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Growth and Nutritional Status of Pre-School Children in India: Rural-Urban and Gender Differences

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A B S T R A C T

This cross-sectional study of growth and nutritional status makes an attempt to find the gender and rural-urban differences among Indian preschool children. This study is based on the data of weight and height of children aged 0–35 months taken from 26 States (total 26,369 children; 13784 boys and 12585 girls). The children are found to be lighter and shorter compared to International standards irrespective of age and sex. Boys are heavier and taller than girls. Urban preschool children are heavier and taller compared to rural counterparts. In the urban area, higher percentages of girls are affected by underweight (37.1%) and stunting (35.0%) than boys. In rural areas, the prevalence of underweight is also higher among girls (47.9%) compared to boys (45.7%), which is found to be much significant ($p < 0.01$). There is a significant rural-urban as well as gender difference in growth and nutritional status of Indian preschool children.

Key words: *growth, nutritional status, pre-school children, India, rural-urban and gender differences*

Introduction

It is well documented that the growth and nutritional status of preschool children are useful and sensitive indicators for judging health of a community or a nation[1,2]. Early childhood is a period of rapid growth and that nutritional insults during this period result into under or over nutrition[3,4].

In Asia, prevalence of undernutrition in the form of protein energy malnutrition (PEM) is the highest in the World[5]. India accounts for about 40 percent undernourished children in the World, contributing significantly to the high morbidity and mortality in the country[6]. Evidence from all over India suggests that the faltering of growth among infants begin as early as in the fourth months of life[7]. But the magnitude of this growth faltering in the form of undernutrition varies from urban to rural habitations and also from boys to girls. In India, there are several small scale studies about the growth and nutritional status among preschool children (both boys and girls), which mainly concentrate in rural areas and only a few in urban slum areas and very rarely in urban affluent areas[8–15]. Besides there are some small scale studies to compare the rural and urban areas and a few large scale studies on Indian preschool children from 8 states[16,17].

International Institute for Population Sciences (IIPS) conducted a large scale study of Indian preschool children from 26 states, which provide data on standards of living and other related information on the growth and nutritional status of children throughout India. The objective of the study is to assess the growth and nutritional status (underweight, stunting and wasting) of the Indian preschool children aged less than three years (35 months) and also to investigate into the differences, if any, due to gender as well as rural and urban habitations.

Materials and Methods

The data on height (cm) and weight (kg) of children below 36 months (26,369) have been taken from Second National Family Health Survey (NFHS-2) conducted in

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1998–99. The survey was coordinated by the International Institute for Population Sciences (IIPS). The NFHS-2 sample covers Indian population living in 26 states.

In the NFHS-2 survey data were collected from 32,393 children born within three years preceding the survey and still alive. The data were collected by investigators who were trained rigorously for a considerable period. The sample size of our study does not match with the published report of NFHS-2 due to some definite purpose of the present study, like we have considered only the last child as well as we have omitted some outlying data to make parity with some socio-economic variables.

Sampling procedure

A uniform sampling design has been considered in all the states of India including urban and rural areas based on Census of India 1991. In each state, the rural sample was selected in two stages: first stage is village selection by PPS (probability proportional to size) on the basis of certain variables like region (group of district/tehsils), village size, percent of scheduled caste (SC)/ scheduled tribe (ST) population, female literacy etc. and for household selection, it was randomly selected. In urban areas, it was three staged. In the first stage, wards were selected with PPS. In the next stage, one Census Enumeration Block (CEB) was randomly selected from each sample Ward. Households were randomly selected within each sample CEB.

Children were weighed and measured with the same type of scales and measuring boards used for adults. For height measurement, children under two years of age were measured in lying position and above 2 years children were measured in standing position.

Age was calculated from the date of birth reported by the respondent and estimated age was recorded as on date of investigation.

In order to maintain uniform survey procedures, manuals dealing with different aspects of the survey were prepared and the field staffs collected data according to the guidelines laid down in the manual.

Means and standard deviations (SD) of height (cm) and weight (kg) of children of age 0–35 months have been calculated by age, sex, rural and urban habitat. Children who fall below –2SD from the median of the respective group are considered to be malnourished termed as underweight, stunting and wasting derived from weight for age, height for age and weight for height indices respectively. The assessment of nutritional status is done through 'Z'-scores and the value was compared with the World Health Organization (WHO) standard[18]. Chi square statistics and t-tests have been used to see habitation and gender wise differences of growth and nutritional status of Indian preschool children.

To draw the relative and simultaneous intervention, logistic regression analysis has been done. The risk of Z-score value being less than –2 has been related with the certain independent variables like place, sex, age of the children and square of the age of the children. The dependent variables are taken as binary. Children who are malnourished, stunted or wasted (i. e., Z-score < – 2) are coded as '1' and others are coded as '0'. An estimated odd ratio of '1' indicates that the nature of dependent variable is no different from the reference category. If the estimated odd ratio is >1, the probability of becoming malnourished is more in this category compared to the reference category and if it is <1, then it is just opposite to that of '>1' case. It was done by 12.0 version of SPSS (Statistical Package for Social Science). Significance levels of $p<0.01$ and 0.05.

Results

The mean and standard deviation of weight and height of Indian preschool children according to age and sex are presented in Tables 1 and 2, and Figures 1a and 1b. The curves of height and weight show a steady increase along with increasing age in both sexes. But the increment in weight and height is more in early months of life and gradually decreases for both boys and girls. It is observed that boys are heavier and taller all through the ages compared to girls. For boys, the increment starts after two years of age, whereas for girls it is around 18 to 21 months with a sharp decrease during 21–24 months. Thus, if we ignore the fluctuation, seen around 18 to 21 months, then the picture is same for girls and boys. Increments are statistically significant ($p<0.01$). On the other hand, both sexes of the present Indian preschool

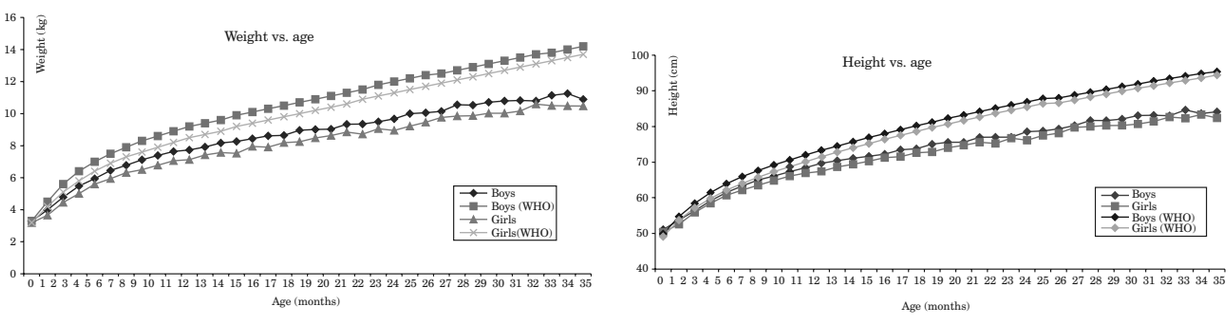

Fig. 1. a) The comparison of weight (kg) with reference (WHO) value. b) The comparison of height (cm) with reference (WHO) value.

