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Fruits, vegetables, milk and animal foods in balanced Indian diets – a critical appraisal

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In the year 2008, the Indian Council of Medical Research (ICMR) constituted the Expert Advisory Committee to review the latest scientific developments pertaining to the human nutrient requirements, re-examine and appropriately revise the earlier 1989[1] Recommended Dietary Allowances (RDAs) for Indians. For this purpose, a group of scientific experts met on several occasions after 2008 to re-examine the earlier RDA of 1989 for Indians, and reviewed international reports as well as Indian studies on RDAs. While making recommendations regarding nutrient requirements for Indians of different age groups, the Expert Advisory Committee also considered other nutrients in addition to those mentioned in the earlier guidelines. Nutrients such as Mg, Na, K, Zn, trace elements such as Cu, Mn, Cr, and Se, as also vitamin E, antioxidants, and dietary fibre were considered in detail and suggested that the RDAs of these should be increased. The Committee submitted a revised report for RDA in the year 2010, and this was published by the ICMR in November 2010[2].

Fruits, vegetables and milk in Indian diets

With the recognition of the importance of preventing micronutrient deficiencies, and in the light of evidence that micro- and phytonutrients are effective in preventing non-communicable diseases, there has been an upward revision in the RDAs for fruits and vegetables (from 150 g/day to 400 g/day) and milk (from 150 g/day to 200 g/day for nonvegetarians and 300 g/day for vegetarians) (Table 1)[2]. The contribution of vegetables and fruits to the vitamin, mineral and fibre content in a balanced Indian diet is shown in Table 2. It is obvious that fruits and vegetables are the major contributors of these essential nutrients and fibre. The new breakup of the RDAs for vegetables and fruits are: 150 g/day of vegetables, 50 g/day of green leafy vegetables, 100 g/day of tubers, and 100 g/day of fruits. It is a matter of concern that the consumption levels of fruits, vegetables, and milk, as reported in surveys carried out by the National Nutrition Monitoring Bureau (NNMB)[3] in rural areas in seven Indian states (Table 3) are much below the Expert Committee's 2010 recommendations. This may be attributable to supply constraints, poor purchasing power, lack of awareness, or a combination of these factors.

Production of vegetables, fruits and milk

The data on all-India as well as state-wise production and per capita availability of fruits and vegetables, as reported by the Horticultural Data Base 2010-11[4] are shown in Tables 4-6. India earns from exports of both fresh and processed fruits and vegetables (Table 7).The net availability of fruits and vegetables (after taking into account the exports) are more than sufficient to meet the computed requirements as indicated in the RDA 2010[2]. The average production of vegetables in 30 states in India works out to 401 g/day/person, whereas the RDA is only 300 g/day/person. Similarly, the average fruit production in 30 states is reported to be 199 g/person/day which is much more than the RDA of 100 g/person/day (Table 7). Thus, the average production of vegetables and fruits in the country is sufficient to meet the RDAs for a balanced diet. However, there are large interstate differences in the availability of vegetables and fruits. Many are available only in particular seasons of the year. Wastage rates in fruits and vegetables are high ranging between 20-30%. In the last five years, the prices of vegetables and fruits have soared, and lack of affordability has become one of the major factors that limits adequate consumption of vegetables, especially in poorer households.

Vegetables and fruits are the major sources of minerals, vitamins and fibre in the Indian diets, even though cereals and millets[5] as well as pulses and legumes[6] do provide minerals like calcium and iron[6]. Appropriate vegetables and fruits which are rich in micronutrients and bioactive compounds to meet the nutritional requirements for good health can be selected from large variety of fruits and vegetables available in India. In addition to providing micronutrients, vegetables and fruits also contain bioactive compounds such as flavonoids (a form of antioxidants) and other health-promoting agents. Future studies and food composition analyses should include the estimation of these bio-

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Table 1: Balanced diet for a moderately active male adult RDA (2010)[2]

Food composition	Amount g/day	Nutrients	Quantity in the diet	RDA
Cereals & Millets	400	Energy (Kcal)	2730	2730
Pulses (legumes)	80	Protein (g)	80	60
Green leafy vegetables	50	Visible fat (g)	30	30
Other vegetables	150	Calcium (mg)	850	600
Roots & Tubers	100	Iron (mg)	20	17
Fruits	100	Zinc (mg)	12	12
Fats & Oils	30	Magnesium (mg)	600	340
Sugar/Jaggery	40	Vitamin A (µg)	120 (200)	600
Nuts & oil seeds	25	β carotene (µg)	4800	4800
Milk	300-[a] 200-[b]	Thiamine (mg)	2.0	1.7
Animal Foods	60	Riboflavin(mg)	1.5 (1.6)	1.6
		Niacin (mg)	20	18
		Vitamin B6	2.0	2.0
		Vitamin C (µg)	80	40
		Folate (µg)	250	200
		Vitamin B12(µg)	0.4 (1.7)	1.0

a - For vegetarians, 300 g of milk,
b - For non-vegetarians, 200 g of milk and 80 g of animal foods (egg/meat/fish);
Vegetarian diets will contain only 120 µg/day of vitamin A and 0.4 µg/day of vitamin B_{12}, whereas non-vegetarian diets will contain 200 µg/day of vitamin A and 1.7 µg/day of vitamin B_1

Table 2: Fibre, minerals and some vitamins contributed by vegetables and fruits to an Indian balanced diet (RDA 2010)[2]

