NNMB Technical Report No.20

NATIONAL NUTRITION MONITORING BUREAU

SPECIAL REPORT

NATIONAL INSTITUTE OF NUTRITION
Indian Council of Medical Research
Hyderabad - 500 007, India
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REPORT ON
DIET AND NUTRITIONAL STATUS OF
ADOLESCENTS

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SUMMARY

Adolescence is a period of rapid growth and maturation in human development, after infancy. Since, there is very little information about dietary and nutritional status of adolescents in India, an assessment of the current diet and nutritional status of adolescents was carried out utilizing the data collected by the National Nutrition Monitoring Bureau (NNMB). In addition, the time trends in diet and nutritional status were determined. The anthropometric data obtained on 12,124 adolescents and 24 hour recall dietary information on 2,579 individuals in 1996-97 were analyzed and, were compared with the anthropometric data obtained on 24,683 adolescents and dietary information on 3,313 individuals obtained from the same villages in 1975-79.

The results revealed that the proportion of adolescent girls getting married before the age of 18 years was 23%. Among them the proportion that could be considered as 'at risk' due to short stature (<145 cms) was 24.1% and that with under weight (<38 kg) was 18.6%. The food and nutrient intakes, in general, were below the RDA. More than two-thirds of adolescents were consuming <70% RDA for vitamin A and riboflavin. The percent of underweight (<Median -2SD of NCHS weight for age) in males was 53% as compared to females (39.5%). About 39% were stunted.

The adolescents measured during 1996-97 were significantly taller and heavier than their counterparts studied in 1975-79 indicating secular changes in growth during a period of twenty years. There was an increase to the extent of 2.5 to 3.5 cms in mean heights and 1 to 1.5 kg in mean weights. In general, there was improvement in the nutrient intakes. The extent of severe deficit with respect to energy (<50% of RDA) decreased from 21% to 9% in boys and 14% to 5% in girls during 1996-97 as compared to 1975-79. The socio-economic variables like type of house, occupation and land holding and per capita monthly income were significantly ($p<0.05$) associated with weight and height for age.

1. INTRODUCTION

Adolescence is a period of rapid growth and maturation in human development after infancy. The nutritional status of adolescent girls, the 'future mothers' contributes significantly to the nutritional status of the community. It is only recently that efforts, though small, are made to include adolescent girls as beneficiaries in some of the health and nutrition intervention programs.

There is very little information about dietary and nutritional status of adolescents in India. Hence, in this report, an assessment of the current diet and nutritional status of adolescents has been made utilizing the large data that was collected by the National Nutrition Monitoring Bureau (NNMB). In addition, the time trends in diet and nutritional status were determined by using the data that was collected by the NNMB in 1975-79 from the same villages.

The NNMB, through its annual surveys, since 1972, established a large database on different representative segments of population belonging to different States. It also conducted repeat surveys in 1988 and 1996 in the same villages that were surveyed in 1975-79. In the present report, results of analysis carried out on the data on adolescents collected during 1996-97 have been used to indicate the current status. These were compared with those obtained in 1975-79 to find out whether there were any time trends in the dietary pattern and nutritional status.

2. METHODS AND MATERIALS

2.1 SAMPLING DESIGN

2.1.1 Selection of villages

In the first repeat survey carried out during 1988-90, in each State about 100-120 villages were surveyed. Of these, 75% were those covered during 1975-79, while the remaining 25% were a new set of villages. A similar sampling procedure was adopted for the second repeat survey, covering 120 villages in each State. Of these, 90 villages were from those covered both in 1975-79 and 1988-90, while the remaining 30 villages were new. In each State, the villages were selected from 8 districts representing different geographic locations of the State. Thus, ninety villages were covered at all the three points of time and the 30 villages covered for the first time. The sampling design is presented in the following flow chart.

2.1.2 Selection of households

From each of the selected villages, 20 households (HHs) were selected by adopting 'cluster sampling method'. For this purpose, the main village and its hamlets (if any) were divided into 5 natural clusters, consisting of groups of houses/streets/ mohallas/areas, which included at least one cluster inhabited by SC/ST community. From each of the selected clusters, 4 consecutive households were surveyed, by selecting the first household randomly.

If the number of households in a given cluster was too large, the cluster was further divided into sub-areas, and one sub area was selected randomly for covering 4 HHs. Thus, in each State, a total of 2400 HHs were targeted for survey.

SAMPLING DESIGN
National Nutrition Monitoring Bureau

Andhra Pradesh | Gujarat | Tamil Nadu | Kerala | Karnataka | Orissa | West Bengal | Uttar Pradesh | Maharashtra | Madhya Pradesh

↓

120 Villages
(Old: 90 + New: 30)

↓

Each Village: 20 Households
(5 clusters of 4 HHs each)

Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 (SC & ST HHs.)

↓

Demographic & Socio-economic particulars : All the 4 HHs.
Anthropometry & clinical assessment : All the available individuals
Household diet survey : One HH
Individual intake diet survey : One HH.

Total Coverage per State

No. of Villages : 120
Nutrition Assessment : 2400 HHs.
Family Diet survey : 600 HHs.
Individual Diet survey : 600 HHs.

2.2 INVESTIGATIONS

The following investigations were carried out in the selected HHs.

2.2.1 Household Particulars

Demographic and socio-economic particulars such as age, sex, occupation, literacy level, family income, possession of agricultural land and live stock, type of dwelling etc. of all the household members were collected, by administering an household schedule in all the households.

2.2.2 Nutrition Assessment

In each village, all the 20 selected HHs, were covered for nutrition assessment. Anthropometric measurements like height, weight, arm circumference and fat fold at triceps were taken on all the available members of the households, using standard equipment and procedures[1]. They were also examined for the presence of clinical signs of nutritional deficiencies.

2.2.3 Diet Survey

Diet survey was conducted in every alternate HH (10 HHs) covered for nutrition assessment. While one-day weighment diet survey was conducted in 5 HHs to assess intakes at the household level, 24-hour recall method of diet survey[2] was conducted in the rest of the households, to assess individual intakes. The following **Table** presents the number of HHs covered for different investigations in each selected village and the total sample covered for various activities.

Method of Survey	No. of HHs Covered
Household socioeconomic profile, Anthropometry & Clinical Examination	20
Household diet survey	5
Individual diet Survey	5

2.3 ANALYSIS

2.3.1 Food and Nutrient Intake of Individuals

The average daily food and nutrient intakes of different physiological groups in the households surveyed were computed. The nutrient intakes were calculated using the values given in Nutritive Value of Indian Foods[4]. The food intakes were compared with the levels recommended in balanced diets for Indians (1981)[5], whereas the average intakes of nutrients were compared with the levels suggested in Nutrient requirements and Recommended Dietary Allowances (RDA) for Indians (1990)[3].

2.3.2 Anthropometry

Mean heights and weights were calculated according to age and sex. The distance charts for height and weights were compared at both the points of surveys, as well as with those of the National Centre for Health Statistics (NCHS) standards[6].

2.3.2.1 SD Classification

Recently, large scale national surveys like National Family Health Survey (1993)[7] have adopted Standard Deviation classification[8] for assessing undernutrition. Therefore, for the purpose of comparison, the percent distribution of adolescents was calculated using NCHS reference values for weight for age to assess undernutrition, and 'height for age', to assess the extent of stunting. Details of the SD classification are given below:

Cut-off level	Nutritional Status	
	Weight for age	Height for age
>Median-2SD	Normal	Normal
Median-2SD to Median-3SD	Moderate undernutrition	Moderate stunting
<Median -3SD	Severe undernutrition	Severe stunting

3. RESULTS

The anthropometric data obtained on 12,124 adolescents and 24 hour recall dietary information on 2,579 individuals in 1996-97 were analyzed to assess (i) the diet and nutritional status of adolescents from eight States, and (ii) the role of socio-economic factors on nutritional status. These results were compared with the anthropometric data obtained on 24,683 adolescents and dietary information on 3,313 individuals obtained from the same villages in 1975-79. The distribution of the sample covered in different States is presented in Table-1.

Table 1 Distribution of Adolescents sample Covered in Different States

State	1975-79	1996-97
Kerala	2330	1304
Tamilnadu	2458	1234
Karnataka	3786	2516
Andhra Pradesh	2855	965
Maharastra	2840	1148
Gujarat	3340	673
Madhya Pradesh	1418	325
Orissa	741	2372
West Bengal	2489	-
Uttar Pradesh	2426	1587
Total	24683	12124

COVERAGE

DIET SURVEY

- House holds: 2,579

ANTHROPOMETRY

- Individuals: 12,124

3.1 CURRENT DIETARY AND NUTRITIONAL STATUS

3.1.1 Profile of the sample surveyed

The coverage of children by sex for anthropometry and diet survey is given in -Table-2&3. The socio-economic and demographic profile of the sample covered is given in Table-4. Majority of them (90.8%) belonged to Hindu religion, while about 27% belonged to scheduled caste community. About 30% belonged to backward communities and about 12% were from scheduled tribes. In general, the families

were large with over 77% belonging to families with 5-10 family members. About 42% of the heads of the households were illiterate.

Almost all the adolescents (97.9%) were residing in their own houses. About 61% of the houses were *kutcha* as compared to 8.1% *pucca* houses. More than a third (37.3%) of the households did not possess any land. The major occupation was agriculture with most of the families belonging to either labourers (27%) or tenant/owner cultivators (45.5%). The mean *per capita* income (PCI) per month of the household was about Rs.250/- at 1996-97 prices. Per capita income of different quartiles was also calculated. It was interesting to note that while the Mean PCI in the lowest quartile was Rs.77/-, in the highest quartile group, it was Rs.626/- indicating the wide variations in the socio-economic status of the rural households.

Table 2 Age and Sex Wise Distribution of Children Covered for Anthropometry

Age (Years)	1975-79		1996-97	
	Boys	Girls	Boys	Girls
10+	2237	1781	1055	979
11 +	1529	1214	663	795
12+	2616	1877	1062	914
13+	1754	1226	697	842
14+	1752	1237	722	750
15+	1420	1070	653	641
16+	1589	1231	678	654
17+	1349	801	519	500
TOTAL	**14246**	**10437**	**6049**	**6075**

Table 3 Sample covered for individual intake Diet Survey according to Age and Sex

Age Group (Yrs)	1975-79		1996-97	
	Boys	Girls	Boys	Girls
10-12	806	725	522	524
13-15	528	462	404	435
16-18	399	393	333	361
TOTAL	**1733**	**1580**	**1259**	**1320**

Table 4 Socio-economic Profile of Households covered

Variable	Description	Percentage
Religion	Hindu	90.8
	Muslim	5.6
	Christian	2.1
	Others	1.4
Community	ST	12.1
	SC	27.2
	BC	29.6
	Others	31.1

Contd.

Table 4 Socio-economic Profile of Households covered (contd.)

Variable	Description	Percentag
Type of family	Nuclear Joint Extended	62. 9 16.
Family Size	1-4 5-10 ≥10	16. 0 77.
Literacy	Illiterate Literate ≥ Primary	41. 9 2.6
House	Own	97.
Type of House	*Kutcha* Semi *Pucca* *Pucca*	60. 8 31.
Land holdings (acres)	Nil 0-5 ≥5	37. 3 8.6
Occupation	Labourer Agriculturist Artisans/Business/ Service Others	27.0 45.5 24.1 3.4

Mean Per Capita monthly Income by quartiles	
Quartiles	(Rs.)
I	77
II	141
III	228
IV	626
Average	250

3.1.2 Marital Status

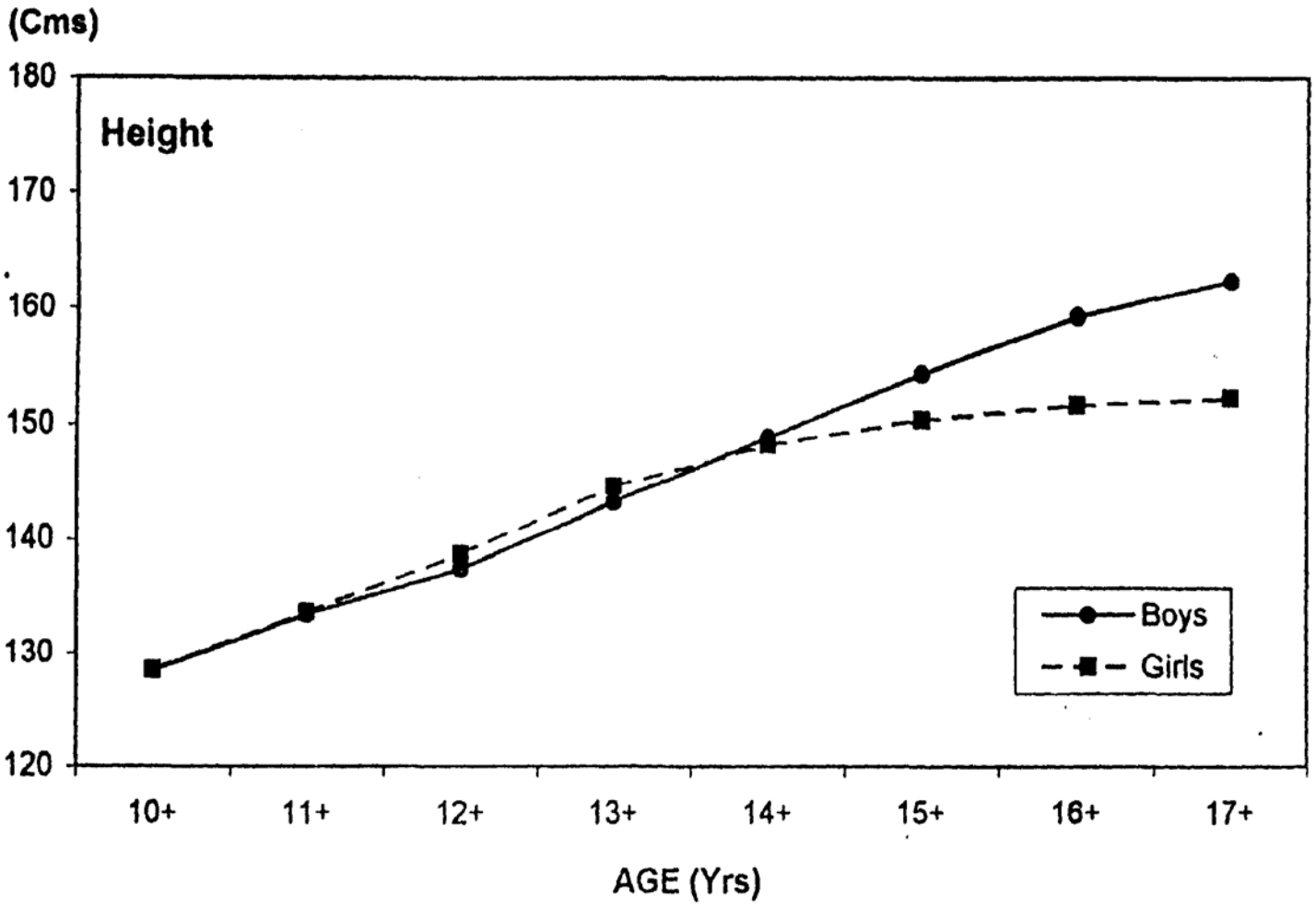
One of the risk factors among adolescent girls is early marriage causing early cessation of growth leading to birth of low birth weight baby. The proportion of adolescent girls getting married before the legal age of 18 years was 23%. Among the married adolescent girls, the proportion of the girls considered 'at risk' due to short stature (<145 cms) was 24.1% and under weight (<38 kg) was 18.6%. In other words, these adolescent girls could be considered as at risk[9] in terms of pregnancy outcome.

3.1.3 Nutritional Anthropometry

3.1.3.1 Mean Anthropometric measurements

The mean and median anthropometric measurements of adolescent children are presented in Table-5. Distance charts for heights and weights by sex are presented in Fig. 1. The girls overtook boys at about 11 years and the boys over took the girls at about 13 years, after which the boys were significantly taller than girls -($P<0.01$). In other words, in the case of the girls, the puberty started about 2 years earlier than the boys. At the age of 17 years, the girls were shorter in height than the boys by about 10 cms and weighed 3 kgs less. At all ages, the adolescents were shorter and lighter than their American counterparts (NCHS).

