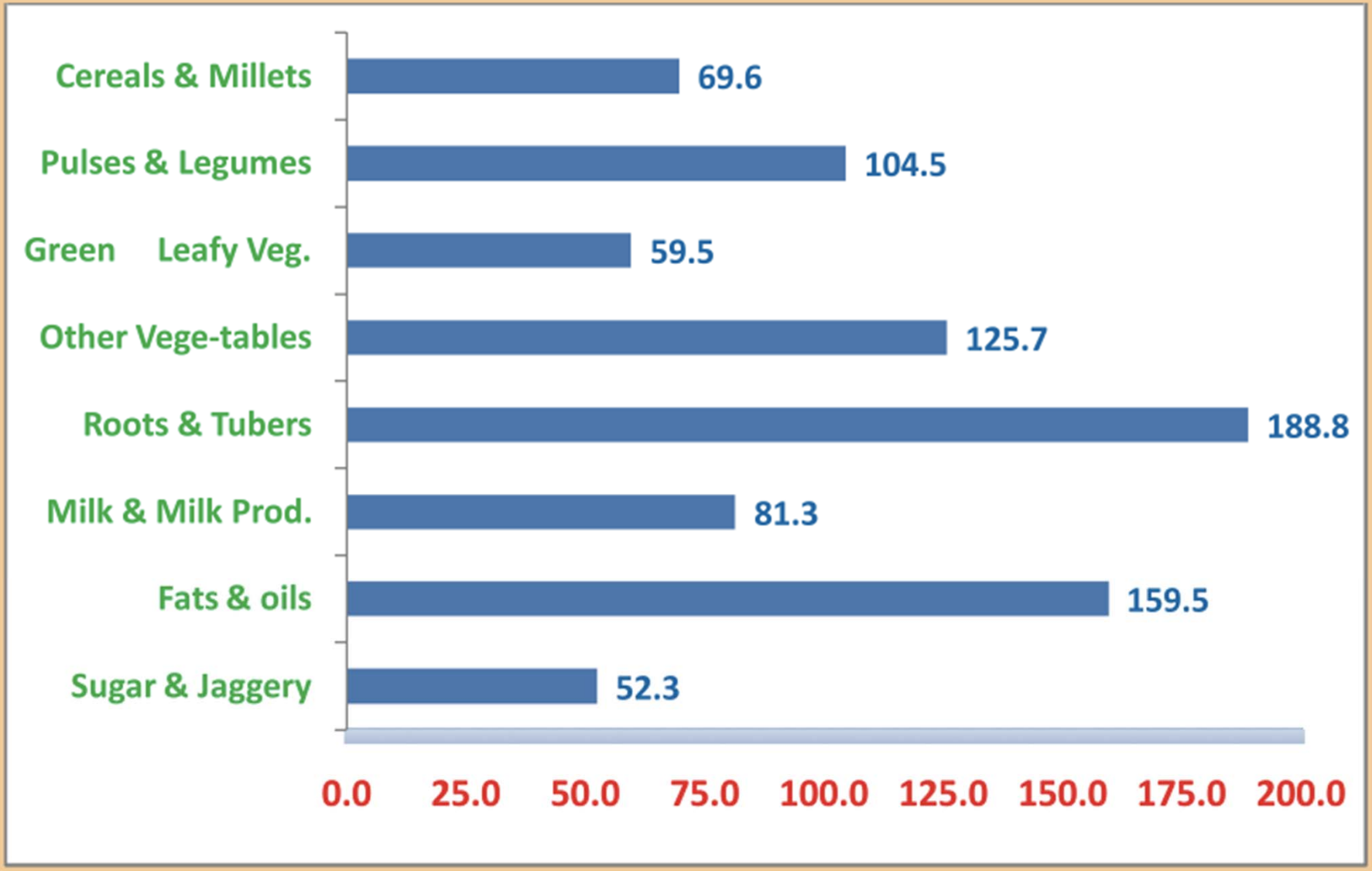
Median Household Intake of Nutrients (per CU/day): Time trends – States* Pooled