Nutrient	GLV	Other Vegetables	Roots & Tubers	Fruits	Total	RDA for an Adult man	% of RDA
Amount Recommended per kg^{S-}/day/g	50	150	100	100	400	-	-
Dietary fibre (g)	1.63	6.45	2.70	1.75	12.58	40	31.5
Soluble DF (g)	0.4	1.80	0.81	0.65	3.66	-	-
Calcium (mg)	113.0	74.7	45.6	24.3	257.6	600	42.3
Iron (mg)	1.75	1.34	0.72	0.50	4.31	17	25.35
Zinc (mg)	0.14	0.54	0.28	0.75	1.71	12	14.3
Magnesium (mg)	46.5	50.4	21.0	19.0	136.9	340	40.3
β carotene (µg)	2776	150.0	603	511	4039	4800	84.2
Thiamine (mg)	0.015	0.100	0.073	0.085	0.2730	1.4	19.5
Riboflavin (mg)	0.143	0.123	0.130	0.070	0.466	1.6	29.1
Niacin acid (mg)	0.35	0.85	0.73	0.45	2.39	18	25.2
Folic acid (µg)	67.5	105.8	93.0	30.0	296.1	200	148.0
Ascorbic acid	31.8	56.6	10.3	16.3	115.0	40mg	287.5
Vitamin B_6	-	-	-	-	-	2.0	-

Table 3: Average daily consumption of vegetables, fruits and milk - NNMB survey (rural) [3]

State	GLV	Other Veg.	Roots & Tubers	Fruits	Milk & Milk Products
Kerala	10.0 g	63.0 g	63.0 g	-	122.0 g
Tamil Nadu	10.0 g	41.0 g	41.0 g	-	88.0 g
Karnataka	8.0 g	27.0 g	27.0 g	-	91.0 g
Andhra	9.0 g	28.0 g	28.0 g	-	85.0 g
Maharashtra	9.0 g	52.0 g	52.0 g	-	151.0 g
Gujarat	7.0 g	53.0	53.0	-	12.0 g
Orissa	47.0 g	64.0	64.0	-	12.0 g
RDA (2010)	50 g	150 g	100 g	100 g	[a]300 g [b]200 g
As % of RDA	14%-94%	18%-42%	27%-64%	-	[a]4%-50.3 % [b]6%-75.5%

a Lactovegetarians RDA (2010)
b Nonvegetarians RDA (2010)

Table 4: Production share of major fruits and vegetable crops in India during 2010-11[4]

Major fruit crop production in 2010-11	Percentage share in production	Major vegetable crop production in 2010-11	Percentage share in production
Banana	39.8	Potato	28.9
Mango	20.3	Tomato	11.3
Citrus	10.0	Onion	10.3
Papaya	5.6	Brinjal	8.1
Guava	3.3	Tapioca	5.5
Apple	3.9	Cabbage	5.4
Pineapple	1.9	Cauliflower	4.6
Sapota	1.9	Okra	3.9
Grapes	1.6	Peas	2.4
Pomegranate	1.0	Sweet potato	0.7
Litchi	0.7	Others	18.8
Others	10.1		
Total 000 MTons	4878	Total 000MTons	146554

Table 5: Production of major vegetables in India (2010 -11)[4]

Vegetables crops	Area under production (hectares)	Production ('000 MT)	Productivity MT/HA
Potatoes	1863	42339	22.1
Tomatoes	866	16,526	19.1
Onions	1064	15,118	14.2
Brinjal	680	11,896	11.5
Tapioca	221	8076	36.5
Okra	496	5784	11.6
Peas	370	3517	9.5
Sweet potato	113	1047	9.3
Others	2083	27567	13.2
Total	8495	146554	17.3

Table 6: Production of major fruits in India (2010 -11)[4]

Fruits Crop	Area under production (hectares)	Production ('000MT)	Productivity MT/HA
Banana	830	29870	36.9
Mango	2297	15,188	6.6
Citrus	846	7464	8.8
Papaya	106	4196	39.6
Guava	205	2462	12.0
Apple	289	2891	10.0
Pineapple	89	1415	15.9
Sapota	160	1424	8.9
Grapes	111	1235	11.1
Pomegranate	107	743	6.9
Litchi	73	497	6.4
Others	1265	7583	6.0
Fruits Total	6383	74878	11.7

components besides vitamins and minerals.

Milk

Milk is an essential food item for a balanced diet to meet the requirements for proteins, vitamins, and minerals particularly calcium. As mentioned earlier, the RDA of milk for Indian vegetarians is 300 g/day. For non-vegetarians it has been set at 200 g/day, with the advice to consume 80 g of meat, eggs or fish to provide vitamin B_{12} and animal proteins to the levels necessary for a balanced diet.

Milk production as reported by National Dairy Development Board in India[7] and percapita availability of milk in India and different states of the country is given in Table 9. Average per capita, milk production is 285 g/day, while intake recommended under RDA is about 230 g (300 g/day for a lactovegetarian and 200 g for a non-vegetarian). At all India level, the average available milk is sufficient to meet the requirements recommended by the ICMR Expert Committee on RDA, but there are substantial interstate variations in the availability of milk. Affordability is another constraint that may come in the way of adequate milk/curd intake in poorer segments of population.

