The Spatial Distribution of Protein Deficiency in Rural India in the Last Three Quinquennial Rounds of NSS*

Raghbendra Jha,
Research School of Pacific and Asian Studies
Australian National University

ABSTRACT

This paper computes protein deficiency indicators across 75 NSS regions for the quinquennial rounds of 1987–88, 1993–94 and 1999–2000. Furthermore, regional inequality in proten deficiency has persisted over time. The economic reforms program has been unable to make any significant dent on the spatial distribution of protein deficiency. The results presented here facilitate easy identification of lagging areas on which nutrition enhancement policy must concentrate.

All correspondence to:

Prof. Raghbendra Jha,
ASARC, RSPAS
Australian National University,
Canberra, ACT 0200, Australia

Fax: + 61 2 6125 0443
Phone: + 61 2 6125 2683
Email: r.jha@anu.edu.au

* Work on this paper was supported by grant number R8121 from DFID, UK. I thank Anurag Sharma for research assistance.

I. Introduction

This paper is addressed to the question of the spatial distribution of protein deficiency and the severity thereof in the Indian economy. Although the current literature has estimated protein deficiency as such, its intensity and particularly its spatial distribution across India have been largely unexplored.[1] A discussion of the spatial distribution has almost exclusively concentrated on the experience of various states. However, as has been discussed in the case of poverty (see Duby and Gangopadhyay (1998) and Jha and Sharma (2003)), there are wide variations within individual states and one needs to work at an even more disaggregated level. This paper provides estimates of the extent and severity of protein deficiency at the level of NSS regions for the 43rd, 50th and 55th rounds (correspnding to the years 1987–88, 1993–94 and 1999–2000 respectively) of the National Sample Survey (NSS).[2] As is well known by now, there are problems of comparability between the 55th and earlier rounds. However, the results for this round are provided herewith for the sake of completeness.

In the liteature the measurement of malnutrition can take either of two routes. First is the route traversed by, among others, Sahn and Stifel (2002). Following Habicht et. al. (1974), Graitcher and Gentry (1981) and Martorell and Habicht (1986) they argue that differences in unconstrained growth of children from different ethnic and racial groups is so minor up to five years that a common reference point is appropriate. Thus for children of upto five years in age, Sahn and Stifel (2002) use the standard *z*-score measure of height for age score as:

$$\text{z - score} = \frac{\text{x}_\text{i} - x_{median}}{\sigma_x} \qquad (1)$$

where x_i is height of child *i*, x_{median} is the median height for a healthy and well-nourished child from a reference population of the same age and gender, and σ_x is the standard

[1] Jha (2000) presented evidence on the non-convergence of poverty rates across states.
[2] The 55th round figures correspnd to the 30-day recall.

deviation from the mean of the reference population.. Typically the *z*-score for a reference population has a standard normal distribution in the limit. Based on this probability statement children whose *z*-scores fall below -2 are classified as malnourished. Some measures of such undernutrition are provided in Appendix Tables from the Family Health Survey figures for 1998–99.

Although this statistic provides a useful measure of malnutrition among children in the age group 0–5 years, its main drawback is that it cannot be used as a measure of undernutrition outside this age group. Typically researchers are interested in the nutrition status of adults for several reasons not the least of which is that this is critical to their labour market experience. This is the second of the two approaches mentioned above.

In the area of undernutrition the literature has focused on two interrelated aspects. One is the prevalence of food inadequacy (PFI) and the other dietary energy supply (DES) per caput. The latter is reported in the *Sixth World Food Survey* of the FAO (2001). The FAO uses a simple methodology to estimate undernutrtion. Given DES data it fits a lognormal distribution to it. It then uses a common cutoff point (related to the Basic Metabolic Rate) for all countries and considers all those that fall below this as undernourished. This approach has been criticised by Svedberg (2000). He points out three possible sources of error. First, DES par caput may be measured with error. Second, the parameters of the lognormal distribution that food consumption is assumed to follow (in essence, the coefficient of variation in the distribution, given that its mean is given by the average DES per caput) could be measured with substantial error. Svedberg also points to the possibility that lognormal distribution may be an inappropriate assumption in itself. Finally the calorie cut-off point which defines the threshold level below which individuals are

assumed to be undernourished may be country specific[3] and it may therefore be inappropriate to assume a common cutoff related to the Basic Metabolic Rate). The approach to measuring undernourishment in this paper is an improvement since nutritional equivalents of consumption baskets are computed directly. This seond approach is, therefore, more desirable.

Undernutrition has huge inefficiency costs associated with it. There is a substantial literature arguing that there is a direct link between nutrition and higher labour productivity. Arcand (2001) takes this logic one step further and models the impact of nutrition on economic growth in a cross-country panel data framework. After considering panel equations describing the growth of per capita GDP as a function of nutritional and other variables and taking account of problems in measurement of the DES (as enunciated by Svedberg (2000) as well as methodology (opting for GMM estimation in order to permit endogeneity of the nutrition variables) he finds a remarkable contribution of the nutrition variable to per capita GDP growth worldwide. The figure is 0.23 to 4.7 per cent worldwide. Countries with above-median PFI would have their annual rates of growth increase by 1.6 percentage points if they had raised their DES per caput to 2770 kcal/day. He argues that there are direct and indirect mechanisms through which higher nutrition positively affects economic growth. The direct mechanism is through improvements in labour productivity. He identifies the indirect mechanisms as those through higher life expectancy (although this is mainly in the long-run) and longer schooling and better schooling outcomes. He also models the phenomenon of nutrition traps in economic growth with low nutrition leading to low rates of economic growth, which then lead to poor nutrition outcomes. He uses a switching regression technique, which distinguishes between high PFI regimes and low PFI regimes. The most significant result of this analysis is that the mean growth rate of GDP per caput for low PFI countries (0.030) is almost four times that for high PFI countries (0.012). Hence

[3] However as Arcand (2001) argues, Svedberg's concerns do not necessarily translate themselves into the disappearance of the statistical significance of the impact of DES per caput or PFI on economic growth.

countries with high incidence of nutritional inadequacy are likely to suffer considerably in terms of poor growth performance. However being a high PFI country does not condemn a country indefinitely to low rates of economic growth. What it does point out to is the strong relevance of high levels of nutrition to attaining high rates of economic growth. In fact Arcand goes on to argue that from a mean difference of just less than $3000 in 1960 the mean difference in GDP per caput between low-median PFI countries and above-median PFI countries had grown to $5000 by 1990. Had the DES per caput been raised to 2770 kcal/day in all countries, this difference would have increased only to $3250. Thus improving nutritional outcomes in high-PFI countries would have considerably reduced income inequality across the world.

Until the publication of Behrman and Deolalikar (1987) there was a dominant view that the only way out of malnutrition for developing countries was to rely on higher economic growth. This was based on calculations, which revealed high elasticities of nutrition with respect to expenditure. The argument by Behrman and Deolalikar is that this literature confuses food expenditure and nutrition elasticities. Even at low levels of income households give considerable weight to such attributes as taste in making marginal food demand decisions, at least in comparison to the weight placed on nutrition. If this is the case then high food income elasticities may be consistent with low nutrient income elasticities. Computations by Behrman and Deolalikar for rural South Indian villages in the ICRISAT dataset reveal this indeed to be the case. Whereas income elasticities for food are high, elasticites for nutrients are uniformly (except in select cases for calories and carotene) and insignificant. Hence there should not be any presumption that improvements in income will necessarily lead to better nutritional outcomes.

Ravallion (1990) pushed this point further and argued that an important distinction needs to be made between nutritional intake and nutritional deprivation. Conflicting results

with respect to nutrient and food income elasticites could be reconciled once we realize that interpersonal nutrient distributions have high density in a neighbourhood of the minimum requirement levels relevant to assessing nutritional deprivation. This is because the marginal effects of a change in the incomes of undernourished households on a headcount index of undernutrition is determined by the product of the income slope of the nutrient intake (proxied by the relevant elasticity) and the slope of the cumulative distribution function of intake, evaluated at the nutrient norm. Using a data set from East Java Ravallion confirms the Behrman–Deolalikar result of low-income elasticity of nutrients. (He studied only calories.) However, he also finds that the calorie distribution function is quite steep in the neighbourhood of reasonable caloric requirements. Further, the income slope of the calorie demand function rise quite sharply as income falls. Thus the income elasticity of calorie demand at mean points can understand considerably the income elasticity of the prevalence of caloric undernutrition relative to fixed norms.

With this background the issue of the determinants of nutrition assumes importance. The literature on direct use of nutrient has been relatively scarce. Melville (1988) examined data from a cross section of developing countries and argued that nutritional status is related to the ownership of land but not to the amount of land owned. Cropping patterns do not seem to have much of an impact. However, considerable work remains to be done. The data set that we have access to permits a more complete inquiry into the determinants of nutritional status.

The plan of this paper is as follows. Section II briefly outlines the methodology for protein deficiency computation used in this paper. Section III provides results on protein deficiency and its severity for the 43rd, 50th and 55th quinquennial rounds of the NSS as well as changes in protein deficiency and its intensity across these three rounds. Section IV concludes.

II. The Approach of this Study

We opted for direcet measurement of nutritional status. Then using the nutritional tables given in Gopalan, Sastri and Balasubramanian (1971) this consumption profile is converted into nutritional equivalents. The NSS gives details of family composition in terms of adult males and females and male and female children. The nutrition components identified are protein, fats, minerals, fibre, carbohydrates, energy, phosphorus, calcium, iron, carotene, thiamine, riboflavin, niacin and vitamin C. In this paper we report results exclusively on protein.[4] Minimum protein requirement of a household is defined as

#male*55+#female*45+#chmale*30+#chfemale*30

where # stands for number, chmale stands for male child and chfemale for female child. The number of members in a household is calculated by giving unit weights to the adults and 0.5 weight to the children. Age specific weights for children are not possible since ages of children are not recorded. In the case of the 55th round this data is based on 30-day recall.

Our estimation of protein deficiency intake and its severity is accomplished using nutritional equivalents of actual consumption baskets for households compared against recommended daily allowance as elaborated in Gopalan et al. (1971). The daily nutritional requirements for protein as reported by Gopalan et al. are reproduced in Table 1 below.

[4] Hence, the possibility of calore-protein substitution in the measurement of undernutrition is not analysed here.

Table 1
Daily Allowances of Protein for Indians
(Recommended by the Nutrition Expert Group in 1968)

Group	*Particulars*	*Proteins (gm.)*
Man		55
Woman		45
	Second half of pregnancy	+10
	Lactation: Up to one Year	+20
Infants	0–6 months	2.3–1.8/kg
	7–12 months	1.8–1.5/kg
Children	1 year	17
	2 years	18
	3 years	20
	4–6 years	22
	7–9 years	33
	10–12 years	41
Adolescents	13–15 years boys	55
	13–15 years girls	50
	16–18 years boys	60
	16–18 years girls	50

Source: adapted from Gopalan et al. (1971), pp. 27

This paper uses the popular Foster–Greer–Thorbecke (FGT) measures of poverty.

