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Working Paper No.139

Estimation of Nutritional Intakes

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December 1981

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Until about the middle of 1960's problem of nutrition was looked upon as a problem of protein deficiency - that too arising out of deficiency in quality protein from animal foods.[1] It was the time when Prof.P.V. Sukhatme started collecting data on nutritional intake and tried to disprove the above 'western' myth. By making 2 x 2 contingency table Sukhatme[2] showed that calorie deficiency was of much greater concern. In almost all classes there was no group who was protein deficient but not calorie deficient. Same facts were supported by Gopalan[3] for India, and Ghassemi[4] for Iran. It was therefore taken as granted that adequate intake of calorie is sufficient condition for adequacy of necessary protein intake, and also a necessary condition for efficient utilisation of proteins in a human body. Undernutrition caused by calorie deficiency became the central piece of concern specially among economists, who took it as basis for their measurement of poverty. Dandekar and Rath[5] in their pioneering study estimated poverty line (a monetary level) on the basis of minimum calorie requirement, and magnitude of the proportion of people living below this level was considered as measurement of poverty. And lots of studies on measurement of poverty using different calorie norms and price indices[6] have come up after that. But all exercises are based on the consideration of calorie only. Importance of other nutrients has been completely ignored by economists. Only recently some have tried to raise the issue on

imbalance of other nutrients.[7]

It is true that whenever enough of calorie is consumed, adequacy of protein intake is also ensured. Not only that, adequate amount of essential amino acids signifying quality of protein is also ensured. In a least cost exercise calorie has generally been found to be the binding constraint (when nutrients are the only constraints), along with one or two other nutrients.[8] But in a real life world where nutrients are not the only considerations, food habits are equally if not more important, calorie is not necessarily a binding constraint vis-a-vis other nutrients (other than protein).[9] Calcium, Vitamin A, iron too turn out to be binding constraints in different cases. Just by estimating calorie level, therefore, one risks underplaying other nutrients which are quite important for proper functioning of human body, and also for efficiency in human work.

"The tragedy of malnutrition is not so much that it is responsible for high mortality but that it cripples and permanently damages the growing generation. Of the many crippling effects, the most devastating is on vision".[10] Number of blind people in India runs to several hundred thousands, and the most common cause of preventable blindness is deficiency of Vitamin A in the diet. Night blindness is another outcome of Vitamin A deficiency. Many green leefy vegetables which are very cheap can provide Vitamin A. Even the consumption of these vegetables is very low compared to what has been recommended. In rural areas of 10 states average consumption was

13 gms per consumer unit per day in 1979[11/] where as recommended level is 100 gms. Another most important nutritional disorder affecting mostly women of child bearing age is anaemia caused by iron deficiency which can again be met by cheap food like green leefy vegetables. "It has been observed that directly or indirectly anaemia is a major cause of much of the maternal mortality in the country". Maternal mortality rate per 1,00,000 live births in India is 252 whereas it is 15.6 in Denmark. Calcium is mainly required as a building material for strong bones. It is however also necessary for the proper contraction of heart and muscles, and clotting of blood. Calcium is therefore an essential element for life process. Similarly other mineral salts containing sodium, potassium, magnesium and iron etc., and othe vitamins also are necessary for proper functioning of human body.

It is therefore necessary to study the average intake and distribution of intake of other nutrients also. We have in this exercise attempted to estimate intake of nutrients calorie, protein, calcium, iron and vitamin A in different expenditure groups in different states in different time points.

2. Data

To estimate nutritional intake one requires data on consumption pattern. National Sample Survey Organisation (NSS)is one agency which collects data on consumer expenditure at regular intervals, using scientific method. But unfortunately these values are generally in monetary units. One, instead requires data on consumption in physical

units. One way to sort out the problem is to convert the monetary values into physical values by using appropriate price levels. Another alternative is to restrict our study to few years for which quantity of major food items is available. As these monetary values are out come of so many transactions at different price levels, it is difficult to estimate an weighted price level for each commodity in the basence of detailed information. It is therefore better to adopt the second alternative. National Institute of Nutrition (NIN) also is recently collecting data to estimate intake of different nutrients. But this does not tell much about distributional aspect which is available in NSS data. NIN data has however one interesting classification which gives intake according to different status say persons having no land, 10 acres of land or more and so on. We will, however first confine ourself to NSS data.

NSS data on calorie and protein intake according to different expenditure class, and also calorie intake class for different states is available for 1971-72. This also gives share of calorie derived from five food groups in different classes as mentioned above. We have however no information on intake of other nutrients. Consumption of 29 major food items in physical units by different expenditure groups has been given for 1961-62. So intake of all the nutrients can be estimated for 1961-62. There may be some under estimation as some of the food items might, have been excluded. One such item is leafy vegetable. But consumption of such items as revealed by NIN report[12/] is so meagre that even the intake of nutrients like iron, calcium or vitamin A will not be significantly underestimated. And other vegetables like brinjal, pumkin, etc. do not contain any significant amount of any nutrients. We have get consumption data of cereals

and substitutes only in physical units for two other years 1972-73 and 1973-74. We will therefore restrict our study to these four years 1961-62, 1971-72, 1972-73 and 1973-74.