TABLE 1
MEAN, SD AND T-TEST OF WEIGHT (KG) OF 0–35 MONTH CHILDREN IN INDIA BY AGE GROUP AND SEX

Age (months)	Boys					Girls					t-test between boys and girls
	Sampled data Present study			WHO ref. data	Differences between reference and sample mean	Sampled data Present study			WHO ref. data	Differences between reference and sample mean	
	N	Mean	SD	Mean		N	Mean	SD	Mean		
0	170	3.29	1.01	3.34	0.05	163	3.18	0.98	3.23	0.05	1.01
1	429	3.99	1.06	4.47	0.48	372	3.65	0.89	4.18	0.53	4.90**
2	470	4.78	1.08	5.56	0.78	437	4.45	1.09	5.12	0.67	4.56**
3	451	5.48	1.25	6.37	0.89	440	5.01	1.05	5.84	0.83	6.06**
4	459	5.94	1.10	7.00	1.06	400	5.59	1.31	6.42	0.83	4.19**
5	425	6.45	1.22	7.51	1.06	446	5.94	1.25	6.89	0.95	6.08**
6	484	6.78	1.11	7.93	1.15	400	6.31	1.27	7.29	0.98	5.77**
7	420	7.12	1.27	8.29	1.17	371	6.50	1.18	7.64	1.14	7.08**
8	387	7.39	1.43	8.61	1.22	357	6.78	1.20	7.94	1.16	6.30**
9	397	7.64	1.25	8.90	1.26	300	7.06	1.26	8.22	1.16	6.01**
10	327	7.73	1.19	9.16	1.43	338	7.13	1.51	8.48	1.35	5.68**
11	318	7.92	1.36	9.41	1.49	312	7.42	1.37	8.71	1.29	4.58**
12	373	8.17	1.36	9.64	1.47	328	7.57	1.48	8.94	1.37	5.54**
13	428	8.26	1.29	9.87	1.61	391	7.52	1.33	9.16	1.64	8.02**
14	451	8.44	1.30	10.09	1.65	411	7.95	1.53	9.38	1.43	5.03**
15	424	8.61	1.42	10.31	1.70	410	7.91	1.51	9.60	1.69	6.89**
16	419	8.64	1.46	10.52	1.88	417	8.19	1.68	9.81	1.62	4.13**
17	428	8.96	1.54	10.73	1.77	372	8.24	1.39	10.02	1.78	6.93**
18	392	9.01	1.44	10.93	1.92	356	8.48	1.44	10.23	1.75	5.02**
19	341	9.03	1.64	11.14	2.11	329	8.63	1.46	10.43	1.80	3.33**
20	341	9.34	1.54	11.34	2.00	297	8.85	1.61	10.64	1.79	3.90**
21	335	9.35	1.52	11.54	2.19	296	8.72	1.52	10.85	2.13	5.18**
22	327	9.49	1.56	11.75	2.26	284	9.06	1.73	11.06	2.00	3.20**
23	303	9.67	1.79	11.95	2.28	287	8.95	1.68	11.26	2.31	5.03**
24	334	10.00	1.68	12.15	2.15	313	9.22	1.61	11.47	2.25	6.01**
25	441	10.05	1.56	12.35	2.30	338	9.46	1.79	11.68	2.22	4.81**
26	374	10.14	1.65	12.54	2.40	371	9.76	1.79	11.89	2.13	3.00**
27	389	10.55	1.84	12.74	2.19	388	9.85	1.72	12.10	2.25	5.47**
28	386	10.53	1.57	12.93	2.40	367	9.87	1.71	12.30	2.43	5.50**
29	427	10.71	1.91	13.11	2.40	416	10.02	1.96	12.50	2.48	5.16**
30	436	10.79	1.73	13.30	2.51	389	10.02	1.72	12.70	2.68	6.38**
31	400	10.82	1.77	13.47	2.65	337	10.16	1.81	12.90	2.74	4.97**
32	306	10.79	1.78	13.65	2.86	280	10.59	1.98	13.09	2.50	1.28
33	334	11.14	1.83	13.83	2.69	275	10.50	2.33	13.28	2.78	3.70**
34	334	11.25	2.26	14.00	2.75	277	10.48	1.85	13.47	2.99	4.62**
35	324	10.89	1.94	14.17	3.28	320	10.47	1.98	13.66	3.19	2.71**

*Significant at 5% level
**Significant at 1% level

TABLE 2
MEAN, SD AND T-TEST OF HEIGHT (CM) OF 0–35 MONTH CHILDREN IN INDIA BY AGE GROUP AND SEX

Age (months)	Boys					Girls					t-test between boys and girls
	Sampled data Present study			WHO ref. data	Differences between reference and sample mean	Sampled data Present study			WHO ref. data	Differences between reference and sample mean	
	N	Mean	SD	Mean		N	Mean	SD	Mean		
0	170	51.08	5.81	49.88	–1.20	163	50.37	5.96	49.14	–1.23	1.10
1	429	53.70	5.28	54.72	1.02	372	52.54	4.99	53.68	1.14	3.19**
2	470	56.35	4.96	58.42	2.07	437	55.87	5.01	57.06	1.19	1.45
3	451	59.12	5.38	61.42	2.30	440	58.42	4.87	59.80	1.38	2.04*
4	459	61.45	5.00	63.88	2.43	400	60.68	5.74	62.08	1.40	2.08*
5	425	63.26	4.62	65.90	2.64	446	62.10	5.33	64.03	1.93	3.44**
6	484	64.95	5.26	67.62	2.67	400	63.48	5.25	65.73	2.25	4.14**
7	420	66.02	4.86	69.16	3.14	371	64.78	4.82	67.28	2.50	3.60**
8	387	67.28	5.73	70.59	3.31	357	66.03	4.43	68.74	2.71	3.35**
9	397	68.48	5.25	71.96	3.48	300	66.90	4.76	70.14	3.24	4.15**
10	327	69.69	5.09	73.28	3.59	338	67.39	5.06	71.48	4.09	5.84**
11	318	70.41	4.93	74.53	4.12	312	68.66	5.28	72.77	4.11	4.30**
12	373	71.08	4.53	75.74	4.66	328	69.38	4.83	74.01	4.63	4.79**
13	428	71.61	5.29	76.91	5.30	391	70.26	5.92	75.21	4.95	3.43**
14	451	72.23	5.17	78.04	5.81	411	71.28	5.51	76.38	5.10	2.60**
15	424	73.43	5.56	79.14	5.71	410	71.53	5.55	77.50	5.97	4.94**
16	419	73.75	5.63	80.21	6.46	417	72.63	5.86	78.60	5.97	2.82**
17	428	75.05	5.37	81.24	6.19	372	72.86	5.82	79.67	6.81	5.50**
18	392	75.54	5.82	82.25	6.71	356	74.02	5.80	80.70	6.68	3.57**
19	341	75.57	6.53	83.24	7.67	329	74.69	5.45	81.71	7.02	1.90
20	341	76.95	5.80	84.19	7.24	297	75.54	5.85	82.70	7.16	3.05**
21	335	76.98	6.39	85.13	8.15	296	75.24	6.08	83.66	8.42	3.50**
22	327	76.99	6.30	86.04	9.05	284	76.72	5.65	84.60	7.88	0.56
23	303	78.52	6.29	86.94	8.42	287	76.10	6.49	85.52	9.42	4.59**
24	334	78.72	6.63	87.81	9.09	313	77.46	6.06	86.41	8.95	2.52**
25	441	79.33	6.65	87.97	8.64	338	78.14	6.53	86.59	8.45	2.50**
26	374	80.28	6.66	88.80	8.52	371	79.71	5.75	87.44	7.73	1.25
27	389	81.72	6.01	89.61	7.89	388	79.97	6.44	88.28	8.31	3.92**
28	386	81.65	5.97	90.41	8.76	367	80.25	6.36	89.10	8.85	3.11**
29	427	82.08	6.89	91.18	9.10	416	80.29	5.77	89.89	9.60	4.09**
30	436	83.06	6.01	91.93	8.87	389	80.67	6.25	90.67	10.00	5.58**
31	400	83.16	6.55	92.66	9.50	337	81.45	6.89	91.44	9.99	3.43**
32	306	83.00	7.19	93.37	10.37	280	82.64	6.98	92.19	9.55	0.61
33	334	84.65	6.67	94.07	9.42	275	82.30	7.31	92.92	10.62	4.11**
34	334	83.64	8.50	94.75	11.11	277	83.33	7.35	93.64	10.31	0.48
35	324	84.14	7.45	95.42	11.28	320	82.43	7.49	94.35	11.92	2.90**

*Significant at 5% level
**Significant at 1% level

children are lighter and shorter compared to WHO standard in all the ages. But the differences in weight and height are relatively low in an early age groups compared to higher age groups. The differences are gradually increasing with the increasing age in both sexes. The maximum differences of weight and height distance curves are noticed around 35 months for both sexes.