FGT poverty measure for a given population is defined by:

$$P_{\alpha} = \int_0^q \left(\frac{z - y}{z} \right)^{\alpha} dy$$

which in discrete terms is

$$P_{\alpha} = \frac{1}{N} \sum_{i=1}^{q} \left(\frac{z - y_i}{z} \right)^{\alpha}$$

where

- N is the sample size,
- y *is* the variable of interest (protein intake),
- z is the minimum protein requirement (a number or a scalar).

Three protein deficiency measures are calculated based on three values of α.

Head Count Index of Protein Deficiency (PG0) $\alpha = 0$:

$$P_0 = \frac{q}{N}$$

This measure fails to capture the extent to which individual protein intake falls below the minimum requirement. Hence we use our second measure: the protein deficiency gap index (P_1) given by the aggregate protein shortfall of the protein-deficient population as a proportion of the minimum protein requirement and normalized by the population size.

Protein Deficiency Gap (P_1) $\alpha = 1$**:**

$$P_1 = \frac{1}{N}\sum_{i-1}^{q}\left(\frac{z - y_i}{z}\right)$$

P_1 captures the acuteness of protein deficiency since it measures the total short fall of the protein-defeicient from the poverty line. In other words, it measures the total amount of protein necessary to remove that protein deficiency. This measure has the drawback that it does not consider the importance of the number of people who are protein deficient. For this reason, it is important to use both measures of protein deficiency jointly. There are certain policy changes that favor one group of protein deficienct and adversely affect another group. In such cases P_0 may not register any change but P_1 may get around this problem to some extent.

Square Protein Deficiency Gap (P_2) $\alpha = 2$:

$$P_2 = \frac{1}{N}\sum_{i-1}^{q}\left(\frac{z - y_i}{z}\right)^2$$

This measures the severity of poverty even more accurately. In discussing protein deficiency, therefore, it is important to use all three measures. The current analysis uses multipliers as the household sampling weights.[5]

[5] For a treatment of multipliers in the three rounds see the documentation for these rounds provided by NSS.

III. Results

Table 2 provides details of the NSS regions used in this paper. The NSS regional code has varied over the years but we use a common set here for purposes of consistency.

Table 2: NSS regions

State	*Region*	*Code used in this paper*
Andhra Pradesh	Coastal	1
Andhra Pradesh	Inland Northern	2
Andhra Pradesh	South western	3
Andhra Pradesh	Inland southern	4
Arunachal Pradesh	Arunachal Pradesh	5
Assam	Plains Eastern	6
Assam	Plains Western	7
Assam	Hills	8
Bihar	Southern	9
Bihar	Northern	10
Bihar	Central	11
Goa	Goa	12
Gujarat	Eastern	13
Gujarat	Plains Northern	14
Gujarat	Plains Southern	15
Gujarat	Dry Areas	16
Gujarat	Saurashtra	17
Haryana	Eastern	18
Haryana	Western	19
Himachal Pradesh	Himachal Pradesh	20
J&K	Mountainious	21
J&K	Outer Hills	22
Karnataka	Cosatal and Ghatas	23
Karnataka	Inlans Eastern	24
Karnataka	Inland Southern	25
Karnataka	Inland Northern	26
Kerala	Northern	27
Kerala	Southern	28
Madhya Pradesh	Chattisgarh	29
Madhya Pradesh	Vindhya	30
Madhya Pradesh	Central	31
Madhya Pradesh	Malwa Plateau	32
Madhya Pradesh	South Central	33
Madhya Pradesh	South western	34
Madhya Pradesh	Northern	35
Maharashtra	Coastal	36
Maharashtra	Inland Western	37
Maharashtra	Inland Northern	38
Maharashtra	Inland Central	39
Maharashtra	Inland Eastern	40
Maharashtra	Eastern	41

Manipur	Plains	42
Manipur	Hills	43
Meghalaya	Meghalaya	44
Mizoram	Mizoram	45
Orissa	Coastal	46
Orissa	Southern	47
Orissa	Northern	48
Punjab	Northern	49
Punjab	Southern	50
Rajasthan	Western	51
Rajasthan	North Eastern	52
Rajasthan	Southern	53
Rajasthan	South Eastern	54
Sikkim	Sikkim	55
Tamil Nadu	Coastal Northen	56
Tamil Nadu	Coastal	57
Tamil Nadu	Southern	58
Tamil Nadu	Inland	59
Tripura	Tripura	60
Uttar Pradesh	Himalayan	61
Uttar Pradesh	Western	62
Uttar Pradesh	Central	63
Uttar Pradesh	Eastern	64
Uttar Pradesh	Southern	65
West Bengal	Himalayan	66
West Bengal	Eastern Plains	67
West Bengal	Central Plains	68
West Bengal	Western Plains	69
Andaman & Nicobar	A&N	70
Chandigarh		71
Dadar & Nagar Haveli		72
Delhi		73
Lakshadweep		74
Pondicherry		75

The results on protein deficiency computations for the three quinquennial rounds follow in Tables 3 to 10 for PG0, PG1 and PG2. These magnitudes are arranged in ascending order to facilitate ranking of regions by their protein deficiency profile.[6]

Thus in Table 3, Northern Madhya Pradesh had the smallest protein deficiency amd Sikkim the highest. In Table 4 southeastern Rajasthan had the lowest PG1 and inland southern Karnataka the highest. Again in Table 5 southeastern Rajasthan had the lowest PG2 and inland southern Karnataka the highest.

[6] Data on all regions may not be reported for each of the rounds. This is because of the lack of convergence of the computational algorithm in these cases.

Table 3: 43rd. Round PG0 in ascending order

			PG0
Madhya Pradesh	Northern	35	0.047252
Rajasthan	Western	51	0.050916
Uttar Pradesh	Southern	65	0.052633
Rajasthan	South Eastern	54	0.055401
Haryana	Western	19	0.067905
J&K	Outer Hills	22	0.091753
Rajasthan	North Eastern	52	0.103185
Madhya Pradesh	Central	31	0.103343
Madhya Pradesh	Malwa Plateau	32	0.10871
Uttar Pradesh	Central	63	0.11348
Himachal Pradesh	Himachal Pradesh	20	0.136232
Uttar Pradesh	Western	62	0.137636
Maharashtra	Inland Central	39	0.142797
Delhi		73	0.150417
J&K	Mountainious	21	0.161305
Haryana	Eastern	18	0.184397
Maharashtra	Inland Eastern	40	0.188609
West Bengal	Himalayan	66	0.190857
Punjab	Southern	50	0.193603
Uttar Pradesh	Eastern	64	0.195382
Madhya Pradesh	Vindhya	30	0.198395
Rajasthan	Southern	53	0.20916
Uttar Pradesh	Himalayan	61	0.216818
Bihar	Northern	10	0.225973
Punjab	Northern	49	0.238624
Madhya Pradesh	South western	34	0.240466
Andhra Pradesh	Coastal	1	0.244602
Chandigarh		71	0.260461
Bihar	Central	11	0.26828
Maharashtra	Inland Northern	38	0.289637
Maharashtra	Inland Western	37	0.291865
Andaman & Nicobar	A&N	70	0.292894
Gujarat	Plains Southern	15	0.295513
Arunachal Pradesh	Arunachal Pradesh	5	0.3071
Gujarat	Saurashtra	17	0.313509
Maharashtra	Eastern	41	0.31734
Karnataka	Inland Northern	26	0.327512
Gujarat	Dry Areas	16	0.342177
Gujarat	Plains Northern	14	0.368682
Assam	Plains Eastern	6	0.384766
Andhra Pradesh	South western	3	0.386371
Madhya Pradesh	South Central	33	0.389267
Andhra Pradesh	Inland Northern	2	0.392676
Lakshadweep		74	0.398627
West Bengal	Central Plains	68	0.399234
Manipur	Plains	42	0.403536
Tripura	Tripura	60	0.405229
Gujarat	Eastern	13	0.42623
Assam	Plains Western	7	0.441425

West Bengal	Western Plains	69	0.466436
Tamil Nadu	Inland	59	0.517347
West Bengal	Eastern Plains	67	0.520544
Tamil Nadu	Coastal	57	0.535886
Goa	Goa	12	0.537584
Kerala	Southern	28	0.543491
Karnataka	Inlans Eastern	24	0.548255
Bihar	Southern	9	0.550296
Orissa	Coastal	46	0.578861
Assam	Hills	8	0.585493
Mizoram	Mizoram	45	0.592054
Manipur	Hills	43	0.596853
Tamil Nadu	Southern	58	0.638697
Andhra Pradesh	Inland southern	4	0.640419
Madhya Pradesh	Chattisgarh	29	0.652248
Meghalaya	Meghalaya	44	0.665041
Maharashtra	Coastal	36	0.665417
Karnataka	Cosatal and Ghatas	23	0.666717
Kerala	Northern	27	0.682011
Tamil Nadu	Coastal Northen	56	0.691645
Karnataka	Inland Southern	25	0.723776
Orissa	Northern	48	0.747502
Orissa	Southern	47	0.751953
Dadar & Nagar Haveli		72	0.758055
Pondicherry		75	0.763108
Sikkim	Sikkim	55	0.875028

Table 4: 43rd Round PG1 in ascending order

			PG1
Rajasthan	South Eastern	54	0.009632
Madhya Pradesh	Northern	35	0.013478
J&K	Outer Hills	22	0.015688
Uttar Pradesh	Southern	65	0.018989
Rajasthan	Western	51	0.019329
Madhya Pradesh	Malwa Plateau	32	0.020004
Uttar Pradesh	Central	63	0.021267
Madhya Pradesh	Central	31	0.022614
Himachal Pradesh	Himachal Pradesh	20	0.025143
Uttar Pradesh	Western	62	0.030544
Maharashtra	Inland Central	39	0.031067
Haryana	Western	19	0.033381
Maharashtra	Inland Eastern	40	0.03583
J&K	Mountainious	21	0.03591
Uttar Pradesh	Himalayan	61	0.039429
Rajasthan	Southern	53	0.040212
West Bengal	Himalayan	66	0.040225
Madhya Pradesh	South western	34	0.041126
Rajasthan	North Eastern	52	0.042042
Madhya Pradesh	Vindhya	30	0.042561
Uttar Pradesh	Eastern	64	0.04282
Haryana	Eastern	18	0.043419