STATES	Period of Survey				RDI (2011)
	1975-79	1988-90	1996-97	2011-12	
Proteins (g)	61.5	58.4	53.7	49.0	60
Energy (Kcal)	2349	2283	2108	1852	2320
Calcium (mg)	606	565	521	433	600
Iron (mg)	17.2	15.5	14.2	13.4	25
Vitamin A (µg)	246	282	300	296	600
Thiamin (mg)	1.46	1.33	1.20	1.20	1.20
Riboflavin (mg)	0.81	0.87	0.90	0.80	1.40
Niacin (mg)	14.7	14.2	12.7	13.7	16
Vitamin C (mg)	39	37	40	46	40
Dietary Folate (µg)	-	-	153	127	200

*KER, TN, KAR, AP, MR, GUJ, ORI (7 States)

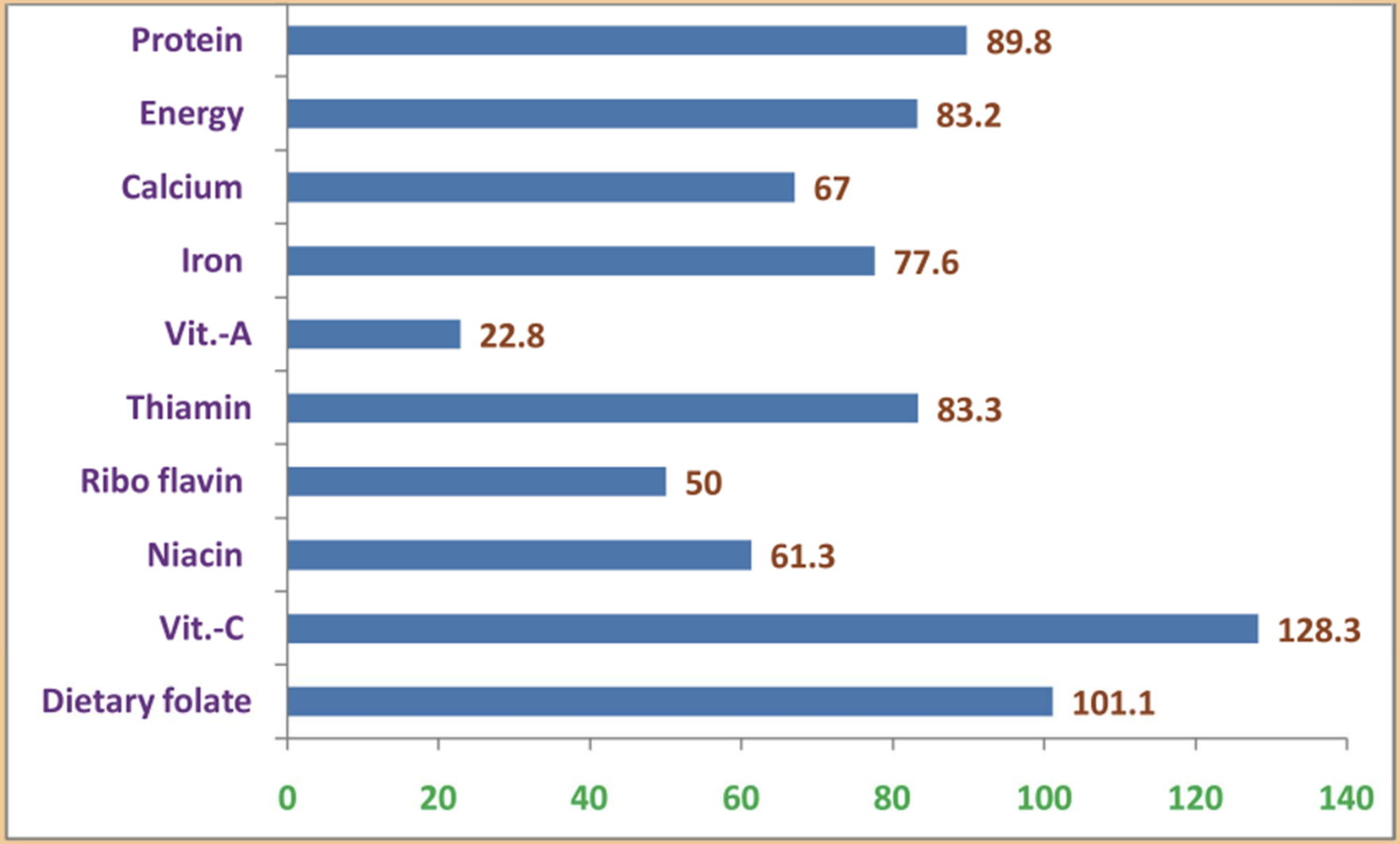
Source: NNMB, Tech Rep 26, 2012

Fig. 4 Average household consumption of foodstuffs as % RDI



NNMB Urban surveys 2017-

Fig. 5 Average Household Consumption Of Nutrients As % RDA



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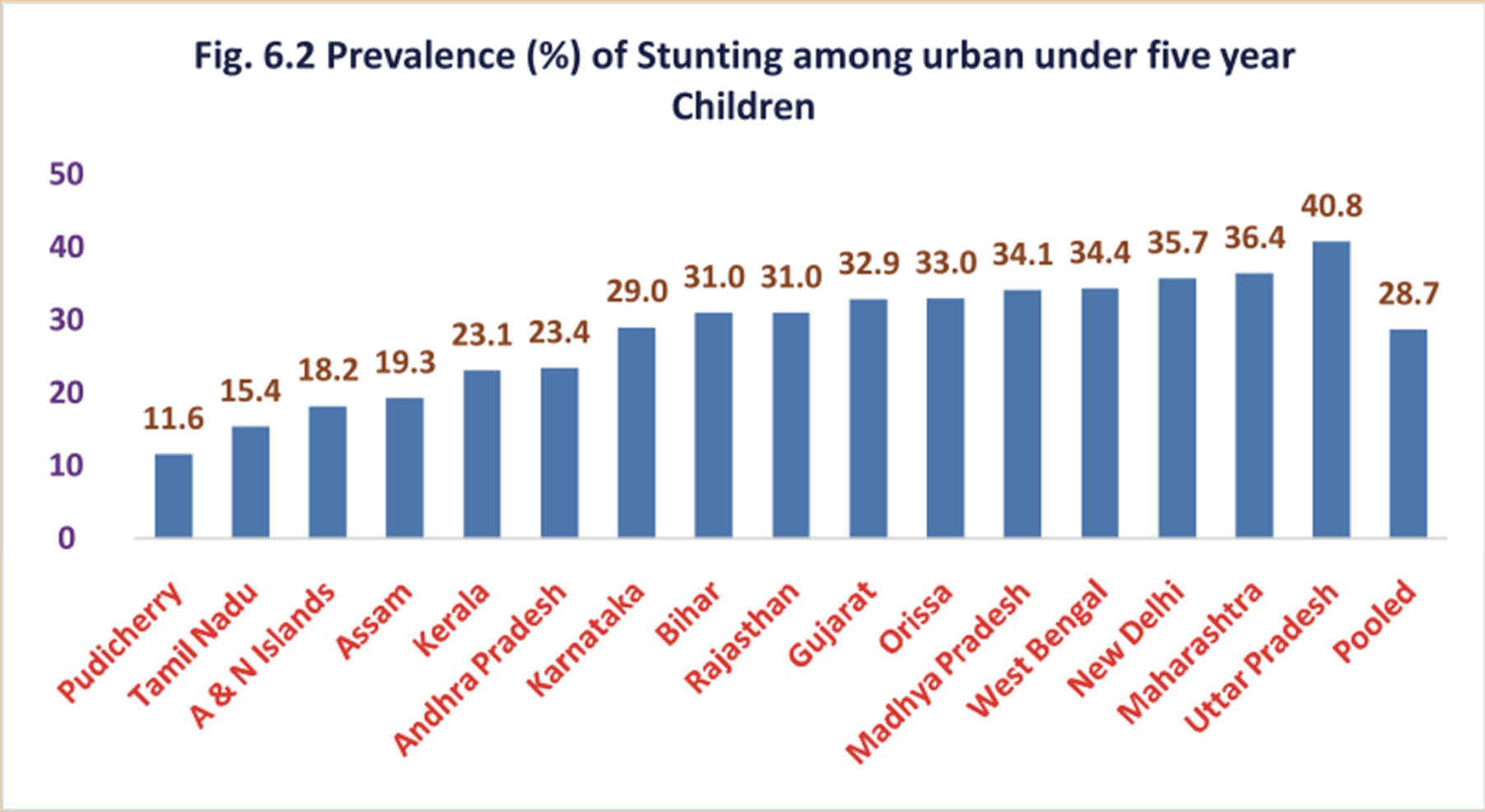