The RDA for milk (including 100 g of curd) has been set at 300 g a day for lactovegetarians. Although this level of milk intake would provide good quantities of protein (0.4 g), calcium (360 mg), vitamin A, many B vitamins, and minerals (Table 10), its contribution of vitamin B_{12} will be only 0.45 µg as against the RDA of 1.0 µg. However, nonvegetarians who consume the recommended quantity of 80 g of animal foods/day will get 1.7 µg of vitamin B_{12}, which meets the RDA. Attempts have been made, but with only limited success, to increase the vitamin B_{12} content in curd by 1 µg/100 g by using modified Lacto bacillus fermented milk to make curd or yoghurt. It would be worthwhile to continue with such efforts. An alternative approach is to fortify the recommended quantity of 100 g of curd with vitamin B_{12}, keeping in mind that orally ingested vitamin B_{12} is absorbed only to the extent of ~80%, and therefore an intake of >1 µg of vitamin B_{12} is necessary to ensure that the RDA is met. There is an advantage in using curd as the vehicle to supply adequate vitamin B_{12}, either by fortifying it with synthetic vitamin B_{12} or by inducing additional

Table 7: Export of Horticultural Products[4]

Exported fruits, vegetables and other products	Quantity (MT)	Value (Rs.Lakhs)
Fresh Onions	1163472.64	174155.41
Other fresh vegetables	490914.05	89293.61
Walnuts	5244.58	158590.59
Fresh Mangoes	59220.79	
Fresh Grapes	99311	41206.32
Other fresh fruits	253850.99	8964.74
Total	2072014.80	38556.28
Processed fruits and vegetables		
Dried preserved vegetables	110173.93	51697.09
Mango pulp	171929.43	81400.66
Other processed fruits and vegetables	622171.31	264733.33
Grand Total	2733144.75	676461.01

Table 8: Vegetables and fruits production and per capita availability in Indian states[4]

State	State population	Vegetable production ('000 MT)	Vegetable availability g/person/day	Fruit Production ('000 MT)	Fruit availability g/person/day
Andhra Pradesh	7,6210,007	11,847.6	425.92	9417	338.54
Arunachal Pradesh	1,0,97,968	38.5	96.07	107.9	269.24
Assam	2,66,55,528	2925.5	300.69	1763.5	181.76
Bihar	8,29,98,509	14,630.2	482.93	3911.8	129.13
Chhattisgarh	2,08,33,803	4248.8	558.73	1569.6	206.41
Goa	13,47,668	57.8	117.50	78.6	200.48
Gujarat	5,06,71,017	9379.5	507.14	7245.0	499.87
Haryana	21,1,4,864	4649.3	607.42	356.6	46.21
Himachal Pradesh	60,77,900	1474.9	664.84	1031.1	464.79
Jammu & Kashmir	1,01,43,700	1559.1	421.10	2208.5	599.74
Jharkhand	2,69,45,829	4112.5	418.14	779.6	79.27
Karnataka	5,28,50,562	9056.4	469.49	6273.6	325.22
Kerala	3,18,41,374	3392.7	291.92	2508.3	215.82
Madhya Pradesh	6,03,48,023	3698.6	122.52	3373.5	153.15
Maharashtra	9,68,78,627	7504.0	212.21	9513.0	269.0
Manipur	21,66,788	236.5	299.03	286.3	362.0
Meghalaya	23,18,822	356.5	421.21	241.9	285.84
Mizoram	8,88,573	115.6	356.43	211,5	625.12
Orissa	3,68,04,660	7790.1	579.89	2048.3	152.47
Punjab	2,43,58,999	3585.8	403.3	1373.2	154.45
Rajasthan	5,65,07,188	885.0	42.91	695.1	33.96
Tamil Nadu	62,40,679	8279.9	363.50	9965.0	437.48
Tripura	31,99,203	532.3	455.85	643.9	551.42
Uttarakhand	84,89,349	1030.9	332.70	718.9	57.74
Uttar Pradesh	16,61,97,921	17679.4	291.44	5368.4	88.50
West Bengal	8,01,76,197	26,725.5	913.25	2952.8	100.98
Andaman & Nicobar Islands	3,56,152	34.5	265.39	28.7	220.78
The other states	1,660,32	346.38	43.03	32.2	-
Total / average	102860328	146554.5	401.51	432.47	199.439

synthesis of the vitamin, because curd is quite stable and is very widely consumed. If the introduction of additional vitamin B_{12} in milk (curd) is achieved, Indians who are lactovegetarians will also be able to meet the RDAs for this essential nutrient.

Reports from the US, Canada and the UK on vitamin B_{12} content in milk reveal that cow's milk is a good source of vitamin B_{12}, with 100 g of the milk containing 0.5-1.0 µg of vitamin B_{12}. One glass of cow's milk (250 g) provides 2.5 µg of vitamin B_{12}, adequate to meet the RDA for an adult man. It is also reported[8] that vitamin B_{12} from cow's milk is more easily absorbed than that from other sources[9]. There is need for a thorough reinvestigation of cow milk and buffalo milk in India to determine their actual vitamin B_{12} content. The vitamin B_{12} content in milk could vary depending upon the processing it undergoes (cooking, heating, converting to curd or yoghurt) and storage conditions (cooled/not cooled)[10]. It may be possible to process the milk so as to retain its vitamin B_{12} content at the maximum possible level, and at least at a level of 0.5 µg/100 g. The vitamin B_{12} content in milk may depend on the feed given to the cow or buffalo. Some recent studies in India[10] report that fresh cow's milk contains ~3.4 µg of vitamin B_{12}-an estimate that appears to be rather high. It has been shown that the vitamin B_{12} content may get reduced by dilution with water, or during storage or boiling (all of which are common household practices) to 2.1 µg (21% decrease). These results have to be reinvestigated to confirm the observations, because it is important to ensure adequate vitamin B_{12} content in milk at the recommended level (0.5 µg/100 g).