Tables 3 and 4, and Figures 2a and 2b, 3a and 3b show the rural and urban differences in weight and height of Indian preschool children by age and sex. Here also the distance curves of weight and height indicate increasing trend in rural and urban boys and girls. But urban boys and girls are heavier and taller compared to rural counterpart all through the ages. The magnitudes of the rural

TABLE 3
URBAN RURAL DIFFERENCES OF MEAN AND SD OF WEIGHT (KG) OF 0–35 MONTHS INDIAN CHILDREN BY SEX

Age (months)	Boys							Girls						
	Rural			Urban			Urban / Rural difference	Rural			Urban			Urban / Rural difference
	N	Mean	SD	N	Mean	SD		N	Mean	SD	N	Mean	SD	
0	136	3.33	1.09	34	3.16	0.63	–0.17	118	3.15	0.93	45	3.27	1.12	0.12
1	311	3.98	0.97	118	4.05	1.28	0.07	287	3.68	0.94	85	3.55	0.72	–0.13
2	361	4.75	1.08	109	4.91	1.11	0.16	335	4.47	1.13	102	4.41	0.97	–0.06
3	341	5.43	1.26	110	5.64	1.24	0.21	340	4.95	1.04	100	5.23	1.08	0.28
4	355	5.89	1.11	104	6.13	1.06	0.24	307	5.51	1.31	93	5.85	1.33	0.34
5	310	6.43	1.27	115	6.54	1.10	0.11	340	5.85	1.24	106	6.25	1.24	0.4
6	366	6.70	1.14	118	7.04	0.96	0.34	299	6.28	1.32	101	6.42	1.16	0.14
7	315	7.07	1.24	105	7.29	1.36	0.22	268	6.46	1.26	103	6.64	0.96	0.18
8	262	7.37	1.48	125	7.46	1.32	0.09	268	6.71	1.24	89	7.02	1.08	0.31
9	284	7.59	1.29	113	7.77	1.17	0.18	224	6.98	1.28	76	7.33	1.19	0.35
10	225	7.59	1.21	102	8.03	1.11	0.44	244	7.01	1.52	94	7.44	1.47	0.43
11	217	7.88	1.41	101	8.03	1.27	0.15	220	7.35	1.39	92	7.62	1.33	0.27
12	271	8.09	1.25	102	8.38	1.60	0.29	227	7.41	1.45	101	7.95	1.51	0.54
13	325	8.18	1.36	103	8.55	1.05	0.37	300	7.43	1.31	91	7.80	1.38	0.37
14	333	8.28	1.28	118	8.88	1.29	0.6	320	7.84	1.57	91	8.37	1.32	0.53
15	314	8.45	1.36	110	9.10	1.50	0.65	309	7.85	1.58	101	8.07	1.25	0.22
16	317	8.54	1.44	102	8.96	1.49	0.42	309	8.08	1.70	108	8.53	1.60	0.45
17	323	8.91	1.49	105	9.13	1.69	0.22	275	8.11	1.38	97	8.61	1.39	0.5
18	295	8.91	1.42	97	9.32	1.47	0.41	258	8.40	1.40	98	8.71	1.53	0.31
19	237	8.76	1.52	104	9.67	1.74	0.91	225	8.40	1.44	104	9.14	1.39	0.74
20	249	9.18	1.40	92	9.80	1.83	0.62	191	8.71	1.58	106	9.12	1.65	0.41
21	247	9.23	1.53	88	9.68	1.49	0.45	225	8.59	1.48	71	9.13	1.59	0.54
22	236	9.32	1.53	91	9.94	1.56	0.62	184	8.86	1.64	100	9.45	1.85	0.59
23	209	9.43	1.77	94	10.22	1.72	0.79	209	8.85	1.71	78	9.24	1.62	0.39
24	248	9.83	1.70	86	10.51	1.55	0.68	219	8.97	1.53	94	9.81	1.66	0.84
25	329	9.91	1.56	112	10.50	1.50	0.59	248	9.36	1.83	90	9.73	1.66	0.37
26	287	9.97	1.62	87	10.72	1.65	0.75	283	9.66	1.90	88	10.11	1.36	0.45
27	274	10.46	1.92	115	10.76	1.63	0.3	280	9.66	1.72	108	10.35	1.63	0.69
28	274	10.41	1.56	112	10.83	1.57	0.42	270	9.82	1.64	97	10.02	1.91	0.2
29	325	10.67	1.91	102	10.85	1.93	0.18	292	9.72	1.64	124	10.74	2.45	1.02
30	330	10.66	1.76	106	11.22	1.59	0.56	291	9.79	1.60	98	10.74	1.91	0.95
31	277	10.64	1.79	123	11.25	1.68	0.61	244	9.93	1.81	93	10.78	1.69	0.85
32	225	10.58	1.76	81	11.36	1.75	0.78	197	10.39	1.96	83	11.05	1.96	0.66
33	237	10.86	1.73	97	11.81	1.93	0.95	210	10.36	2.45	65	10.97	1.81	0.61
34	237	11.01	2.15	97	11.85	2.42	0.84	201	10.36	1.90	76	10.80	1.73	0.44
35	226	10.55	1.81	98	11.67	2.03	1.12	240	10.33	1.86	80	10.91	2.26	0.58

TABLE 4
URBAN RURAL DIFFERENCES OF MEAN AND SD OF HEIGHT (CM) OF 0–35 MONTHS INDIAN CHILDREN BY SEX

Age (months)	Boys							Girls						
	Rural			Urban			Urban / Rural difference	Rural			Urban			Urban / Rural difference
	N	Mean	SD	N	Mean	SD		N	Mean	SD	N	Mean	SD	
0	136	51.08	5.82	34	51.10	5.86	0.02	118	50.62	6.58	45	49.70	3.85	–0.92
1	311	53.54	5.54	118	54.12	4.53	0.58	287	52.57	5.21	85	52.45	4.19	–0.12
2	361	56.20	4.98	109	56.86	4.88	0.66	335	55.88	5.36	102	55.85	3.68	–0.03
3	341	58.88	5.53	110	59.87	4.81	0.99	340	58.17	4.93	100	59.29	4.56	1.12
4	355	61.16	4.87	104	62.44	5.33	1.28	307	60.40	5.57	93	61.63	6.20	1.23
5	310	63.22	4.60	115	63.36	4.69	0.14	340	62.00	5.43	106	62.44	4.99	0.44
6	366	64.67	5.36	118	65.81	4.85	1.14	299	63.47	5.30	101	63.52	5.14	0.05
7	315	65.84	4.88	105	66.54	4.78	0.70	268	64.61	5.08	103	65.24	4.05	0.63
8	262	67.23	6.05	125	67.39	4.99	0.16	268	65.88	4.64	89	66.46	3.68	0.58
9	284	68.19	5.40	113	69.20	4.78	1.01	224	66.39	4.72	76	68.39	4.59	2.00
10	225	69.05	5.03	102	71.10	4.98	2.05	244	67.20	5.24	94	67.87	4.56	0.67
11	217	69.92	5.04	101	71.45	4.54	1.53	220	68.33	5.51	92	69.45	4.61	1.12
12	271	70.96	4.38	102	71.41	4.90	0.45	227	69.06	4.88	101	70.09	4.67	1.03
13	325	71.35	5.56	103	72.44	4.23	1.09	300	69.72	5.68	91	72.01	6.40	2.29
14	333	71.63	5.00	118	73.90	5.28	2.27	320	70.77	5.34	91	73.10	5.74	2.33
15	314	73.12	5.44	110	74.32	5.82	1.20	309	71.38	5.84	101	71.97	4.55	0.59
16	317	73.53	5.69	102	74.44	5.39	0.91	309	72.31	6.02	108	73.54	5.32	1.23
17	323	74.87	5.53	105	75.62	4.82	0.75	275	72.51	6.15	97	73.83	4.67	1.32
18	295	75.18	6.20	97	76.65	4.28	1.47	258	73.86	5.96	98	74.44	5.37	0.58
19	237	74.56	6.20	104	77.86	6.72	3.30	225	74.27	5.68	104	75.59	4.80	1.32
20	249	76.66	5.80	92	77.72	5.76	1.06	191	74.55	5.85	106	77.33	5.45	2.78
21	247	76.50	6.52	88	78.31	5.85	1.81	225	74.79	6.11	71	76.67	5.78	1.88
22	236	76.42	6.47	91	78.48	5.62	2.06	184	76.09	5.54	100	77.87	5.71	1.78
23	209	77.57	6.65	94	80.64	4.80	3.07	209	75.65	6.53	78	77.31	6.26	1.66
24	248	78.22	6.61	86	80.14	6.52	1.92	219	76.56	6.03	94	79.55	5.64	2.99
25	329	78.74	6.69	112	81.07	6.23	2.33	248	77.83	6.69	90	79.00	6.02	1.17
26	287	79.69	7.07	87	82.22	4.59	2.53	283	79.26	5.91	88	81.18	4.95	1.92
27	274	81.43	6.33	115	82.42	5.11	0.99	280	79.44	6.67	108	81.36	5.60	1.92
28	274	81.12	6.21	112	82.95	5.13	1.83	270	79.83	6.04	97	81.43	7.08	1.60
29	325	81.75	7.02	102	83.12	6.39	1.37	292	79.61	5.40	124	81.91	6.30	2.30
30	330	82.42	5.98	106	85.07	5.70	2.65	291	79.94	6.12	98	82.81	6.15	2.87
31	277	82.50	6.39	123	84.64	6.69	2.14	244	80.74	6.91	93	83.30	6.51	2.56
32	225	82.08	7.28	81	85.54	6.32	3.46	197	81.59	7.12	83	85.11	5.97	3.52
33	237	83.83	6.82	97	86.64	5.87	2.81	210	81.50	7.34	65	84.86	6.65	3.36
34	237	82.98	8.62	97	85.26	8.01	2.28	201	83.13	7.73	76	83.87	6.25	0.74
35	226	83.16	7.34	98	86.41	7.25	3.25	240	82.15	7.29	80	83.26	8.05	1.11