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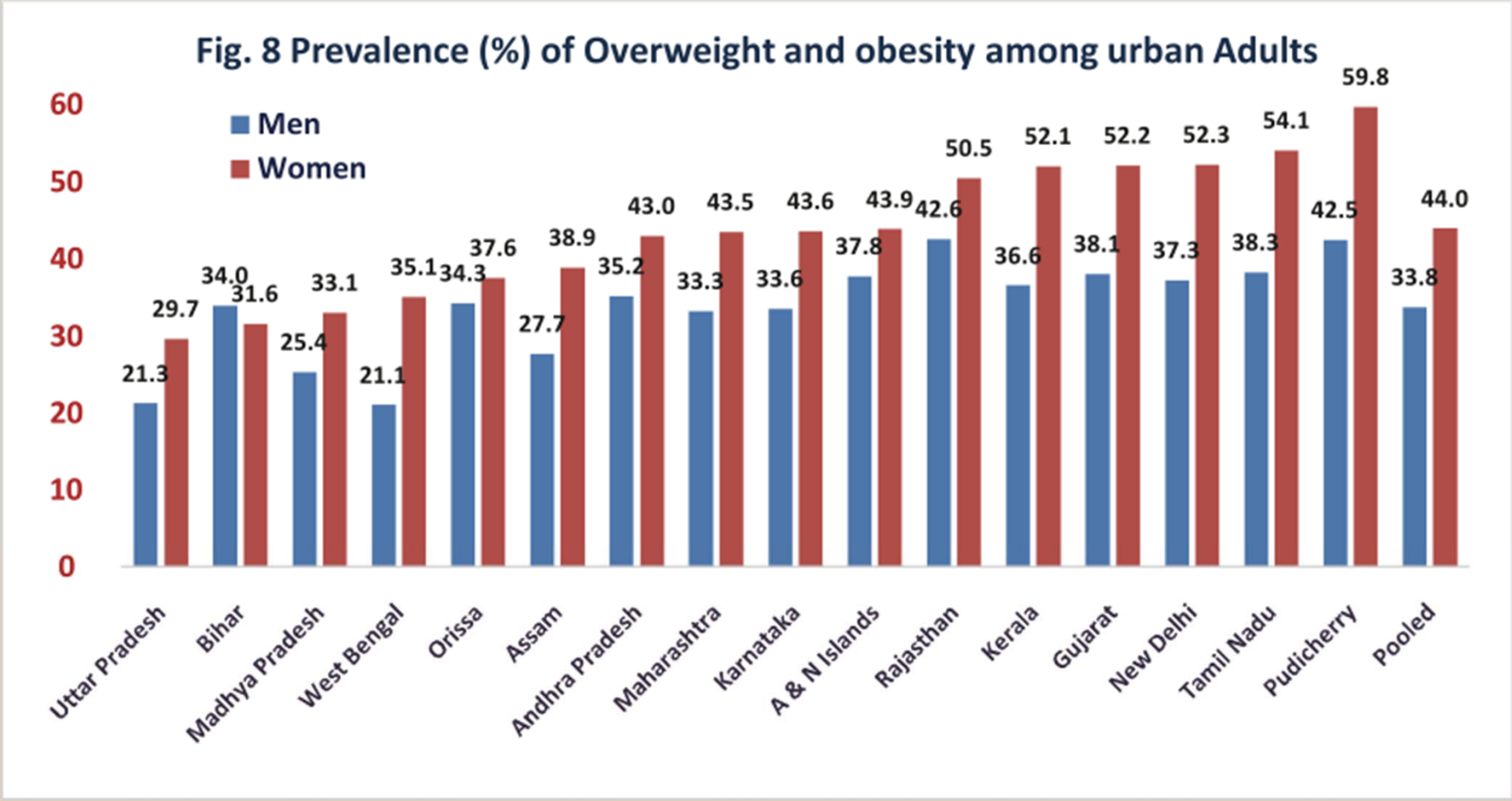