We have first estimated intake of calorie, protein, calcium, iron and Vitamin A in terms of per capita per day by different expenditure classes for 1961-62. Share of these nutrients from different five groups (consistent with 1971-72 grouping)[13], and also from cereals and substitutes has then been estimated. As there has not been any one to one correspondence between expenditure classes of 1961-62 and that of 1971-72, and for that matter between any two years, it is not possible to compare these shares in different expenditure groups for these two years. Share of 'all classes' can however be compared. We have therefore, instead of strictly following NSS expenditure groupings, aggregated them to form three expenditure groups. They may be called, lower, middle and higher expenditure groups. Shares have now been estimated in different expenditure groups for 1961-62 and also for 1971-72. Now within a group all the NSS classes are supposed to have similar shares of nutritional intake from different foodgroups. We expect shares of nutrients from cereals and substitutes in 1971-72 to remain some for 1972-73 and 1973-74. also. Since in 1971-72 report there is no such group as 'cereals and substitutes only' but a foodgroup consisting of cereals, substitute root vegetables and sugar, and also that share of other nutrients from different groups is not available, we have updated the shares of 1961-62 in terms of 1971-72 shares under the tacit assumption that

(i) Change in the share of calorie intake from cereals and substitutesis same as that of from food group I, and (ii) change in the share of other nutrients from cereals and substitutes is same as the change in the share of calorie from cereals and substitutes.

3. Share of Calorie from cereals etc.

Share of calorie from foodgroup I consisting of cereals, millets, root vegetables and sugar has been given in Table 1. When we compare these figures with those in Table 2 which are share of different nutrients from different food groups in a balanced diet, we find that our existing diet pattern is heavily dependent on cereals and substitutes. Even in the higher expenditure group characterised by group III, share of calorie from food group I is much higher compared to desired level reflected in balanced diet.[14/] This bias in favour of cereals is mainly because of low income level and lower relative price of cereals, or for that matter, of foodgroup I. As we move from lower expenditure group to higher expenditure group share of calorie from foodgroup I goes down. This can perhaps be termed as modified Engel's law so that as income goes up share of consumption of cereals and substitutes in total food consumption (also in total consumption) goes down. This is the reason why percapita production and percapita consumptions of cereals are weakly correlated. Increase in production of cereals is a manifestation of increase in income. At low level of income increase in production of cereals (or increase in income) induces to more consumption of cereals, then after a certain level of consumption increase in income diverts the

Table 1: Share of calorie from cereals and substitutes in three expenditure classes and in aggregate in 1961-62 and 1971-72

Rural

	I		II		III		All Classes		% change of share in 1971-72 over 1961-62		
	1961-62	1971-72	1961-62	1971-72	1961-62	1971-72	1961-62	1971-72	I	II	III
Andhra Pradesh	90.7	89.7	86.4	82.2	79.9	76.8	87.4	82.9	-1.1	-4.8	-3.9
Assam	90	89.2	86.5	87.1	81.7	81.4	86.9	86.1	- .8	.69	- .37
Bihar	89.5	90.7	85.8	86.6	79.5	78.0	86.5	86.6	1.3	.93	-1.9
Gujarat	86.7	86.8	78.1	78.9	71.6	72.1	79.2	78.2	0.1	1.02	.69
Jammu & Kashmir	87.8	86.2	87.3	82.8	85.4	80.3	72.1	82.6	-1.8	-5.15	-5.9
Kerala	90.3	85.5	86.7	80.3	74.8	67.9	87	78.2	-5.3	-7.4	-9.2
Madhya Pradesh	90.2	81.7	85.8	72.9	77.4	58.9	86.3	77.9	-9.4	-15	-23
Maharashtra	80.3	85.7	84.2	81.2	85.1	75.4	85.4	81.4	6.7	-2.7	-11.4
Mysore	79.3	89.7	86.3	84.2	81.6	75.7	86.2	83.8	13.1	-2.4	-7.2
Orissa	93.6	93.3	88.9	89.7	88.4	78.4	90.5	89.4	-.3	.89	-11.3
Punjab	88.8	87.9	83.4	79.6	77.1	68.6	81.5	73.6	-1.01	-4.6	-11
Rajasthan	92.3	90.6	86.8	83.7	75.3	78.2	86.2	84.6	-1.8	-3.6	3.9
Tamil Nadu	92.3	87.3	85.7	83.8	79.1	62.6	86	81.3	5.4	-2.2	-20.8
Uttar Pradesh	86.3	88.3	84.5	84.6	79.8	76.6	83.7	83.9	2.3	.12	-4.0
West Bengal	91.2	89.8	87.4	86.1	82.3	80.1	88	86.2	-1.5	-1.5	-2.7
All India	89.3	88.1	85	82.9	79.5	73.4	85.7	82.4	-1.3	-2.5	-7.7

Table 1 Continued

Urban

	I		II		III		All Classes		% change of share in 1971-72 over 1961-62		
	1961-62	1971-72	1961-62	1971-72	1961-62	1971-72	1961-62	1971-72	I	II	III
Andhra Pradesh	84.6	84.2	76.9	74.9	75.5	52.5	78.2	71.6	-.5	-2.6	-17.2
Assam	54	87.2	80.1	81.4	65.4	66.4	72.9	72.9	61	1.6	1.5
Bihar	85.7	87.9	81.7	82.5	70.7	68.9	79.5	77.1	2.6	.98	-2.5
Gujarat	72.2	78.6	67.1	69.9	60.4	58.9	64.2	65.7	8.8	4.17	-2.5
Jammu & Kashmir	85.9	84.2	82.7	79.1	75.9	69.9	81.5	76.9	-1.98	-4.4	-7.9
Kerala	86.3	83.3	80.3	76.8	70.9	59.9	78.5	70.7	-3.5	-4.4	-15.5
Madhya Pradesh	85.9	86.5	76.7	78.5	69.5	61.2	76.7	71.3	.7	2.3	-11.9
Maharashtra	85.2	84.1	73.8	74	58.9	53.9	70.7	64.3	-1.3	.27	-8.5
Mysore	80.3	84.7	78.9	77.4	84.3	63.9	78.6	73.5	5.5	-1.9	-24.2
Orissa	91.3	90.0	83.1	84.4	71.2	65.8	81.4	76.2	-1.4	1.6	-7.6
Punjab	90.3	84.9	70.7	76.1	67.3	59.5	74.8	66.2	-5.9	7.6	-11.6
Rajasthan	87.2	85.7	79.3	73.7	72.2	61.6	78.8	69.9	-1.7	-7.1	-14.7
Tamil Nadu	87.9	83.8	80.1	78.1	65.2	59.6	78.4	72.1	-3.9	-2.5	-8.6
Uttar Pradesh	83.7	87	75.6	79.9	67.5	65.9	76.1	76.1	3.9	5.6	-2.4
West Bengal	88.2	84	76.3	80.3	70.1	59.3	74.5	70.1	-4.8	5.2	-15.4
All India	84.7	85	76.3	76.5	66.5	60.7	75.3	71.1	.3	.26	-8.7