and urban height differences are higher than weight differences in both sexes all through the ages. These differences are more in 18 months onwards among both sexes and the differences of height are higher among boys than girls especially in higher age groups compared to the initial stage of their life.

The gender and rural-urban differences in weight and height are presented in Table 5. It is observed that the differences of weight and height are higher among boys and girls of the same habitation (rural or urban) rather than same sex of different habitations (rural and urban).

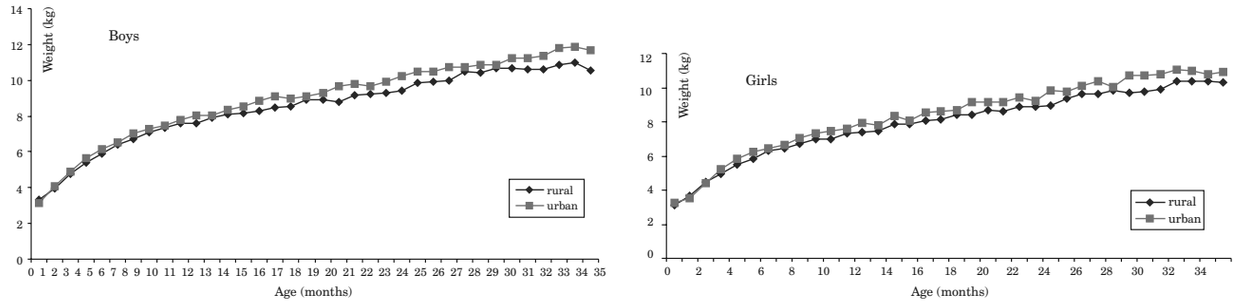

Fig. 2. a) The comparison of weight (kg) between rural-urban boys. b) The comparison of weight (kg) between rural-urban girls.

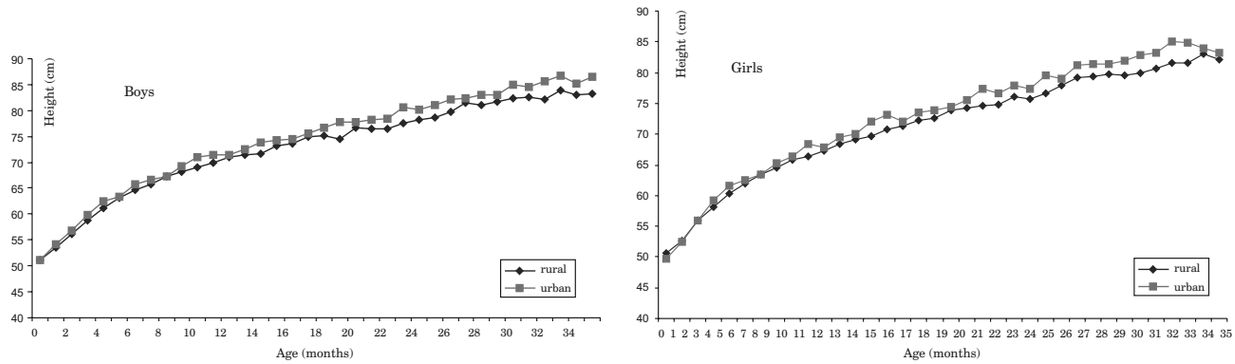

Fig. 3. a) The comparison of height (cm) between rural-urban boys. b) The comparison of height (cm) between rural-urban girls.

The distribution of mean z score of nutritional indices represents that both rural boys and girls have lower values of mean z scores than their urban counterparts (Table 6) all through the ages and specifically in higher ages, which is reflected in the percentage distribution of nutritional status on the basis of weight for age index (Table 7) of both boys and girls of rural and urban habitations. From 10 months onwards, 35 percent of children have weight deficit and it increases in percentage according to increase in age. The maximum percentage of underweight (67.9%) is noticed among rural girls at 35 months of age. High percentages of rural preschool children are affected by underweight compared to urban counterpart more or less all through the ages. More than 50 percent of rural girls are observed to be underweight from 12 months onwards followed by rural boys. Similarly, percentages of height deficit for age (stunting) of boys and girls residing in rural and urban habitations are comparatively higher than underweight, more or less, all through the ages (Table 8). It is also observed that percentages of stunting increase with increasing age of children and highest percentage (70.7%) is reported among rural girls at 21 months of age. Here also rural preschool children are affected more by stunting compared to urban children all through the ages and girls are mostly affected than boys. On the other hand, though the percentage of wasting (weight for height) is comparatively lower than underweight and stunting yet it is observed that about 20 percent of children within 1 month of age are affected by weight deficit for height (wasting) and rural girls are reported highest percentage within 1 month and also at 35 months (28.8%). The percentages of occurrence of underweight and stunting are highest in rural area and girls are affected more (Table 9).

According to Table 10, in urban area, higher percentages of girls are affected by underweight (37.1%) and stunting (35.0%) but not significantly different than boys. Whereas wasting is significantly ($p<0.01$) higher among boys (14.1%) than girls (11.6%). In case of rural area, though the prevalence of underweight is significantly ($p<0.01$) higher among girls (47.9%) compared to boys (45.7%) but the prevalence of stunting and wasting are significantly ($p<0.01$) higher among boys than girls.

The logistic regression analysis (Table 11) shows that rural and female children are more affected than urban and male children except in case of wasting, where boys are more affected than girls. The results also show a significant positive effect on age and age square for all the three types of under nutrition.