Bihar	Northern	10	0.046949
Punjab	Northern	49	0.04785
Gujarat	Saurashtra	17	0.051661
Gujarat	Plains Southern	15	0.056645
Gujarat	Plains Northern	14	0.058581
Bihar	Central	11	0.059346
Punjab	Southern	50	0.060373
Manipur	Plains	42	0.061859
Chandigarh		71	0.063689
Gujarat	Dry Areas	16	0.065882
Maharashtra	Inland Northern	38	0.06891
Maharashtra	Inland Western	37	0.069381
Andhra Pradesh	Coastal	1	0.079776
Maharashtra	Eastern	41	0.082582
Lakshadweep		74	0.086592
Andhra Pradesh	Inland Northern	2	0.090886
Assam	Plains Eastern	6	0.091476
Assam	Plains Western	7	0.094313
Madhya Pradesh	South Central	33	0.098176
Karnataka	Inland Northern	26	0.101554
Arunachal Pradesh	Arunachal Pradesh	5	0.101751
Tripura	Tripura	60	0.103326
Andaman & Nicobar	A&N	70	0.117511
Manipur	Hills	43	0.121028
West Bengal	Central Plains	68	0.124008
Gujarat	Eastern	13	0.134692
West Bengal	Western Plains	69	0.137365
Andhra Pradesh	South western	3	0.139393
Bihar	Southern	9	0.142941
Tamil Nadu	Coastal	57	0.142977
Orissa	Coastal	46	0.146622
West Bengal	Eastern Plains	67	0.147454
Assam	Hills	8	0.158361
Tamil Nadu	Inland	59	0.173348
Madhya Pradesh	Chattisgarh	29	0.177435
Meghalaya	Meghalaya	44	0.185698
Karnataka	Inlans Eastern	24	0.192791
Karnataka	Cosatal and Ghatas	23	0.193985
Orissa	Northern	48	0.203777
Mizoram	Mizoram	45	0.20755
Maharashtra	Coastal	36	0.217676
Kerala	Southern	28	0.22243
Orissa	Southern	47	0.231665
Goa	Goa	12	0.236882
Tamil Nadu	Southern	58	0.244147
Kerala	Northern	27	0.262778
Pondicherry		75	0.272325
Tamil Nadu	Coastal Northen	56	0.27823
Andhra Pradesh	Inland southern	4	0.295998
Sikkim	Sikkim	55	0.328907
Dadar & Nagar Haveli		72	0.381523
Karnataka	Inland Southern	25	0.407288

Table 5: 43rd Round PG2 in ascending order

			PG2
Delhi		73	0.001126
Rajasthan	South Eastern	54	0.004293
J&K	Outer Hills	22	0.005521
Madhya Pradesh	Northern	35	0.006891
Uttar Pradesh	Central	63	0.007737
Madhya Pradesh	Malwa Plateau	32	0.008572
Himachal Pradesh	Himachal Pradesh	20	0.009214
Uttar Pradesh	Southern	65	0.011484
Uttar Pradesh	Himalayan	61	0.012047
Madhya Pradesh	Central	31	0.012117
Maharashtra	Inland Central	39	0.012442
Maharashtra	Inland Eastern	40	0.012672
Gujarat	Saurashtra	17	0.012967
Rajasthan	Western	51	0.013334
J&K	Mountainious	21	0.013566
Uttar Pradesh	Western	62	0.014291
West Bengal	Himalayan	66	0.014658
Madhya Pradesh	Vindhya	30	0.015156
Manipur	Plains	42	0.015301
Madhya Pradesh	South western	34	0.015413
Gujarat	Plains Southern	15	0.016007
Rajasthan	Southern	53	0.016179
Gujarat	Plains Northern	14	0.016943
Bihar	Northern	10	0.01712
Uttar Pradesh	Eastern	64	0.017172
Punjab	Northern	49	0.02102
Haryana	Eastern	18	0.022242
Bihar	Central	11	0.022841
Haryana	Western	19	0.023878
Gujarat	Dry Areas	16	0.0243
Chandigarh		71	0.025079
Assam	Plains Eastern	6	0.02872
Maharashtra	Inland Western	37	0.029076
Rajasthan	North Eastern	52	0.029106
Lakshadweep		74	0.030093
Assam	Plains Western	7	0.030284
Maharashtra	Eastern	41	0.031327
Andhra Pradesh	Inland Northern	2	0.031923
Maharashtra	Inland Northern	38	0.033599
Manipur	Hills	43	0.034048
Madhya Pradesh	South Central	33	0.036224
Punjab	Southern	50	0.038221
Tripura	Tripura	60	0.039216
Andhra Pradesh	Coastal	1	0.040975
Arunachal Pradesh	Arunachal Pradesh	5	0.049955
Karnataka	Inland Northern	26	0.051053
West Bengal	Central Plains	68	0.053239
Tamil Nadu	Coastal	57	0.054559
Bihar	Southern	9	0.055885

West Bengal	Eastern Plains	67	0.057258
Assam	Hills	8	0.058218
West Bengal	Western Plains	69	0.062768
Gujarat	Eastern	13	0.064204
Orissa	Coastal	46	0.064448
Meghalaya	Meghalaya	44	0.067144
Andaman & Nicobar	A&N	70	0.069006
Madhya Pradesh	Chattisgarh	29	0.073314
Andhra Pradesh	South western	3	0.074958
Karnataka	Cosatal and Ghatas	23	0.075019
Orissa	Northern	48	0.078055
Tamil Nadu	Inland	59	0.08186
Karnataka	Inlans Eastern	24	0.092421
Maharashtra	Coastal	36	0.092743
Orissa	Southern	47	0.09484
Mizoram	Mizoram	45	0.097397
Kerala	Southern	28	0.11213
Pondicherry		75	0.115953
Goa	Goa	12	0.121509
Kerala	Northern	27	0.124066
Tamil Nadu	Southern	58	0.125977
Tamil Nadu	Coastal Northen	56	0.140181
Sikkim	Sikkim	55	0.149757
Andhra Pradesh	Inland southern	4	0.176815
Dadar & Nagar Haveli		72	0.227409
Karnataka	Inland Southern	25	0.27488

Table 6: 50th Round PG0 in ascending order

			PG0
Haryana	Western	19	0.034114
Punjab	Southern	50	0.050086
Uttar Pradesh	Western	62	0.05256
Andaman & Nicobar	A&N	70	0.054606
J&K	Mountainious	21	0.058907
Haryana	Eastern	18	0.062273
Punjab	Northern	49	0.068631
Uttar Pradesh	Southern	65	0.071696
Uttar Pradesh	Central	63	0.086224
Lakshadweep		74	0.091198
Bihar	Central	11	0.0919
Uttar Pradesh	Eastern	64	0.098636
Chandigarh		71	0.099348
Delhi		73	0.100887
Madhya Pradesh	Central	31	0.116116
Madhya Pradesh	Vindhya	30	0.118013
Meghalaya	Meghalaya	44	0.122642
Bihar	Northern	10	0.123524
Tamil Nadu	Coastal	57	0.126714
Madhya Pradesh	Northern	35	0.127259
Assam	Hills	8	0.133772
Manipur	Plains	42	0.136818
Maharashtra	Eastern	41	0.138787

Rajasthan	South Eastern	54	0.142503
Assam	Plains Western	7	0.142752
Andhra Pradesh	Inland Northern	2	0.143282
Tripura	Tripura	60	0.145576
West Bengal	Himalayan	66	0.155613
Rajasthan	North Eastern	52	0.170972
West Bengal	Western Plains	69	0.171549
West Bengal	Eastern Plains	67	0.179906
Karnataka	Cosatal and Ghatas	23	0.181876
Madhya Pradesh	Chattisgarh	29	0.185168
West Bengal	Central Plains	68	0.186618
Andhra Pradesh	South western	3	0.186987
Andhra Pradesh	Coastal	1	0.189013
Assam	Plains Eastern	6	0.205761
Orissa	Coastal	46	0.210164
Madhya Pradesh	Malwa Plateau	32	0.215709
Manipur	Hills	43	0.222569
Madhya Pradesh	South Central	33	0.225001
Orissa	Northern	48	0.231724
Andhra Pradesh	Inland southern	4	0.237012
Tamil Nadu	Inland	59	0.249555
Pondicherry		75	0.252774
Mizoram	Mizoram	45	0.263536
Karnataka	Inlans Eastern	24	0.273771
Kerala	Southern	28	0.302853
Orissa	Southern	47	0.305519
Gujarat	Saurashtra	17	0.305785
Tamil Nadu	Southern	58	0.316769
Gujarat	Plains Northern	14	0.317002
Goa	Goa	12	0.322914
Kerala	Northern	27	0.324347
Himachal Pradesh	Himachal Pradesh	20	0.332749
Uttar Pradesh	Himalayan	61	0.333585
Tamil Nadu	Coastal Northen	56	0.333958
Bihar	Southern	9	0.347198
Rajasthan	Southern	53	0.352585
Gujarat	Dry Areas	16	0.360589
Gujarat	Plains Southern	15	0.365547
Sikkim	Sikkim	55	0.381623
Maharashtra	Coastal	36	0.415769
Gujarat	Eastern	13	0.434848
J&K	Outer Hills	22	0.442122
Madhya Pradesh	South western	34	0.448359
Rajasthan	Western	51	0.457001
Arunachal Pradesh	Arunachal Pradesh	5	0.489777
Maharashtra	Inland Eastern	40	0.49199
Maharashtra	Inland Northern	38	0.535003
Maharashtra	Inland Western	37	0.568545
Maharashtra	Inland Central	39	0.575486
Karnataka	Inland Northern	26	0.643752
Karnataka	Inland Southern	25	0.659243
Dadar & Nagar Haveli		72	0.699144

Table 7: 50th Round PG1 in ascending order

			PG1
Punjab	Southern	50	0.010076
Haryana	Western	19	0.011717
Assam	Hills	8	0.012529
Uttar Pradesh	Western	62	0.013117
Punjab	Northern	49	0.014448
Haryana	Eastern	18	0.014452
Uttar Pradesh	Central	63	0.016491
Manipur	Plains	42	0.017444
Uttar Pradesh	Eastern	64	0.018478
Assam	Plains Western	7	0.01851
J&K	Mountainious	21	0.018859
Meghalaya	Meghalaya	44	0.021369
Bihar	Central	11	0.022445
Andaman & Nicobar	A&N	70	0.02245
Bihar	Northern	10	0.023313
West Bengal	Eastern Plains	67	0.023657
West Bengal	Himalayan	66	0.023817
West Bengal	Western Plains	69	0.024385
Uttar Pradesh	Southern	65	0.025676
Madhya Pradesh	Central	31	0.026346
Andhra Pradesh	Inland Northern	2	0.026606
Assam	Plains Eastern	6	0.02741
Tamil Nadu	Coastal	57	0.028801
Madhya Pradesh	Vindhya	30	0.02885
Madhya Pradesh	Chattisgarh	29	0.029604
West Bengal	Central Plains	68	0.029766
Lakshadweep		74	0.030366
Tripura	Tripura	60	0.031235
Delhi		73	0.032349
Orissa	Coastal	46	0.033015
Orissa	Northern	48	0.034623
Andhra Pradesh	Coastal	1	0.035662
Chandigarh		71	0.036431
Madhya Pradesh	Northern	35	0.039019
Karnataka	Cosatal and Ghatas	23	0.039987
Maharashtra	Eastern	41	0.04144
Andhra Pradesh	South western	3	0.044012
Rajasthan	South Eastern	54	0.04828
Tamil Nadu	Inland	59	0.048633
Mizoram	Mizoram	45	0.049569
Manipur	Hills	43	0.054874
Madhya Pradesh	South Central	33	0.056123
Karnataka	Inlans Eastern	24	0.058568
Rajasthan	North Eastern	52	0.059664
Pondicherry		75	0.063753
Andhra Pradesh	Inland southern	4	0.063912
Tamil Nadu	Southern	58	0.063975
Orissa	Southern	47	0.065541
Madhya Pradesh	Malwa Plateau	32	0.065869