Fig -1.
DISTANCE CHART FOR HEIGHT AND WEIGHT OF ADOLESCENTS BY SEX



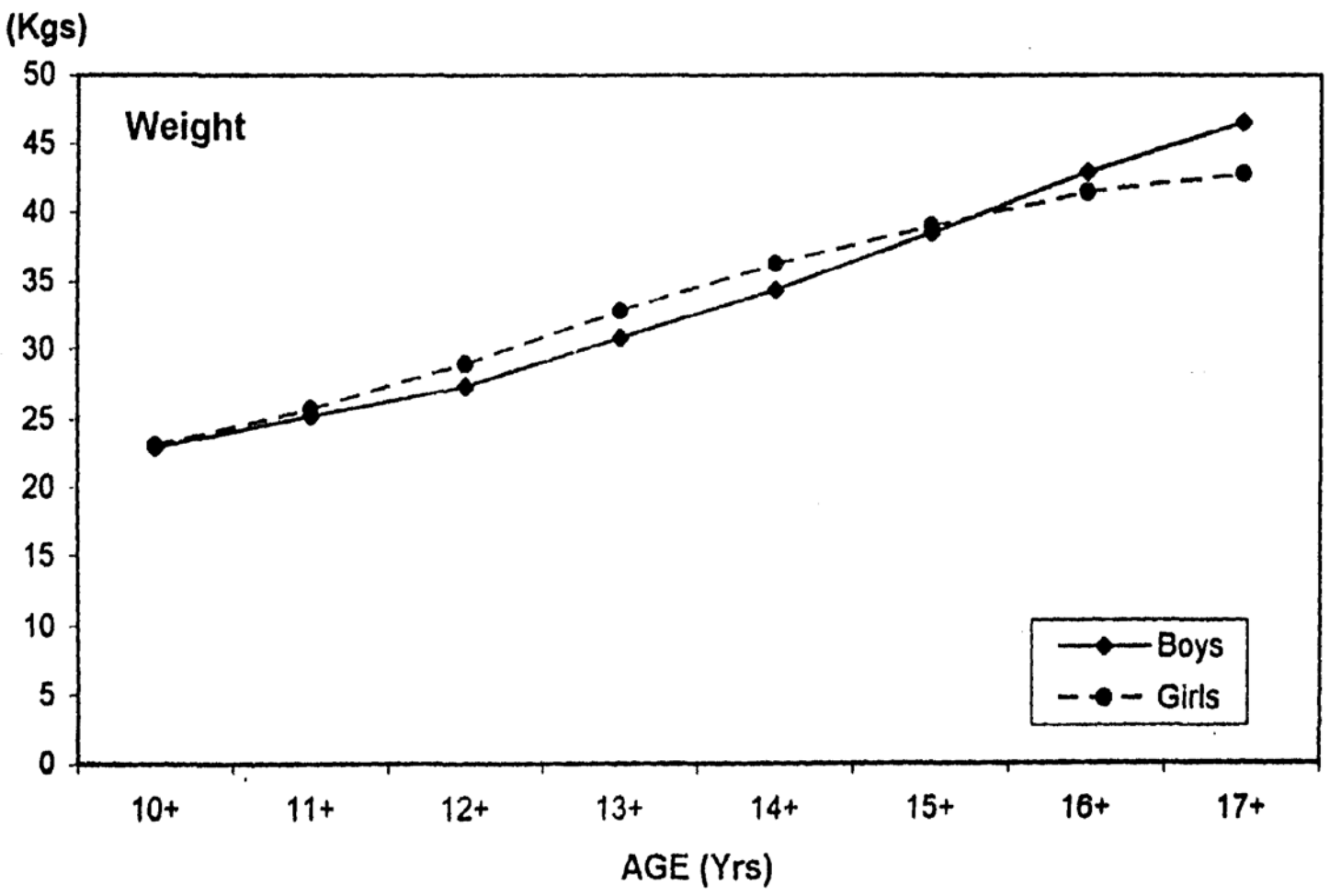


Table 5 Average Heights and Weights of Boys and Girls according to Age

Age (Years)		Boys				Girls			
		Height (cm)		Weight (kg)		Height (cm)		Weight (kg)	
		1975-79	1996-97	1975-79	1996-97	1975 -79	1996-97	1975-79	1996-97
10+	Mean	125.8	128.1	22.1	23.1	125.8	128.1	22.1	23.1
	SD	7.2	7.0	3.6	3.8	7.6	7.2	3.9	3.8
	Median	125.7	127.3	21.8	22.9	125.4	128.0	21.6	22.9
11+	Mean	130.2	133.1	23.8	25.1	131.0	133.1	24.4	25.7
	SD	7.1	6.6	3.7	3.9	7.8	7.3	4.0	4.4
	Median	130.4	133.0	23.6	24.9	130.8	133.2	24.0	25.0
12+	Mean	134.8	137.4	26.1	27.3	135.4	138.4	27.1	28.7
	SD	7.7	7.5	4.3	4.7	7.9	7.5	5.0	5.4
	Median	134.8	137.4	25.7	26.6	135.8	138.7	26.6	28.1
13+	Mean	139.5	143.0	28.6	30.8	140.3	144.1	30.4	32.6
	SD	7.9	8.0	4.8	5.8	8.2	6.8	5.6	5.6
	Median	139.4	142.6	28.1	30.2	140.9	144.3	30.0	32.5
14+	Mean	145.3	148.6	32.4	34.8	145.1	147.9	34.5	36.0
	SD	8.6	8.4	6.0	6.4	7.4	6.5	6.2	5.5
	Median	145.7	149.1	32.0	34.0	145.6	148.2	34.5	36.0
15+	Mean	150.6	153.0	35.9	38.6	147.5	149.8	37.5	38.9
	SD	8.8	8.6	6.5	6.4	6.7	6.1	6.2	5.8
	Median	151.1	153.3	36.0	38.5	147.6	150.4	37.3	39.0
16+	Mean	155.9	158.0	40.1	42.3	149.4	151.2	39.9	41.3
	SD	7.8	8.4	6.2	6.8	6.2	5.8	5.7	5.2
	Median	156.6	159.0	40.3	42.1	149.4	151.3	39.8	41.0
17+	Mean	159.1	161.2	43.1	46.0	150.0	152.1	41.1	42.8
	SD	7.0	7.0	5.9	6.2	6.2	6.3	5.6	5.6
	Median	159.6	161.5	43.2	45.8	150.1	152.5	40.6	42.8

3.1.3.2 SD Classification

The adolescents were categorized into different grades of nutritional status, based on weight for age and height for age by SD classification using NCHS Standards. All those children with weight for age / height for age equal to or more than Median - 2SD were taken as normal, those with Median - 2SD to Median - 3SD as moderately undernourished and all those with <Median - 3SD were taken as severely undernourished.

Stunting

The Z analysis of data indicated that the over all prevalence of stunting (<Median height -2SD) was similar in both the sexes (boys: 39.5% and girls: 39.1%). The percentage of stunting increased as the age advanced in boys from 34.7% at 10 years to 59.7% at 17 years. In the case of girls, the percentage of stunting increased with increasing age (32.5% to 46.7%) up to 13 years after which it decreased to 37.2% at the age of 17 years (Table-6).

Underweight

In case of body weights, the percent of undernutrition (<Median -2SD of NCHS weight for age) in males was 53.1% as compared to females (39.5%). As in the case of height, the percent Of boys with undernutrition increased from 41.6% at 10 years to 68.6% at 17 years, while in girls, the extent of under nutrition increased (37.8% to 45.3%) till the age of 12 years and plateaued at 39.0% in the later age groups (Table-6).

Table 6 Per cent Distribution of Adolescents According to Stunting and Underweight

Age (Yrs)	Boys		Girls	
	Stunting (Height for Age < Median-2SD)	Underweight (Weight for Age < Median -2SD)	Stunting (Height for Age < Median-2SD)	Underweight (Weight for Age < Median -2SD)
10+	34.7	41.6	32.5	37.8
11+	31.2	42.1	37.4	42.4
12+	32.8	51.6	44.7	45.3
13+	32.1	51.2	46.7	37.6
14+	36.3	55.8	41.2	35.7
15+	48.9	58.5	37.9	39.0
16+	51.8	66.1	34.1	39.0
17+	59.7	68.6	37.2	37.6
χ^2	223.85 (P< 0.01)	195.8 (P<0.01)	60.9 (P< 0.01)	23.3 (P< 0.01)

ANTHROPOMETRY

- **The proportion of stunted increased with increasing of age.**
- **The percent of undernutrition was higher in boys than in girls.**

Body Mass index

It is well known that Body Mass Index (BMI) is not constant with age in growing children. Hence, medians of BMI were calculated to assess the differences between ages **(Table-7).** These BMI values for age and sex were compared with those reported for NHANES survey in USA. The proportion of adolescents below the 5th percentile of NHANES ranged from 44% in 17 years age group to 77.6% in 11 years among boys and from 16.4% in 17 years to 62.7% in 10 years among girls. However, the extent of undernutrition was considerably less among girls than their male counterparts in each of the age groups **(Table-8).**

Table 7 Median Body Mass Index of Adolescents

Age (Years)	1975-79		1996-97		NHANES	
	Boys	Girls	Boys	Girls	Boys	Girls
10+	13.9	13.9	13.7	13.9	16.7	17.0
11+	14.0	14.2	13.9	14.2	17.3	17.7
12+	14.4	14.8	14.3	14.7	17.9	18.4
13+	14.7	15.4	14.8	15.5	18.5	18.9
14+	15.3	16.4	15.4	16.5	19.2	19.3
15+	15.8	17.2	16.0	17.3	19.9	19.7
16+	16.5	17.9	16.8	17.9	20.6	20.1
17+	17.0	18.3	17.6	18.5	21.1	20.4

NNI

Table 8 Distribution of adolescents below 5th Percentile of NHANES - BMI

Age (Years)	Boys	Girls
10+	72.7	62.7
11 +	77.6	61.0
12+	76.9	57.1
13+	72.2	47.2
14+	70.5	32.2
15+	64.6	25.0
16+	56.9	19.2
17+	43.9	16.4

3.2 FOOD AND NUTRIENT INTAKE

The Mean daily intakes of different foods of adolescents according to age and sex are presented in **Tables- 9 & 10.**

The mean intakes of all the nutrients were below the RDA in all the age groups of adolescents irrespective of sex. **(Tables-11,12 & 13)**

In order to assess the extent of severity of food deficit, the nutrient intakes were expressed as % of RDA and the distribution of adolescents consuming <50% and <70% of RDA was calculated for both the sexes **(Table-14).** In general, in both the sexes, the proportion of adolescents consuming inadequate amounts was higher in case of micronutrients than that of protein, energy and total fat. More than two-thirds of adolescents were consuming <70% RDA for vitamin A and riboflavin. It was interesting to note that because of higher RDA in boys, the extent of deficiency with respect to iron was higher than in girls.

Table 9 Food Intakes (g/day) by Age Groups

Age Group (Years)		1975-79 Cereals & Millets	Millets	Cereals	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	1996-97 Cereals & Millets	Millets	Cereals	Pulses	Green Leafy Veg.	Other veg.	Roots & Tubers
Boys															
10-12	**Mean**	340	120	220	27	9	41	43	371	98	273	26	15	35	39
	SD	167.45	192.90	170.05	40.37	32.03	62.43	76.77	141.75	166.70	159.14	28.70	40.22	48.82	53.00
13-15	**Mean**	378	120	258	26	12	51	51	428	120	308	28	12	47	49
	SD	192.22	207.29	197.72	34.96	39.11	83.47	91.99	178.36	206.85	185.46	30.58	35.47	71.72	65.69
16-18	**Mean**	463	150	313	35	10	48	61	515	118	397	32	23	58	52
	SD	211.53	250.76	229.69	54.41	34.72	73.51	103.07	202.39	229.70	210.86	35.01	61.84	73.42	61.98
Girls															
10-12	**Mean**	328	121	207	24	8	43	40	349	99	249	25	14	38	41
	SD	163.46	199.84	150.30	35.01	26.62	169.5	65.89	128.41	154.30	150.23	27.86	46.57	54.20	53.42
13-15	**Mean**	366	134	233	25	8	40	49	400	92	307	26	16	44	54
	SD	192.63	235.40	158.36	30.32	27.01	62.72	81.01	145.64	161.54	168.74	31.25	41.67	58.95	153.52
16-18	**Mean**	384	128	256	28	10	54	58	445	88	355	27	13	50	57
	SD	208.19	242.51	177.66	33.17	33.08	94.63	103.70	171.28	169.12	183.18	28.92	36.04	64.08	67.03

Table 10 Food intakes (g/day) by Age Groups

Age Group (Years)		1975-79 Nuts & Oil Seeds	Condi. & Spices	Fruits	Fish	Other Flesh Foods	Milk& Milk Prod.	Fats	Sugar & Jagg.	1996-97 Nuts & Oil seeds	Condi. & Spices	Fruits	Fish	Other Flesh Foods	Milk& Milk prod.	Fats	Sugar & Jagg.
Boys																	
10-12	**Mean**	6	9	10	7	1	47	7	14	10	12	20	14	3	66	11	19
	SD	18.94	10.34	35.10	21.17	5.28	91.09	10.60	20.38	21.98	10.98	47.11	42.51	13.98	102.46	15.33	22.41
13-15	**Mean**	8	9	10	9	1	51	9	15	15	13	35	18	4	65	11	19
	SD	23.74	9.89	41.24	23.55	8.01	101.43	27.07	19.43	28.38	12.46	254.26	45.11	18.64	105.45	10.27	19.30
16-18	**Mean**	6	11	10	9	1	54	10	16	20	16	24	24	5	68	13	19
	SD	17.60	13.59	37.78	28.53	7.61	121.40	15.93	24.53	42.64	31.65	50.11	55.05	26.10	100.83	14.58	19.00
Girls																	
10-12	**Mean**	5	10	10	6	1	45	7	14	11	11	22	12	3	53	9	19
	SD	12.65	11.05	30.99	23.59	9.03	79.95	12.33	22.01	22.58	10.55	52.25	35.82	17.38	83.40	9.52	20.10
13-15	**Mean**	7	10	9	8	1	49	7	16	11	11	16	14	3	56	10	18
	SD	17.15	13.27	31.25	24.43	6.06	84.67	10.20	20.77	23.09	9.90	30.75	45.22	21.80	89.32	9.04	23.49
16-18	**Mean**	9	10	15	9	1	53	9	15	18	13	22	18	4	71	11	19
	SD	18.97	10.62	62.34	21.77	12.40	94.64	13.53	21.00	34.94	14.56	47.97	47.37	21.45	110.08	9.74	19.71

FOOD INTAKES

- **Intake of all foods, except cereals & millets and roots & tubers, was below the RDI in all ages.**
- **Consumption of protective foods such as GLVs, fruits, pulses and milk was grossly inadequate.**

Table 11 Average daily Intake of Nutrients among 10-12 year adolescents by Sex and Period of survey

Nutrients		Boys		Girls	
		1975-79	1996-97	1975-79	1996-97
Protein (g)	Mean	43	46	41	43
	Median	40	43	39	40
	SD	19.63	17.8	18.52	16.12
Total Fat (g)	Mean	19	24	18	22
	Median	14	19	14	18
	SD	16.2	17.77	15.18	15.88
Energy (kcal)	Mean	1552	1749	1484	1643
	Median	1438	1719	1394	1614
	SD	603.3	551.14	557.09	501.14
Calcium (mg)	Mean	407	439	387	419
	Median	271	320	268	313
	SD	422.23	360.72	416.95	355.81
Iron (mg)	Mean	21.6	21.4	20.7	20.3
	Median	18.8	19.8	17.9	18.5
	SD	11.4	9.2	11.1	9.7
Vitamin A (µg)	Mean	109	276	185	243
	Median	101	131	105	111
	SD	300.6	427.73	270.70	478.51
Thiamin (mg)	Mean	1.14	1.05	1.08	0.99
	Median	1.00	0.90	0.90	0.80
	SD	0.81	0.62	0.78	0.55
Riboflavin (mg)	Mean	0.67	0.80	0.62	0.73
	Median	0.60	700.00	0.60	0.70
	SD	0.39	0.39	0.36	0.32
Niacin (mg)	Mean	11.2	11.1	10.7	10.3
	Median	9.5	10.3	9.1	9.3
	SD	6.2	4.9	5.9	4.5
Vitamin-C (mg)	Mean	29.6	33.6	28.8	33.5
	Median	21.0	23.9	19.9	24.4
	SD	31.8	33.0	54.9	36.7

Table 12 11 Average daily Intake of Nutrients among 13-15 year adolescents by Sex and Period of survey

Nutrients		Boys		Girls	
		1975-79	1996-97	1975-79	1996-97
Protein (g)	Mean	48	52	45	48
	Median	43	49	41	44
	SD	21.52	19.28	19.51	18.72
Total Fat (g)	Mean	22	28	19	23
	Median	17	22	16	20
	SD	29.64	18.66	14.18	10.56
Energy (kcal)	Mean	1732	1990	1627	1853
	Median	1619	1899	1566	1812
	SD	699.40	643.32	604.5	502.8
Calcium (mg)	Mean	442	491	407	451
	Median	304	368	299	324
	SD	454.69	420.35	396.32	402.3
Iron (mg)	Mean	23.8	23.8	22.1	22.5
	Median	20.7	21.4	19.9	20.8
	SD	13.0	10.6	11.3	9.2
Vitamin A (µg)	Mean	228	275	186	266
	Median	114	138	103	133
	SD	384.94	460.79	271.73	359.7
Thiamin (mg)	Mean	1.26	1.20	1.18	1.08
	Median	1.00	1.00	1.00	0.90
	SD	0.92	0.74	0.83	0.63
Riboflavin (mg)	Mean	0.74	0.88	0.69	0.82
	Median	0.60	0.80	0.60	0.70
	SD	0.43	0.41	0.36	0.40
Niacin (mg)	Mean	12.6	12.5	11.7	11.5
	Median	10.4	11.6	10.3	10.6
	SD	7.3	5.4	6.1	4.7
Vitamin-C (mg)	Mean	36.8	37.8	30.2	38.4
	Median	24.2	27.0	22.1	28.2
	SD	43.4	40.3	29.4	37.8

Table 13 11 Average daily Intake of Nutrients among 16-18 year adolescents by Sex and Period of survey

Nutrients		Boys		Girls	
		1975-79	1996-97	1975-79	1996-97
Protein (g)	Mean	58	62	48	52
	Median	55	58	44	50
	SD	26.33	23.5	20.7	18.05
Total Fat (g)	Mean	23	33	22	29
	Median	17	26	17	24
	SD	19.65	24.04	17.98	19.67
Energy (kcal)	Mean	2036	2371	1751	2069
	Median	1927	2276	1704	2019
	SD	741.75	741.12	630.16	573.0
Calcium (mg)	Mean	478	579	436	496
	Median	328	438	317	361
	SD	494.60	455.6	386.68	415.12
Iron (mg)	Mean	27.9	29.0	23.9	23.7
	Median	25.3	25.7	22.2	21.7
	SD	13.9	12.5	11.7	8.8
Vitamin A (µg)	Mean	230	426	234	258
	Median	120	184	115	145
	SD	366.9	1102.5	419.02	324.8
Thiamin (mg)	Mean	1.52	1.37	1.23	1.14
	Median	1.30	1.10	1.00	0.90
	SD	1.02	0.83	0.86	0.65
Riboflavin (mg)	Mean	0.86	1.06	0.74	0.90
	Median	0.80	1.00	0.60	0.80
	SD	0.46	0.51	0.40	0.37
Niacin (mg)	Mean	15.3	14.9	12.6	12.6
	Median	13.5	13.6	10.9	11.9
	SD	8.1	6.2	6.6	5.0
Vitamin-C (mg)	Mean	35.6	46.7	37.9	40.8
	Median	23.7	37.2	25.8	32.4
	SD	38.3	40.0	40.4	33.6

NUTRIENT INTAKES

- **Median nutrient intakes were below the RDA.**
- **About 60-80 % of adolescents consumed micronutrients <70% of RDA.**

3.3 TIME TRENDS

As indicated earlier, the changes in the diet and nutritional status, if any, were assessed by comparing the data collected during 1975-79 and 1996-97.