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Table 1B: Growth Rate and Yields of Food grain, Oilseeds and Pulses (percent per annum)

Crop Group/crops	Production		Yields	
	1986-87 to 1996-97	1996-97 to 2007-08	1986-87 to 1996-97	1996-97 to 2007-08
Food grains	2.93	0.93	3.21	1.04
Cereals	3.06	0.97	3.36	1.19
Coarse cereals	1.19	1.53	3.66	2.25
Pulses	1.32	0.36	1.49	-0.02
Oilseeds	6.72	1.99	3.32	1.49
Rice	3.06	1.02	2.37	1.22
Wheat	4.09	0.65	2.93	0.34

Source: ***As in S.Mahendra Dev, and A. Sharma, 2011. There being filled trend rates based on CACP, 2009.***

Anil Chandy I, Food Security in India , IIPH Delhi, 2013,

Table 4: Estimated Production and Projected Demand of Cereals and Non-Cereals

Crop	2008-09			2011-12			2020
	Projected Demand	Projected Production	Surplus/ shortfall	Projected Demand	Projected Production	Surplus/ shortfall	Projected Demand
Rice	92.87	99.15	6.28	98.79	104.21	5.42	111.9
Wheat	72.72	80.58	7.86	77.36	83.61	6.25	79.9
Coarse cereals	35.9	39.48	3.58	38.19	35.75	-2.44	37.3
Pulses	17.51	14.66	-2.85	19.91	15.73	-4.18	23.8
Food grains	219.0	233.88	14.88	234.26	239.3	5.04	252.8
Sugarcane	275.9	271.25	-4.66	322.54	305.51	-17.03	--
Oilseeds	47.4	28.16	-19.27	53.39	27.53	-25.86	--

Source: Ministry of Agriculture (2009)

Anil Chandy I, Food Security in India , IIPH Delhi, 2013,

Global Warming- Our future is disappearing

Impact of climate change

- **The Greatest Challenge of Climate change will be its impact on Food and Nutrition security and the way to manage them.**