Discussion

This study presents a brief glimpse of growth and nutritional status of 0–35 months children of India through the second National Family Health Survey data. The study reveals that the increment of growth in terms of weight and height is faster in earlier months than the later months. The children are lighter and shorter com-

TABLE 5
T-TESTS FOR EQUITY OF MEANS BY DIFFERENT VARIABLES

Age (months)	Weight				Height			
	t-test between rural and urban boys	t-test between rural and urban girls	t-test between rural boys and girls	t-test between urban boys and girls	t-test between rural and urban boys	t-test between rural and urban girls	t-test between rural boys and girls	t-test between urban boys and girls
0	1.19	0.64	1.42	0.55	0.02	1.10	0.59	1.21
1	0.54	1.36	3.83**	3.53**	1.11	0.22	2.21*	2.71**
2	1.33	0.53	3.34**	3.49**	1.23	0.06	0.81	1.70
3	1.54	2.30**	5.43**	2.56**	1.81	2.12*	1.77	0.90
4	2.01*	2.18*	4.00**	1.62	2.19*	1.71	1.86	0.98
5	0.88	2.90**	5.89**	1.84	0.27	0.78	3.10**	1.41
6	3.19**	1.02	4.34**	4.28**	2.16*	0.08	2.89**	3.38**
7	1.47	1.47	5.87**	3.99**	1.29	1.25	2.97**	2.12*
8	0.60	2.26*	5.55**	2.67**	0.27	1.20	2.88**	1.57
9	1.34	2.17*	5.32**	2.50**	1.83	3.26**	4.00**	1.17
10	3.23**	2.38**	4.60**	3.15**	3.44**	1.16	3.90**	4.74**
11	0.95	1.61	3.96**	2.18*	2.70**	1.84	3.15**	3.03**
12	1.65	3.03**	5.54**	1.97*	0.81	1.82	4.53**	1.97*
13	2.89**	2.27**	7.01**	4.22**	2.10*	3.07**	3.62**	0.54
14	4.35**	3.23**	3.92**	2.79**	4.06**	3.47**	2.12*	1.03
15	4.01**	1.44	5.08**	5.44**	1.89	1.05	3.84**	3.28**
16	2.50**	2.47**	3.65**	2.02*	1.46	2.00*	2.60**	1.22
17	1.19	3.05**	6.81**	2.40*	1.33	2.19*	4.90**	2.68**
18	2.41**	1.75	4.24**	2.85**	2.60**	0.88	2.55	3.18**
19	4.61**	4.43**	2.62**	2.42**	4.27**	2.18*	0.52	2.80**
20	2.95**	2.08*	3.25**	2.73**	1.51	4.10**	3.76**	0.49
21	2.42**	2.53**	4.62**	2.23*	2.42*	2.36*	2.94**	1.77
22	3.24**	2.67**	2.94**	1.98*	2.84**	2.54**	0.56	0.74
23	3.66**	1.79	3.41**	3.84**	4.54**	1.97*	2.98**	3.85**
24	3.41**	4.21**	5.75**	2.93**	2.35*	4.21**	2.84**	0.65
25	3.56**	1.76	3.81**	3.42**	3.35**	1.53	1.62	2.39*
26	3.73**	2.45**	2.10*	2.66**	3.92**	3.03**	0.79	1.44
27	1.57	3.67**	5.16**	1.88	1.62	2.87**	3.60**	1.47
28	2.39**	0.92	4.30**	3.32**	2.98**	1.98*	2.46*	1.75
29	0.82	4.25**	6.65**	0.38	1.84	3.55**	4.26**	1.43
30	3.08**	4.43**	6.46**	1.94	4.11**	4.00**	5.09**	2.72**
31	3.28**	4.05**	4.50**	2.03*	2.99**	3.17**	3.01**	1.48
32	3.44**	2.57**	1.04	1.07	4.05**	4.25**	0.70	0.45
33	4.20**	2.17*	2.46**	2.82**	3.78**	3.47**	3.46**	1.75
34	2.97**	1.84	3.36**	3.32**	2.31*	0.82	0.19	1.28
35	4.71**	2.07*	1.29	2.33*	3.69**	1.09	1.49	2.71**

*Significant at 5% level
**Significant at 1% level

TABLE 6
Z SCORE DISTRIBUTION OF NUTRITIONAL STATUS OF PRE-SCHOOL CHILDREN IN INDIA BY SEX AND RURAL-URBAN DIFFERENCES

Age (months)	Boys						Girls					
	Rural			Urban			Rural			Urban		
	WAZ	HAZ	WHZ	WAZ	HAZ	WHZ	WAZ	HAZ	WHZ	WAZ	HAZ	WHZ
0	0.15	0.26	–1.04	–0.26	0.27	–1.19	–0.16	0.35	–1.43	0.08	–0.07	–0.64
1	–0.46	–0.42	–0.23	–0.35	–0.18	–0.31	–0.51	–0.43	–0.57	–0.72	–0.48	–0.78
2	–0.52	–0.73	0.16	–0.33	–0.48	0.14	–0.36	–0.37	–0.08	–0.44	–0.38	–0.16
3	–0.58	–0.84	0.28	–0.36	–0.46	0.17	–0.60	–0.56	–0.11	–0.23	–0.10	–0.16
4	–0.73	–0.94	0.01	–0.49	–0.47	–0.14	–0.68	–0.62	–0.12	–0.26	–0.14	–0.04
5	–0.88	–1.00	–0.06	–0.77	–0.95	0.08	–0.96	–0.80	–0.20	0.81	–0.63	0.27
6	–1.17	–1.18	–0.22	–0.83	–0.75	–0.25	–1.07	–0.93	–0.17	–0.86	–0.91	0.00
7	–1.31	–1.36	–0.20	–1.09	–1.10	–0.16	–1.39	–1.11	–0.37	–1.18	–0.87	–0.38
8	–1.47	–1.41	–0.27	–1.37	–1.35	–0.29	–1.55	–1.18	–0.46	–1.21	–0.96	–0.35
9	–1.64	–1.57	–0.36	–1.45	–1.19	–0.60	–1.64	–1.49	–0.31	–1.28	–0.76	–0.55
10	–1.99	–1.73	–0.71	–1.54	–0.96	–0.84	–1.92	–1.66	–0.51	–1.49	–1.42	–0.22
11	–1.99	–1.86	–0.62	–1.84	–1.29	–1.03	–1.85	–1.69	–0.50	–1.59	–1.29	–0.57
12	–2.03	–1.90	–0.76	–1.74	–1.74	–0.50	–2.02	–1.85	–0.71	–1.51	–1.49	–0.32
13	–2.15	–2.14	–0.67	–1.80	–1.75	–0.67	–2.20	–2.01	–0.83	–1.85	–1.21	–1.06
14	–2.23	–2.41	–0.69	–1.67	–1.60	–0.63	–2.00	–2.03	–0.67	–1.51	–1.22	–0.64
15	–2.22	–2.22	–0.93	–1.63	–1.79	–0.42	–2.14	–2.17	–0.83	–1.95	–1.97	–0.77
16	–2.27	–2.39	–0.91	–1.89	–2.07	–0.69	–2.09	–2.19	–0.82	–1.69	–1.78	–0.65
17	–2.06	–2.21	–0.95	–1.87	–1.96	–0.91	–2.19	–2.44	–0.75	–1.76	–2.01	–0.63
18	–2.17	–2.39	–0.89	–1.82	–1.90	–0.96	–2.07	–2.30	–0.82	–1.80	–2.11	–0.67
19	–2.41	–2.83	–0.87	–1.65	–1.77	–0.63	–2.20	–2.46	–0.97	–1.58	–2.03	–0.47
20	–2.16	–2.39	–1.12	–1.66	–2.06	–0.60	–2.07	–2.65	–0.62	–1.73	–1.77	–0.97
21	–2.23	–2.67	–0.86	–1.87	–2.11	–0.85	–2.30	–2.83	–0.85	–1.85	–2.24	–0.71
22	–2.26	–2.92	–0.71	–1.78	–2.29	–0.61	–2.21	–2.69	–0.91	–1.73	–2.13	–0.75
23	–2.28	–2.78	–0.93	–1.67	–1.86	–0.89	–2.35	–3.06	–0.81	–2.03	–2.55	–0.71
24	–2.24	–2.32	–0.60	–1.63	–1.71	–0.25	–2.41	–2.47	–0.89	–1.70	–1.54	–0.73
25	–2.25	–2.37	–0.62	–1.74	–1.65	–0.57	–2.20	–2.31	–0.75	–1.90	–1.95	–0.69
26	–2.28	–2.29	–0.78	–1.66	–1.52	–0.74	–2.08	–2.10	–0.81	–1.71	–1.52	–0.78
27	–1.96	–1.97	–0.74	–1.73	–1.68	–0.69	–2.20	–2.26	–0.79	–1.65	–1.69	–0.56
28	–2.08	–2.27	–0.72	–1.76	–1.73	–0.70	–2.21	–2.35	–0.75	–2.05	–1.89	–0.82
29	–1.97	–2.28	–0.57	–1.84	–1.88	–0.78	–2.37	–2.62	–0.82	–1.59	–1.96	–0.12
30	–2.06	–2.28	–0.77	–1.65	–1.52	–0.82	–2.42	–2.73	–0.80	–1.71	–1.91	–0.42
31	–2.15	–2.44	–0.80	–1.72	–1.84	–0.52	–2.41	–2.68	–0.84	–1.79	–1.96	–0.50
32	–2.26	–2.73	–0.67	–1.73	–1.77	–0.61	–2.17	–2.63	–0.48	–1.69	–1.65	–0.68
33	–2.15	–2.42	–0.83	–1.51	–1.66	–0.54	–2.28	–2.83	–0.56	–1.85	–1.90	–0.67
34	–2.13	–2.82	–0.33	–1.57	–2.20	–0.06	–2.37	–2.56	–0.90	–2.06	–2.36	–0.63
35	–2.49	–2.93	–1.01	–1.77	–2.07	–0.67	–2.48	–3.00	–0.72	–2.08	–2.70	–0.28