Summary

1. An Expert Advisory Committee was appointed by the Indian Council of Medical Research in 2008 to draw up revised RDAs of various nutrients for Indians. In 2010, the Committee came out with the new recommendations for RDAs and also provided the composition of a balanced diet to meet these requirements.

2. The balanced diet recommended by the Committee contains higher quantities of vegetables, fruits and milk to ensure adequate intake of food stuffs to meet the daily

Table 9: Milk production and per capita availability during 2010-11 in Indian states[7]

State	Production 000Tones	Per capita availability g/day	State	Production 000Tones	Per capita availability g/day
All India	121848	281*	Orissa	1671	113
Andhra Pradesh	11203	364	Punjab	9423	937
Arunachal Pradesh	28	63	Rajasthan	13234	538
Assam	790	71	Sikkim	43	194
Bihar	6517	184	Tamil Nadu	6831	278
Goa	70	93	Tripura	104	80
Gujarat	9321	435	Uttar Pradesh	21031	289
Haryana	6267	679	West Bengal	4471	137
Himachal Pradesh	1102	446	Andaman & Nicobar	25	142
Jammu & Kashmir	1109	378	Chandigarh	45	87
Karnataka	5114	237	Dadra	11	83
Kerala	2645	210	Daman & Diu	1	14
Madhya Pradesh	7514	287	Delhi	480	72
Maharashtra	8044	197	Lakshadweep	2	71
Meghalaya	79	83	Pondicherry	47	94
Manipur	78	88	Chhattisgarh	1029	117
Mizoram	11	31	Uttaranchal	1383	383
Nagaland	76	93	Jharkhand	1555	136

* The per capita availability is 281 g/day/person, which is higher than the average per capita milk requirement of 258 g/day. This average requirement is calculated assuming that 70% of the population is non vegetarians (RDA for milk 240 g/day) and 30% are vegetarians (300 g/day).

Table 10: Vitamin B_{12} Contribution from Milk

	Milk volume (ml)	Vitamin B_{12} content (µg)	Total vitamin B_{12} content (µg)
RDA 2010	300	0.45	0.45
As milk	200	0.3	1.45
As curd fortified with 1 µg vitamin B_{12}	100	1.15	
As per latest value for vitamin B_{12} content in milk* (0.5 µg/100 ml)*	300	1.5	1.5
As per earlier value for vitamin B_{12} content in milk	200	0.3	1.9
Animal food for Non.veg.	Animal food	1.6	
As per latest value for vitamin B_{12} content in milk* (0.5 µg/100 ml)	200	1.0	2.6
Animal food for non.veg	Animal food	1.6	

requirement of vitamins, minerals and dietary fibre for a moderately active adult male.

3. Available data (population census figures of 2011 and production figures for 2010-2011) show that the production and supply of vegetables, fruits and milk are sufficient to meet the average per capita RDA needs of the Indian population.

4. Currently used food composition tables suggest that vitamin B_{12} intake may be insufficient in vegetarian diets, whereas non-vegetarians can meet the requirement from animal foods.

5. However, there are reports from the US, Canada and other countries showing high vitamin B_{12} content in milk. If these data hold good for milk in India, the Committee's RDA for milk (300 ml) can by itself meet the vitamin B_{12} requirement for vegetarians. It is, therefore, important that the vitamin B_{12} content of milk (buffalo and cow) in India be reinvestigated. If vitamin B_{12} content of milk is at least 0.5 µg/100 g, the RDA for vitamin B_{12} for vegetarians (as well as non-vegetarians) can be met from milk.

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References

1. Indian Council of Medical Research-Nutrient Requirement and Recommended Dietary Allowances for Indians-A Report of the Expert Group of the Indian council of Medical Research. National Institute of Nutrition, Hyderabad, 1989.

2. Indian Council of Medical Research-Nutrient Requirement and Recommended Dietary Allowances for Indians-A Report of the Expert Group of the Indian council of Medical Research. National Institute of Nutrition, Hyderabad, 2010.

3. Report of the National Nutrition Monitoring Bureau during 1983-1996. www.ninindia.org/nnmb.htm accessed on 16.12.2012.

4. Indian Horticultural Data Base 2010-11nhb.gov.in/area-pro/database-2011.pdf •.accessed on 16.12.2012 .

5. Rao BSN. Millets in Indian Diets. An overview, NFI Bulletin. 33 (3): 1-7, 2012.

6. Rao BSN. Pulses and legumes as functional foods, NFI Bulletin. 23(1):1-4, 2002.

7. Milk production in India – National Dairy Development Board http://www.nddb.org/English/Statistics/Pages/Milk-Production.aspx•.accessed on 16.12.2012.

8. Malte JJ, Guay F. Bioavailability of vitamin B12 in cows milk. Br J Nutr., 107, 61, 2012.

9. Drewnowski A. The contribution of milk and milk products to micronutrient density and affordability of the US diet. J. Am. Coll. Nutri, 4225-85, 2011.

10. Bahman S, Yadav N, Kumar A, Ganguly N, Garg V, Marwaha SS. Impact of household practices on the nutritional profile of milk. Indian Journal of Public Health. 56, 82-87, 2012.