3.3.1 Secular trends in growth

Distance charts for height and weight for each sex according to period of survey are presented in **Figs. 2 and 3.** The adolescents measured during 1996-97 were significantly taller and heavier than their counterparts studied in 1975-79 indicating secular changes in growth during a period of twenty years. There was an increase to the extent of 2.5 to 3.5 cm and 1 to 1.5 kg, which was statistically significant (P<0.05).

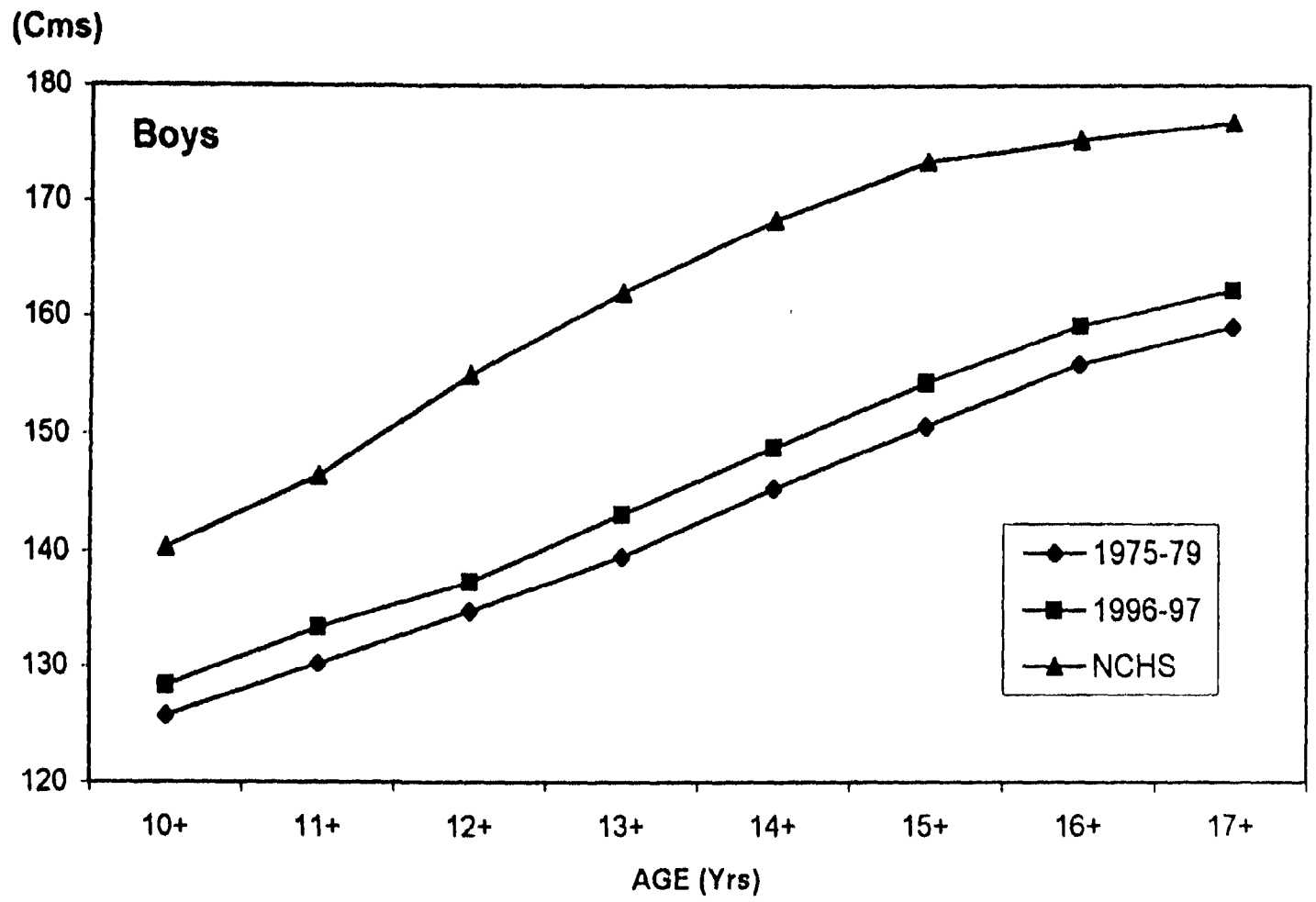
3.3.2 Nutrient Intakes

The distribution of children according to intakes expressed as % RDA (<70% and <50% of RDA) at both the points of time indicates that in the case of most of the nutrients there was reduction in the proportion of adolescents having deficient dietary intakes over the last two decades. The extent of severe deficit with respect to energy (<50% of RDA) decreased from 21% to 9% in boys and 14% to 5% in girls in 1996-97 as compared to 1975-79. The extent of decline in case of Iron and vitamin 'A' was less as compared to other nutrients. In other words, in general, there was improvement in the nutrient intakes **(Table-14; Figs. 4 to 7)** over a period of two decades.

Table 14 Distribution (%) of Adolescents according to Intake of Nutrients as % of RDA

Nutrients	Percent RDA	Boys		Girls	
		1975-79	1996-97	1975-79	1996-97
Protein	<50	7.3	2.5	8.9	3.7
	<70	23.4	12.9	25.2	15.4
Total Fat	<50	32.3	18.2	34.3	23.0
	<70	50.6	31.6	50.6	37.7
Energy	<50	21.1	9.3	14.3	5.3
	<70	54.3	34.0	43.5	24.8
Calcium	<50	48.8	36.9	49.0	43.2
	<70	65.6	54.2	68.7	59.6
Iron	<50	45.8	41.5	18.1	10.8
	<70	70.9	73.2	39.1	35.5
Vitamin A	<50	84.8	75.4	85.1	79.0
	<70	89.2	82.2	90.0	83.8
Thiamin	<50	29.1	19.0	30.6	16.2
	<70	41.1	41.4	40.4	39.5
Riboflavin	<50	59.5	43.1	55.4	37.8
	<70	80.2	73.6	74.7	64.5
Niacin	<50	27.1	18.6	22.8	13.6
	<70	52.9	46.3	46.6	40.6
Vitamin C	<50	45.0	36.5	46.1	37.2
	<70	58.8	49.7	60.0	49.6

Fig-2.
DISTANCE CHART FOR HEIGHT BY YEAR OF SURVEY



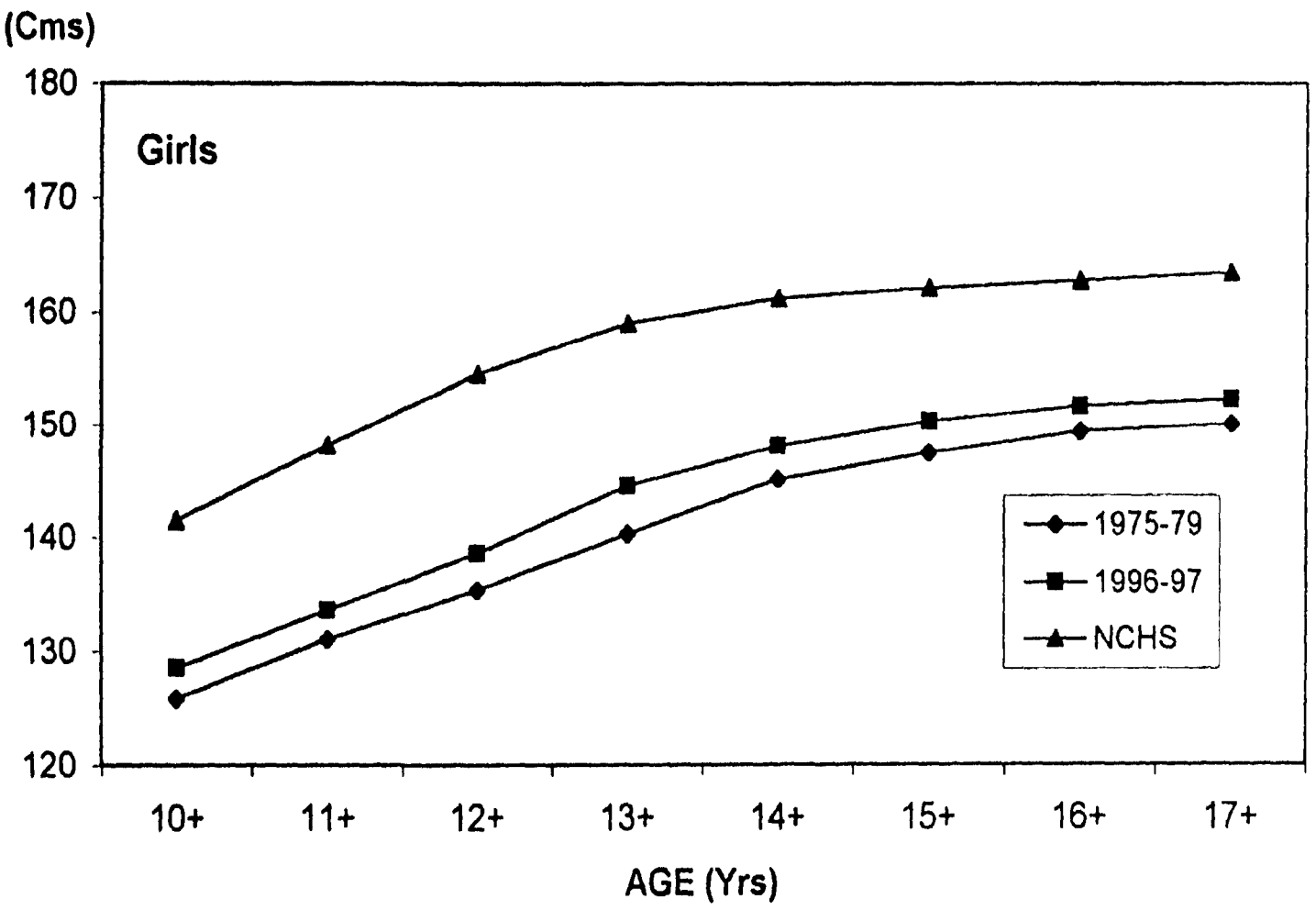
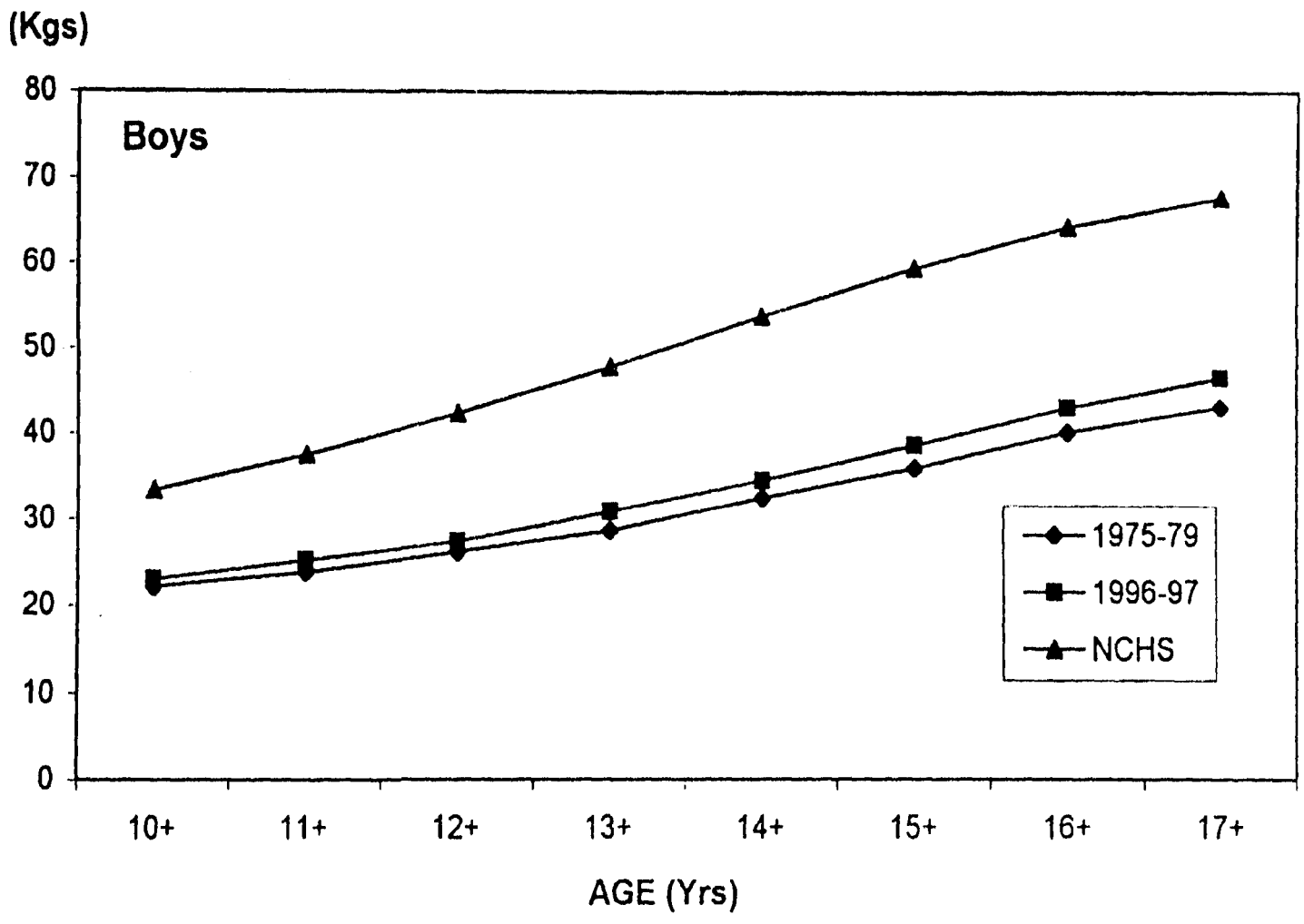