Gujarat	Saurashtra	17	0.068831
Kerala	Northern	27	0.075598
Goa	Goa	12	0.076665
Kerala	Southern	28	0.077148
Tamil Nadu	Coastal Northen	56	0.078496
Bihar	Southern	9	0.078813
Sikkim	Sikkim	55	0.083707
Gujarat	Plains Northern	14	0.085635
Uttar Pradesh	Himalayan	61	0.086229
Gujarat	Dry Areas	16	0.101825
Maharashtra	Coastal	36	0.110149
Himachal Pradesh	Himachal Pradesh	20	0.110723
Gujarat	Plains Southern	15	0.115517
Gujarat	Eastern	13	0.132489
Rajasthan	Southern	53	0.136865
J&K	Outer Hills	22	0.139292
Maharashtra	Inland Eastern	40	0.144962
Arunachal Pradesh	Arunachal Pradesh	5	0.158144
Madhya Pradesh	South western	34	0.174412
Rajasthan	Western	51	0.185465
Maharashtra	Inland Western	37	0.187726
Maharashtra	Inland Central	39	0.192947
Maharashtra	Inland Northern	38	0.195017
Karnataka	Inland Northern	26	0.21884
Karnataka	Inland Southern	25	0.227062
Dadar & Nagar Haveli		72	0.25102

Table 8: 50th Round PG2 in ascending order

			PG2
Assam	Hills	8	0.00179
Manipur	Plains	42	0.003423
Punjab	Southern	50	0.003434
Assam	Plains Western	7	0.004415
West Bengal	Eastern Plains	67	0.005753
Uttar Pradesh	Western	62	0.005929
West Bengal	Himalayan	66	0.005982
Uttar Pradesh	Central	63	0.00626
Assam	Plains Eastern	6	0.006781
West Bengal	Western Plains	69	0.006832
Haryana	Eastern	18	0.007371
Uttar Pradesh	Eastern	64	0.007425
Bihar	Northern	10	0.007443
Haryana	Western	19	0.007476
Punjab	Northern	49	0.007943
Andhra Pradesh	Inland Northern	2	0.008109
Orissa	Northern	48	0.008385
Orissa	Coastal	46	0.009171
Bihar	Central	11	0.009245
Meghalaya	Meghalaya	44	0.009284
Madhya Pradesh	Chattisgarh	29	0.009463
Tripura	Tripura	60	0.009738
West Bengal	Central Plains	68	0.009902

J&K	Mountainious	21	0.010561
Madhya Pradesh	Vindhya	30	0.011711
Madhya Pradesh	Central	31	0.012184
Andhra Pradesh	Coastal	1	0.012214
Tamil Nadu	Coastal	57	0.012257
Karnataka	Cosatal and Ghatas	23	0.013055
Uttar Pradesh	Southern	65	0.013104
Andaman & Nicobar	A&N	70	0.015113
Tamil Nadu	Inland	59	0.015239
Andhra Pradesh	South western	3	0.016247
Mizoram	Mizoram	45	0.016304
Lakshadweep		74	0.016711
Madhya Pradesh	Northern	35	0.018195
Delhi		73	0.019281
Chandigarh		71	0.019383
Manipur	Hills	43	0.020792
Pondicherry		75	0.02087
Rajasthan	South Eastern	54	0.021032
Maharashtra	Eastern	41	0.021225
Karnataka	Inlans Eastern	24	0.021366
Madhya Pradesh	South Central	33	0.021817
Orissa	Southern	47	0.021956
Tamil Nadu	Southern	58	0.022082
Gujarat	Saurashtra	17	0.026485
Goa	Goa	12	0.027145
Kerala	Northern	27	0.027616
Andhra Pradesh	Inland southern	4	0.028273
Rajasthan	North Eastern	52	0.028437
Bihar	Southern	9	0.028466
Kerala	Southern	28	0.03018
Tamil Nadu	Coastal Northen	56	0.030959
Madhya Pradesh	Malwa Plateau	32	0.031434
Uttar Pradesh	Himalayan	61	0.031499
Gujarat	Plains Northern	14	0.034393
Sikkim	Sikkim	55	0.036349
Gujarat	Dry Areas	16	0.04178
Maharashtra	Coastal	36	0.043375
Gujarat	Plains Southern	15	0.049266
Himachal Pradesh	Himachal Pradesh	20	0.052852
Gujarat	Eastern	13	0.054772
J&K	Outer Hills	22	0.059038
Maharashtra	Inland Eastern	40	0.061175
Rajasthan	Southern	53	0.070908
Arunachal Pradesh	Arunachal Pradesh	5	0.071108
Maharashtra	Inland Western	37	0.089056
Maharashtra	Inland Northern	38	0.092185
Madhya Pradesh	South western	34	0.092328
Maharashtra	Inland Central	39	0.094901
Rajasthan	Western	51	0.099529
Karnataka	Inland Northern	26	0.101731
Karnataka	Inland Southern	25	0.10492
Dadar & Nagar Haveli		72	0.111028

Table 9: 55th Round PG0 in ascending order

			PG0
Haryana	Western	19	0.000247
Mizoram	Mizoram	45	0.000398
Gujarat	Saurashtra	17	0.000434
Madhya Pradesh	Vindhya	30	0.001694
Haryana	Eastern	18	0.001699
Madhya Pradesh	Northern	35	0.002511
Rajasthan	Western	51	0.0028
Rajasthan	North Eastern	52	0.003029
Uttar Pradesh	Himalayan	61	0.00306
West Bengal	Himalayan	66	0.003369
Meghalaya	Meghalaya	44	0.003565
Assam	Plains Eastern	6	0.00382
Punjab	Northern	49	0.004457
Tripura	Tripura	60	0.004676
Chandigarh		71	0.004889
Delhi		73	0.005045
Manipur	Plains	42	0.005563
West Bengal	Eastern Plains	67	0.006142
Maharashtra	Inland Western	37	0.006477
West Bengal	Central Plains	68	0.007074
Rajasthan	South Eastern	54	0.007617
Uttar Pradesh	Southern	65	0.009693
Manipur	Hills	43	0.009825
Uttar Pradesh	Central	63	0.009858
Bihar	Northern	10	0.010399
Punjab	Southern	50	0.011838
Himachal Pradesh	Himachal Pradesh	20	0.012618
Gujarat	Dry Areas	16	0.012974
Uttar Pradesh	Western	62	0.014286
Orissa	Coastal	46	0.014408
Karnataka	Inlans Eastern	24	0.015105
Rajasthan	Southern	53	0.016672
Goa	Goa	12	0.017706
Karnataka	Inland Southern	25	0.017928
Madhya Pradesh	South western	34	0.019173
Assam	Plains Western	7	0.019724
Madhya Pradesh	Central	31	0.021289
Uttar Pradesh	Eastern	64	0.022424
Andhra Pradesh	Inland Northern	2	0.02317
Bihar	Central	11	0.023997
Maharashtra	Coastal	36	0.024405
Karnataka	Cosatal and Ghatas	23	0.026177
Madhya Pradesh	Malwa Plateau	32	0.026244
Maharashtra	Eastern	41	0.026534
Gujarat	Plains Southern	15	0.026633
Karnataka	Inland Northern	26	0.026752
Lakshadweep		74	0.027039
Bihar	Southern	9	0.028885
Madhya Pradesh	South Central	33	0.030617

Maharashtra	Inland Eastern	40	0.032314
Gujarat	Eastern	13	0.034277
Madhya Pradesh	Chattisgarh	29	0.03464
Orissa	Northern	48	0.034651
West Bengal	Western Plains	69	0.042668
Andhra Pradesh	South western	3	0.0433
Kerala	Southern	28	0.043741
Andhra Pradesh	Coastal	1	0.049834
Andaman & Nicobar	A&N	70	0.056145
Kerala	Northern	27	0.056995
Pondicherry		75	0.058712
Maharashtra	Inland Central	39	0.060174
Tamil Nadu	Coastal	57	0.062293
Dadar & Nagar Haveli		72	0.063481
Sikkim	Sikkim	55	0.069264
Andhra Pradesh	Inland southern	4	0.071126
Arunachal Pradesh	Arunachal Pradesh	5	0.077096
Maharashtra	Inland Northern	38	0.081478
Orissa	Southern	47	0.09988
Tamil Nadu	Inland	59	0.107001
Tamil Nadu	Southern	58	0.109005
Tamil Nadu	Coastal Northen	56	0.152548

Table 10: 55th Round PG1 in ascending order

			PG1
Gujarat	Saurashtra	17	3.16E–05
Haryana	Western	19	4.84E–05
West Bengal	Himalayan	66	6.76E–05
Madhya Pradesh	Northern	35	0.000203
Meghalaya	Meghalaya	44	0.00021
Uttar Pradesh	Himalayan	61	0.000278
Mizoram	Mizoram	45	0.000299
Tripura	Tripura	60	0.000348
Manipur	Hills	43	0.000579
Uttar Pradesh	Southern	65	0.000586
Delhi		73	0.000607
Haryana	Eastern	18	0.000625
Manipur	Plains	42	0.000856
Madhya Pradesh	Vindhya	30	0.001092
Rajasthan	North Eastern	52	0.001407
Bihar	Northern	10	0.001456
Punjab	Northern	49	0.001614
Maharashtra	Inland Western	37	0.001721
West Bengal	Central Plains	68	0.002006
Goa	Goa	12	0.002384
Rajasthan	Western	51	0.002413
Maharashtra	Eastern	41	0.00248
West Bengal	Eastern Plains	67	0.002556
Assam	Plains Eastern	6	0.002756
Uttar Pradesh	Central	63	0.00288
Rajasthan	South Eastern	54	0.002889

Assam	Plains Western	7	0.003351
Madhya Pradesh	Central	31	0.003462
Chandigarh		71	0.003624
Uttar Pradesh	Western	62	0.003879
Bihar	Central	11	0.004012
Bihar	Southern	9	0.004593
Himachal Pradesh	Himachal Pradesh	20	0.004684
Uttar Pradesh	Eastern	64	0.004687
Punjab	Southern	50	0.004691
Orissa	Coastal	46	0.005025
Maharashtra	Coastal	36	0.005029
Madhya Pradesh	South Central	33	0.005076
Madhya Pradesh	South western	34	0.005191
Andhra Pradesh	Inland Northern	2	0.005197
Gujarat	Dry Areas	16	0.006543
Karnataka	Inland Southern	25	0.007707
Madhya Pradesh	Malwa Plateau	32	0.008609
Kerala	Southern	28	0.008884
Madhya Pradesh	Chattisgarh	29	0.009678
Rajasthan	Southern	53	0.009831
Maharashtra	Inland Eastern	40	0.009949
Lakshadweep		74	0.010664
Karnataka	Inlans Eastern	24	0.010754
Orissa	Northern	48	0.011061
Tamil Nadu	Coastal	57	0.012872
Kerala	Northern	27	0.012887
Karnataka	Inland Northern	26	0.013011
Karnataka	Cosatal and Ghatas	23	0.014279
Pondicherry		75	0.014618
Andhra Pradesh	Inland southern	4	0.015288
Andaman & Nicobar	A&N	70	0.016422
West Bengal	Western Plains	69	0.016587
Gujarat	Plains Southern	15	0.017598
Orissa	Southern	47	0.018213
Andhra Pradesh	Coastal	1	0.018598
Tamil Nadu	Southern	58	0.021335
Andhra Pradesh	South western	3	0.021477
Gujarat	Eastern	13	0.022646
Arunachal Pradesh	Arunachal Pradesh	5	0.023361
Tamil Nadu	Inland	59	0.02604
Tamil Nadu	Coastal Northen	56	0.036918
Maharashtra	Inland Central	39	0.046655
Dadar & Nagar Haveli		72	0.048849
Sikkim	Sikkim	55	0.049036
Maharashtra	Inland Northern	38	0.053592