Table 2

Percentage of Calorie and Protein to be derived from different foodgroups

Foodgroup	Calorie	Protein
I Cereals & Millets, Root vegetables and sugar	55	35
II Pulses and Nuts	10	14
III Milk & Products, Meat, Fish, Egg and other flesh food	17	49
IV Edible oils	14	0
V Vegetables, fruits and other	4	4

Source: Diet Atlas of India, 1971.

consumption towards noncereal items,[15] That's why although production of cereals and consumption of cereals are weakly correlated percapita production of cereals and percapita intake of calorie are strongly correlated.[16] As agricultural production or cereals production is a major component of percapita income level in Indian context, increase in percapita intake of calorie is very much dependent on increase in percapita production of cereals. This not only increases the average intake but benefit percolates to lower deciles even.[17]

Comparing two different time points 1961-62 and 1971-72 we find that share of calorie from food group I has generally decreased in later period. But interesting point is that this decrease is more in higher expenditure group. In urban areas of Assam however share has increased in all three classes[18], increase being more in lower expenditure group. As we have already mentioned that higher share of calorie from foodgroup I reflects a lower level of income it seems that relative inequlaity in real income has increased between 1961-62 and 1971-72 in most of the states, and also in all India in both rural and urban areas. As income elasticity of cereals etc. consumption is decreasing, and if income elasticity of calorie intake be either constant or increasing this widening of gap of share of calorie from cereals etc. between different expenditure class may take place even if there is proportional rise of income in all expenditure classes thus without worsening the income distribution. We would however like to rule out this case.[19] This fact gets strengthened for quite a few

states, and also for all India rural and all India urban areas when we look at Table 3. We have presented percapita intake of calorie by three different expenditure groups in two different time points. Here we find that percapita intake of calorie itself has generally decreased in later period. This may seem odd as decrease in share of calorie from cereals has been taken to be an indicator of rise of income. It therefore seems that this decreased share in lower expenditure class is more because of change in taste pattern rather than a change in income. It is however more true for two lower expenditure groups. Now in rural areas of Andhra Pradesh, Bihar, Gujarat, Rajasthan, all India and urban areas of Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Mysore, Punjab, Rajasthan and all India we find a monotonicity in the decrease. It is higher in lower expenditure group and lower in higher expenditure group which implies that a gap in calorie intake across different expenditure group has increased indirectly signifying that inequality in real income too might have increased. In rural areas of J mmu and Kashmir, Mysore, Punjab and West Bengal and Urban areas of Assam, Jammu and Kashmir however, opposite has happened. Percentage decline of caloric intake in lower expenditure group has been less compared to that in higher expenditure group - so that inequality in calorie intake has decreased. But in none of these areas decrease in share of calorie from food group I has been less in higher expenditure group, and more in lower expenditure group so that it can't be straightforward inferred that inequality in real income in these areas had decreased. In other areas disparity

Table 3

Changes in Calorie intake between 1961-62 and 1971-72

(Rural)

	Percapita per day intake of calorie						Percentage change in percapita intake of calorie in 1971-72 over 1961-62		
	1961-62 I	1971-72 I	1961-62 II	1971-72 II	1961-62 III	1971-72 III	I	II	III
Andhra Pradesh	1665	1462	2421	2257	3400	3234	- 12.19	-6.8	-4.8
Assam	1692	1242	2369	2094	3581	2963	- 26.6	-11.6	-17.3
Bihar	1798	1445	2693	2438	4417	4242	- 19.6	-15.7	-3.96
Gujarat	1806	1493	2337	2210	3498	3415	- 17.3	-5.43	-2.4
Kerala	1063	1040	1738	1676	2536	2755	- 2.16	-3.57	8.64
Jammu&Kashmir	1688	2074	3045	2708	4312	3698	22.86	-11.07	-14 .24
Madhya Pradesh	2129	1998	3022	2805	4647	5003	- 6.15	-7.18	7.66
Maharashtra	1937	1121	2404	1903	3804	2652	-42.12	-20.8	-30.3
Mysore	2102	1712	2611	2136	4300	3139	-18.55	-24.01	-27.0
Orissa	1778	815	2744	2067	5063	3074	-54.16	-24.67	-39.28
Punjab	1750	3702	2756	2205	4040	3102	111.54	-19.99	-23.22
Rajasthan	2347	735	2928	2441	4369	3637	-68.68	-16.7	-16.7
Tamilnadu	1572	1560	2269	1858	3432	3050	-.7	-18.11	-11.13
Uttar Pradesh	2013	1381	2828	2455	4169	3305	-31.39	-13.19	-20.7
West Bental	1658	1566	2245	1859	3698	2634	-5.55	-17.19	-28.77
All India	2038	1568	2523	2376	3639	3658	-23.06	-5.8	.52