Fig - 3.
DISTANCE CHART FOR WEIGHT BY YEAR OF SURVEY



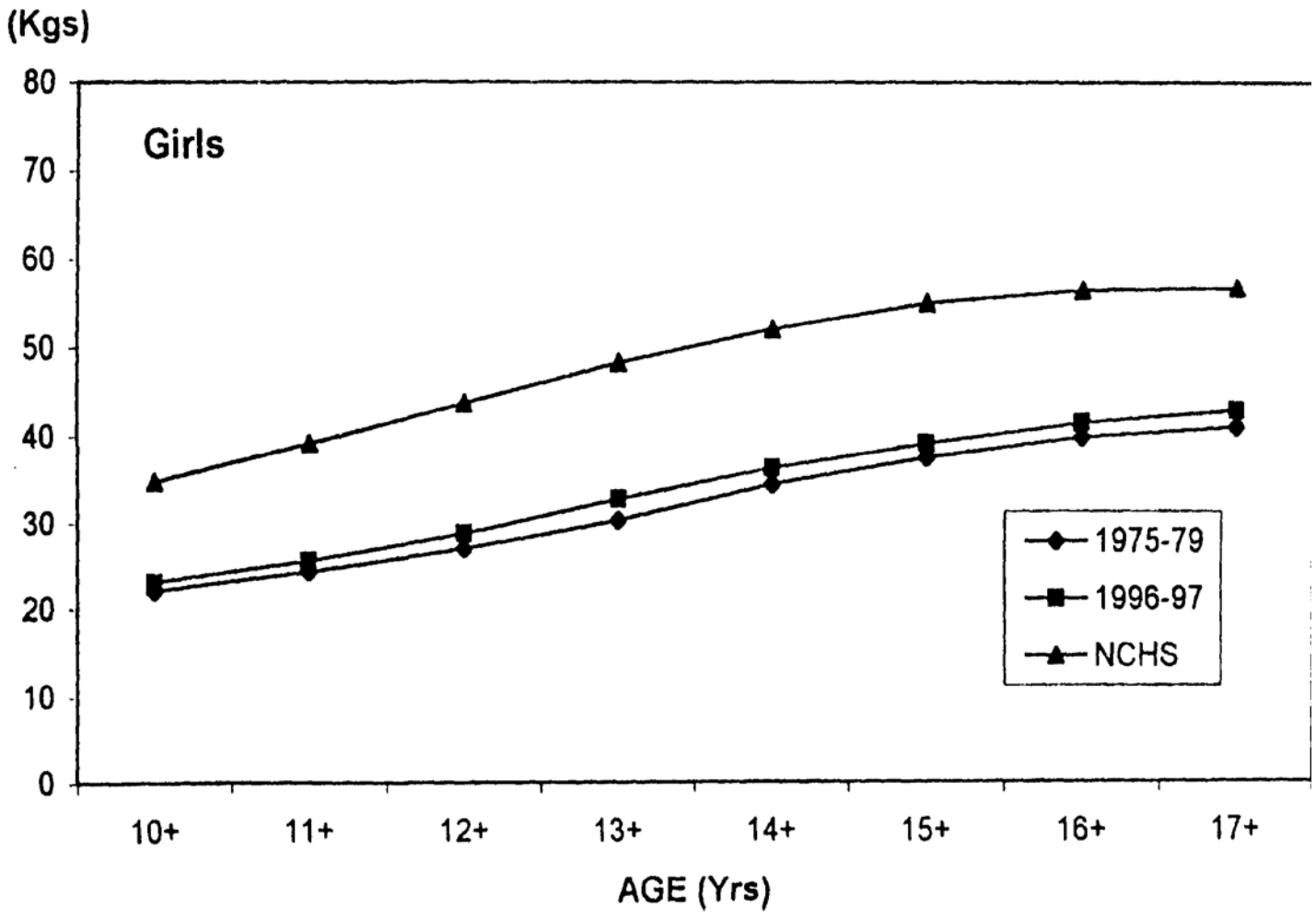


Fig - 4.
DISTRIBUTION OF ADOLESCENTS WITH PROTEIN INTAKE OF <RDA

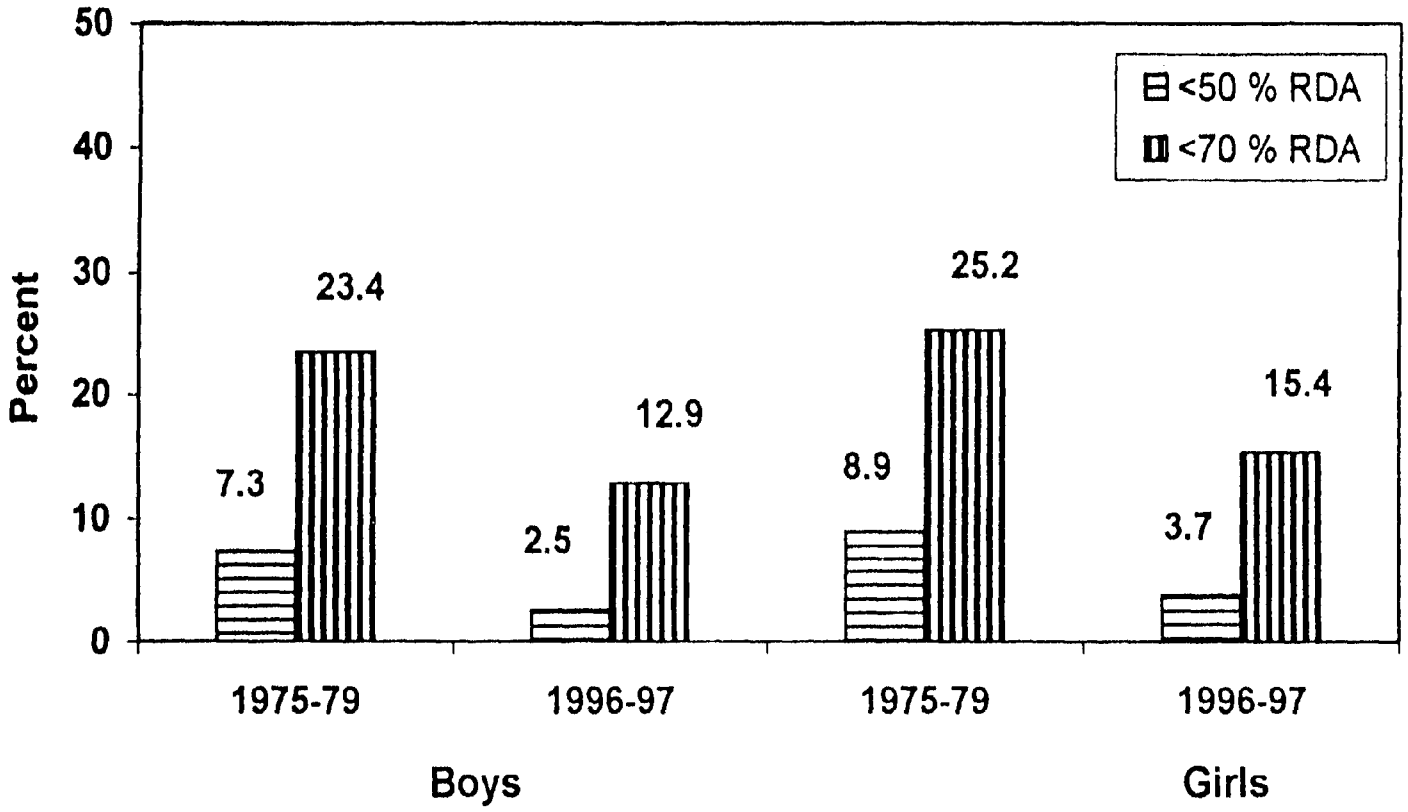


Fig - 5.
DISTRIBUTION OF ADOLESCENTS WITH ENERGY INTAKE OF <RDA

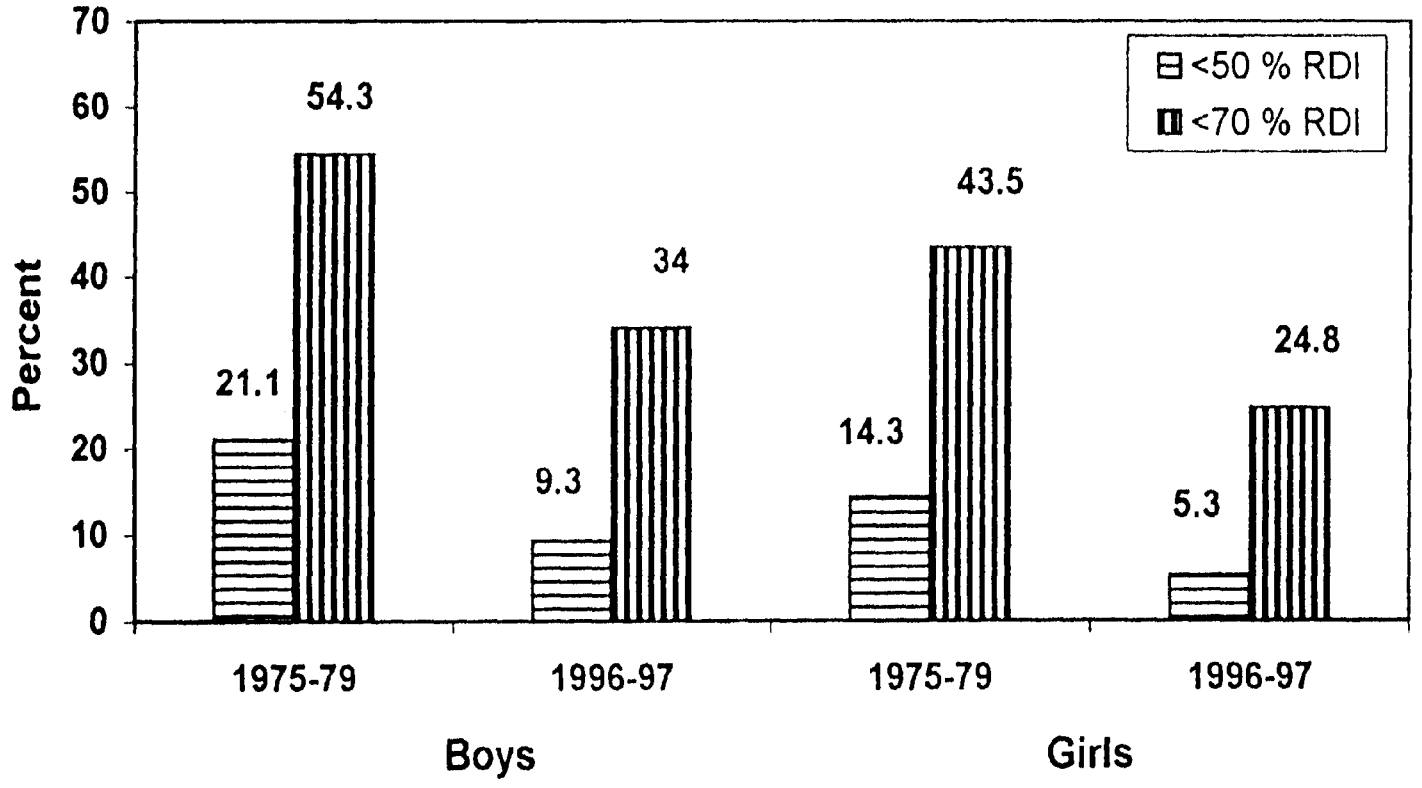


Fig - 6.

DISTRIBUTION OF ADOLESCENTS WITH VITAMIN A INTAKE OF <RDA

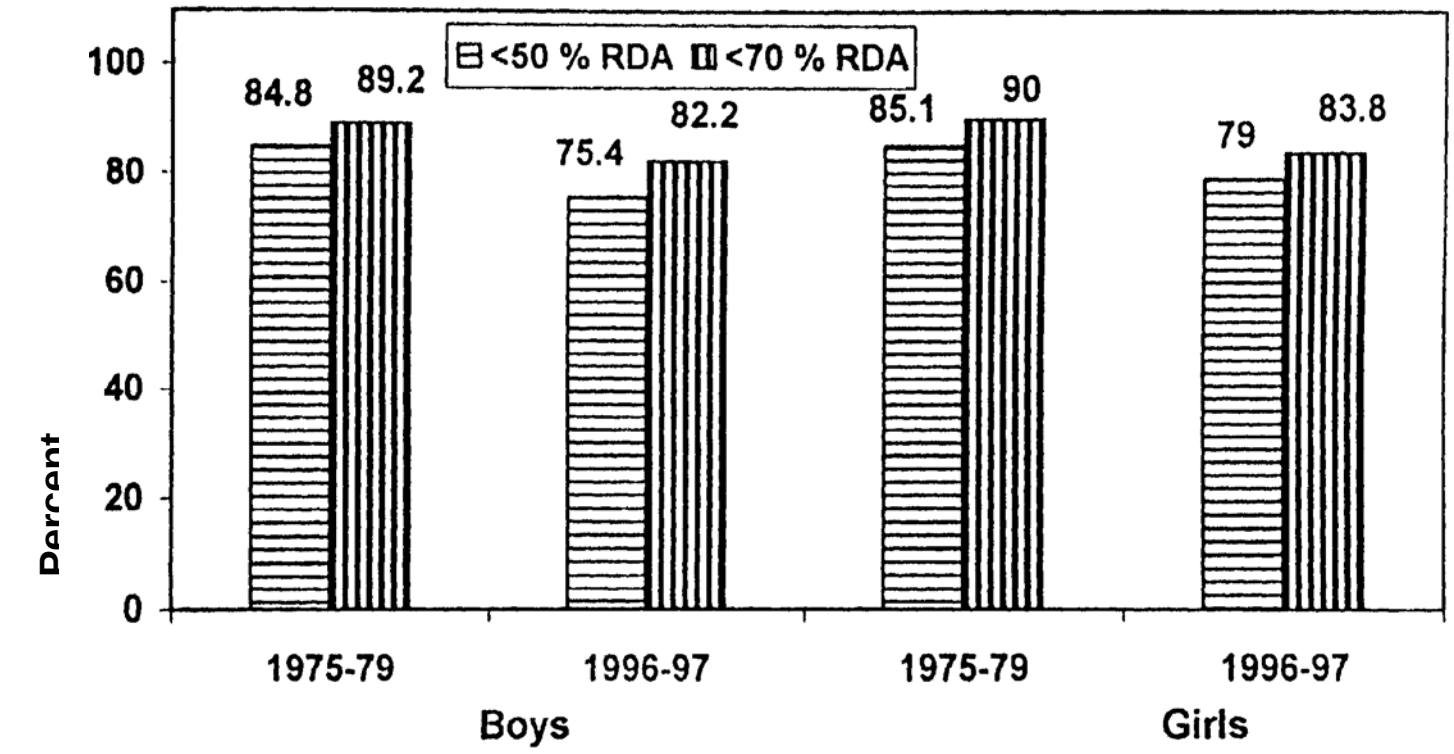
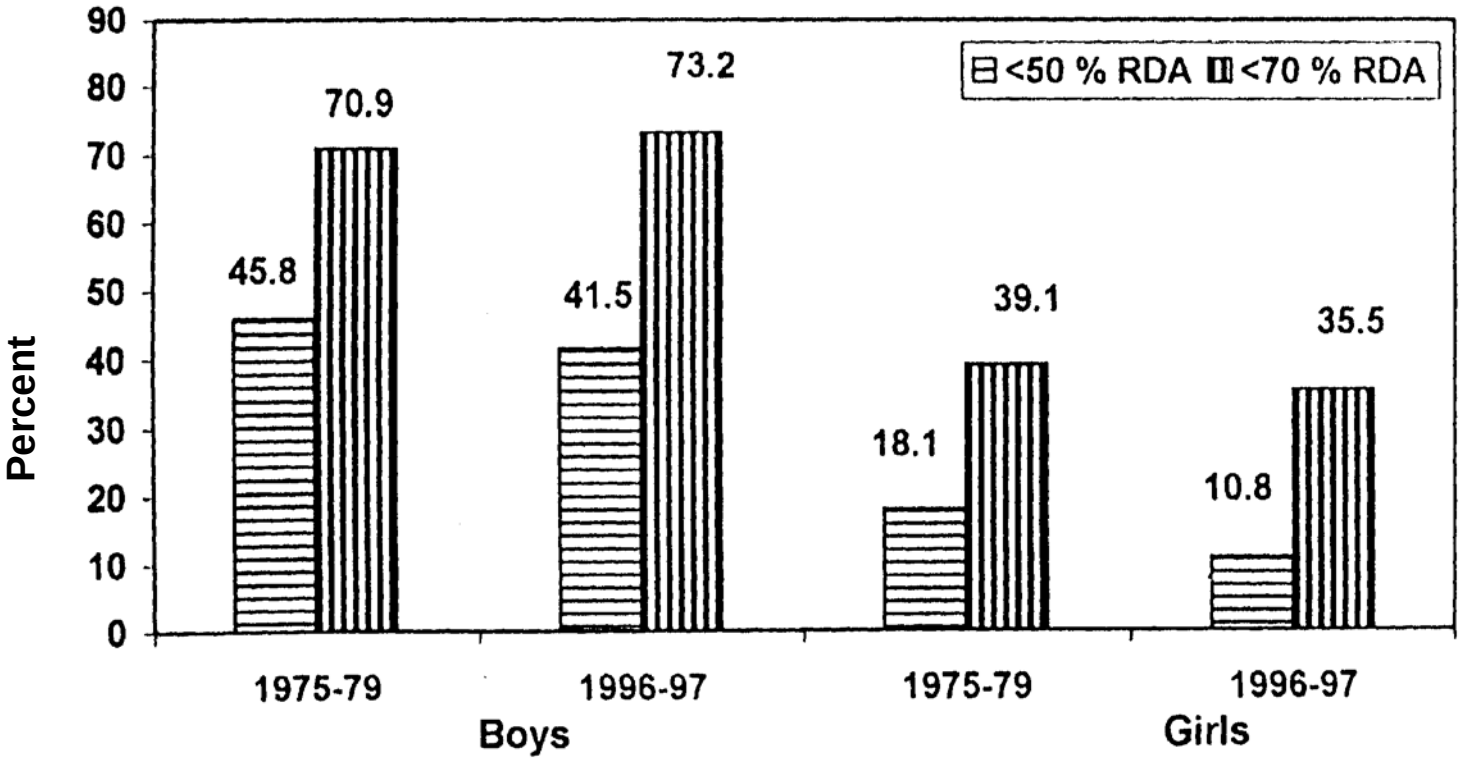


Fig-7.

PERCENT DISTRIBUTION OF ADOLESCENTS WITH IRON INTAKE OF <RDI



TIME TRENDS

Food and Nutrient Intake

- **Cereal intake increased over period in all ages.**
- **Intakes of income elastic foods such as fish, fruits, milk, fats & oils and sugar increased in all ages.**
- **Intakes of all the nutrients except thiamin increased in all the ages in both sexes.**

Anthropometry

- **Adolescents in 1996-97 were significantly taller and heavier than their counterparts in 1975-79.**

3.3.3 Socio-economic factors and dietary and nutritional status

The association between various demographic and socio-economic on one hand and anthropometric parameters on the other was studied. For the purpose, standard deviation classification of height/age and weight/age were used. For assessing the significance of relationships of each variable χ^2 test was used. The adolescents were divided into two groups of normal (Median-2SD) and undernourished (<Median -2SD).

The variables like religion, community, type of family, literacy status, type of house, land holdings, occupation and per capita income were significantly associated with the nutritional status as assessed by height/age ($P<0.05$) **(Table-15).** The extent of stunting in Christians was marginally less (31.8%) than among Hindus (39.4%), and those of SC community (42.7%). The adolescents belonging to extended family had lower prevalence of stunting (34.6%) as compared to those belonging to joint family (42.0%).

The percentage of stunting among adolescents was higher in those living in *kutcha* houses (40.5%) than those living in *pucca* houses (31.8%). The extent of stunting was higher in labourer families (40.3%). The extent of stunting decreased with increasing size of land holdings. The prevalence of stunting among adolescents decreased with increasing per capita income.

All the demographic variables like religion, community, type of family, family size, literacy status, type of house, land holdings, occupation and per capita income were significantly associated with weight/age ($P<0.05$) **(Table-15).** The percentage of undernutrition was higher among Hindus (46.2%) and those from ST community. On the other hand, among the adolescents belonging to extended family, the percentage of undernutrition was less (40.7%) as compared to joint family (48.6%). The adolescents of literate head of the household had lower undernutrition.

The extent of undernutrition was higher among those living in *kutcha* houses; involved in agriculture labour, among the landless and those with lower PCI.