WAZ – weight for age, HAZ – height for age, WHZ – weight for height

TABLE 7
PERCENTAGE DISTRIBUTION OF NUTRITIONAL STATUS (WEIGHT FOR AGE) OF PRE-SCHOOL CHILDREN IN INDIA BY SEX AND RURAL-URBAN DIFFERENCES

Age (months)	Boys								Girls							
	Rural				Urban				Rural				Urban			
	N	UW	Nor.	OW	N	UW	Nor.	OW	N	UW	Nor.	OW	N	UW	Nor.	OW
0	136	12.5	72.8	14.7	34	11.8	85.3	2.9	118	7.6	84.7	7.6	45	8.9	84.4	6.7
1	311	11.6	84.2	4.2	118	10.2	82.2	7.6	287	11.8	82.9	5.2	85	11.8	83.5	4.7
2	361	8.9	87.5	3.6	109	8.3	88.1	3.7	335	12.2	82.4	5.4	102	9.8	84.3	5.9
3	341	9.4	87.4	3.2	110	8.2	86.4	5.5	340	13.2	83.2	3.5	100	10.0	85.0	5.0
4	355	11.8	86.2	2.0	104	7.7	91.3	1.0	307	17.3	78.8	3.9	93	8.6	83.9	7.5
5	310	17.4	80.0	2.6	115	15.7	84.3	0.0	340	19.7	77.4	2.9	106	15.1	81.1	3.8
6	366	18.9	79.2	1.9	118	6.8	92.4	0.8	299	25.1	71.9	3.0	101	19.8	78.2	2.0
7	315	31.1	68.3	0.6	105	22.9	75.2	1.9	268	32.5	66.0	1.5	103	21.4	77.7	1.0
8	262	32.4	65.3	2.3	125	32.8	66.4	0.8	268	33.6	64.9	1.5	89	23.6	75.3	1.1
9	284	43.7	54.6	1.8	113	31.9	67.3	0.9	224	37.5	62.1	0.4	76	26.3	72.4	1.3
10	225	45.8	53.3	0.9	102	37.3	62.7	0.0	244	50.0	48.4	1.6	94	40.4	58.5	1.1
11	217	52.1	46.5	1.4	101	41.6	57.4	1.0	220	46.4	52.7	0.9	92	40.2	58.7	1.1
12	271	53.9	45.4	0.7	102	47.1	52.0	1.0	227	50.7	48.0	1.3	101	38.6	59.4	2.0
13	325	57.5	41.5	0.9	103	44.7	55.3	0.0	300	60.0	39.7	0.3	91	41.8	58.2	0.0
14	333	60.4	39.3	0.3	118	36.4	62.7	0.8	320	55.6	43.4	0.9	91	38.5	59.3	2.2
15	314	58.9	40.1	1.0	110	40.9	58.2	0.9	309	59.2	39.5	1.3	101	54.5	45.5	0.0
16	317	59.6	40.1	0.3	102	48.0	52.0	0.0	309	55.3	42.7	1.9	108	39.8	59.3	0.9
17	323	51.1	47.7	1.2	105	49.5	47.6	2.9	275	63.6	36.4	0.0	97	45.4	54.6	0.0
18	295	62.0	37.6	0.3	97	45.4	54.6	0.0	258	55.4	44.2	0.4	98	43.9	55.1	1.0
19	237	63.7	35.9	0.4	104	38.5	59.6	1.9	225	60.9	38.7	0.4	104	36.5	63.5	0.0
20	249	55.4	44.6	0.0	92	38.0	59.8	2.2	191	55.0	43.5	1.6	106	46.2	51.9	1.9
21	247	61.5	38.1	0.4	88	48.9	51.1	0.0	225	63.1	36.4	0.4	71	45.1	53.5	1.4
22	236	62.3	37.3	0.4	91	48.4	50.5	1.1	184	62.0	37.0	1.1	100	46.0	53.0	1.0
23	209	56.0	42.6	1.4	94	39.4	59.6	1.1	209	63.6	35.9	0.5	78	52.6	46.2	1.3
24	248	58.5	40.3	1.2	86	45.3	52.3	2.3	219	64.4	35.2	0.5	94	38.3	61.7	0.0
25	329	57.1	41.6	1.2	112	42.0	58.0	0.0	248	59.3	39.5	1.2	90	54.4	43.3	2.2
26	287	61.7	38.3	0.0	87	43.7	55.2	1.1	283	56.9	40.3	2.8	88	39.8	60.2	0.0
27	274	53.3	44.9	1.8	115	41.7	57.4	0.9	280	59.3	40.0	0.7	108	44.4	53.7	1.9
28	274	55.8	44.2	0.0	112	44.6	55.4	0.0	270	58.9	40.4	0.7	97	55.7	44.3	0.0
29	325	50.5	48.6	0.9	102	52.0	47.1	1.0	292	65.8	33.9	0.3	124	45.2	51.6	3.2
30	330	54.8	44.2	0.9	106	41.5	58.5	0.0	291	67.7	32.3	0.0	98	45.9	51.0	3.1
31	277	57.4	42.2	0.4	123	38.2	61.8	0.0	244	62.3	36.1	1.6	93	39.8	60.2	0.0
32	225	60.0	39.6	0.4	81	45.7	53.1	1.2	197	55.3	42.6	2.0	83	38.6	61.4	0.0
33	237	53.6	46.0	0.4	97	36.1	60.8	3.1	210	63.3	34.8	1.9	65	53.8	46.2	0.0
34	237	53.2	45.1	1.7	97	41.2	54.6	4.1	201	62.7	36.3	1.0	76	55.3	44.7	0.0
35	226	12.5	72.8	14.7	98	45.9	53.1	1.0	240	67.9	32.1	0.0	80	60.0	38.8	1.3

Nor – normal, UW – underweight, OW – overweight

TABLE 8
PERCENTAGE DISTRIBUTION OF NUTRITIONAL STATUS (HEIGHT FOR AGE) OF PRE-SCHOOL CHILDREN IN INDIA BY SEX AND RURAL-URBAN DIFFERENCES