Table 3: Continued (Urban)

	Percapita per day intake of Calorie						Percentage change in percapita intake of calorie in 1971-72over 1961-62		
	1961-62	1971-72	1961-62	1971-72	1961-62	1971-72			
	I		II		III		I	II	III
Andhra Pradesh	1462	1304	2011	1870	2751	2713	-10.8	-7.01	-1.38
Assam	294	1148	1896	1884	2614	2330	290.47	- .63	-10.8
Bihar	1694	1332	2266	2071	2921	2861	-20.19	- 8.6	-2.05
Gujarat	1155	1312	1875	1885	2616	2767	13.59	.53	5.77
Jammu & Kashmir	1522	1710	2162	2176	4106	2786	12.35	.64	-32.15
Kerala	844	906	1746	1534	2212	2591	7.35	-12.14	17.13
Madhya Pradesh	1455	1400	2052	2043	2759	2977	- 3.78	-.44	7.9
Maharashtra	1640	1334	1851	1794	2131	2485	-18.66	- 3.08	16.61
Mysore	1571	1307	2060	1801	2321	2481	-16.8	-12.57	6.89
Orissa	1617	1291	2018	2002	2949	2734	-20.16	- .79	-7.29
Punjab	1488	1202	1976	1852	2419	2752	-19.22	-6.27	13.77
Rajasthan	1766	1633	2226	2239	2955	3008	-7.53	.58	1.79
Tamilnadue	1254	1118	1881	1661	2511	2579	-10.84	-11.69	2.71
Uttar Pradesh	1518	1514	2175	2037	2792	2717	- .26	-6.35	-2.69
West Bengal	1210	1221	2114	1786	2156	2475	.91	-15.52	14.79
All India	1433	1301	1993	1867	2480	2653	-9.21	-6.32	6.97

in calorie intake has increased between two of the three groups. Overall impression thus is obtained from the above analysis that inequality in real income on the average has increased in sixties. This is however subject to the fact that only two time periods have been considered. Different result may come up if end points are changed. Also results may change if groupings of expenditure classes are changed. It may be worthwhile to note here that better results may be obtained if population instead of expenditure classes had been grouped so that in different time periods consumption pattern and intake levels of nutrients of lowest 30 per cent, middle 60 per cent, or top 10 per cent people could have been compared.

4. Average intake of nutrients

We have already mentioned that our main effort in this exercise is to estimate average intake and distribution of not only calorie but of other nutrients also. We have chosen four other important nutrients for our purpose. They are-protein, calcium, vitamin A and iron. Before commenting upon our estimates let us first clarify few points. Percapita intake of calorie for 1971-72 has been estimated by using data[20] on per consumer unit intake, consumer unit and average household size of each of the 10 expenditure classes. This is therefore weighted average of percapita intake of calorie of different expenditure group. If instead, percapita intake is estimated by intake of per consumer unit, number of consumer units per household and average household size of all classes combined[21] of the same table, we get a slightly different result which is given in Sengupta and Joshi[22]. This may be because of rounding off

effect which in later case is accumulated in all the three variables. Or there may be some anamoly in the NSS data itself. Difference generally however is not very much. Our estimate of percapita intake of calorie for 1973-74 is different from that given in Sengupta and Joshi[23] because of different estimation procedure itself. Our method is based on cereals consumption and share of calorie from cereals, where as they seem to have estimated from 'detailed tabulation of NSS 28th round Survey data'[24]. Generally our estimates are lower than their estimates. Although differences in general are not very much in rural areas, same is however not true for urban areas (See Table 5). As we don't have detailed consumption level of all the items, and their conversion norms are not known, we will stick to our estimates. If however their estimates are correct it will imply that share of calorie from cereals has further gone down in 1973-74.

With the above limitations in the back of our mind our general observation is that percapita intake of all the nutrients has decreased over time. Although there is an increase in 1973-74 over the previous year, the level is much lower compared to what prevailed in 1961-62. Percapita intake of all the nutrients except vitamin A is lower in urban areas. So if these figures be compared with the aggregate norms it will seem that availability itself of calorie was much lower than the norm in urban areas in even 1961-62 not to speak of later period when the situation has further deteriorated. Norms have been calculated on the basis of requirement for different group of people say moderate

or heavy male worker, infant, child of particular age group etc. and percentage distribution of population in those classes at all India level. Now since there is dominance of heavy worker in rural areas, if weighted average be estimated for rural and urban areas seperately norm for urban area will be less than the aggregated norm. And this is what Planning Commission[25] has done where requirements for rural and urban areas have been estimated to be 2400 and 2100 calories per capita per day respectively. And weighted average of these two figures is close to 2356 calories percapita per day estimated seperately. According to same logic percapita requirement for each state too should vary as the distribution of population must be different in each state. We however for our purpose assume that there is no significant interstate difference in requirement although it has been estimated[26] that norm for calorie in Kerala should be lower than all India norm. Similarly norms of other nutrients should also very between rural and urban areas. But fortunately variation in requirement of these nutrients among different workers is almost nil. Whereas difference in requirement of calorie between a sedentary and heavy male worker is 1500 calorie or more than 60 per cent, protein, calcium, iron and Vitamin A requirements are same for both of these categories.[27] As the difference in norm for calorie in rural and urban areas is mainly because of difference in the nature of work, and not because of difference in age sex composition we can safely assume that norms for other nutrients are same for both rural and urban areas. Norms and also content of Vitamin A in different food items are given in three