NUTRITION NEWS

The 44th National Conference of the Nutrition Society of India was held at Sri Venkateswara University, Tirupati on 16th and 17th November 2012. The theme of the Conference was "Current Trends in Food Security to meet National Nutritional Challenges".

Gopalan Oration: The Thirty-sixth Gopalan Oration was delivered by Prof. Reynaldo Martorell, (Hubert Department of Global Health, Emory University, NE, Atlanta, USA) on "The First 1000 Days and Human Development: Implications for India".

Srikantia Memorial Lecture: The Twenty-fourth Srikantia Memorial Lecture was delivered by Dr.B.S. Ramakrishna (Adjunct Professor of Medicine, Yale University) on "Gut Microbiota : Roles in Nutrition and Perturbations in Disease".

Dr. Rajammal P. Devadas Memorial Award: The Third Dr. Rajammal P. Devadas Memorial Award lecture was delivered by Prof. Vijaya Khader (Former Dean, ANGRAU, Hyderabad) on "Impact of Economic Empowerment of Women on Health Security – Lessons from Studies in South India and Kenya".

Two symposia were held during the conference: Symposium-1: Functional Foods andHealth. Symposium-2: Traditional and Novel Technologies for Nutritional Security.

FOUNDATION NEWS

• Study Circle Lecture

"Feeding the critically ill child – a holistic approach" by Dr Sarath Gopalan (Deputy Director, Nutrition Foundation of India) on 15th October 2012.

• Annual Foundation Day and C. Ramachandran Memorial Lecture

The Annual Foundation Day of NFI was celebrated on 22nd November 2012. On this occasion, Dr B. Sesikeran (Former Director, National Institute of Nutrition, Hyderabad) delivered the C. Ramachandran Memorial Lecture on "Changing scenario of micronutrient deficiencies".

• Symposium

NFI organized a one-day symposium on "Newer Health and Nutrition Challenges" on 23rd November 2012. The programme of the symposium is given below

Dr Chandramouli (RGI): Annual health survey: -mortality Indicators

Dr RC Sethi (Addl RGI): Key findings on injury and morbidity from annual health survey

Dr Prema Ramachandran (Director, NFI): Infant growth: data from ongoing NFI studies

Dr Sarath Gopalan (Executive Director, CRNSS): Celiac disease – the clinician's perspective

Dr Ramesh Bhat (Former DD, NIN) : Food safety challenges in India and measures to overcome them

Dr B Sesikeran (Former Director, NIN): Safety and efficacy assessment of Bioactive Molecules/ functional foods/ nutraceuticals

Dr Prabhakaran (Prof., PHFI): Non communicable diseases in India : dynamics, dimensions and directions

Dr Geeta Trilok Kumar (Associate Prof., (IHE): Effect of Vitamin D supplementation on mortality, morbidity and growth in low birth weight term infants

Dr K Madhavan Nair (Scientist E, NIN): Anaemia in pregnancy: iron, folate and vitamin B_{12} status

The symposium was well attended and there were useful discussions after the presentations .

Food production, food price inflation and food security

Prema Ramachandran

When India became independent in 1947, it was not self-sufficient in food production; rapid population growth imposed a great strain on the country's efforts to reduce the gap between supply and requirement of food grains. India was a net importer of food grains in the 'Fifties and 'Sixties, and its dependence on imported food was reflected in the picturesque term a "ship to mouth" existence. Recognizing that self-sufficiency in food grain production is the essential prerequisite for national and household food security, the Indian government embarked on multi-pronged interventions to achieve self-sufficiency in food production.

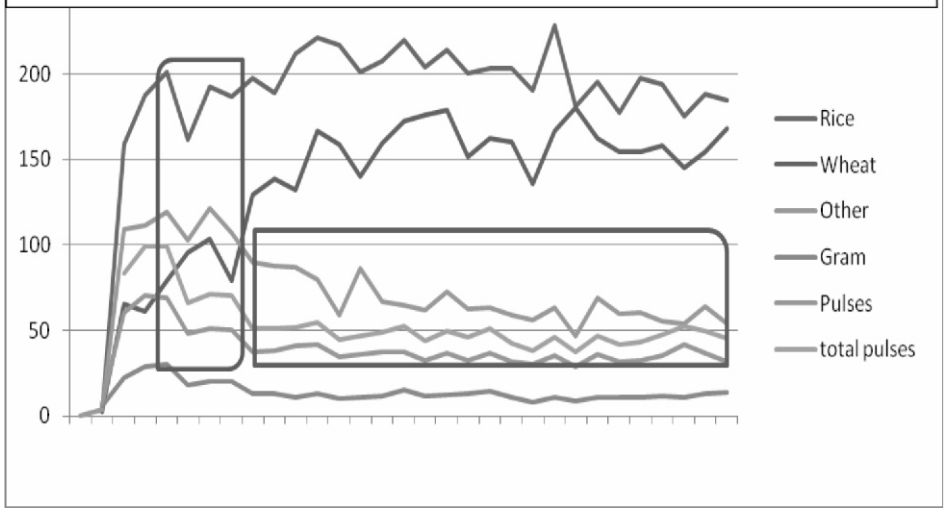
It was recognised that farmers have to be assured of returns for their investment if they are to meet the policy makers' prescription to grow more food grains to bridge the gap between demand and supply. Several steps were taken to ensure congruence among economic policies, especially those related to agriculture. The major policy initiative included land reforms to enable farmers to invest their money, time and labour in improving farm yield.