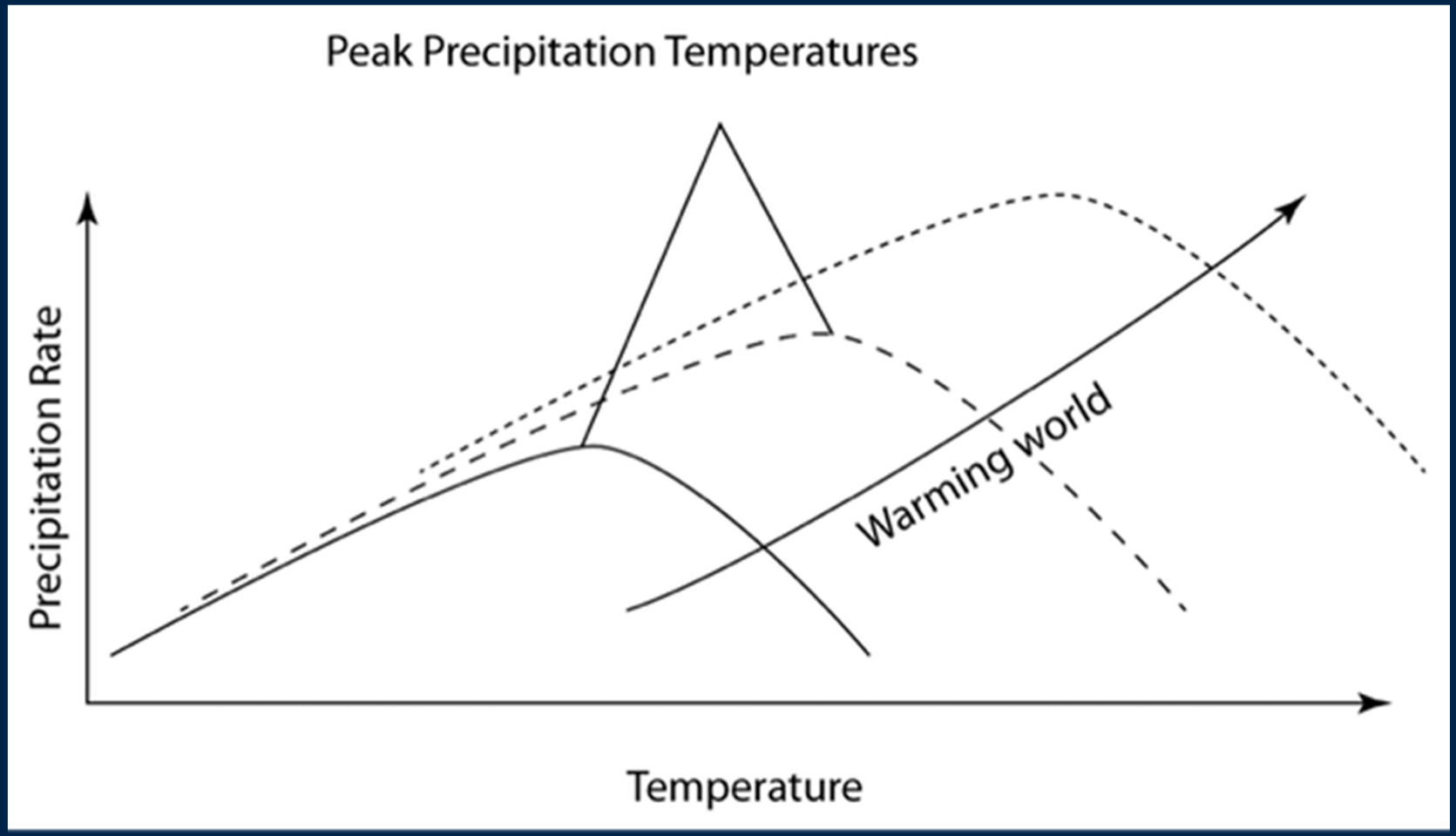
FAO-WHO

Climate change is likely to cause multiple effects on food and nutrition security due to multiple environmental impacts affecting agriculture

Small holder farmers who are the majority are likely to be most affected. (Niles TM et al 2018).

Severe and recurrent droughts with low availability of water for irrigation will result either in crop failures or lower yields.