Table 15 Distribution of Adolescents according to Stunting and Under Weight by Socioeconomic status

Variable	Description	% Stunted (<Median-2SD)	Chi-Square	P Value	% Under-Weight (<Median-2SD)	Chi-Square	P Value
Religion	Hindu Muslim Christian Others	39.4 36.7 31.8 49.6	12.2	<0.05	46.2 43.9 34.3 55.6	16.9	<0.05
Community	SC ST BC Others	42.7 37.6 39.3 37.0	20.0	<0.05	45.0 49.4 46.2 43.1	22.0	<0.05
Type of Family	Nuclear Joint Extended	40.0 42.0 34.6	23.8	<0.05	46.9 48.6 40.7	28.0	<0.05
Family Size	1-4 5-10 >10	37.7 39.8 36.6	4.2	>0.05	44.5 46.6 40.4	10.2	<0.05
Literacy	Illiterate Literate ≥Primary	40.8 45.3 37.8	12.5	<0.05	48.3 48.2 44.2	15.7	<0.05
Own house	Owned Not owned	39.1 44.4	0.2	>0.05	45.8 47.4	0.2	>0.05
Type of House	Kutcha Semi Pucca Pucca	40.5 38.9 31.8	21.8	<0.05	48.3 44.1 35.2	52.7	<0.05
Land holdings (acres)	Nil 0-5 >5	41.7 33.7 38.5	21.0	<0.05	48.1 43.2 44.8	11.8	<0.05
Occupation	Labourer Farmer Artisan/Busi-ness/Service Others	40.3 39.4 39.5 27.5	19.5	<0.05	47.4 46.6 44.6 34.8	20.2	<0.05
Mean per Capita Monthly Income (Rs.) by Quartiles	<25 26-50 51-75 ≥76	42.9 41.6 39.0 33.4	51.2	<0.05	49.7 47.6 45.9 40.1	48.5	<0.05

SOCIO ECONOMIC V/s NUTRITION STATUS

- Extent of stunting was significantly higher in SC community.
- Prevalence of undernutrition was higher among ST community.
- Proportions of stunted were higher, in adolescents living in *kutcha* houses.
- The proportion of stunted and undernourished children was higher in the households with low *per capita* income.

4. COMMENTS

The nutritional status of adolescent girls, the 'future mothers' contributes significantly to the nutritional status of the community. An assessment of the current diet and nutritional status of adolescents was made utilizing the large data collected by the National Nutrition Monitoring Bureau (NNMB). In addition, the time trends in diet and nutritional status were determined by comparing with the data that was collected by the NNMB in 1975-79 from the same villages. Most of the adolescents belonged to families involved in agriculture with a per capita income of about Rs. 250.

About 23% of adolescent girls were married before the legal age of 18 years. Among the married adolescent girls, about 19-24% of adolescent girls could be considered as 'at risk' because of either short stature or underweight. Undernutrition (<Median -2SD of NCHS weight for age) was widespread both in males (53.1%) and females (39.5%). The prevalence of stunting (<Median height -2SD) in both the sexes was similar (boys: 39.5% and girls: 39.1%).

The proportion of adolescents below the 5th percentile of NHANES-BMI ranged from 44% in 17 years of age to 78% in 11 years among boys and from 16% in 17 years to 63% in 10 years among girls. However, the extent of thinness was considerably less among girls as compared to their male counterparts. The mean intakes of all the nutrients were below the RDA in all the age groups of adolescents irrespective of sex. In general,Xin both the sexes, about two-thirds of adolescents were consuming inadequate amounts of micronutrients. Perhaps, because of higher RDA, the extent of dietary deficiency in iron was higher in boys than in girls. There was improvement in the nutrient intakes in 1996-97 as compared to 1975-79. The extent of severe deficit with respect to energy (<50% of RDA) decreased from 21% to 9% in boys and 14% to 5% in girls during 1975-79 to 1996-97. The adolescents measured during 1996-97 were significantly taller and heavier than their counterparts studied about two decades back indicating secular changes in growth during a period of twenty years. There was an increase to the extent of 2.5 to 3.5 cm in height and 1 to 1.5 kg in weight.

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NATIONAL NUTRITION MONITORING BUREAU

REPORT ON
DIET AND NUTRITIONAL STATUS
OF ELDERLY

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CONTENTS

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SUMMARY

Aging is one of the important developments of the 20th century. The present aged population in India is about 56 million (6.7%). There is dearth of comprehensive information on the nutritional status of elderly. This report presents the results based on the current status of the elderly population using the available large data collected in different states of the country by the National Nutrition Monitoring Bureau (NNMB). The objectives were to assess the current status of diet and nutritional status of elderly population and the time trends if any, in their diet and nutritional status over two decades.

About 922 elderly individuals were covered for diet survey and 3646 for anthropometric measurements during 1996-97, while the coverage was 858 and 3659 respectively for the period during 1975-79. The mean intakes of cereals and millets together are 445g and 357g in males and females respectively. The consumption of pulses, GLV and other vegetables was less than RDl in both the sexes. The mean intake of Milk and Milk Products was below the RDl. The mean and median intake of protein was slightly below the RDl in both the sexes. The mean intakes of energy for male and females are 2167 and 1764 kcals. About 65% elderly population consumed more than the RDl of energy. In the case of vitamin A and riboflavin, the intakes were below the RDl. In about 59%, the intakes of Vit.A were less than 30% of RDl and only 13% consumed more than the RDl. Protein-Calorie adequacy status was observed in large proportion of elderly (male: 90% and female: 67%).

The prevalence of Chronic Energy Deficiency (CED) (BMI <18.5) was relatively more among males (53.5%) than in females (49.4%). The prevalence of overweight/obesity (BMI > 25.0) was 4.2% in males, and 7.7% in females. The mean intakes of cereals & millets, GLV, other vegetables, nuts & oils, milk & milk products and sugar & Jaggery were higher in 1996-97 than those of 1975-79. The median intakes of nutrients among the elderly were higher in 1996-97 than of 1975-79. The median intakes of most of the nutrients, except iron and niacin were statistically significantly different between periods (p<0.05). A comparison between periods revealed that the extent of CED declined from about 62.3% in 1975-79 to 53.5% in 1996-97 among males and from 63.8% to 49.4% among females. An increasing trend was observed in the proportion of normal, overweight and obesity between 1975-79 and 1996-97.

1. INTRODUCTION

The twentieth century has seen an unprecedented transition from high birth and death rates to low fertility and mortality rates[1], resulting in increased longevity. Thus, aging of the population is one of the important developments of the 20th century during which there has been a considerable increase both in absolute and relative numbers of older people (60 years and above) in both developed and developing countries[2]. This new development could be attributed to decline in the mortality rates due to improved health care facilities, changed life styles and diversification of food habits.

According to the UN estimates[2], the elderly population was about 350 million in 1975. The projected figures for the years 2000 and 2025 are 590 and 1,100 million respectively. Currently, it is estimated that there are about 580 million elderly people in the world, of whom 355 million are in the developing countries. By the year 2020, it is estimated that there will be more than 700 million elderly people in the developing world[2]. In India, the present population of elderly is about 56 million (6.7%). In 20 years time, the number is expected to increase to 158 million, constituting roughly 8-9 per cent of the total population[2].

The increased proportion of aged population, due to higher life expectancy, is not necessarily devoid of any problems, and, in fact it invites a lot of socio-economic, psychological, physiological and health and nutritional problems. Hence, the health of the elderly has been attracting the attention of the medical professionals, psychologists, social scientists, nutritionists and governmental and non-governmental organizations all over the world. Adequate, appropriate and sufficient nutrition is essential to the health and well being of elderly. Generally the elderly people are nutritionally most vulnerable, the primarily due to poor dietary intake. Other factors, which contribute to undernutrition among the aged, are decreased physical activity, mental depression mostly due to isolation, maldistribution of food, poor eating habits, chronic ill health and dental problems.

In India, there is dearth of comprehensive information on the nutritional status of elderly. There is, therefore, a need to develop database on the diet and nutritional status of the elderly from different parts of the country to enable the Government and NGOs to formulate policies and initiate strategies, which would contribute to the well being of elderly population. In this report, an attempt has been made to assess the current status of the elderly population using the available large data collected in different states of the country by the National Nutrition Monitoring Bureau (NNMB) during 1996-97.

1.1 OBJECTIVES

1. To assess the current status of diet and nutritional status of elderly population in eight states where NNMB has been collecting information annually.

2. To assess time trends, if any, in their diet and nutritional status during the last two decades.

2. MATERIALS AND METHODS

The NNMB has been carrying out annual diet and nutrition surveys since 1972. The data collected during 1996-97 by the NNMB on diet and nutritional in the rural areas of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, Gujarat, Orissa has been utilized to asses the current nutritional status of elderly[3]. In addition, to assess the time trends, data collected during 1975-79 in the same villages was utilized.

2.1 SAMPLING DESIGN

2.1.1 Selection of villages

The NNMB surveyed 120 villages in each state, 90 of which were those surveyed during 1975-79 and 30 were newly selected villages. The sample was so selected as to represent the dietary and nutritional status at the state level.

2.1.2 Selection of households

From each of the selected villages, 20 households were selected by adopting cluster-sampling method. For this purpose, the main village and its hamlets, if any, were divided into five natural clusters consisting of groups of houses/streets/bastis/ *mohallas/areas,* of which SC community inhabited one cluster. From each of the clusters, 4 consecutive households were surveyed by selecting the first household randomly. Of the 20 HHs, ten were selected for diet survey. Of those 5 were selected for one day household weighment diet survey and remaining 5 HHs were selected for 24 hour dietary recall on all the members of the HH

2.1.3 Information

The following information has been used:

1. Socio-economic and demographic profile of the HHs and the individuals surveyed.
2. Diet survey of individuals by 24 dietary recall.
3. Anthropometric data on height, body weight, MUAC and FFT and
4. Clinical nutrition profile.

2.2 Statistical Analysis

Statistical analysis was performed using SPSS 7.5 windows version. The data was analyzed by dividing the elderly into the following three specific age groups:

- 60-69 years
- 70-79 years
- $\geq$80 years

Mean and SD values of food intakes and mean, median and SD values of nutrient consumption were calculated according to age, sex and the periods of survey. Mean, median and SD's of anthropometric measurements for the three age groups were calculated. Comparison of mean values of food and nutrient intakes were tested by ANOVA 'F' test with multiple comparison procedure and non parametric test of Kruskal Wallis one way ANOVA were utilized, whenever the assumption of homogeneity of variance was violated. Median test was used for comparison of medians between two periods for nutrients.

The results were compared with that of the adults below the age of 60 years (i.e. non-elderly adults). The time trends over period were assessed by comparing the data collected in 1996-97 with that collected during 1975-79.

Prevalence rates of chronic energy deficiency (CED) were calculated using Body Mass Index (BMI). BMI is the ratio between weight in kg and the square of height in metres. Association of BMI, food and nutrient intakes with socio economic parameters was analyzed with chi-square test.

3. RESULTS AND DISCUSSION

About 922 elderly individuals were covered for diet survey and 3646 for anthropometric measurements during 1996-97, while the coverage was 858 and 3659 respectively for the period during 1975-79 **(Table 1).**

Table 1 SAMPLE COVERAGE

Details	Year of study	Age in Years						Total
		60-69		70-79		≥80		
		M	F	M	F	M	F	
Diet Survey	1996-97	312	325	100	121	22	42	922
	1975-79	276	316	110	100	26	30	858
Nutrition Assessment	1996-97	1325	1295	444	390	104	88	3646
	1975-79	1516	1094	516	343	124	66	3659

COVERAGE		
	1975-79	1996-97
DIET SURVEY • Individuals:	858	922
ANTHROPOMETRY • Individuals:	3,659	3,646

3.1 SOCIO ECONOMIC PROFILE

The details of socioeconomic status of the population surveyed in 1996-97 are presented in **Table 2 .**

3.1.1 Religion

Majority of households of the elderly surveyed belonged to Hindu Religion (81.6%), while the rest were Christians (5.3%), Muslims (4%) and others (9.1%).

3.1.2 Community

About 29% belonged to SC and ST population, while the rest belonged to other communities.

3.1.3 Type of House

About 47.4% of the houses were *kutcha* and the rest were *semi pucca* (39.0%) or *pucca* (13.6%).

3.1.4 Type of Family

About 75% of the households were nuclear or extended nuclear families, while the rest of 25% were joint families .

3.1.5 Major Occupation of Head of Household

Agriculture was the major occupation of a majority of the households. About 39% of the households were engaged in agriculture, while about 21% were either agricultural labourers or other labourers.

3.1.6 Landholdings

A majority of the households belonged to either landless (39%) or small farmers having less than 5 acres (45%).

3.1.7 Family Size

About 30% of the elderly belonged to HHs having < 4 members, 26% of the HH had ≥7.

3.1.8 Literacy Status

About 65.6% of heads of the HHs were illiterates.

Table 2 SOCIO ECONOMIC PROFILE

Variable	Categories	%
Community	SC+ST	29.2
	Others	70.8
Type of House	*Kutcha*	47.4
	Semi Pucca	39.0
	Pucca	13.6
Type of family	Nuclear*	74.9
	Joint	25.1
Occupation	Labourer	21.4
	Agriculturist	39.3
	Others (Service, Business etc)	39.3
Land holdings (Acres)	No land	38.7
	<5	44.6
	5 – 10	9.2
	≥10	7.5
Family size	1-4	30.4
	5-6	43.7
	≥7	25.9
Literacy Status	Illiterate	65.6
	Literates	34.4

* Nuclear + Extended nuclear

3.2 DIETARY CONSUMPTION

3.2.1 Foods

The consumption of foodstuffs (g/day) according to age and sex is presented in **Tables 3 and 4** & **Fig. 1.**

The cereals and millets formed the bulk of dietaries of the elderly, as in other age groups. The intake of cereals and millets in males were 338 g and 107 g respectively, whereas in females, the intakes were 291 g and 66 g respectively.

The variation in dietary intake was large. Mean intakes of cereals and millets together were more than RDI. (Males: 445 g and Females: 357 g). In all the age groups and in both the sexes, the consumption of cereals and millets was above the RDI[5]. The cereal intake was considerably reduced in oldest age group of ≥ 80 years.

The mean intake of pulses in male and female was 31 g and 27 g respectively. The consumption of pulses and green leafy vegetables was less than RDI in all age groups in both the sexes.

The intake of other vegetables, though was better than that of green leafy vegetables in all the age groups in both the sexes, was still lower than the RDI. The elderly males consumed higher than the suggested level of (50 g) of roots and tubers in all age groups. Mean intakes of sugar & Jaggery for males and females were 25 g and 21 g respectively.

3.2.2 Nutrients

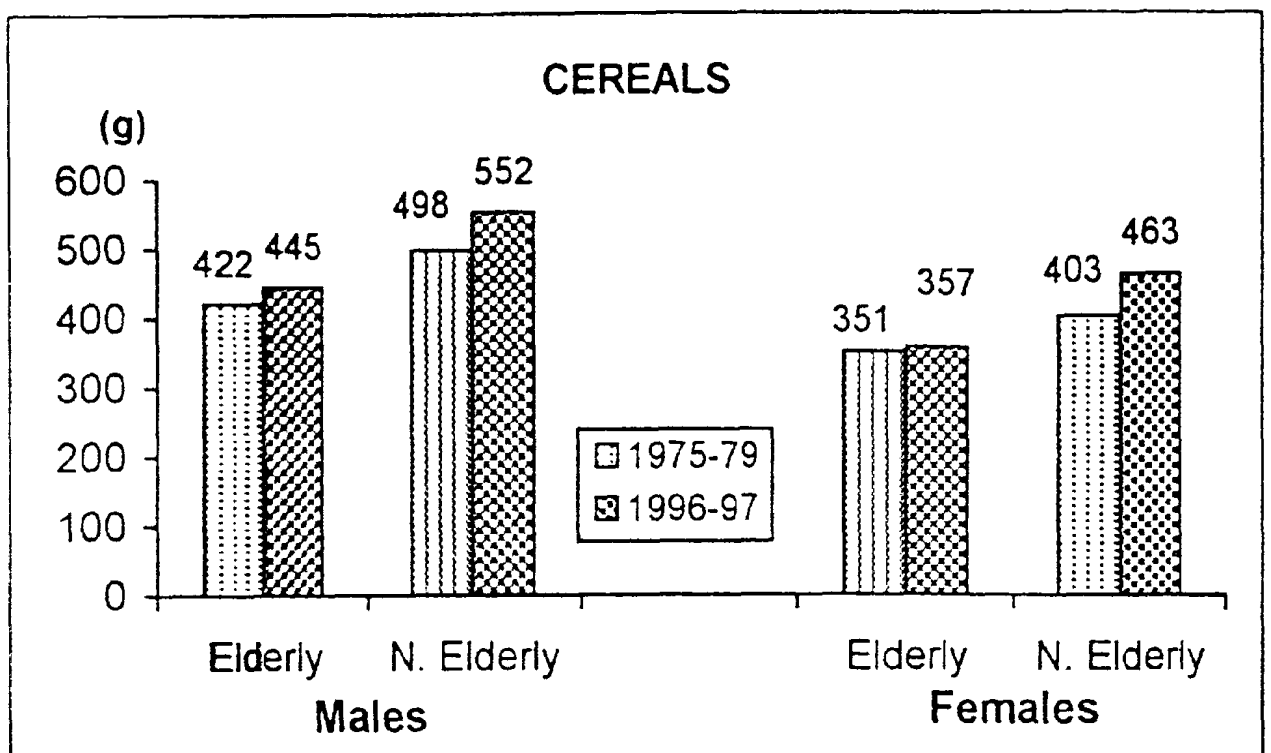
The mean and median intakes of nutrients, calculated for three age groups and sexes, are presented in Tables 5 & 6 and are compared with RDI values suggested by the Expert Committee of ICMR[4,5](1990) **(Fig.2).**