Table 11: 55th Round PG2 in ascending order

			PG2
West Bengal	Himalayan	66	1.36E–06
Gujarat	Saurashtra	17	2.31E–06
Haryana	Western	19	9.48E–06

Meghalaya	Meghalaya	44	2.52E–05
Tripura	Tripura	60	0.000034
Uttar Pradesh	Southern	65	4.01E–05
Uttar Pradesh	Himalayan	61	6.33E–05
Manipur	Hills	43	6.53E–05
Madhya Pradesh	Northern	35	8.47E–05
Delhi		73	0.000145
Manipur	Plains	42	0.000182
Mizoram	Mizoram	45	0.000225
Haryana	Eastern	18	0.00023
Maharashtra	Eastern	41	0.000395
Goa	Goa	12	0.000459
Bihar	Northern	10	0.000536
Madhya Pradesh	Central	31	0.000689
Assam	Plains Western	7	0.000845
Maharashtra	Inland Western	37	0.000918
Rajasthan	North Eastern	52	0.00093
Madhya Pradesh	Vindhya	30	0.000939
Punjab	Northern	49	0.000943
West Bengal	Central Plains	68	0.001385
Bihar	Southern	9	0.001556
Madhya Pradesh	South Central	33	0.001571
Bihar	Central	11	0.001572
Uttar Pradesh	Central	63	0.001615
Maharashtra	Coastal	36	0.001683
Rajasthan	South Eastern	54	0.001693
Uttar Pradesh	Western	62	0.00186
West Bengal	Eastern Plains	67	0.002017
Rajasthan	Western	51	0.002094
Uttar Pradesh	Eastern	64	0.002121
Punjab	Southern	50	0.002126
Assam	Plains Eastern	6	0.002253
Andhra Pradesh	Inland Northern	2	0.002586
Madhya Pradesh	South western	34	0.00291
Chandigarh		71	0.002986
Himachal Pradesh	Himachal Pradesh	20	0.002996
Kerala	Southern	28	0.003396
Orissa	Coastal	46	0.003847
Gujarat	Dry Areas	16	0.003904
Maharashtra	Inland Eastern	40	0.00397
Tamil Nadu	Coastal	57	0.004037
Lakshadweep		74	0.004212
Kerala	Northern	27	0.0047
Karnataka	Inland Southern	25	0.004772
Andhra Pradesh	Inland southern	4	0.0056
Madhya Pradesh	Malwa Plateau	32	0.00565
Pondicherry		75	0.005882
Madhya Pradesh	Chattisgarh	29	0.00666
Orissa	Southern	47	0.006716
Tamil Nadu	Southern	58	0.007336
Orissa	Northern	48	0.007924

Karnataka	Inland Northern	26	0.008497
Rajasthan	Southern	53	0.008564
Karnataka	Inlans Eastern	24	0.008855
Karnataka	Cosatal and Ghatas	23	0.010506
Arunachal Pradesh	Arunachal Pradesh	5	0.010797
Andaman & Nicobar	A&N	70	0.011
West Bengal	Western Plains	69	0.011152
Tamil Nadu	Inland	59	0.012351
Andhra Pradesh	Coastal	1	0.012512
Gujarat	Plains Southern	15	0.014391
Tamil Nadu	Coastal Northen	56	0.016196
Gujarat	Eastern	13	0.017554
Andhra Pradesh	South western	3	0.018113
Maharashtra	Inland Central	39	0.038279
Sikkim	Sikkim	55	0.041205
Dadar & Nagar Haveli		72	0.041388
Maharashtra	Inland Northern	38	0.045537

We now assess how the various regions have performed in respect of protein deficiency over this time period. Thus in Table 12 the head count ratio for 1993–94 is subtracted from that for 1987–88 for each region. These differences are then arranged in ascending order. The first entry in Table 13 indicates that the head count ratio was 0.43269 lower in 1987–88 compared to 1993–94 in inland central Maharshtra. Negative changes indicate worsening performance whereas positive changes indicate improved performance. Thus, over the period 1987–88 to 1993–94 the deterioration in the head count ratio was greatest in inland central Maharshtra. The greatest improvement was in Meghalaya.

Table 12: Protein Deficiency Changes Between 43rd – 50th Rounds (PG0)

	Deteriorating PG0		
Maharashtra	Inland Central	39	-0.43269
Rajasthan	Western	51	-0.40609
J&K	Outer Hills	22	-0.35037
Karnataka	Inland Northern	26	-0.31624
Maharashtra	Inland Eastern	40	-0.30338
Maharashtra	Inland Western	37	-0.27668
Maharashtra	Inland Northern	38	-0.24537
Madhya Pradesh	South western	34	-0.20789
Himachal Pradesh	Himachal Pradesh	20	-0.19652
Arunachal Pradesh	Arunachal Pradesh	5	-0.18268
Rajasthan	Southern	53	-0.14343
Uttar Pradesh	Himalayan	61	-0.11677
Madhya Pradesh	Malwa Plateau	32	-0.107

Rajasthan	South Eastern	54	-0.0871
Madhya Pradesh	Northern	35	-0.08001
Gujarat	Plains Southern	15	-0.07003
Rajasthan	North Eastern	52	-0.06779
Uttar Pradesh	Southern	65	-0.01906
Gujarat	Dry Areas	16	-0.01841
Madhya Pradesh	Central	31	-0.01277
Gujarat	Eastern	13	-0.00862
	Improving PG0		
Gujarat	Saurashtra	17	0.007724
Uttar Pradesh	Central	63	0.027256
Haryana	Western	19	0.033791
West Bengal	Himalayan	66	0.035244
Delhi		73	0.04953
Gujarat	Plains Northern	14	0.05168
Andhra Pradesh	Coastal	1	0.05559
Dadar & Nagar Haveli		72	0.058911
Karnataka	Inland Southern	25	0.064533
Madhya Pradesh	Vindhya	30	0.080382
Uttar Pradesh	Western	62	0.085075
Uttar Pradesh	Eastern	64	0.096746
J&K	Mountainious	21	0.102397
Bihar	Northern	10	0.10245
Haryana	Eastern	18	0.122124
Punjab	Southern	50	0.143517
Chandigarh		71	0.161113
Madhya Pradesh	South Central	33	0.164266
Punjab	Northern	49	0.169993
Bihar	Central	11	0.17638
Maharashtra	Eastern	41	0.178554
Assam	Plains Eastern	6	0.179005
Andhra Pradesh	South western	3	0.199384
Bihar	Southern	9	0.203099
West Bengal	Central Plains	68	0.212616
Goa	Goa	12	0.21467
Andaman & Nicobar	A&N	70	0.238288
Kerala	Southern	28	0.240638
Andhra Pradesh	Inland Northern	2	0.249394
Maharashtra	Coastal	36	0.249648
Tripura	Tripura	60	0.259653
Manipur	Plains	42	0.266718
Tamil Nadu	Inland	59	0.267792
Karnataka	Inlans Eastern	24	0.274484
West Bengal	Western Plains	69	0.294888
Assam	Plains Western	7	0.298673
Lakshadweep		74	0.307428
Tamil Nadu	Southern	58	0.321927
Mizoram	Mizoram	45	0.328519
West Bengal	Eastern Plains	67	0.340638
Kerala	Northern	27	0.357664
Tamil Nadu	Coastal Northen	56	0.357687

Orissa	Coastal	46	0.368697
Manipur	Hills	43	0.374285
Andhra Pradesh	Inland southern	4	0.403408
Tamil Nadu	Coastal	57	0.409172
Orissa	Southern	47	0.446435
Assam	Hills	8	0.451722
Madhya Pradesh	Chattisgarh	29	0.46708
Karnataka	Cosatal and Ghatas	23	0.484841
Sikkim	Sikkim	55	0.493405
Pondicherry		75	0.510335
Orissa	Northern	48	0.515778
Meghalaya	Meghalaya	44	0.542399

Table 13: Protein Deficiency Changes Between 43rd – 50th Rounds (PG1)

	Deteriorating PG1		
Rajasthan	Western	51	-0.16614
Maharashtra	Inland Central	39	-0.16188
Madhya Pradesh	South western	34	-0.13329
Maharashtra	Inland Northern	38	-0.12611
J&K	Outer Hills	22	-0.1236
Maharashtra	Inland Western	37	-0.11835
Karnataka	Inland Northern	26	-0.11729
Maharashtra	Inland Eastern	40	-0.10913
Rajasthan	Southern	53	-0.09665
Himachal Pradesh	Himachal Pradesh	20	-0.08558
Gujarat	Plains Southern	15	-0.05887
Arunachal Pradesh	Arunachal Pradesh	5	-0.05639
Uttar Pradesh	Himalayan	61	-0.0468
Madhya Pradesh	Malwa Plateau	32	-0.04586
Rajasthan	South Eastern	54	-0.03865
Gujarat	Dry Areas	16	-0.03594
Gujarat	Plains Northern	14	-0.02705
Madhya Pradesh	Northern	35	-0.02554
Delhi		73	-0.02273
Rajasthan	North Eastern	52	-0.01762
Gujarat	Saurashtra	17	-0.01717
Uttar Pradesh	Southern	65	-0.00669
Madhya Pradesh	Central	31	-0.00373
	Improving PG1		
Gujarat	Eastern	13	0.002202
Uttar Pradesh	Central	63	0.004777
Madhya Pradesh	Vindhya	30	0.013712
West Bengal	Himalayan	66	0.016408
J&K	Mountainious	21	0.017051
Uttar Pradesh	Western	62	0.017427
Haryana	Western	19	0.021664
Bihar	Northern	10	0.023636
Uttar Pradesh	Eastern	64	0.024343
Chandigarh		71	0.027259
Haryana	Eastern	18	0.028967
Punjab	Northern	49	0.033403