Policy-cum-investment decisions included assigning priority to building dams and irrigation canals to improve the area under cultivation and reduce the impact of the vagaries of the monsoon on food production. Under this enabling environment, the advent of technology of high-yielding varieties of rice and wheat, and investment in lab-to-land agriculture extension education provided the necessary impetus for the Green Revolution; the responsiveness of the farming community ensured rapid increase in food grain production[1]. The accelerating convergence of policies, programmes, and R&D efforts enabled the country to achieve self-sufficiency in food production within a decade. Ever since, India has not only continued to meet the needs of the growing population as regards food grains (Figure 1)[1], but has also built up adequate buffer stocks. The Green Revolution and the massive increase in production of rice and wheat within a decade thereafter are testimony to what can be achieved when economists, agriculture scientists, and farmers pull together. The production projections for 2030 indicate that, in spite of several constraints, India will remain self-sufficient in food grains.

Improving access to food

In the 1970s, although India achieved self-sufficiency in food production at the national level, 3/4th of Indians spent 3/4th of their income on food; in spite of this, 3/4th of preschool children were undernourished. When dealing with national and household food security, India has always had to balance two conflicting imperatives-(i) to ensure sufficient remuneration to farmers and (ii) to keep food prices low. In the period between 1950 and 1970, agriculture provided employment for 2/3rd to 3/4th of the population in different States. A majority of small and marginal farmers were poor, and unless agriculture provided them with adequate remuneration, they would continue to remain poor and food-insecure. At the same time, because of the high poverty and food insecurity among other segments of population, it was imperative to keep the food prices low. The Government of India, therefore, adopted a two-pronged strategy.

Fig 1 Percapita net availability of food grains (grams /percapita / perday)



In order to ensure that agriculture remains an economically viable option for farmers and that they would continue to grow more food grains, the government introduced a slew of measures:

- increasing fertilizer production
- making fertilizers available at subsidized rates
- providing minimum support prices for food grains, and
- farm-level procurement of food grains

These measures played a major role in assuring farmers of reasonable and assured income from producing food crops, and thereby enabled them to improve their household food security.

In the immediate post-independence era, poverty and lack of purchasing power were the major determinants of low food consumption. In the four decades thereafter, India's economic growth was steady but slow, and per capita income continued to be low. Efforts were made to improve gross domestic product (GDP) growth and boost per capita income and the overall economic status of the population. However, these efforts did not result in high GDP growth rates until the 1990s[2]. From the 1970s India had invested in poverty alleviation programmes, including the food-for-work programme, to improve the purchasing power of households from poorer segments of the population. In order to improve household food security among the poor, the focus was on:

- administered prices of food grains to keep food grain costs low
- improving public food distribution to improve access to food
- food subsidy especially to poor and marginalised segments of the population, and
- making food supplements available to vulnerable segments of the population.

Figure 2: Time trends on% share of food and non food expnditure on consumer expenditure (from NSSO rounds 27-61 coverning 1973 -2004 in urban and rual popualtion)

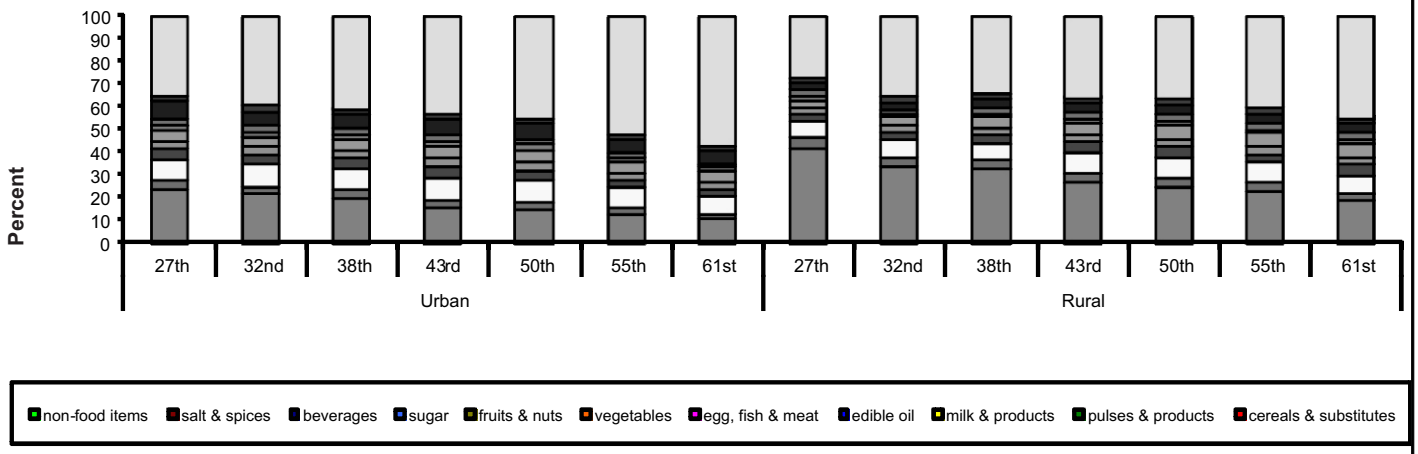


Figure 3: % per capita expenditure on cereals to total expenditure (Rural)