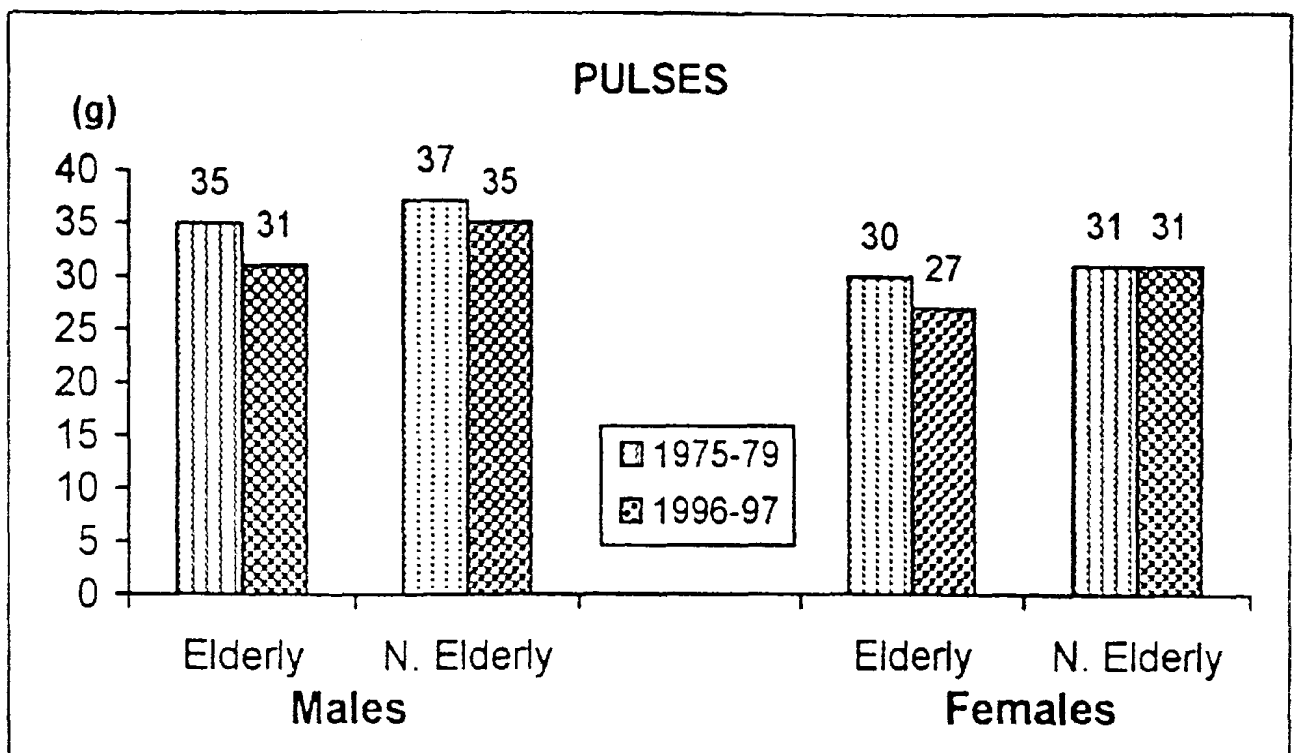
The mean and median intakes of protein were slightly less than the RDI in both the sexes. The intakes were higher in the younger age group (60-69 years) than in the other age groups, in both the sexes, though it was statistically significant only in females ($p<0.01$). The intakes among non-elderly adults were higher than the elderly adults. The median energy intakes of males (2080 Kcal) and females (1689) were less than the RDI. (RDI for energy among elderly was calculated according to their body weights). The mean intakes of energy, which were in marginally higher than the medians for male and females were 2167 and 1764 kcal. The mean intakes decreased with increasing age. The consumption of iron in both the sexes was lower than the RDI. The average consumption of calcium was, however more than the RDI (400 mg) in both the sexes.

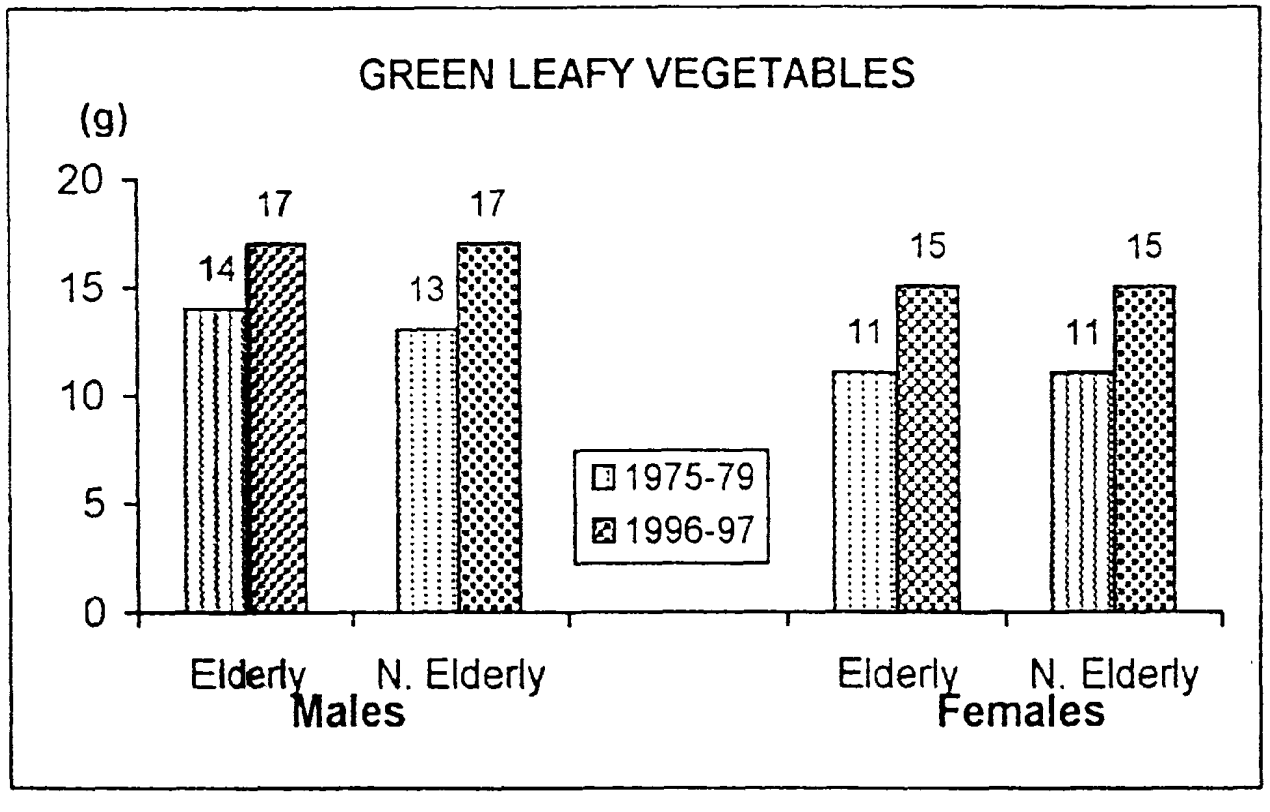
The intake of vitamin A was below the RDI (600 µg) in all age groups. The median intake was more in males (168 µg) than females (137 µg). The intakes increased with increasing age among the males. The median intake of thiamin was marginally lower than the RDI (Males: 1.2 mg and females: 1.0 mg). In the case of non-elderly adults the intakes were more than the elderly (males: 1.4 mg and females: 1.2 mg). The consumption was more among younger age groups of the elderly in both the sexes.

The consumption of riboflavin was less than the RDI in all three age groups. Mean intakes were significantly different between ages in females ($p<0.05$). The riboflavin intake among non-elderly adults was comparable with the elderly in both the sexes. The mean intake of vitamin C was more than the recommended level of 40 mg for males (46 mg), while it was comparable in females (39 mg), in each age group. The median intakes were, however, less than RDI.

Fig.1 : MEAN DAILY INTAKE OF FOODS (g/CU/day)







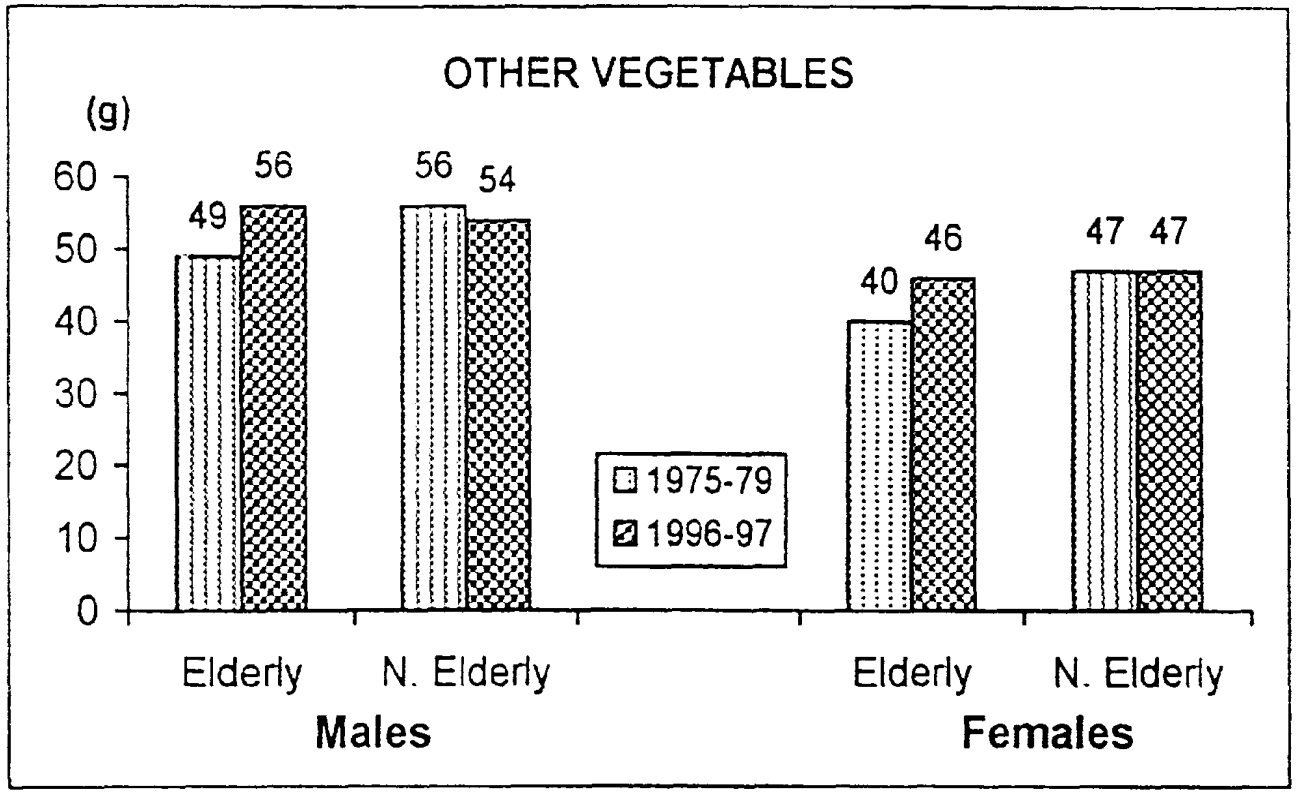
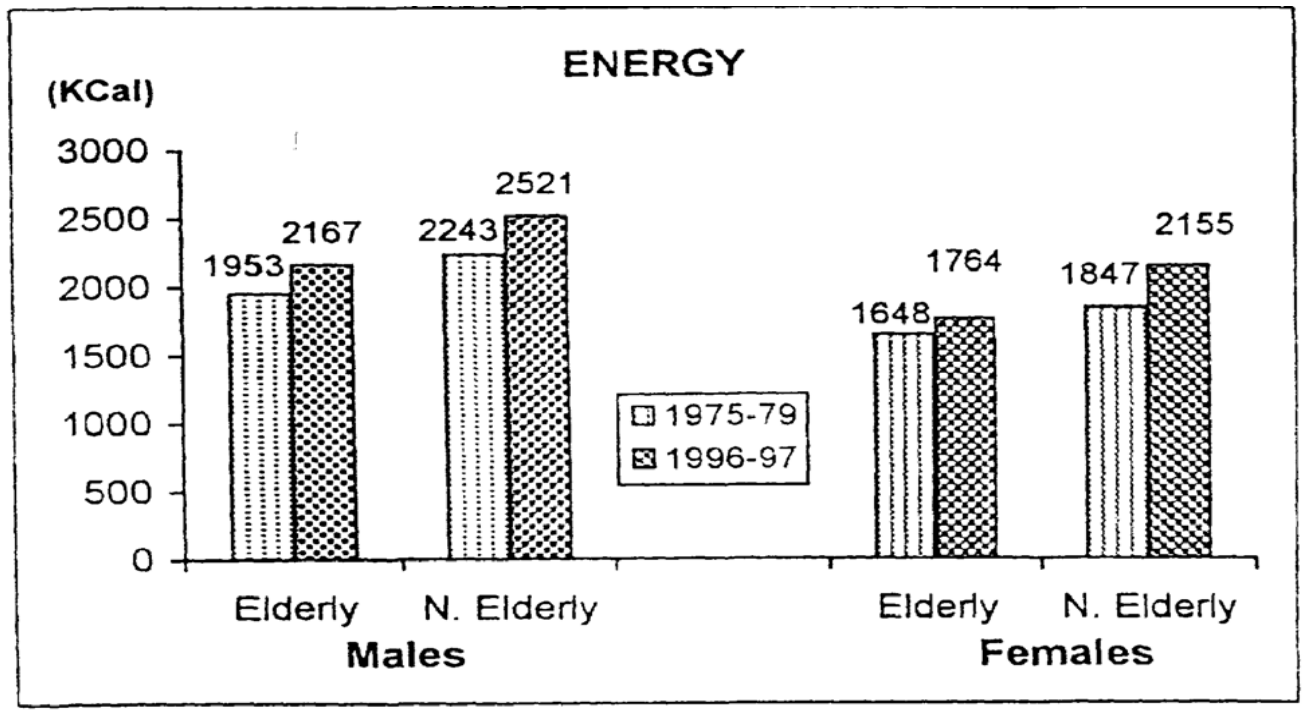
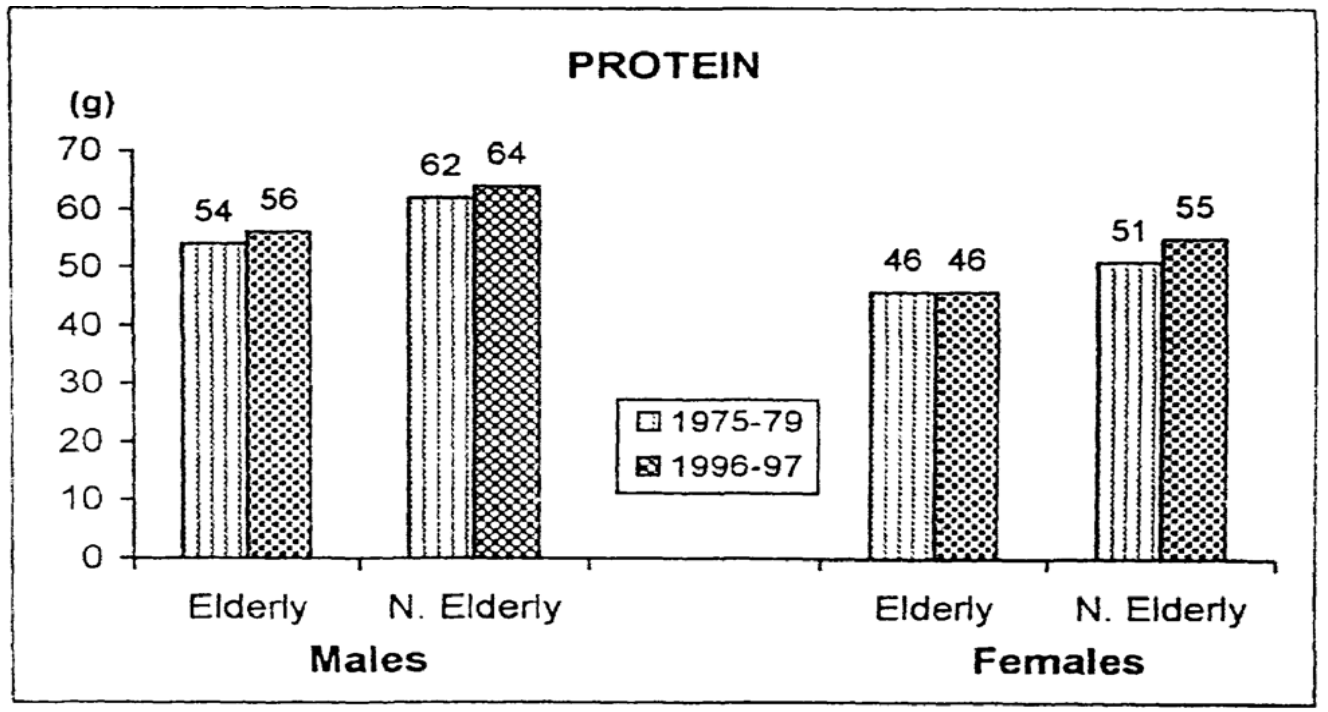
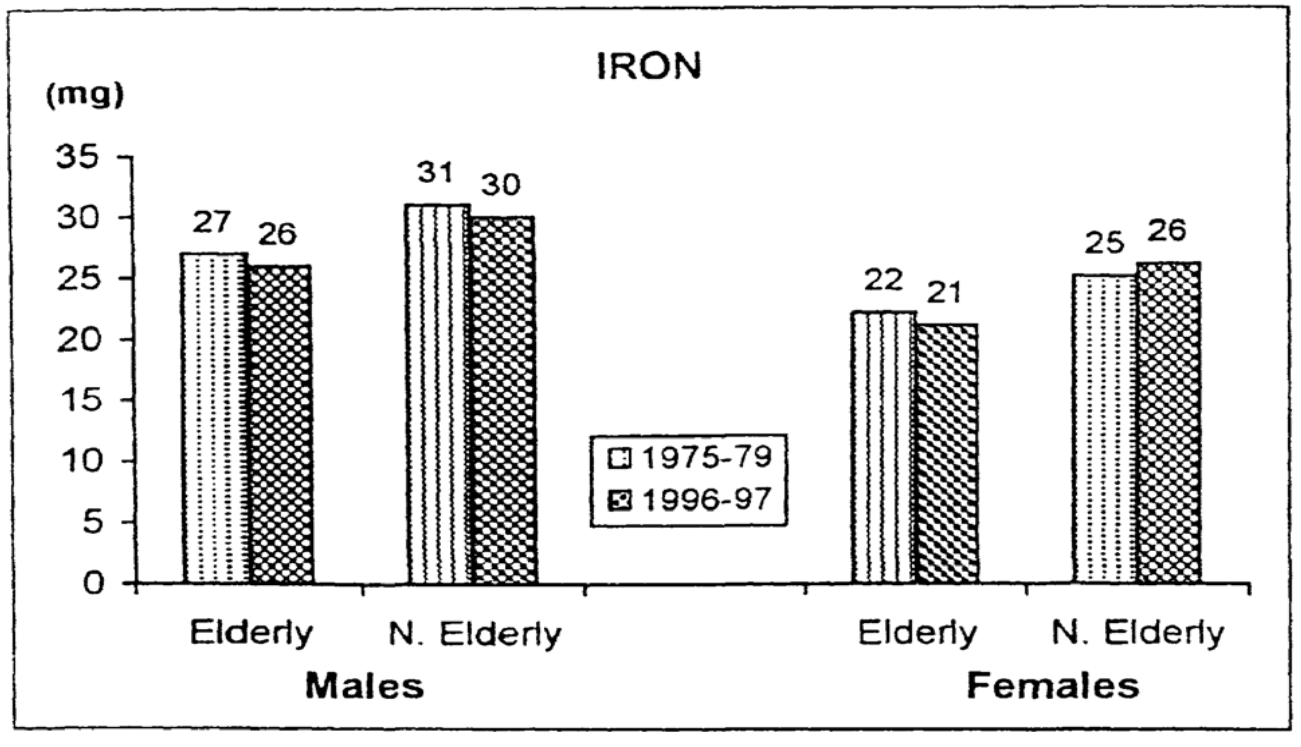