Bihar	Central	11	0.036901
Maharashtra	Eastern	41	0.041143
Madhya Pradesh	South Central	33	0.042053
Andhra Pradesh	Coastal	1	0.044114
Manipur	Plains	42	0.044415
Punjab	Southern	50	0.050297
Lakshadweep		74	0.056227
Assam	Plains Eastern	6	0.064066
Bihar	Southern	9	0.064128
Andhra Pradesh	Inland Northern	2	0.06428
Manipur	Hills	43	0.066154
Tripura	Tripura	60	0.072091
Assam	Plains Western	7	0.075804
West Bengal	Central Plains	68	0.094242
Andaman & Nicobar	A&N	70	0.095061
Andhra Pradesh	South western	3	0.095381
Maharashtra	Coastal	36	0.107527
West Bengal	Western Plains	69	0.11298
Orissa	Coastal	46	0.113607
Tamil Nadu	Coastal	57	0.114176
West Bengal	Eastern Plains	67	0.123796
Tamil Nadu	Inland	59	0.124715
Dadar & Nagar Haveli		72	0.130503
Karnataka	Inlans Eastern	24	0.134223
Kerala	Southern	28	0.145282
Assam	Hills	8	0.145832
Madhya Pradesh	Chattisgarh	29	0.147831
Karnataka	Cosatal and Ghatas	23	0.153999
Mizoram	Mizoram	45	0.157981
Goa	Goa	12	0.160217
Meghalaya	Meghalaya	44	0.164329
Orissa	Southern	47	0.166124
Orissa	Northern	48	0.169153
Tamil Nadu	Southern	58	0.180172
Karnataka	Inland Southern	25	0.180226
Kerala	Northern	27	0.187181
Tamil Nadu	Coastal Northen	56	0.199734
Pondicherry		75	0.208572
Andhra Pradesh	Inland southern	4	0.232086
Sikkim	Sikkim	55	0.2452

Table 14: Protein Deficiency Changes Between 43rd – 50th Rounds (PG2)

	Deteriorating PG2		
Rajasthan	Western	51	-0.08619
Maharashtra	Inland Central	39	-0.08246
Madhya Pradesh	South western	34	-0.07691
Maharashtra	Inland Western	37	-0.05998
Maharashtra	Inland Northern	38	-0.05859
Rajasthan	Southern	53	-0.05473
J&K	Outer Hills	22	-0.05352
Karnataka	Inland Northern	26	-0.05068

Maharashtra	Inland Eastern	40	-0.0485
Himachal Pradesh	Himachal Pradesh	20	-0.04364
Gujarat	Plains Southern	15	-0.03326
Madhya Pradesh	Malwa Plateau	32	-0.02286
Arunachal Pradesh	Arunachal Pradesh	5	-0.02115
Uttar Pradesh	Himalayan	61	-0.01945
Delhi		73	-0.01816
Gujarat	Dry Areas	16	-0.01748
Gujarat	Plains Northern	14	-0.01745
Rajasthan	South Eastern	54	-0.01674
Gujarat	Saurashtra	17	-0.01352
Madhya Pradesh	Northern	35	-0.0113
Uttar Pradesh	Southern	65	-0.00162
Madhya Pradesh	Central	31	-6.8E-05
	Improving PG2		
Rajasthan	North-Eastern	52	0.000669
Uttar Pradesh	Central	63	0.001477
J&K	Mountainious	21	0.003006
Madhya Pradesh	Vindhya	30	0.003445
Chandigarh		71	0.005696
Uttar Pradesh	Western	62	0.008362
West Bengal	Himalayan	66	0.008676
Gujarat	Eastern	13	0.009432
Bihar	Northern	10	0.009677
Uttar Pradesh	Eastern	64	0.009747
Maharashtra	Eastern	41	0.010101
Manipur	Plains	42	0.011878
Punjab	Northern	49	0.013078
Manipur	Hills	43	0.013256
Lakshadweep		74	0.013383
Bihar	Central	11	0.013596
Madhya Pradesh	South Central	33	0.014408
Haryana	Eastern	18	0.014871
Haryana	Western	19	0.016402
Assam	Plains Eastern	6	0.021939
Andhra Pradesh	Inland Northern	2	0.023815
Assam	Plains Western	7	0.02587
Bihar	Southern	9	0.027419
Andhra Pradesh	Coastal	1	0.028761
Tripura	Tripura	60	0.029478
Punjab	Southern	50	0.034788
Tamil Nadu	Coastal	57	0.042302
West Bengal	Central Plains	68	0.043337
Maharashtra	Coastal	36	0.049368
West Bengal	Eastern Plains	67	0.051505
Andaman & Nicobar	A&N	70	0.053893
Orissa	Coastal	46	0.055277
West Bengal	Western Plains	69	0.055936
Assam	Hills	8	0.056428
Meghalaya	Meghalaya	44	0.05786
Andhra Pradesh	South western	3	0.058711

Karnataka	Cosatal and Ghatas	23	0.061964
Madhya Pradesh	Chattisgarh	29	0.063851
Tamil Nadu	Inland	59	0.066621
Orissa	Northern	48	0.06967
Karnataka	Inlans Eastern	24	0.071054
Orissa	Southern	47	0.072883
Mizoram	Mizoram	45	0.081093
Kerala	Southern	28	0.08195
Goa	Goa	12	0.094364
Pondicherry		75	0.095082
Kerala	Northern	27	0.09645
Tamil Nadu	Southern	58	0.103895
Tamil Nadu	Coastal Northen	56	0.109222
Sikkim	Sikkim	55	0.113408
Dadar & Nagar Haveli		72	0.116381
Andhra Pradesh	Inland southern	4	0.148542
Karnataka	Inland Southern	25	0.16996

Table 15: Protein Deficiency Changes Between 43rd – 55th Rounds (PG0)

	Deteriorating PG0		
Rajasthan	South Eastern	54	-0.0536
Rajasthan	North Eastern	52	-0.04936
Rajasthan	Western	51	-0.01835
Madhya Pradesh	Northern	35	-0.01292
	Improving PG0		
Uttar Pradesh	Southern	65	0.009966
Haryana	Western	19	0.041728
J&K	Outer Hills	22	0.065001
Madhya Pradesh	Malwa Plateau	32	0.084305
Madhya Pradesh	Central	31	0.100832
Uttar Pradesh	Central	63	0.107338
Himachal Pradesh	Himachal Pradesh	20	0.121128
Maharashtra	Inland Central	39	0.132972
Uttar Pradesh	Western	62	0.134267
West Bengal	Himalayan	66	0.134712
J&K	Mountainious	21	0.143376
Rajasthan	Southern	53	0.146867
Delhi		73	0.150417
Madhya Pradesh	South western	34	0.158988
Haryana	Eastern	18	0.171779
Madhya Pradesh	Vindhya	30	0.179221
Maharashtra	Inland Eastern	40	0.185044
Punjab	Southern	50	0.185986
Uttar Pradesh	Eastern	64	0.188308
Andhra Pradesh	Coastal	1	0.194768
Chandigarh		71	0.201749
Bihar	Northern	10	0.201977
Uttar Pradesh	Himalayan	61	0.207124
Punjab	Northern	49	0.221952
Arunachal Pradesh	Arunachal Pradesh	5	0.230004
Bihar	Central	11	0.250575

Maharashtra	Inland Western	37	0.265331
Andaman & Nicobar	A&N	70	0.265855
Maharashtra	Inland Northern	38	0.284074
Gujarat	Plains Southern	15	0.29508
Gujarat	Saurashtra	17	0.313261
Maharashtra	Eastern	41	0.316942
Karnataka	Inland Northern	26	0.325818
West Bengal	Central Plains	68	0.335753
Gujarat	Dry Areas	16	0.340478
Andhra Pradesh	South western	3	0.343071
Gujarat	Plains Northern	14	0.355708
Andhra Pradesh	Inland Northern	2	0.369505
Assam	Plains Eastern	6	0.380947
Madhya Pradesh	South Central	33	0.38279
Tripura	Tripura	60	0.382805
Manipur	Plains	42	0.389128
Lakshadweep		74	0.398627
Gujarat	Eastern	13	0.399598
Assam	Plains Western	7	0.4217
West Bengal	Western Plains	69	0.461392
Manipur	Hills	43	0.496974
Goa	Goa	12	0.503306
Karnataka	Inlans Eastern	24	0.504514
Tamil Nadu	Inland	59	0.507489
West Bengal	Eastern Plains	67	0.515655
Kerala	Southern	28	0.517247
Tamil Nadu	Coastal	57	0.532827
Bihar	Southern	9	0.539897
Assam	Hills	8	0.556608
Orissa	Coastal	46	0.567023
Andhra Pradesh	Inland southern	4	0.569294
Mizoram	Mizoram	45	0.587598
Karnataka	Cosatal and Ghatas	23	0.609721
Madhya Pradesh	Chattisgarh	29	0.621631
Tamil Nadu	Southern	58	0.624411
Meghalaya	Meghalaya	44	0.63039
Maharashtra	Coastal	36	0.633104
Kerala	Northern	27	0.660722
Tamil Nadu	Coastal Northen	56	0.686969
Karnataka	Inland Southern	25	0.689135
Orissa	Northern	48	0.744473
Orissa	Southern	47	0.749153
Dadar & Nagar Haveli		72	0.758055
Pondicherry		75	0.763108
Sikkim	Sikkim	55	0.768027

Table 16: Protein Deficiency Changes Between 43rd – 55th Rounds (PG1)

	Deteriorating PG1		
Madhya Pradesh	Northern	35	-0.03318
Rajasthan	Western	51	-0.02971
Madhya Pradesh	South western	34	-0.01247

Rajasthan	South Eastern	54	-0.0117
	Improving PG1		
Uttar Pradesh	Southern	65	0.002403
J&K	Outer Hills	22	0.002677
Rajasthan	North Eastern	52	0.005124
Delhi		73	0.009624
Himachal Pradesh	Himachal Pradesh	20	0.014389
Madhya Pradesh	Malwa Plateau	32	0.014975
Uttar Pradesh	Central	63	0.018711
Haryana	Western	19	0.019103
Madhya Pradesh	Central	31	0.022411
West Bengal	Himalayan	66	0.023803
Rajasthan	Southern	53	0.02734
J&K	Mountainous	21	0.028204
Uttar Pradesh	Western	62	0.030476
Maharashtra	Inland Central	39	0.030488
Maharashtra	Inland Eastern	40	0.03562
Madhya Pradesh	Vindhya	30	0.03737
Punjab	Northern	49	0.03802
Haryana	Eastern	18	0.038734
Uttar Pradesh	Himalayan	61	0.038843
Uttar Pradesh	Eastern	64	0.040814
Bihar	Northern	10	0.042937
Chandigarh		71	0.049071
Gujarat	Saurashtra	17	0.051613
Gujarat	Plains Northern	14	0.052038
Gujarat	Plains Southern	15	0.056613
Manipur	Plains	42	0.056835
Bihar	Central	11	0.056962
Punjab	Southern	50	0.057484
Andhra Pradesh	Coastal	1	0.061178
Gujarat	Dry Areas	16	0.065257
Maharashtra	Inland Western	37	0.066901
Maharashtra	Inland Northern	38	0.068054
West Bengal	Central Plains	68	0.07516
Arunachal Pradesh	Arunachal Pradesh	5	0.07839
Maharashtra	Eastern	41	0.082283
Andhra Pradesh	Inland Northern	2	0.085689
Lakshadweep		74	0.086592
Assam	Plains Eastern	6	0.08872
Assam	Plains Western	7	0.090962
Madhya Pradesh	South Central	33	0.096455
Tripura	Tripura	60	0.098639
Karnataka	Inland Northern	26	0.100462
Manipur	Hills	43	0.102815
Andaman & Nicobar	A&N	70	0.106847
Gujarat	Eastern	13	0.117094
Andhra Pradesh	South western	3	0.117916
West Bengal	Western Plains	69	0.136758
Bihar	Southern	9	0.141485
Orissa	Coastal	46	0.14193