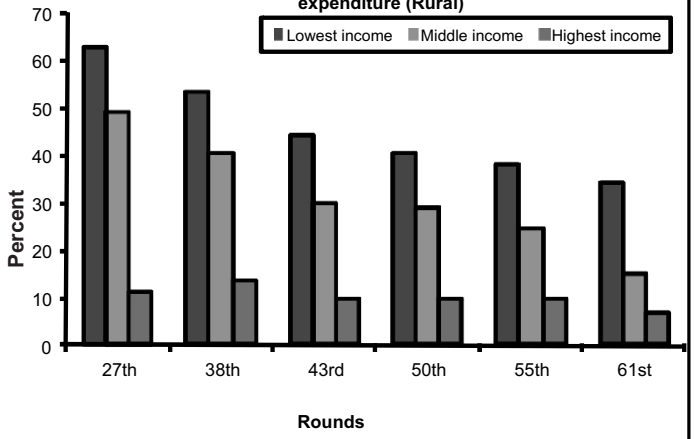
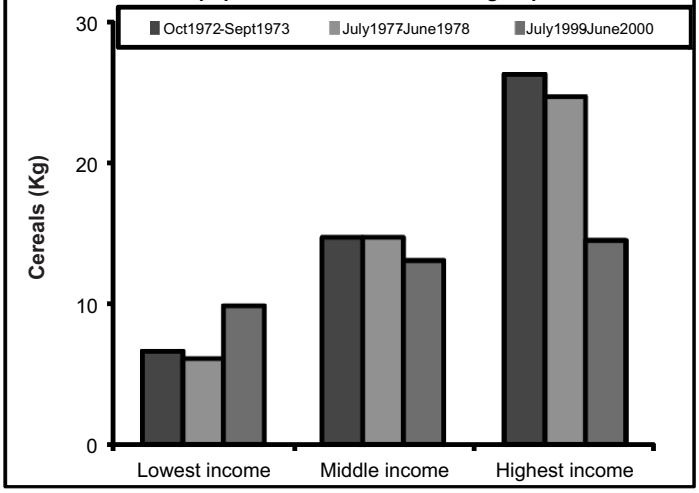


Figure 4: Quantity of Cereals (Kg) consumption in ruralpopulation in differnt income groups

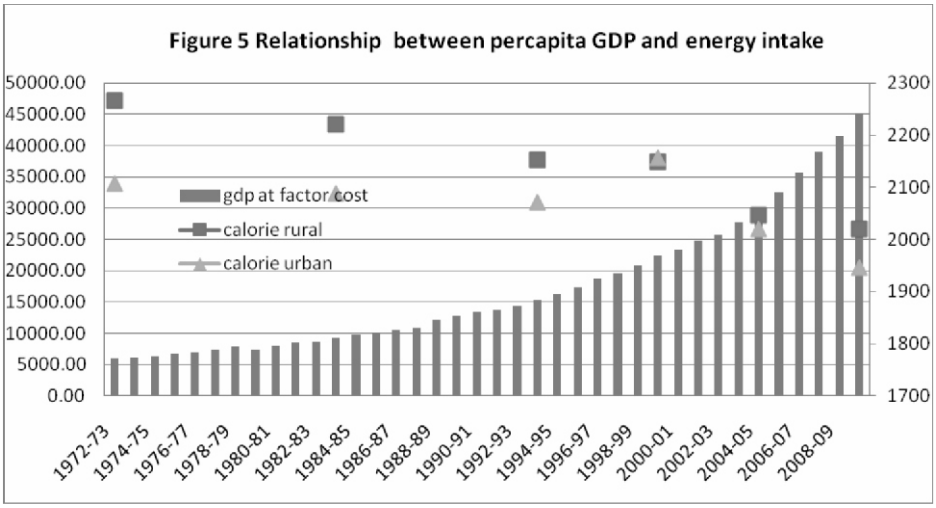


As a result of these measures, there has been a reduction in the percentage of household income expended on food grains, without any concomitant reduction in household energy intake (Figures 2, 3 and 4)[3] .