Fig. 2 : MEAN DAILY INTAKE OF NUTRIENTS (per CU/day)







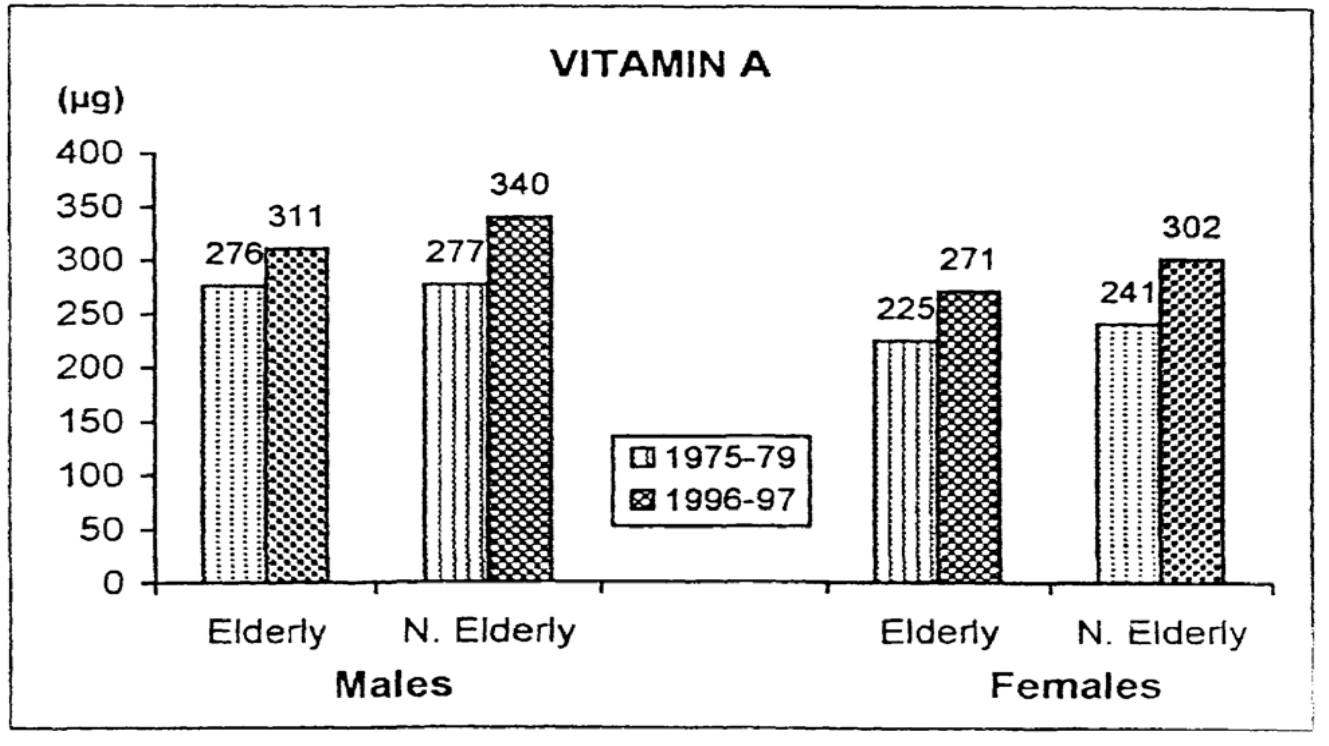


Table 3 INTAKE OF FOOD STUFFS (g/day) AMONG ELDERLY INDIVIDUALS - MALES

Age (Years)	N		Cereals & Millets	Cereals	Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Milk & Milk Prod.	Fats & Oils	Sugar & Jaggery
60-69	312	Mean	455	342	113	31	17	59	51	20	25	18	3	91	13	22
		SD	170	200	202	37	38	74	83	37	63	47	21	222	15	25
70-79	100	Mean	439	347	92	31	12	49	54	23	30	24	4	92	13	26
		SD	159	205	173	40	41	57	63	56	52	57	22	112	11	27
≥80	22	Mean	335	253	82	28	30	48	60	15	15	22	2	96	10	54
		SD	131	173	130	36	84	59	82	20	27	46	7	14	11	70
Pooled	434	Mean	445	338	107	31	17	56	52	21	26	20	4	92	13	25
		SD	168	201	192	37	42	70	78	42	59	50	21	198	14	44
F ratio			5.5**	2.1	0.7	0.1	1.7	0.9	0.1	0.3	0.7	0.5	0.1	0.01	0.5	5.4**

** p<0.01

Table 4 INTAKE OF FOOD STUFFS (g/day) AMONG ELDERLY INDIVIDUALS - FEMALES

Age (Years)	N		Cereals & Millets	Cereals	Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Milk & Milk Prod.	Fats & Oils	Sugar & Jaggery
60-69	325	Mean	378	301	77	28	14	47	51	15	21	19	3	73	12	20
		SD	154	170	153	34	39	64	72	32	45	45	16	100	11	22
70-79	121	Mean	323	278	44	24	21	41	44	18	24	20	2	70	11	22
		SD	150	151	112	35	51	54	70	28	52	51	11	106	26	43
≥80	42	Mean	285	251	34	21	5	56	39	15	24	13	1	79	8	19
		SD	104	114	85	27	16	58	66	23	38	34	6	89	5	21
Pooled	488	Mean	357	291	66	27	15	46	49	16	22	19	2	73	11	21
		SD	153	162	140	34	41	61	71	30	47	46	14	101	16	29
F ratio			11.3**	2.4	3.3*	1.4	2.9	1.1	0.9	0.4	0.2	0.4	0.4	0.1	0.9	0.2

* p<0.05; ** p<0.01

Table 5 INTAKES OF NUTRIENTS AMONG ELDERLY INDIVIDUALS - MALES

Age (Years)	N		Protein (g)	Total fat (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
60-69	312	Mean	57	33	2187	554	27	306	1.3	1.0	13.9	46
		Median	52	26	2049	402	24	161	1	1	12.6	37
		SD	23	26	692	587	12	379.6	0.8	0.6	6.2	37.1
70-79	100	Mean	56	35	2169	569	25	307	1.2	1.0	13.0	42
		Median	54	28	2174	459	23	178	1	1	11.6	32
		SD	21	26	668	440	10	485.3	0.62	0.5	5.4	37.3
≥80	22	Mean	45	28	1860	594	23	410	1.0	0.9	10.2	60
		Median	45	25	1719	423	20	227	0.9	0.8	10.1	33
		SD	14	18	837	480	13	758	0.4	0.5	3.3	78.5
Pooled	434	Mean	56	33	2167	559	26	311	1.2	1.0	13.5	46
		Median	52	27	2080	412	24	168	1	0.9	12.3	35
		SD	22	26	696	551	11	425.2	0.7	0.6	6.1	40.2
F ratio			2.7	0.7	2.3	0.1	2.1	0.6	2.3	0.3	4.3*	1.9

* p<0.05

Table 6 INTAKE OF NUTRIENTS AMONG ELDERLY INDIVIDUALS - FEMALES

Age (Years)	N		Protein (g)	Total fat (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
60-69	325	Mean	48	28	1847	459	22	262	1.0	0.8	11.3	39
		Median	44	23	1783	369	20	135	0.8	0.8	10.8	32
		SD	18	19	586	337	9.8	366.8	0.6	0.3	4.6	34.1
70-79	121	Mean	43	27	1649	459	20	327	0.9	0.8	10.4	40
		Median	40	22	1540	381.3	18	146	0.7	0.7	9.4	27
		SD	19	28	674	374.2	10.3	538.3	0.6	0.3	5.1	40.8
≥80	42	Mean	37	23	1447	428	17	176	0.8	0.7	8.8	35
		Median	38	20	1436	334.7	17	137	0.7	0.7	9	33
		SD	13	13	392	299.9	6	151	0.4	0.3	3.2	21.6
Pooled	488	Mean	46	27	1764	456	21	271	1.00	0.8	10.9	39
		Median	42	22	1689	371	19	137	0.8	0.8	10.2	31
		SD	18	22	608	342.8	9.8	405.5	0.6	0.3	4.7	34
F ratio			8.0**	1.1	11.4**	0.2	6.4**	2.4*	5.7**	4.6**	6.6**	0.4

* p<0.05; ** p<0.01

TIME TRENDS

FOOD AND NUTRIENT INTAKE

- Intakes increased for all the foodstuffs except pulses over a period of time.

NUTRIENTS

- Intake of all nutrients except iron and thiamin increased over a period of time.

FOOD AND NUTRIENT INTAKES IN INDIVIDUALS

- Intake of all the Foods except Cereals & Millets was less than RDI.
- Intake of all the nutrients except calcium, thiamin and vitamin C was less than RDI.
- Mean Intake of calories decreased with increasing age.

3.2.3 Distribution of Nutrient Intake by per cent of RDI

Distributions of individuals according to intake of major nutrients as per cent of RDI are presented in Table 7.

About 65% elderly population consumed more than the RDI of energy. The percentage consuming more than RDI were slightly more among the males (71%) than in females (60%). The corresponding figures for the non-elderly adults were 52% and 64% respectively. It may be noted that while the RDI of elderly is based on actual weights. A negligible proportion of elderly (1.4%) consumed energy below 50% of RDI. The consumption of protein was less than 50% of RDI in about 2% of the elderly. As in the other age groups, the micronutrient intakes were inadequate.

The intake of vitamin A was very unsatisfactory. In about 59%, the intakes were less than 30% of RDI, while only 13% consumed more than the RDI. The intakes of riboflavin were more than RDI in only 11% of individuals, while 5.2% were consuming <30% RDI **(Table 7).** About 16% consumed less than 50% of RDI of thiamin. In about 38% the intakes were more than RDI.

Table 7 DISTRIBUTION OF ELDERLY ACCORDING TO NUTRIENT INTAKES BY PERCENT OF RDI

Nutrient	Year	< 50	50-60	60-70	70-80	80-90	90-100	≥100	χ^2
Energy	1975-79	3.6	5.6	7.9	9.4	10.4	9.9	53.1	37.40***
	1996-97	1.4	2.8	5.6	6.3	8.8	10.3	64.8	
Protein	1975-79	2.8	4.4	5.7	7.8	8.0	6.6	65.4	14.46*
	1996-97	1.5	3.1	3.7	5.2	7.7	8.2	70.5	
Thiamin	1975-79	21.4	5.8	5.4	4.9	5.2	5.9	51.3	73.24***
	1996-97	15.8	10.1	10.0	9.8	8.9	7.8	37.6	
Niacin	1975-79	18.1	12.1	10.0	11.3	8.4	7.2	32.9	26.62***
	1996-97	14.1	10.1	12.4	12.0	9.7	8.5	31.3	

Nutrient	Year	<30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	≥100	χ^2
Calcium	1975-79	8.3	5.7	9.7	9.4	7.5	6.4	5.6	6.1	41.4	18.21*
	1996-97	7.5	4.6	7.2	6.1	7.3	7.6	5.7	5.3	48.8	
Iron	1975-79	3.4	7.3	12.4	14.1	10.5	9.3	8.0	5.9	29.0	28.47***
	1996-97	3.6	6.3	10.4	10.5	15.7	12.1	9.5	8.1	23.6	
Vit. A	1975-79	70.4	7.7	4.0	2.8	2.2	1.7	1.5	0.7	9.0	29.0***
	1996-97	58.6	10.4	6.3	4.1	2.5	2.1	2.1	1.5	12.5	
Ribo-flavin	1975-79	16.7	14.6	16.7	13.9	10.3	7.2	5.1	3.7	11.9	139.53***
	1996-97	5.2	5.7	24.4	12.5	12.1	13.6	7.5	8.1	10.8	
Vit. C	1975-79	31.1	4.8	7.0	6.5	6.5	6.6	4.3	2.6	30.5	50.23***
	1996-97	20.0	4.8	6.0	4.7	7.2	5.7	6.5	5.5	39.7	

*** p<0.05; *** p<0.001**

3.2.4 Protein Calorie adequacy status

- The protein and energy requirement curves are assumed to follow gaussian distribution, with a coefficient of variation of 15%. The ICMR Expert Committee suggested mean requirements of energy for different ages, whereas in the case of protein, the RDI corresponded to Mean + 2SD of actual requirements. The

Individuals with less than Mean - 2 SD of requirements of energy/protein were categorized as energy/protein inadequate.

Protein-Calorie adequacy status was observed in a large proportion of elderly (Male: 90%; Female: 82%). As the age advanced the inadequacy status also increased in both the sexes.

3.3 NUTRITIONAL STATUS

The mean, median and SDs of anthropometric measurements according to age, sex and period of survey are presented in **Tables 8 to 10.** The mean heights of elderly decreased in both the sexes, as the age advanced. However, such a trend was noticed only among males.

The nutritional status of the elderly was assessed based on Body Mass Index (BMI). It is the ratio of weight in kgs, and square of height in meters. The mean BMI was higher in the younger age group of males, while in the case of females it was higher in the older age group. The elderly were grouped into different nutritional grades using James[6-8] Classification, was given below.

BMI	Nutritional Grade
<16.0	III degree CED
16.0-17.0	II degree CED
17.0-18.5	I degree CED
18.5-20.0	Low normal
20.0 - 25.0	Normal
25.0-30.0	I degree obesity
>30.0	II degree obesity

Table 8 ANTHROPOMETRIC MEASUREMENTS OF MALES BY AGE AND PERIOD OF SURVEY

YEAR	AGE (Years)	N		HEIGHT (Cms)	WEIGHT (Kgs)	BMI
1975-79	60-69	1516	Mean Median SD	161.8 162.0 6.65	47.5 46.3 8.53	18.1 17.7 2.89
	70-79	516	Mean Median SD	160.8 160.6 6.73	46.5 44.8 9.26	18.0 17.5 3.08
	≥80	124	Mean Median SD	160.3 160.2 7.46	47.1 46.4 8.21	18.3 18.1 2.80
1996-97	60-69	1325	Mean Median SD	160.7 161.0 6.60	48.4 47.0 8.94	18.7 18.3 3.00
	70-79	444	Mean Median SD	160.1 160.2 6.64	47.6 46.4 8.91	18.6 18.2 3.16
	≥80	104	Mean Median SD	158.2 158.8 7.21	46.3 45.4 8.64	18.4 18.4 3.08

Table 9 ANTHROPOMETRIC MEASUREMENTS OF FEMALES BY AGE GROUPS AND PERIOD OF SURVEY

YEAR	AGE (Years)	N		HEIGHT (cms)	WEIGHT (kgs)	BMI
1975-79	60-69	1094	Mean	147.3	39.5	18.2
			Median	147.0	38.0	17.5
			SD	6.08	8.05	3.33
	70-79	343	Mean	146.2	38.0	17.7
			Median	146.0	36.3	17.2
			SD	6.41	7.35	3.03
	≥80	66	Mean	146.0	37.4	17.5
			Median	146.6	36.5	17.6
			SD	6.42	7.09	2.91
1996-97	60-69	1295	Mean	148.3	42.8	19.4
			Median	148.2	41.2	18.6
			SD	6.13	8.61	3.65
	70-79	390	Mean	147.3	41.5	19.0
			Median	147.0	40.2	18.3
			SD	6.12	8.44	3.65
	≥80	88	Mean	146.1	41.7	19.5
			Median	146.6	40.0	18.8
			SD	6.99	8.12	3.69

The prevalence of Chronic Energy Deficiency (CED) (BMI <18.5) was relatively more among males (53.5%) than in females (49.4%). It was observed that the proportion of CED increased with increasing age among males, while it was the lowest among the females of 80 years and above. This may be due to the common observation that, in general, BMI is higher in females than males. The prevalence of obesity (BMI > 25.0) was 4.2% in males, and 7.7% in females (Table-10 & Fig.3a, 3b & 4a, 4b).