Table 4: Percapita intake of nutrients in different years

Rural

	CALORIE				PROTEIN (gm.)			VITAMIN-A (Bcarotene, µg)		
	1961-62	1971-72	1972-73	1973-74	1961-62	1972-73	1973-74	1961-62	1972-73	1973-74
Andhra Pradesh	2243	2167	2100	2222	58.9	57	58.2	242	228	218
Assam	2344	2172	1932	2051	58.6	50	52.8	124	69	73.9
Bihar	2522	2300	2127	2133	70.4	66	63.8	250	280	246.4
Gujarat	2380	2308	1842	2005	70.2	59	64.6	578	432	499.7
Jammu & Kashmir	3638	2840	2581	2692	81	72	74	431	365	392
Kerala	1568	1925	1430	1494	40	36	36.3	78	64	60.3
Madhya Pradesh	2873	2894	2750	2846	83	80	85	442	342	428
Maharashtra	2255	2063	1763	1900	67.4	58	61.1	350	315	403.4
Mysore	2749	2265	2092	2168	74	66	68.2	398	196	225
Orissa	2379	2112	1897	2041	58	48	50	122	56	52
Punjab	2904	3139	2041	2183	85	68	88	1008	518	653
Rajasthan	2998	2719	2445	2466	94	95	82	839	968	928
Tamil Nadu	2124	1990	1952	2047	54.6	48	49	190	131	119
Uttar Pradesh	2797	2531	2254	2224	84	76	74	521	391	356
West Bengal	2172	1936	1785	1738	52	47	46	126	122	125
All India	2483	2392	2160	2213	69	66	67	357	300	319

Table 4: Continued

Urban

	Calorie				Protein (gm)			Vitamin A		
	1961-62	1971-72	1972-73	1973-74	1961-62	1972-73	1973-74	1961-62	1972-73	1973-74
Andhra Pradesh	2017	2032	2025	2123	53.6	55	57	239	203	196
Assam	2049	2090	1856	1963	57.8	51	54	322	124	179
Bihar	2293	2245	2002	2017	66	63	61	322	325	319
Gujarat	1935	2123	1800	1790	55	55	55	524	452	465
Jammu & Kashmir	2386	2265	2080	2128	58	53	53	380	340	316
Kerala	1580	1674	1501	1508	41	41	41	107	133	119
Madhya Pradesh	2053	2292	1980	1985	67	66	67	404	344	348
Maharashtra	1837	2039	1543	1644	54	54	57	467	632	802
Mysore	2044	1914	1749	1771	57.8	48	48	354	219	240
Orissa	2207	2203	1986	1998	58.4	56	56	226	125	129
Punjab	2006	2271	1808	1875	64.6	70	73	754	677	705
Rajasthan	2319	2414	2149	2106	74.9	73	72	590	1012	1057
Tamil Nadu	1920	1796	1725	1803	49	39	40	228	56	58
Uttar Pradesh	2094	2125	1843	1906	66	62	63	539	413	424
West Bengal	2021	2013	1678	1810	54	52	56	282	245	287
All India	2015	2069	1791	1851	58.4	49	50	411	728	693

Table 4: Continued

	Calcium (mg.)			Iron (mg.)		
	1961-62	1972-73	1973-74	1961-62	1972-73	1973-74
RURAL						
Andhra Pradesh	367	216	203.1	30	25	26
Assam	206	94	99.4	25	21	22.4
Bihar	354	222	210.1	35	32	29.7
Gujarat	504	287	345.9	34	28	31.1
Jammu & Kashmir	348	174	157	35	33.5	32
Kerala	208	183	203.1	16	16	15.2
Madhya Pradesh	370	495	559	47	44	49
Maharashtra	403	189	197.1	35	31	30.6
Mysore	899	334	366	41	26	26.2
Orissa	250	122	104	27	21	22
Punjab	757	197	304	53	40	53
Rajasthan	470	367	278	41	51	43
Tamil Nadu	380	160	140	27	21	21
Uttar Pradesh	513	304	286	44	47	44
West Bengal	190	122	117	23	25	23
All India	416	251	254	35	34	34
URBAN						
Andhra Pradesh	268	153	144	24	24	25
Assam	306	96	109	23	20	22
Bihar	349	222	199	34	35	32
Gujarat	426	225	219	30	30	29
Jammu & Kashmir	292	125	116	29	29	27
Kerala	182	145	153	17	18	17
Madhya Pradesh	409	253	265	40	39	39
Maharashtra	329	249	249	28	32	31
Mysore	500	210	200	29	20	20
Orissa	276	126	126	26	26	27
Punjab	534	333	352	43	45	47
Rajasthan	506	265	256	45	42	40
Tamil Nadu	272	62	64	22	17	17
Uttar Pradesh	449	221	221	41	38	38
West Bengal	316	160	172	25	27	28
All India	375	176	174	31	26	26

different terms Retinol, Bcarotene and International Units We have reduced them to Bcarotene.