Age (month)	Boys								Girls							
	Rural				Urban				Rural				Urban			
	N	Stunted	Nor.	Tall	N	Stunted	Nor.	Tall	N	Stunted	Nor.	Tall	N	Stunted	Nor.	Tall
0	136	13.2	66.9	19.9	34	8.8	70.6	20.6	118	16.9	66.1	16.9	45	11.1	80.0	8.9
1	311	19.6	69.5	10.9	118	12.7	78.8	8.5	287	18.8	71.4	9.8	85	10.6	81.2	8.2
2	361	21.6	70.6	7.8	109	15.6	79.8	4.6	335	15.5	74.9	9.6	102	12.7	80.4	6.9
3	341	22.9	71.0	6.2	110	12.7	80.9	6.4	340	16.8	76.5	6.8	100	13.0	75.0	12.0
4	355	22.8	74.1	3.1	104	13.5	82.7	3.8	307	21.5	69.7	8.8	93	11.8	77.4	10.8
5	310	25.2	71.3	3.5	115	20.0	78.3	1.7	340	20.0	73.5	6.5	106	17.9	79.2	2.8
6	366	27.3	68.0	4.6	118	16.1	78.8	5.1	299	25.8	69.2	5.0	101	18.8	77.2	4.0
7	315	30.8	66.0	3.2	105	20.0	77.1	2.9	268	25.4	70.1	4.5	103	22.3	73.8	3.9
8	262	31.3	64.1	4.6	125	28.0	69.6	2.4	268	29.9	66.0	4.1	89	16.9	82.0	1.1
9	284	36.3	60.6	3.2	113	23.9	74.3	1.8	224	32.6	66.5	0.9	76	14.5	77.6	7.9
10	225	36.9	61.8	1.3	102	25.5	69.6	4.9	244	38.9	59.0	2.0	94	36.2	61.7	2.1
11	217	45.2	52.5	2.3	101	37.6	57.4	5.0	220	38.6	59.1	2.3	92	25.0	71.7	3.3
12	271	44.3	54.6	1.1	102	35.3	64.7	0.0	227	44.1	53.7	2.2	101	29.7	68.3	2.0
13	325	52.0	46.2	1.8	103	39.8	59.2	1.0	300	50.3	47.7	2.0	91	30.8	64.8	4.4
14	333	61.3	37.8	0.9	118	34.7	61.9	3.4	320	51.6	46.6	1.9	91	28.6	64.8	6.6
15	314	55.1	42.4	2.5	110	49.1	46.4	4.5	309	55.7	40.5	3.9	101	46.5	53.5	0.0
16	317	58.4	40.1	1.6	102	49.0	50.0	1.0	309	57.0	39.2	3.9	108	42.6	55.6	1.9
17	323	55.7	42.4	1.9	105	48.6	49.5	1.9	275	60.7	36.7	2.5	97	50.5	47.4	2.1
18	295	59.3	39.0	1.7	97	46.4	53.6	0.0	258	57.8	39.5	2.7	98	51.0	48.0	1.0
19	237	66.7	32.9	0.4	104	45.2	51.0	3.8	225	62.2	36.0	1.8	104	52.9	46.2	1.0
20	249	59.8	38.6	1.6	92	46.7	50.0	3.3	191	66.0	33.0	1.0	106	43.4	51.9	4.7
21	247	65.2	34.4	0.4	88	52.3	47.7	0.0	225	70.7	28.0	1.3	71	50.7	49.3	0.0
22	236	69.5	30.1	0.4	91	51.6	47.3	1.1	184	64.1	35.3	0.5	100	59.0	37.0	4.0
23	209	63.6	34.4	1.9	94	43.6	55.3	1.1	209	69.9	28.7	1.4	78	56.4	42.3	1.3
24	248	51.6	46.8	1.6	86	39.5	59.3	1.2	219	54.8	44.3	0.9	94	35.1	64.9	0.0
25	329	56.5	41.9	1.5	112	35.7	62.5	1.8	248	56.0	41.9	2.0	90	51.1	46.7	2.2
26	287	53.7	44.6	1.7	87	40.2	59.8	0.0	283	55.1	42.4	2.5	88	35.2	63.6	1.1
27	274	45.6	52.2	2.2	115	39.1	60.9	0.0	280	0.0	100.0	0.0	108	0.0	100.0	0.0
28	274	55.1	43.1	1.8	112	39.3	58.9	1.8	270	58.9	39.3	1.9	97	48.5	45.4	6.2
29	325	52.6	46.8	0.6	102	47.1	50.0	2.9	292	66.1	33.9	0.0	124	41.1	58.9	0.0
30	330	55.8	43.3	0.9	106	35.8	62.3	1.9	291	67.0	32.6	0.3	98	46.9	51.0	2.0
31	277	61.0	38.6	0.4	123	36.6	62.6	0.8	244	64.3	33.6	2.0	93	44.1	55.9	0.0
32	225	64.0	35.6	0.4	81	39.5	60.5	0.0	197	63.5	34.5	2.0	83	42.2	55.4	2.4
33	237	55.3	44.3	0.4	97	33.0	67.0	0.0	210	64.3	34.8	1.0	65	44.6	55.4	0.0
34	237	63.3	35.9	0.8	97	42.3	57.7	0.0	201	58.2	39.8	2.0	76	57.9	42.1	0.0
35	226	13.2	66.9	19.9	98	8.8	70.6	20.6	240	16.9	66.1	16.9	80	11.1	80.0	8.9

Nor – normal

TABLE 9
PERCENTAGE DISTRIBUTION OF NUTRITIONAL STATUS (WEIGHT FOR HEIGHT) OF PRE-SCHOOL CHILDREN IN INDIA BY SEX AND RURAL-URBAN DIFFERENCES

Age (month)	Boys								Girls							
	Rural				Urban				Rural				Urban			
	N	UW	Nor.	OW	N	UW	Nor.	OW	N	UW	Nor.	OW	N	UW	Nor.	OW
0	136	25.0	70.6	4.4	34	20.6	79.4	0.0	118	28.8	66.9	4.2	45	20.0	71.1	8.9
1	311	13.2	75.6	11.3	118	12.7	82.2	5.1	287	15.3	77.0	7.7	85	10.6	89.4	0.0
2	361	8.0	81.2	10.8	109	11.0	76.1	12.8	335	11.6	80.0	8.4	102	9.8	78.4	11.8
3	341	8.8	79.2	12.0	110	6.4	84.5	9.1	340	9.4	83.5	7.1	100	9.0	83.0	8.0
4	355	10.4	79.4	10.1	104	11.5	79.8	8.7	307	10.7	78.8	10.4	93	7.5	84.9	7.5
5	310	12.3	76.1	11.6	115	7.8	79.1	13.0	340	12.9	77.6	9.4	106	10.4	77.4	12.3
6	366	11.7	80.1	8.2	118	8.5	85.6	5.9	299	12.7	78.6	8.7	101	11.9	80.2	7.9
7	315	11.4	81.3	7.3	105	13.3	79.0	7.6	268	10.8	83.6	5.6	103	11.7	79.6	8.7
8	262	15.6	76.7	7.6	125	15.2	76.8	8.0	268	10.4	81.7	7.8	89	6.7	87.6	5.6
9	284	14.8	77.1	8.1	113	12.4	81.4	6.2	224	11.2	81.3	7.6	76	10.5	84.2	5.3
10	225	20.0	73.3	6.7	102	19.6	77.5	2.9	244	13.9	78.7	7.4	94	8.5	83.0	8.5
11	217	18.9	73.7	7.4	101	15.8	82.2	2.0	220	12.7	79.5	7.7	92	10.9	83.7	5.4
12	271	15.1	79.7	5.2	102	16.7	77.5	5.9	227	16.3	78.9	4.8	101	10.9	82.2	6.9
13	325	20.6	72.6	6.8	103	14.6	79.6	5.8	300	24.3	69.7	6.0	91	17.6	80.2	2.2
14	333	19.5	73.6	6.9	118	17.8	78.8	3.4	320	18.4	75.0	6.6	91	11.0	85.7	3.3
15	314	25.8	69.1	5.1	110	15.5	79.1	5.5	309	21.0	73.1	5.8	101	15.8	81.2	3.0
16	317	24.0	70.0	6.0	102	18.6	74.5	6.9	309	22.0	71.2	6.8	108	10.2	86.1	3.7
17	323	20.1	76.2	3.7	105	23.8	70.5	5.7	275	16.7	76.7	6.5	97	16.5	77.3	6.2
18	295	23.7	70.5	5.8	97	17.5	79.4	3.1	258	19.4	74.4	6.2	98	16.3	79.6	4.1
19	237	19.8	74.3	5.9	104	21.2	76.0	2.9	225	22.7	72.9	4.4	104	10.6	81.7	7.7
20	249	22.5	72.3	5.2	92	16.3	76.1	7.6	191	16.2	75.9	7.9	106	17.9	78.3	3.8
21	247	24.3	71.7	4.0	88	22.7	70.5	6.8	225	18.7	76.0	5.3	71	12.7	81.7	5.6
22	236	21.6	71.2	7.2	91	16.5	76.9	6.6	184	23.9	70.7	5.4	100	13.0	83.0	4.0
23	209	23.4	70.8	5.7	94	18.1	79.8	2.1	209	18.7	76.6	4.8	78	12.8	82.1	5.1
24	248	20.6	72.6	6.9	86	16.3	73.3	10.5	219	21.9	73.1	5.0	94	13.8	83.0	3.2
25	329	20.1	73.3	6.7	112	15.2	78.6	6.3	248	22.6	69.0	8.5	90	8.9	86.7	4.4
26	287	18.8	75.3	5.9	87	13.8	85.1	1.1	283	14.8	80.9	4.2	88	6.8	90.9	2.3
27	274	19.0	74.5	6.6	115	12.2	84.3	3.5	280	20.0	75.4	4.6	108	8.3	88.9	2.8
28	274	16.1	77.7	6.2	112	14.3	83.0	2.7	270	15.9	78.9	5.2	97	16.5	79.4	4.1
29	325	13.2	82.5	4.3	102	11.8	84.3	3.9	292	16.4	81.2	2.4	124	8.9	83.1	8.1
30	330	14.8	79.4	5.8	106	13.2	84.9	1.9	291	15.5	79.7	4.8	98	12.2	79.6	8.2
31	277	20.2	75.1	4.7	123	10.6	84.6	4.9	244	15.2	80.7	4.1	93	7.5	88.2	4.3
32	225	15.6	80.4	4.0	81	9.9	85.2	4.9	197	15.2	78.7	6.1	83	15.7	78.3	6.0
33	237	16.5	81.4	2.1	97	8.2	85.6	6.2	210	15.2	78.1	6.7	65	9.2	83.1	7.7
34	237	14.3	79.7	5.9	97	6.2	84.5	9.3	201	15.4	80.1	4.5	76	9.2	85.5	5.3
35	226	25.0	70.6	4.4	98	20.6	79.4	0.0	240	28.8	66.9	4.2	80	20.0	71.1	8.9