Tamil Nadu	Coastal	57	0.142699
West Bengal	Eastern Plains	67	0.14383
Assam	Hills	8	0.153768
Tamil Nadu	Inland	59	0.170469
Madhya Pradesh	Chattisgarh	29	0.172359
Meghalaya	Meghalaya	44	0.174637
Karnataka	Cosatal and Ghatas	23	0.181099
Karnataka	Inlans Eastern	24	0.183907
Orissa	Northern	48	0.20237
Mizoram	Mizoram	45	0.205936
Maharashtra	Coastal	36	0.207727
Kerala	Southern	28	0.21382
Goa	Goa	12	0.214236
Orissa	Southern	47	0.229252
Tamil Nadu	Southern	58	0.240268
Kerala	Northern	27	0.259317
Pondicherry		75	0.272325
Tamil Nadu	Coastal Northen	56	0.277882
Andhra Pradesh	Inland southern	4	0.28071
Sikkim	Sikkim	55	0.302867
Dadar & Nagar Haveli		72	0.381523
Karnataka	Inland Southern	25	0.39761

Table 17: Protein Deficiency Changes Between 43rd – 55th Rounds (PG2)

	Deteriorating PG2			
Madhya Pradesh	Northern	137	35	-0.03139
Madhya Pradesh	South western	136	34	-0.03012
Rajasthan	Western	211	51	-0.02787
Rajasthan	South Eastern	214	54	-0.00304
J&K	Outer Hills	102	22	-0.00298
	Improving PG2			
Uttar Pradesh	Southern	255	65	0.000332
Himachal Pradesh	Himachal Pradesh	91	20	0.000359
Delhi		311	73	0.001126
West Bengal	Himalayan	261	66	0.003658
Uttar Pradesh	Central	253	63	0.00572
Madhya Pradesh	Malwa Plateau	134	32	0.00689
J&K	Mountainious	101	21	0.008794
Manipur	Plains	151	42	0.011454
West Bengal	Central Plains	263	68	0.011851
Uttar Pradesh	Himalayan	251	61	0.012007
Madhya Pradesh	Central	133	31	0.012032
Rajasthan	Southern	213	53	0.012141
Madhya Pradesh	Vindhya	132	30	0.012246
Maharashtra	Inland Central	144	39	0.012377
Punjab	Northern	201	49	0.012457
Maharashtra	Inland Eastern	145	40	0.012646
Rajasthan	North Eastern	212	52	0.01291
Gujarat	Saurashtra	75	17	0.012957
Gujarat	Plains Northern	72	14	0.013039
Haryana	Western	82	19	0.013372

Uttar Pradesh	Western	252	62	0.01429
Bihar	Northern	52	10	0.015548
Uttar Pradesh	Eastern	254	64	0.015787
Gujarat	Plains Southern	73	15	0.016005
Chandigarh		281	71	0.019197
Haryana	Eastern	81	18	0.019246
Bihar	Central	53	11	0.022382
Gujarat	Dry Areas	74	16	0.02407
Assam	Plains Eastern	41	6	0.026467
Manipur	Hills	152	43	0.027332
Andhra Pradesh	Coastal	21	1	0.028463
Maharashtra	Inland Western	142	37	0.02868
Andhra Pradesh	Inland Northern	22	2	0.029337
Assam	Plains Western	42	7	0.029439
Lakshadweep		321	74	0.030093
Maharashtra	Eastern	146	41	0.031102
Maharashtra	Inland Northern	143	38	0.033417
Madhya Pradesh	South Central	135	33	0.035307
Punjab	Southern	202	50	0.036528
Tripura	Tripura	241	60	0.037096
Arunachal Pradesh	Arunachal Pradesh	31	5	0.039158
Gujarat	Eastern	71	13	0.049813
Karnataka	Inland Northern	114	26	0.050113
West Bengal	Eastern Plains	262	67	0.054272
Tamil Nadu	Coastal	232	57	0.054496
Bihar	Southern	51	9	0.055349
Assam	Hills	43	8	0.056662
Andhra Pradesh	South western	23	3	0.056845
Meghalaya	Meghalaya	161	44	0.05922
Orissa	Coastal	191	46	0.062321
West Bengal	Western Plains	264	69	0.062623
Andaman & Nicobar	A&N	271	70	0.064794
Karnataka	Cosatal and Ghatas	111	23	0.070319
Madhya Pradesh	Chattisgarh	131	29	0.071743
Orissa	Northern	193	48	0.077125
Tamil Nadu	Inland	234	59	0.080245
Maharashtra	Coastal	141	36	0.088774
Karnataka	Inlans Eastern	112	24	0.089024
Orissa	Southern	192	47	0.092746
Mizoram	Mizoram	171	45	0.096454
Goa	Goa	61	12	0.103955
Kerala	Southern	122	28	0.10648
Pondicherry		331	75	0.115953
Kerala	Northern	121	27	0.123377
Tamil Nadu	Southern	233	58	0.124118
Sikkim	Sikkim	221	55	0.137406
Tamil Nadu	Coastal Northen	231	56	0.140147
Andhra Pradesh	Inland southern	24	4	0.171216
Dadar & Nagar Haveli		291	72	0.227409
Karnataka	Inland Southern	113	25	0.26822

Table 18: Protein Deficiency Changes Between 50th – 55th Rounds (PG0)

	Improving PG0		
Haryana	Western	19	0.007937
Rajasthan	North Eastern	52	0.018423
Andaman & Nicobar	A&N	70	0.027567
Uttar Pradesh	Southern	65	0.029028
Rajasthan	South Eastern	54	0.033498
Chandigarh		71	0.040636
J&K	Mountainious	21	0.040979
Punjab	Southern	50	0.042469
Uttar Pradesh	Western	62	0.049192
Haryana	Eastern	18	0.049655
Punjab	Northern	49	0.051959
Madhya Pradesh	Northern	35	0.067085
Bihar	Central	11	0.074195
Uttar Pradesh	Central	63	0.080082
Meghalaya	Meghalaya	44	0.087991
Lakshadweep		74	0.091198
Uttar Pradesh	Eastern	64	0.091562
Madhya Pradesh	Vindhya	30	0.09884
West Bengal	Himalayan	66	0.099468
Bihar	Northern	10	0.099527
Delhi		73	0.100887
Assam	Hills	8	0.104886
Madhya Pradesh	Central	31	0.113604
Andhra Pradesh	Inland Northern	2	0.120112
Manipur	Plains	42	0.122411
Manipur	Hills	43	0.122689
Assam	Plains Western	7	0.123027
West Bengal	Central Plains	68	0.123138
Tripura	Tripura	60	0.123152
Tamil Nadu	Coastal	57	0.123654
Karnataka	Cosatal and Ghatas	23	0.12488
Maharashtra	Eastern	41	0.138388
Andhra Pradesh	Coastal	1	0.139179
Andhra Pradesh	South western	3	0.143687
Madhya Pradesh	Chattisgarh	29	0.154551
Andhra Pradesh	Inland southern	4	0.165886
West Bengal	Western Plains	69	0.166504
West Bengal	Eastern Plains	67	0.175017
Madhya Pradesh	Malwa Plateau	32	0.191304
Orissa	Coastal	46	0.198326
Assam	Plains Eastern	6	0.201942
Madhya Pradesh	South Central	33	0.218524
Orissa	Northern	48	0.228695
Karnataka	Inlans Eastern	24	0.23003
Tamil Nadu	Inland	59	0.239698
Pondicherry		75	0.252774
Mizoram	Mizoram	45	0.259079
Sikkim	Sikkim	55	0.274622
Kerala	Southern	28	0.276609

Goa	Goa	12	0.288637
Rajasthan	Southern	53	0.290292
Tamil Nadu	Southern	58	0.302484
Orissa	Southern	47	0.302719
Kerala	Northern	27	0.303058
Gujarat	Plains Northern	14	0.304028
Gujarat	Saurashtra	17	0.305537
Himachal Pradesh	Himachal Pradesh	20	0.317645
Uttar Pradesh	Himalayan	61	0.323892
Tamil Nadu	Coastal Northen	56	0.329283
Bihar	Southern	9	0.336798
Gujarat	Dry Areas	16	0.35889
Gujarat	Plains Southern	15	0.365113
Madhya Pradesh	South western	34	0.366881
Maharashtra	Coastal	36	0.383456
Rajasthan	Western	51	0.387738
Gujarat	Eastern	13	0.408216
Arunachal Pradesh	Arunachal Pradesh	5	0.41268
J&K	Outer Hills	22	0.41537
Maharashtra	Inland Eastern	40	0.488425
Maharashtra	Inland Northern	38	0.52944
Maharashtra	Inland Western	37	0.54201
Maharashtra	Inland Central	39	0.565662
Karnataka	Inland Southern	25	0.624603
Karnataka	Inland Northern	26	0.642058
Dadar & Nagar Haveli		72	0.699144

Table 19: Protein Deficiency Changes Between 50th – 55th Rounds (PG1)

	Deteriorating PG1		
West Bengal	Central Plains	68	-0.01908
Madhya Pradesh	Northern	35	-0.00764
Haryana	Western	19	-0.00256
	Improving PG1		
Punjab	Northern	49	0.004617
Punjab	Southern	50	0.007187
West Bengal	Himalayan	66	0.007395
Assam	Hills	8	0.007936
Uttar Pradesh	Southern	65	0.009089
Haryana	Eastern	18	0.009768
Meghalaya	Meghalaya	44	0.010308
J&K	Mountainious	21	0.011153
Andaman & Nicobar	A&N	70	0.011786
Manipur	Plains	42	0.01242
Uttar Pradesh	Western	62	0.013049
Uttar Pradesh	Central	63	0.013935
Assam	Plains Western	7	0.015159
Uttar Pradesh	Eastern	64	0.016472
Andhra Pradesh	Coastal	1	0.017064
Bihar	Northern	10	0.019301
West Bengal	Eastern Plains	67	0.020033