Now, according to average intake of nutrients which does not tell more than the nature of total supply, average intake of protein and iron in all the reference years in both rural and urban areas have been adequate except in few cases. This means that if the distribution had been fair enough so that every one consumed according to his need, every one would have had sufficient intake of protein and iron. So far as intake of calorie is concerned supply was more or less adequate in 1961-62 and 1971-72. There was however deficit ranging from marginal to moderate in quite a few states in both rural and urban areas. Except for few cases deficit was not much higher. In next two years i.e. 1972-73 and 1973-74 situation however deteriorated significantly, and even at all India level average intake was less than required norm in both rural and urban areas. Situation regarding intake of Calcium and Vitamin A has however been much worse rather alarming. Except for five cases (out of 15 states and all India rural and urban in 3 years) average intake of calcium was much less than the requirement. At some places intake was less than even half of the requirement. If this has been the case with calcium intake, the fact regarding intake of Vitamin A is that it has been in most of the cases 10 to 20 per cent of the total requirement. If we consider to incorporate the distributional problem, situation regarding these three nutrients will obviously become further pessimistic.

Table .5

Percapita intake of Calorie in 1973-74 from two different sources.

	Rural		Percentage difference between A & B	Uraban		Percentage difference between A & B
	A	B		A	B	
1. Andhra Pradesh	2222	2209	-.59	2123	2192	3.14
2. Assam	2051	2105	2.6	1963	2098	6.4
3. Bihar	2133	2186	2.4	2017	2197	8.2
4. Gujarat	2005	2180	8.0	1790	2194	18.4
5. Jammu&Kashmir	2692	2742	1.8	2128	2696	21.1
6. Kerala	1494	1534	2.6	1508	1571	4.0
7. Madhya Pradesh	2846	2422	-17.5	1985	2371	16.3
8. Maharashtra	1900	2044	7.0	1644	2081	20.1
9. Mysore	2168	2211	1.94	1771	2158	17.9
10. Orissa	2041	2125	3.95	1998	2128	6.1
11. Punjab	2183	2818	22.5	1875	2708	30.8
12. Rajasthan	2466	2719	9.3	2106	2635	20.1
13. Tamilnadu	2047	2012	-1.7	1803	2036	- 11.4
14. Uttar Predesh	2224	2450	9.2	1906	2393	20.3
15. West Bengal	1738	2070	16.07	1810	2101	13.8
16. All India	2213	2328	4.09	1851	2263	18.2

Source: A) From Table 4

B) Sengupta, S. and Joshi, P.D. " Consumption of Cereals and energy content of food consumption" Sarvekshana, Vol. II No.1, July 1978

Table 6

Percapita requirement level of different nutrients

	Aggregate	Rural	Urban
Calorie	2356	2400*	2100*
Protein(gm)	44	-	-
Vitamin A (Bcarotene µg.)	2500	-	-
Calcium (mg)	500	-	-
Iron (mg)	23	-	-

*Source : Report of the Taskforce on Projections of Minimum needs and effective consumption demand, Planning Commission (PPD), January 1979.

5. Distribution of Nutrients

It's a matter of common sense that average intake of the population does not say much about the actual intake of different segments of the population. One way is to estimate intake of different groups viz. economic, demographic, or social etc., and then to compare the intake with the actual requirement, and also to compare the intake of different groups. Alternatively proportion of people having the intake below their requirement can be estimated. As we have already estimated calorie intake for different expenditure groups (Table 3), and it's fairly evident that intake increases with increasing consumer expenditure - it's more meaningful to estimate extent of malnutrition with respect to different nutrients. While doing this one will naturally face the problem of norm[28]. We will however without going into detail assume for the time being that if average intake of a particular expenditure group is lower than the average requirement, all the persons in that group are supposed to have intake below their respective requirement.[29] Reverse will be the case if the actual intake is more than the average requirement. This however will be true if the distribution of requirement, and that of intake are same except the parameter 'mean' within the particular expenditure group. More stringent condition however is that population structure with reference to age, sex and activity be same in all expenditure classes. Otherwise requirement norm will vary from one expenditure class to another. Family size being higher because of more children lower expenditure class may have a lower norm.

Table 7: Percentage of people below cut off level of nutrients*

States/Nutrient	Vitamin A (B carotene 2500 mg per capita per day)			Calcium (500 mg per capita per day)		
	1961-62	1972-73	1973-74	1961-62	1972-73	1973-74
Rural						
Andhra Pradesh	100	100	100	94.0	97.8	100
Assam	100	100	100	95.9	100	100
Bihar	100	100	100	85.7	99.6	100
Gujarat	100	100	100	59.7	100	99.7
Jammu & Kashmir	100	100	100	93.7	100	100
Kerala	100	100	100	100	100	100
Madhya Pradesh	98.7	100	100	80.2	9.1	1.3
Maharashtra	100	100	100	69.2	100	100
Mysore	100	100	100	5.1	99.8	93.9
Orissa	100	100	100	96.0	100	100
Punjab	89.6	100	100	32.3	100	94
Rajasthan	98.4	100	100	83.3	88.9	99.1
Tamil Nadu	100	100	100	79.8	100	100
Uttar Pradesh	100	100	100	48.3	99	100
West Bengal	100	100	100	97.8	100	100
All India	100	100	100	64.1	99.6	100
Urban						
Andhra Pradesh	100	100	100	100	100	100
Assam	100	100	100	88.4	100	100
Bihar	100	100	100	77.7	100	100
Gujarat	100	100	100	53.2	100	100
Jammu & Kashmir	100	100	100	93.6	100	100
Kerala	100	100	100	100	100	100
Madhya Pradesh	100	100	100	76.9	100	100
Maharashtra	100	100	100	90.9	100	100
Mysore	100	100	100	13.7	100	100
Orissa	100	100	100	91.8	100	100
Punjab	100	100	100	32.9	100	100
Rajasthan	100	100	100	16.1	100	100
Tamil Nadu	100	100	100	96.2	100	100
Uttar Pradesh	100	100	100	62.9	100	100
West Bengal	100	100	100	91.5	100	100
All India	100	100	100	89.2	100	100

*Figures in parenthesis are cut off values.