Nor – normal, UW – underweight, OW – overweight

TABLE 10
PERCENTAGE DISTRIBUTION OF NUTRITIONAL STATUS OF PRE-SCHOOL CHILDREN IN INDIA BY RURAL-URBAN DIFFERENCES

Nutritional Indices	Habitation	Gradation	Boys	Girls	(B + G)	Chi-square tests 'p' values
Weight for age	Urban	Underweight	35.3	37.1	36.2	4.123 df=2
		Normal	63.2	61.1	62.2	
		Overweight /Obese	1.4	1.8	1.6	
		Total	3676	3328	7004	
	Rural	Underweight	45.7	47.9	46.8	12.507** df=2
		Normal	52.8	50.4	51.7	
		Overweight /Obese	1.4	1.7	1.5	
		Total	10108	9257	19365	
Height for age	Urban	Stunted	34.7	35.0	34.8	2.537 df = 2
		Normal	62.8	61.8	62.3	
		Tall	2.6	3.2	2.8	
		Total	3676	3328	7004	
	Rural	Stunted	47.2	45.7	46.5	9.914** df =2
		Normal	50.1	51.0	50.5	
		Overweight/Obese	2.71	3.3	3.0	
		Total	10108	9257	19365	
Weight for height	Urban	Wasted	14.1	11.6	12.9	9.435** df = 2
		Normal	80.2	82.6	81.3	
		Overweight/Obese	12.9	5.8	5.8	
		Total	3676	3328	7004	
	Rural	Wasted	17.4	16.4	16.9	5.054* df = 2
		Normal	75.9	77.3	76.5	
		Overweight/Obese	6.7	6.3	6.5	
		Total	10108	9257	19365	

B+ G – Boys + Girls
*Significant at 5% level; **Significant at 1% level

pared to WHO standard all through the ages[18] but the margin of difference between the present study and WHO standard is very wide after 6 months onwards. Therefore growth retardation among Indian preschool children is increasing with their increasing age. It may be due to their dietary inadequacy (qualitative and quantitative) in their later age especially in rural areas of India[19].

Our findings also suggest that in India there is better growth and nutritional status in urban children than rural children. Compared to urban India, in rural India, due to low status, women give birth to the maximum number of lowbirth weight babies, which ultimately leads to under nutrition among their children. In India, food allocation is not the major cause of gender discrimination. Discrimination of health care leads to high percentage of morbidity among girls than boys. Thus it leads to high nutritional deficiency among girls than boys. Another factor is the unequal intra-household food distribution within the family where pre-school children receive inadequate food while adults have adequate intake[20]. Desire for male child often results in large families, which ultimately leads to higher rate of underweight, stunted and wasted children. Preference for male children is par-

TABLE 11
LOGISTIC REGRESSIONS OF WEIGHT FOR AGE, HEIGHT FOR AGE AND WEIGHT FOR HEIGHT ON DIFFERENT SOCIOECONOMIC VARIABLES

Variables	Weight for age	Height for age	Weight for Height
Sex of the children			
Male	0.909***	0.974	1.109***
Type of place			
Urban	0.589***	0.564***	0.721***
Age of the children	1.256***	1.196***	1.082***
Age of the children ^{2}	0.995***	0.997***	0.998***
Chi-square	3484.326***	2870.578***	212.931

Reference category: Sex = Female; Type of place = Rural
*Significant at 5% level; **Significant at 1% level

ticularly due to social customs like dowry, poor social, economic and educational status and lack of decision making power of women in the society. Ramalingaswami et al.[21] stated that women in India have lower status and less decision making power than other developing and developed countries. This limits women's ability to access the resources needed for their child health and nutrition which is strongly associated with the low birth weight as well as poor feeding behaviour in the first year of life.

According to National Human Development Report[22], poverty has been minimized between early 1980s and early 1990s, but there exists a large disparity between rural and urban areas for almost all the categories of the socio-economic groups. There is a strong urban bias in the pattern of health expenditure and the rate of utilization of the rural health budget is low. Urban areas have greater access to health services, safe water, and sanitation facilities. As a result: in rural areas death rate per 1,000 is 9.6 per cent while in urban areas it is 6 per cent[22]. It is evident that 70.1 per cent of urban dwellers have access to piped water but in case of rural people, it is as low as 18.7 per cent (NFHS-2). Regarding data on households with access to toilet facilities, only 9.48 per cent of rural households and 63.85 per cent in the urban households[22]. In India, 30.54 per cent of rural households had electricity; in the case of urban areas it was 75.78 per cent[22].

Apart from these, differences of weight and height are higher between boys and girls of same habitation than different habitations. This may be influenced by different genetic potentiality of boys and girls along with different nutrient consumption between sexes. The dietary insufficiencies are mainly reflected through high prevalence of underweight, stunting and wasting in Indian preschool children. Rural children especially girls are in worst position. NNMB study revealed that about 45 percents of preschool children are underweight and 62 percent are stunted in rural India[23]. Lower food intakes are the main cause of under/malnutrition and growth retardation (stunting) in early childhood in poor communities[13]. Similarly the high prevalence of wasting within 1 month may be due to high prevalence of underweight during birth of these preschool children. Overall, Indian preschool children are affected by growth retardation along with high prevalence of underweight, stunting and wasting especially among rural girls.

It is therefore desirable that effective interventions programmes are initiated for improving nutritional status of children especially among rural girls.

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RAST I PREHRAMBENO STANJE PREDŠKOLSKE DJECE U INDIJI: RURALNO-URBANE I SPOLNE RAZLIKE

S A Ž E T A K

Ova presječna studija o rastu i prehrambenom stanju predstavlja pokušaj utvrđivanja spolnih i ruralno-urbanih razlika među indijskom predškolskom djecom. Studija se temelji na mjerama težine i visine djece stare 0-35 mjeseci u 26 saveznih država (ukupno 26,369 djece; 13,784 dječaka i 12,585 djevojčica). Pokazalo se da su djeca lakša i niža u usporedbi s međunarodnim standardima, neovisno o dobi i spolu te da su dječaci teži i viši od djevojčica. Predškolska djeca u urbanim sredinama su također teža i viša u usporedbi sa djecom iz ruralnih sredina. U urbanim područjima, viši je udio pothranjenih (37,1%) i nedovoljno razvijenih (35,0%) djevojčica nego dječaka. U ruralnim područjima, prevalencija pothranjenosti je također viša među djevojčicama (47,9%) nego među dječacima (45,7%), što se pokazalo vrlo značajnim ($p<0,01$). Može se zaključiti da postoje značajne urbano-ruralne i spolne razlike s obzirom na rast i prehrambeno stanje indijske predškolske djece.