Bihar	Central	11	0.020061
Andhra Pradesh	Inland Northern	2	0.021409
Chandigarh		71	0.021813
Andhra Pradesh	South western	3	0.022535
Rajasthan	North Eastern	52	0.022745
Madhya Pradesh	Vindhya	30	0.023658
West Bengal	Western Plains	69	0.023778
Madhya Pradesh	Chattisgarh	29	0.024528
Assam	Plains Eastern	6	0.024654
Madhya Pradesh	Central	31	0.026142
Tripura	Tripura	60	0.026549
Rajasthan	South Eastern	54	0.026945
Karnataka	Cosatal and Ghatas	23	0.0271
Orissa	Coastal	46	0.028324
Tamil Nadu	Coastal	57	0.028523
Lakshadweep		74	0.030366
Delhi		73	0.032349
Orissa	Northern	48	0.033217
Manipur	Hills	43	0.036661
Maharashtra	Eastern	41	0.041141
Tamil Nadu	Inland	59	0.045754
Mizoram	Mizoram	45	0.047956
Andhra Pradesh	Inland southern	4	0.048624
Karnataka	Inlans Eastern	24	0.049684
Goa	Goa	12	0.054019
Madhya Pradesh	South Central	33	0.054402
Sikkim	Sikkim	55	0.057667
Tamil Nadu	Southern	58	0.060096
Madhya Pradesh	Malwa Plateau	32	0.06084
Orissa	Southern	47	0.063129
Pondicherry		75	0.063753
Kerala	Southern	28	0.068538
Gujarat	Saurashtra	17	0.068782
Kerala	Northern	27	0.072136
Bihar	Southern	9	0.077357
Tamil Nadu	Coastal Northen	56	0.078149
Gujarat	Plains Northern	14	0.079092
Uttar Pradesh	Himalayan	61	0.085643
Himachal Pradesh	Himachal Pradesh	20	0.099969
Maharashtra	Coastal	36	0.1002
Gujarat	Dry Areas	16	0.1012
Gujarat	Eastern	13	0.114892
Gujarat	Plains Southern	15	0.115485
Madhya Pradesh	South western	34	0.12082
Rajasthan	Southern	53	0.123993
J&K	Outer Hills	22	0.126281
Arunachal Pradesh	Arunachal Pradesh	5	0.134783
Rajasthan	Western	51	0.136429
Maharashtra	Inland Eastern	40	0.144751
Maharashtra	Inland Western	37	0.185246
Maharashtra	Inland Central	39	0.192368

Maharashtra	Inland Northern	38	0.194161
Karnataka	Inland Southern	25	0.217384
Karnataka	Inland Northern	26	0.217749
Dadar & Nagar Haveli		72	0.25102

Table 20: Protein Deficiency Changes Between 50th – 55th Rounds (PG2)

	Deteriorating PG2		
West Bengal	Central Plains	68	-0.03149
Madhya Pradesh	Northern	35	-0.02008
West Bengal	Himalayan	66	-0.00502
Haryana	Western	19	-0.00303
Andhra Pradesh	South western	3	-0.00187
Punjab	Northern	49	-0.00062
Manipur	Plains	42	-0.00042
Andhra Pradesh	Coastal	1	-0.0003
	Improving PG2		
Assam	Hills	8	0.000235
Meghalaya	Meghalaya	44	0.00136
Punjab	Southern	50	0.001741
Uttar Pradesh	Southern	65	0.001951
West Bengal	Eastern Plains	67	0.002767
Assam	Plains Western	7	0.00357
Uttar Pradesh	Central	63	0.004243
Haryana	Eastern	18	0.004375
Assam	Plains Eastern	6	0.004527
Andhra Pradesh	Inland Northern	2	0.005523
J&K	Mountainious	21	0.005789
Bihar	Northern	10	0.00587
Uttar Pradesh	Western	62	0.005928
Uttar Pradesh	Eastern	64	0.00604
West Bengal	Western Plains	69	0.006687
Orissa	Coastal	46	0.007045
Orissa	Northern	48	0.007455
Tripura	Tripura	60	0.007618
Madhya Pradesh	Chattisgarh	29	0.007891
Karnataka	Cosatal and Ghatas	23	0.008355
Bihar	Central	11	0.008786
Madhya Pradesh	Vindhya	30	0.008801
Goa	Goa	12	0.009591
Andaman & Nicobar	A&N	70	0.010901
Madhya Pradesh	Central	31	0.0121
Tamil Nadu	Coastal	57	0.012194
Rajasthan	North Eastern	52	0.012241
Chandigarh		71	0.013501
Tamil Nadu	Inland	59	0.013624
Rajasthan	South Eastern	54	0.013696
Manipur	Hills	43	0.014076
Mizoram	Mizoram	45	0.015361
Lakshadweep		74	0.016711
Karnataka	Inlans Eastern	24	0.01797
Delhi		73	0.019281

Orissa	Southern	47	0.019862
Tamil Nadu	Southern	58	0.020222
Pondicherry		75	0.02087
Madhya Pradesh	South Central	33	0.020899
Maharashtra	Eastern	41	0.021001
Andhra Pradesh	Inland southern	4	0.022673
Sikkim	Sikkim	55	0.023998
Kerala	Southern	28	0.02453
Gujarat	Saurashtra	17	0.026476
Kerala	Northern	27	0.026927
Bihar	Southern	9	0.02793
Madhya Pradesh	Malwa Plateau	32	0.029751
Gujarat	Plains Northern	14	0.030489
Tamil Nadu	Coastal Northen	56	0.030925
Uttar Pradesh	Himalayan	61	0.031459
Maharashtra	Coastal	36	0.039405
Gujarat	Eastern	13	0.040381
Gujarat	Dry Areas	16	0.04155
Himachal Pradesh	Himachal Pradesh	20	0.043997
Madhya Pradesh	South western	34	0.046791
Gujarat	Plains Southern	15	0.049263
J&K	Outer Hills	22	0.050541
Rajasthan	Western	51	0.058324
Arunachal Pradesh	Arunachal Pradesh	5	0.060311
Maharashtra	Inland Eastern	40	0.061149
Rajasthan	Southern	53	0.06687
Maharashtra	Inland Western	37	0.08866
Maharashtra	Inland Northern	38	0.092003
Maharashtra	Inland Central	39	0.094835
Karnataka	Inland Southern	25	0.09826
Karnataka	Inland Northern	26	0.100791
Dadar & Nagar Haveli		72	0.111028

At this juncture, it is natural to ask whether the ranks of NSS regions by measures of protein deficiency differ significantly across the years. To address this we calculate Kendall's coefficient of concordance (see Boyle and McCarthy (1997)) to track the mobility of individual NSS regionss over time. The motivation for calculating it in the context of our work is to determine if the regions that were reatively deprived earlier are still deprived or whether there has been any convergence. Kendall's coefficient of concordance, *W,* is used to determine the association among the rankings obtained by various regions in different years. (For a lucid discussion of this methodology as used in this paper as well as by Boyle and McCarthy (1997) see Seigel (1956)).

If all the regions had the same ranks in all three years, then the variance of the sum of the ranks over the years of all the regions would be the maximum. The coefficient of concordance can be thought of as an index of divergence of the actual agreement from the maximum possible (perfect) agreement. The degree of actual agreement in ranks obtained by the regions in various years is reflected by the degree of variance among the *J* (total number of regions) sums of the ranks. Thus *W* is calculated as:

$W = s/\{(1/12)(k^2)J(J^2-1)\}$

where, *s* = sum of squares of the observed deviations from the mean of R_j (the sum of the ranks obtained by a particular region in different years), that is,

$$s = [\sum_j R_j - \sum_j R_j / N]^2$$

and

k = no. of years (the set of rankings.)

J = no. of regions.

Now, $(1/12)k^2(J^3-J)$= maximum possible sum of squared deviations, i.e. the sum of *s* which would occur with perfect agreement among *k* rankings.

The value of the rank concordance index ranges from zero to one. The coefficient of concordance is calculated for the three years 1987-88, 1993-94 and 1999-2000. This enables us to study the mobility of ranks at each point in time. The probability associated with the occurrence under H_O (rankings are unrelated to each other) of any value as large as an observed *W* can be determined by finding χ^2 by the formula

$\chi^2 = s/[(1/12)kJ(J+1)] = k(J-1)W$

with degrees of freedom J-1.

For PG0, PG1, PG2 the value of the Kendall statistics were 0.61, 0.58 and 0.55 respectively. In each case these are highly significant. This indicates that there is remarkable stability in rankings of regions by proten deficiency. Inequality has persisted over time and

the reforms have not made a signficant impact on this inequality. Convergence in terms of values cannot be tested for because we need several more data points for this.

IV. Conclusions

The spatial distribution of poverty in India has emerged as a matter of urgent concern in recent times. Although much of this spatial analysis has concentrated on the poverty experiences of states, there is considerable evidence of wide variations within states particularly, but not exclusively, the larger ones. Along with poverty nutritional deficiency has also been a matter of concern. This paper has presented evidence on the protein deficiency experiences of 75 NSS regions for the quinquennial rounds of 1987–88, 1993–94 and 1999–2000. The results presented here facilitate easy identification of lagging areas on which anti-poverty policy must concentrate. Of particular concern are the areas with negative values for changes in Tables 14 to 19. It is well known that 55th round figures for poverty are an "underestimate" of poverty from the vantage point of the methodology adopted in the 43rd and 50th rounds. It is, therefore, likely that from the vantage of the earlier rounds the protein deficiency figures from the 55th round are probably underestimates. If, despite this, protein deficiency has deteriorated in these regions it should be a matter of urgent concern.

Furthermore, regional inequality in proten deficiency has persisted over time. The economic reforms program has been unable to make any significant dent on the spatial distribution of protein deficiency.

References

Arcand, J. (2001), "Undernourishment and Economic Growth: The efficiency cost of hunger", FAO Economic and Social Development Paper, No.147, FAO: Rome.

Behrman, J, and A. Deolalikar (1987), "Will Developing Country Nutrition Improve with Income? A case study of rural South India", *Journal of Political Economy*, 95(3): 492–507.

Boyle GA, McCarthy TE (1997) A Simple Measure of β Convergence, *Oxford Bulletin of Economics and Statistics,* 59(2)::257-264.

Dubey, A. and S. Gangopadhyay (1998), *Where are the Poor in India*, CSO, New Delhi.

FAO, (2001), *Sixth World Food Survey*, Rome: Food and Agricultural Organisation.

Gopalan, C., Sastri, B. and S. Balasubramanian (1971), *Nutritive Values of Indian Foods,* Hyderabad: National Institute of Nutrition, Indian Council of Medical Research.

Graitcher, P. and E. Gentry (1981), "Measuring Children: One reference for all", *Lancet*, 2: 297–9.

Habicht, J., Martorell, R., Yarbrough, Malina, R. and R. Klein (1974), "Height and Weight Standards for Preschool Children: How relevant are ethnic differences in growth potential", *Lancet*, 1: 611–14.

Jha, R. (2000), "Growth, Inequality and Poverty in India: Spatial and temporal characteristics", *Economic and Political Weekly*, 35(11): 921–8.

Jha, R. and A. Sharma (2003), "The Spatial Distribution of Poverty in Rural India in the Last Three Quinquennial Rounds of NSS", ASARC Working Paper 2003/02, ANU.

Melville, B. (1988), "Are Land Availability and Cropping Pattern Critical Factors in Determining Nutritional Status?", *Food and Nutrition Bulletin*, 10(2): 44–8.

Ravallion, M. (1990) "Income Effects on Undernutrition", *Economic Development and Cultural Change*, 38(3): 489–515.

Sahn, D. and D. Stifel (2002), "Robust Comparison of Malnutrition in Developing Countries", *American Journal of Agricultural Economics*, 84(3): 716–35.

Seigel, SG (1956) *Nonparametric Statistics for the Behavioral Sciences***.** McGraw-Hill Book Company, New York.

Svedberg (2000), *Poverty and Undernutrition: Theory, measurement, and policy*, Oxford: Oxford University Press.