At the same time members of lower expenditure group may be engaged in heavier works compared to their counterparts in higher expenditure group, and the norm for lower expenditure class may be higher. This kind of difficulty can be overcome if intake be given in terms of per consumer unit. Tabulation for 1971-72 has indeed been done in this term, and distributional aspect for that year has been examined elsewhere.[30] One therefore must be cautious while using the statistic 'proportion of people below norm'. We will therefore present only the figures regarding calcium and Vitamin A (Table 7) for illustrative purpose. These figures should be taken as qualitative rather than as quantitative measures. What we find for all the three years is that almost 100 percent people are below the requirement level. Much more valid statement however is that there is almost no expenditure class where mean intake level is more than the average recommended level. Protein and iron are not very scarce intakes in this respect. It is therefore very urgent to place our attention on nutrients like Vitamin A and Calcium also along with calorie.

A better picture can however be obtained if NIN[31] tables be used from where intakes of different nutrients at all India level have been estimated for different age sex activity group (Table 8). Here also we find that all the groups are deficient in Calorie and Vitamin A. Iron deficiency is much more severe among pregnant women. Otherwise it can't be said that there is a bias against women so far as nutritional intake is concerned. In fact maximum deficiency in calorie is among male heavy workers if we exclude children of 0-1

Table 8

Percapita intake of nutrients of different demographic group*

	Protein		Calorie		iron		Vitamin A(B	
	Percapita intake	deficit or surplus	intake	deficit	intake	deficit	intake	deficit
0-1	17.6	3.53	586	-51.2	7.5	-50	562	-43.8
0-2	24	33.3	823	-31.4	11	-26.7	599	-40.1
0-3	27	42.1	933	-22.2	13	-13.3	621	-37.9
4-7	32	45.4	1110	-26	15.8	5.3	647	-46.1
7-10	38	15.2	1328	-26.2	18.6	24	616	-61.5
10-13	43	4.9	1505	-28.3	21.6	44	739	-69.2
13-16 Boys	49	-10.9	1723	-31.1	24.5	-2	954	-68.2
13-16Girls	45	-10	1621	-35.2	22.4	-36	777	-74.1
16-18 Boys	59	- 1.7	2003	-33.2	28.7	14.8	977	-67.4
16-18Girls	48	- 4	1697	-22.9	23.7	-32.3	967	-67.8
Adult Male(Sedentary)	62	12.7	2169	- 9.6	29.7	48.5	1130	-62.3
Adult Male(Moderate)	62	12.7	2210	-21.1	32.2	61	1072	-64.3
"	56	1.8	2000	-48.7	28.9	44.5	1281	-57.3
Adult female (Sedentary)	50	11.1	1790	-5.8	24.8	-17.3	957	-68.1
" (Moderate)	51	13.3	1858	-15.6	28.1	- .57	828	-72.4
Pregnant Adult female (Sedentary)	45	-18.2	1540	-30	21.3	-46.8	815	-72.8
Lactatius females (Sedentary)	54	-16.9	1904	-32	27.1	- 9.7	1052	-77.1
Lactating females (Moderate)	56	-13.9	1924	-33.7	29.6	- 1.3	1095	-76.2

*Weighted average of intake of nine states (See Table 9) for States and source of data), and surplus or deficit of each group has been calculated from the norm of that particular group.

group. It is therefore income again which is more important factor influencing nutritional intake. It is supplemented by another tabulation of NIN report where calorie intake has been given according to land holdings (Table 9). If land holdings be taken as an indicator of income level, it is quite evident that both protein and calorie intake increase with income.

6. Summary and Conclusion

Our main intention in this paper has been to estimate intake of different nutrients including calorie. And we have found that intakes of Vitamin A and Calcium along with that of calorie are too meagre. There is practically no expenditure class where average intakes of calcium and vitamin A are more than the recommended level. NIN data too indicates the deficiency regarding Vitamin A and Calorie. Protein and iron intakes in general are however not much less. There is however a deficiency of iron intake among pregnant women. What we have found is that income is the major factor influencing intake of nutrients. Percapita intake of calorie and percapita production of cereals are positively correlated. Per capita production of cereals, and per capita consumption of cereals show a good correlation if latter be expressed as quadratic function of the former. This shows that with the increase of per capita production of cereals which is an indicator of rise in income, consumption of cereals first increases; later the expenditure is diverted to non cereals items. Also intakes of calorie and protein increase with the size of land holdings. They are least among landless labourers. So far as time

Table 9: Intake of nutrients in different economic group (1975-78)

	No land	Less than 5 acres	5 -10 acres	More than 10 acres	Laboures	Cultivators	Others
Calorie (Per consumer unit per day)							
Kerala	1824	1904	2232	1589	1718	2040	2015
Tamil Nadu	2108	2320	2671	2718	2012	2548	2321
Karnataka	2312	2576	2860	3099	2338	2901	2526
Andhra Pradesh	2274	2480	2824	2974	2358	2805	2338
Maharashtra	2006	2178	2251	2517	1948	2413	2150
Gujarat	1999	2042	2234	2444	1941	2219	2097
Madhya Pradesh	1977	1939	2108	2403	1905	2221	2059
West Bengal	1866	2346	3055	3052	1806	2543	2414
Uttar Pradesh	1991	2116	2227	2377	2000	2192	2043
Protein (gm. per consumer unit per day)							
Kerala	44.2	44.3	57.5	34.6	37.7	49.3	49
Tamil Nadu	52.3	56.6	66.7	67.2	49.6	62.4	57.7
Karnataka	63.3	65.3	76.3	86.5	63.2	77	67
Andhra Pradesh	53.8	59.7	72.3	74.3	55.7	70.4	55.9
Maharashtra	58.8	62.5	65.7	73.8	57.5	70.3	62.3
Gujarat	57.2	60.1	64.5	70.6	56.9	65	58.8
Madhya Pradesh	58.0	59.9	67.1	74.5	57.3	69.5	61.5
West Bengal	43.7	59.2	76.3	75.2	46.7	63.3	61.3
Uttar Pradesh	64.2	66.2	73.9	77.7	64.4	69.9	65.1