Between 2008 and 2015 – 4 droughts in Maharashtra (my India 2016)



Abraham J; (2017) The Guardian

- Excessive precipitation and cloud bursts and flash floods occurring prior to harvest could add to crop losses

- Higher ambient temperatures , particularly for winter crops like wheat would reduce grain filling and lower the over yield per hectare.

Higher levels of atmospheric CO_2 is likely to reduce the yields of C3 crops like rice, wheat, soy beans peanuts etc. that cannot handle very high levels due to their inherent photosynthetic pathways

Unlike C4 photosynthetic crops like millets, sorghum, sugar cane which will survive and flourish under such adverse climatic conditions. Use double the amount of CO_2

The consequences of all these would be higher food prices, inability of classical agriculture to increase production and further worsening of malnutrition in the country (Krishnamurthy t al 2012-WFP))

- Compositional changes in food crops are possible when flooding affects arable land.
- This could either wipe out the nutrient rich top soil or bring contaminants from upstream industrial areas
- When soil nutrients get depleted the plant nutrient profiles will be poorer resulting in qualitative changes in foods
- Lead to nutrient deficiency despite food adequacy

Both drought and floods affect the production of fodder crops which are needed for livestock maintenance and cause a fall in meat and dairy outputs contributing to protein inadequacy

Folates and free phenolic acids in 26 wheat cultivars showed a downtrend with total rainfall and an upward trend with mean temperatures.

Arabinoxylans a major dietary fiber in cereals came down with increase in temperatures and went up with higher rainfall. (Shewry et al 2010)

At high temperatures wheat dough strength gets adversely affected due to decrease in the proportion of insoluble Glutenin to soluble Gliadin (Bluementhal et al 1993).

High temperatures during the stages of wheat grain filling cause an increase in sucrose and reducing sugars and a reduction in starch (Jenner 1991)- thus raising the GI(Glycemic Index) of wheat flour.

Under severe drought conditions pest attacks increase

Higher pesticides use, higher residues and unsafe food.

This is also known to increase the pests getting resistant to the sprayed chemicals (Khodaverdi H, 2016)

Grain storage under heavy and persistent rainfall and higher humidity after harvest would result in fungal contamination .

More extensive if the crop were to be pest infested at pre harvest stages.

Levels of fungal toxins like aflatoxins and fumanosins will be higher after such adverse climatic conditions.

When humidity was greater than 70% wheat was extensively affected by the Karnal Bunt (Bandyopadhyay and Fredericksen 1999).

Higher deoxynivalenol in wheat and even diarrheal toxins in shell fish are known to happen when ambient temperatures are very high. (Fels-Klerx 2012)

Rise in sea levels, coastal erosion, soil salinity and loss of agricultutral productivity in coastal cultivations

Periods of drought associated with food and nutrition inadequacies have led to long-term consequences for children born or even conceived during those periods. (Fuentes and Feck 2007).

Individuals exposed to the Dutch winter famine in 1944-45 in-utero had higher rates of insulin resistance, vascular disease, morbidity and mortality in adulthood (Lumey LH, 1998)

Mitigation strategies to increase food productivity

- Increase area under cultivation
- Crop varieties adaptable to climate change
- Improve soil nutrition with appropriate agricultural practices
- Use modern biotechnology for quick results
- Lower greenhouse gases
- Minimise post harvest losses

Advantages & Disadvantages of Various Strategies

STRATEGY	ADVANTAGES	LIMITATIONS
Short Term (Nutrient Supplemen-tation)	Immediate Benefit Very Effective, if properly implemented.	Expensive, Needs Manpower, Inadequate/Irregular Supplies, Inadequate/Irregular Coverage, Non-compliance, Not Sustainable.
Long Term (Nutrition Education/ Dietary Diversification)	Desirable, Sustainable, No cost involved.	Difficult to achieve, Time consuming. Behavior change Better purchasing power
Medium Term (Food Fortification)	Easy, Cost effective, Good compliance, Sustainable, Easy to Regulate.	Risk due to several foods being fortified


Thank you