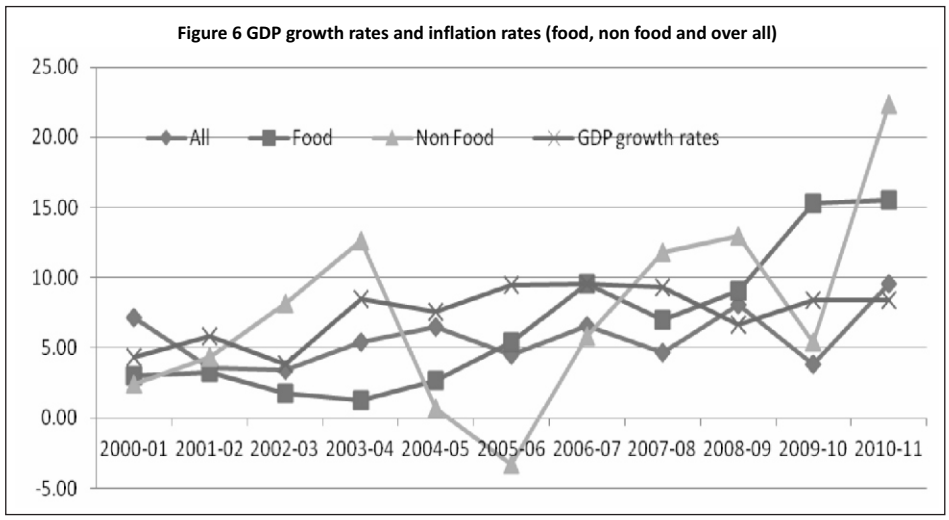
GDP growth and calorie intake

Over most of the past two decades, there has been an acceleration in economic growth in the country. During the last decade, India's rate of growth has been the second fastest in the world. In most developing countries that are undergoing rapid economic growth, there is a concurrent increase in energy intake and consumption of animal foods by the population. Time trends in GDP growth at factor cost between 1972-73 and 2009-10[2], and the per capita energy intake of urban rural households over this same period (based on NSSO data)[3] are given in Figure 5. The rapid increase in GDP in the 1990s was accompanied by a progressive reduction in per capita energy intake in both urban and rural areas, mainly in the middle-and high-income groups; over that same period, there was a small increase in per capita energy intake in the low-income group. Given that the expenditure on food as a proportion of overall consumer expenditure has shown a progressive decline, and that food grain costs remained low till 2008, the decline in energy intake cannot be attributed to economic constraints.

Figure 5 Relationship between percapita GDP and energy intake



Over the past few decades there has been some reduction in physical activity in both urban and rural populations, and



over the last two decades this decline has been steep mainly because of better transport facilities and increasing mechanisation of both work-related and domestic domain-related activities. It is possible that the lower energy intake, particularly of food grains, is a natural response to lower energy requirements.

These data suggest that the population is perceptive and rapidly adapts to changing lifestyles and habits; this might account for the relatively slow increase in obesity rates in India. Adequate physical activity is essential for health and wellbeing. Currently efforts are being made to increase discretionary physical activity in all segments of the population so that they remain normally nourished and healthy.

Food price inflation and food security

The year 2008 witnessed a steep increase in food grain prices globally, and a consequent increase in the number of food-insecure households. India has also been experiencing steep and sustained increases in food prices during the last few years. Available data from the NSSO surveys up to the year 2009[3] indicate, however, that this situation has not resulted in any further reduction in food intake. The growing fear that high food prices could result in erosion of household food security, not only among the poorer segments of population, but also among the low-middle-income groups, prompted the government to give high priority to economic measures to tame inflation rates. There has been a slowing down of economic growth in India, and currently the GDP growth rate is less than 6%[2]. The tight economic policy, aimed at curbing inflation, has been blamed as one of the factors responsible for the slowdown in GDP growth since 2009. Currently, however, despite the government's efforts, food price inflation continues to be high, whereas GDP growth continues to be low. This combination is a cause for concern.

India has been tracking GDP growth rates as well as inflation rates (both food and non-food) over the last several decades. Data on GDP growth rates and inflation rates based on the Whole Sale Price index[4], compiled by the Central Statistical Organisation (CSO), provide the yearly as well as the cumulative changes in inflation rates under three heads - all commodities, only food, and only non-food (Figure 6). As compared to non-food price inflation, food price inflation has been higher since 2005. During the years between 2000 and 2008, GDP growth rates were higher than food price inflation rates. The NSSO survey 2009-10 showed that, even though food prices had nearly doubled during this decade, there was no reduction in per capita energy intake. It would appear, therefore, that households somehow managed to cope with rising prices of food because the growth in per capita income was higher than the inflation rates, both overall and for food in particular. Since 2009, the GDP growth has been falling. The consumer price index showed that, since 2010, food price inflation exceeded the GDP growth rates. The fall in GDP growth rates may hobble income growth rates, thereby impairing the ability of the population to absorb the sustained high rates of food price inflation without adverse effects on household food security.

Over the decades, India has experienced several periods of food price inflation due to a variety of factors such as drought, rise in transport costs, and supply-demand gaps. A review of the available information on food security during these decades suggests that, whenever food price inflation rates were higher than the per capita GDP growth rates, there was a rise in household food insecurity and consequent distress, especially among the poor. Viewed from this perspective, the current scenario of low GDP growth plus high food price inflation is a worrisome combination. India's progress towards food security can be accelerated only by a combination of economic measures that will simultaneously and successfully address the twin tasks of promoting GDP growth and slowing inflation, especially with respect to food. In addition the food security of the poor has to be addressed: the National Rural Employment Guarantee Act is aimed to improve purchasing power of the poor and reduce food insecurity.

The public distribution system supplies food grains at a subsidised cost to the poor. Some states like Tamil Nadu provide food at a highly subsided price. There are ongoing programmes of food supplementation for the vulnerable groups-Integrated Child Development Services provides food supplements to preschool children, pregnant and lactating women and Midday Meal programme provides a meal to primary and upper primary school children studying in government and government aided schools. If the current shortcomings in coverage, content and quality of these programmes are corrected, it is possible to substantially reduce food insecurity among the poor and vulnerable segments of the population.

The author is Director, Nutrition Foundation of India.

References

1. Agricultural statistics at a glance agricoop.nic.in/Agristatistics.htm accessed on 19.12.2012.

2 RBI Handbook of Statistics on Indian Economy, Major Growth rates and ratios .http://dbie.rbi.org.in/DBIE/dbie.rbi?site=publications accessed on 19.12.2012.

3. Ministry of Statistics and Programme Implementation, various NSSO reports http://mospi.nic.in/mospi_new/site/Publications.aspx?status=1&menu_id=22 accessed on 19.12.2012.

4. RBI Handbook of Statistics on Indian Economy, WPI Annual Average http://dbie.rbi.org.in/DBIE/dbie.rbi?site=publications accessed on 19.12.2012.

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