Source: Annual Report (1979) of National Nutrition Monitoring Bureau, National Institute of Nutrition, Hyderabad.

trend is concerned it is definite that calorie situation has deteriorated between sixties and seventies (subject to the choice of end points). Percapita intake has decreased, But no such trend emerges within last three years i.e. 1971-72, 1972-73 and 1973-74. Also inequality in real income seems to have increased between sixties and seventies as gap in share of calorie from cereals and substitutes in all states, and also gap in calorie intake in quite a few states between different expenditure groups have widened in between 1961-62 and 1971-72.

Notes and References

I am thankful to Sudipto Mundle and Chandan Mukherjee for their helpful comments. I am however responsible for errors which are still there.

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10. Gopalan, C. et.al. : Nutritive value of Indian foods, NIN, 1977

11. National Nutritional Monitoring Bureau (NNMB) : Report for the year 1979, NIN, 1980.

12. Gopalan, C. et.al. (1977) op.cit.

13. National Sample Survey, Calorie Protein content of food items consumed per diem per consumer units 26th round, (238), 1976.

14. In urban areas of Maharashtra and Gujarat specially, and most of other states also share of calorie from food group I is not very high in 1961-62.

15. Correlation coefficient between percapita production and percapita consumption of cereals is.42 in 1970-71 and .28 in 1973-74.

If y be per capita consumption of cereals and x be per capita production of cereals across different states, following regression results are obtained for two different years. Figures in parenthesis are T values, astericks sign indicating significance at 5 per cent level.

1970-71

(i) $Y = 153.7 + .11\ x \quad ; \quad \bar{R}^2 = .17$
$\qquad\qquad (9.9^*) \quad (1.7)$

(ii) $Y = 68.04 + .87x - .0013X^2 \quad ; \quad \bar{R}^2 = .61$
$\qquad\qquad (2.83^*) \quad (4.4^*) \quad (3.98^*)$

1973-74

(i) $Y = 159.33 + .08x \quad ; \quad \bar{R}^2 = .08$
$\qquad\qquad (10.3^*) \quad (1.07)$

(ii) $Y = 59.56 + .98x - .0015x^2 \quad ; \quad \bar{R}^2 = .67$
$\qquad\qquad (2.75^*) \quad (5.4^*) \quad (5.1^*)$

Above relations show that although y and x are poorly correlated in linear relationship, they are highly correlated in a quadratic relationship with all the co-efficients being significant at 5 percent level. Quadratic equation implies that initially consumption will rise with the production level and later it will decline. If x (per capita production of cereals) be taken as an income indicator then income

elasticity of a function $y = a+bx-cx^2$

may be given by $n = \frac{bx - 2cx^2}{a + bx - cx^2}$

Initially when $bx - cx^2 > bx - 2cx^2 > 0$ $\quad n < 1$ (necessary item)

Later when $bx = 2cx^2$ $\quad n = 0$

and if $bx < 2cx^2$ $\quad n < 0$ (Inferior item)

16. Correlation coefficient between percapita production and percapita calorie intake is .71 in 1973-74 and .75 between production of cereals for 1970-71 and intake of calorie of 1971-72.

Also see Panikar, P.G.K. "Interregional variation in calorie intake" Working Paper No.111, Centre for Development Studies, Trivandrum 1980

17. Dasgupta, R : "A cross sectional analysis of poverty and undernutrition in rural India" Working Paper No.126, Centre for Development Studies, Trivandrum 1981.

18. Increase of 61 per cent in share in class I of urban areas of Assam seems to be because of some data problem.

19. This possible interpration has been pointed by Sudipto Mundle. We then tried to estimate the functional relationship between share of calorie from cereals etc. and income level, and double log specification fitted best. Following are the results at all India level for 1981-82. Figures in parenthesis are T values. Y is share of calorie from cereals etc. and x is percapita income for 30 days.

Rural

$$\underset{}{\ln Y} = \underset{(433.3)}{4.65} - \underset{(20.04)}{.066 \ln x} \quad ; \quad DF_2 = 11, \; R^2 = .973$$

Urban

$$\ln y = \underset{(237.4)}{4.74} - \underset{(20.56)}{.126 \ln x} \quad DF = 11, \; R^2 = .975$$

Above equations imply constant negative income elasticity which disproves that relative income inequality might not have worsened. T values are significant at 5 per cent level.

20. NSS (1976) op.cit

21. ibid

22. Sengupta, S and Joshi P.D. "Consumption of cereals and energy content of food consumption" Sarvekhana, Vol.II, No.1, July 1978.

23. ibid

24. ibid (footnote of Table 4)

25. Perspective Planning Division (PPD). Report of the Taskforce on projections of minimum needs and effective Consumption demand, Planning Commission, New Delhi, 1979.

26. Centre for Development Studies (CDS), Poverty, Unemployment and Development Policy - A case study of selected issues with reference to Kerala, Orient Longman, 1977.

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31. NMMB op.cit.