In the case of non-elderly adults, the prevalence of CED was lower than the elderly in both the sexes (Males: 44.2%; Females: 46.8%).

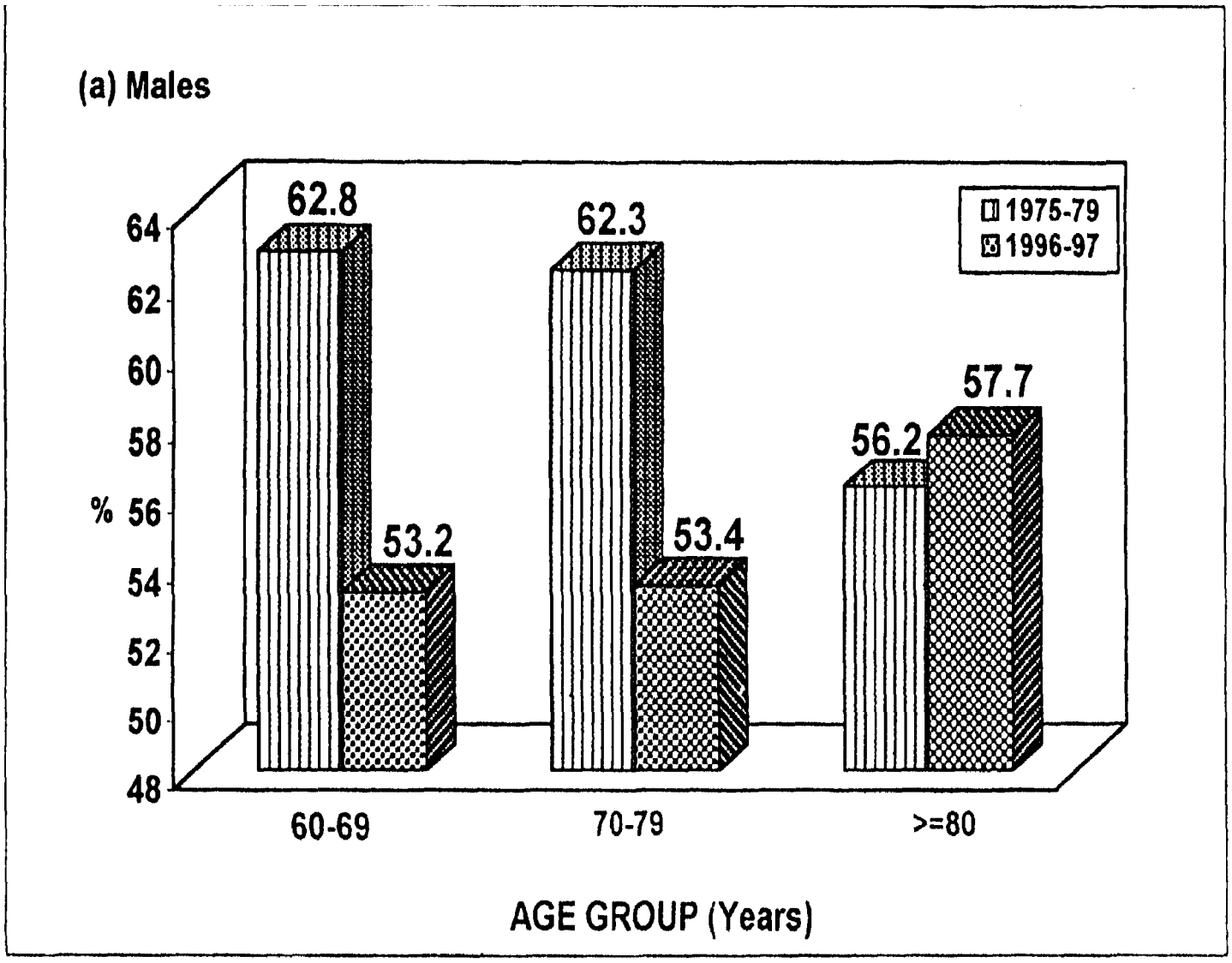
Table 10 DISTRIBUTION (%) OF ELDERLY BY AGE AND SEX ACCORDING TO BMI

Age (Years)	Male			Female		
	<18.5	18.5-25.0	≥25.0	<18.5	18.5-25.0	≥25.0
60-69	53.2	42.7	4.1	48.7	43.4	7.9
70-79	53.4	42.1	4.5	52.3	41.3	6.4
≥80	57.7	38.5	3.8	48.3	42.5	9.2
Pooled	53.5	42.3	4.2	49.4	42.9	7.7
Non-elderly (18-59yrs)	44.2	51.8	4.0	46.8	47.3	5.9

Males: χ^2 = 0.96 (NS); Females: χ^2=2.34(NS)

Fig.3

PREVALENCE (%) OF CHRONIC ENERGY DEFICIENCY AMONG ELDERLY BY AGE



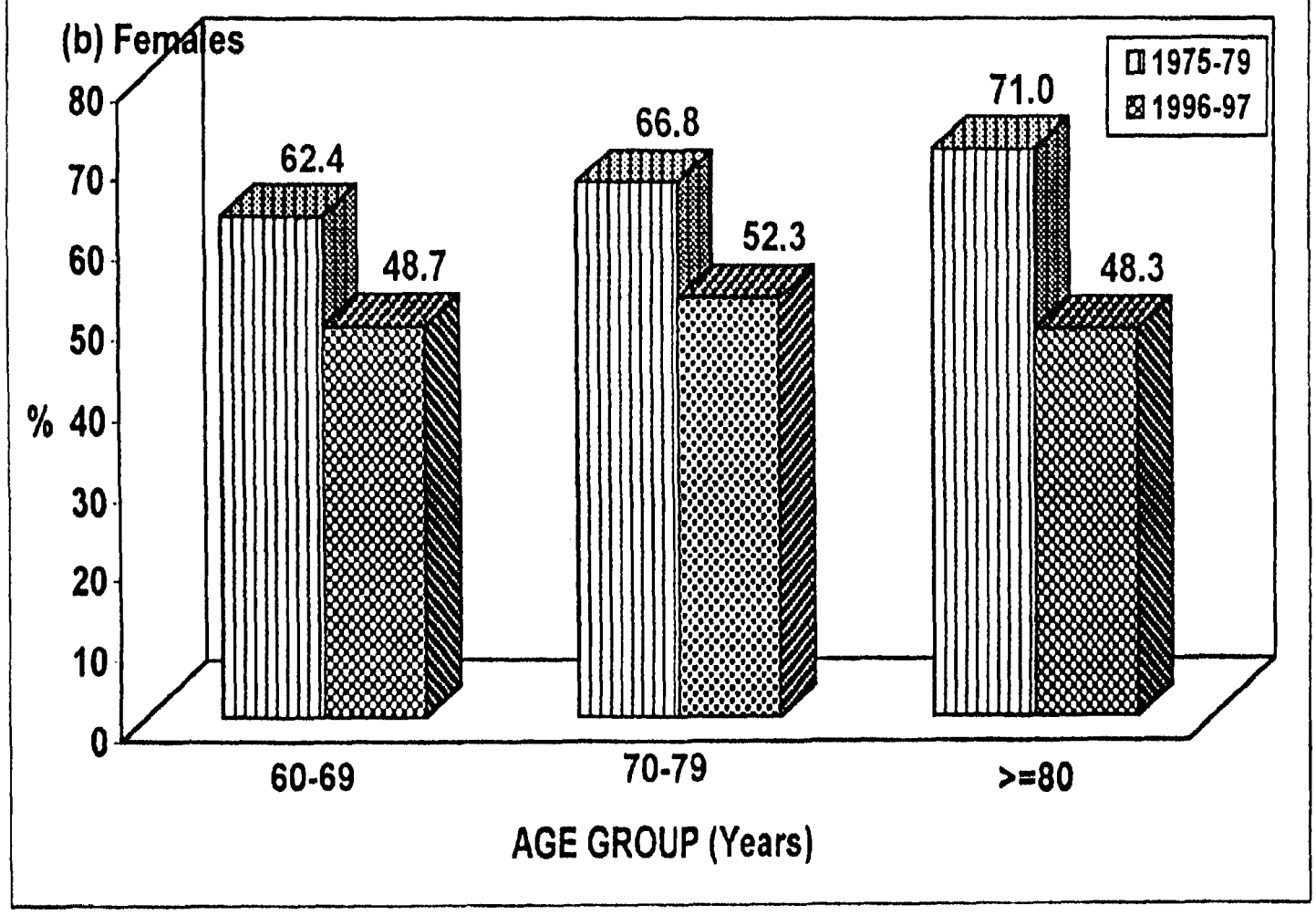
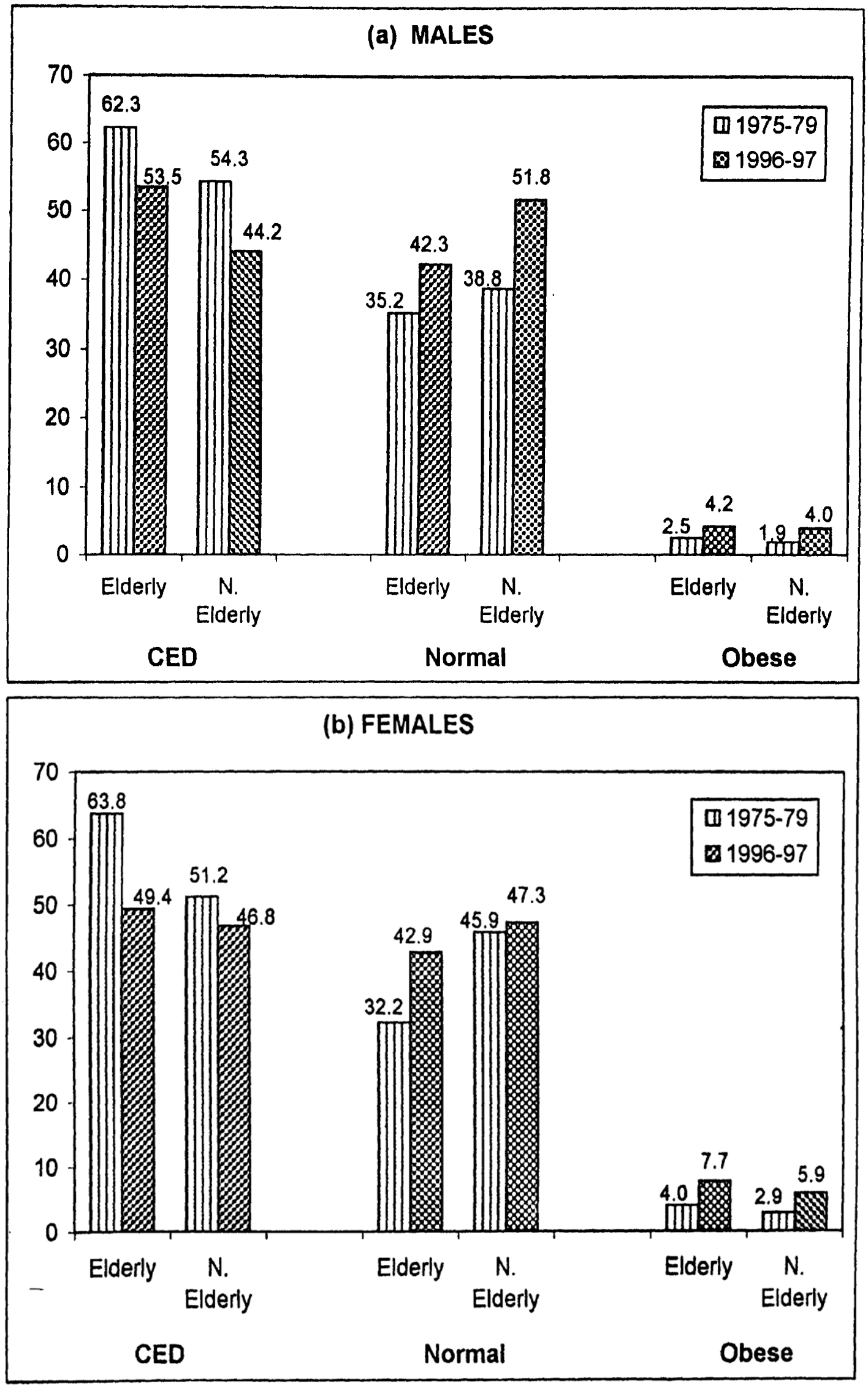


Fig. 4

DISTRIBUTION (%) OF ELDERLY & NON ELDERLY ACCORDING TO BMI BY YEAR OF SURVEY



4. TIME TRENDS IN FOOD AND NUTRIENT INTAKES

The average intakes of different foods are presented in **Tables 11 & 12.** The mean intakes of all foodstuffs were higher in 1996-97 than those of 1975-79, except with respect to pulses in case of males and females and roots & tubers among females. The intakes of GLV, millets, fish and foods continued to be negligible at both points of time.

The median intakes of nutrients among the elderly were higher in 1996-97 than those of 1975-79 except with respect to thiamin in both the sexes. **(Table13 & 14).** The medians of most of the nutrients, except iron and niacin were statistically significantly different between periods ($p<0.05$).

A comparison between the two periods revealed that the extent of CED declined from about 62.3% in 1975-79 to 53.5% in 1996-97 among the males and from 63.8% to 49.4% among the females. There was a concomitant increasing trend in the proportion of normal, overweight / obesity between 1975-79 and 1996-97 **(Table 15).**

Table 11 MEAN INTAKE OF FOOD STUFFS (g/day) AMONG ELDERLY BY AGE AND PERIOD OF SURVEY - MALES

Age (Yrs.)	Year	N	Cereals & Millets	Cereals	Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oils	Fruits	Fish	Other Flesh foods	Milk & Milk Prod.	Fats & Oils	Sugar & Jaggery
60-69	1975-79	276	431	261	170	38	15	49	48	8	10	8	1	61	9	19
	1996-97	312	455	342	113	31	17	59	51	20	25	18	3	91	13	22
70-79	1975-79	110	399	262	137	30	13	51	61	11	17	9	2	71	9	20
	1996-97	100	439	347	92	31	12	49	54	23	30	24	4	92	13	26
≥ 80	1975-79	26	423	260	163	29	9	30	77	9	9	8	0	90	9	20
	1996-97	22	335	253	82	28	30	48	60	15	15	22	2	96	10	54
Pooled	1975-79	412	422	261	161	35	14	49	54	9	12	8	1	66	9	19
	1996-97	434	445	338	107	31	17	56	52	21	26	20	4	92	13	25
Non-elderly (18-59yrs)	1975-79	3921	498	328	170	37	13	56	62	8	14	9	11	67	12	18
	1996-97	3713	552	429	123	35	17	54	57	17	28	18	5	72	15	20
'F' Ratios for Elderly	Between ages		3.7*	1.2	1.4	1.2	0.5	1.1	1.4	0.6	1.6	0.6	0.3	0.3	0.0	4.6**
	Between periods		0.2	5.8*	7.0**	0.3	1.9	1.2	0.6	7.8**	4.1*	9.2**	1.3	1.1	1	12.7**

*p<0.05; ** p<0.01

Table 12 MEAN INTAKE OF FOOD STUFFS (g/day) AMONG ELDERLY BY AGE AND PERIOD OF SURVEY - FE MALES

Age (Yrs.)	Year	N	Cereals & Millets	Cereals	Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oils	Fruits	Fish	Other Flesh foods	Milk & Milk Prod.	Fats & Oils	Sugar & Jaggery
60-69	1975-79	316	361	233	128	32	11	36	45	8	11	8	4	57	8	19
	1996-97	325	378	301	77	28	14	47	51	15	21	19	3	73	12	20
70-79	1975-79	100	335	236	99	28	11	47	48	5	13	9	3	51	8	17
	1996-97	121	322	278	44	24	21	41	44	18	24	20	2	70	11	22
≥ 80	1975-79	30	305	177	128	19	7	54	80	6	11	6	1	44	7	14
	1996-97	42	285	251	34	21	5	56	39	15	24	13	1	79	8	19
Pooled	1975-79	446	351	230	121	30	11	40	48	7	11	8	4	55	7	18
	1996-97	488	357	291	66	27	15	46	49	16	22	19	2	73	11	21
Non-elderly (18-59yrs)	1975-79	4080	403	265	138	31	11	47	50	8	11	8	6	57	10	26
	1996-97	4050	463	361	102	31	15	47	51	15	27	16	4	70	13	20
'F' Ratios for elderly	Between ages		10.7**	3.4*	2.9	2.9	2.0	1.6	0.9	0.1	0.3	0.5	0.7	0.2	0.9	0.3
	Between periods		0.1	15.5***	16.5***	0.3	1.0	0.07	3.2	16.1**	8.4**	7.9**	0.3	6.6**	2.1	1.6

*p<0.05; ** p<0.01; *** p<0.001

Table 13 INTAKES OF NUTRIENTS AMONG ELDERLY BY AGE AND PERIOD OF SURVEY – MALES

Age (Yrs.)	Year	N		Protein (g)	Total fat (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (μg)	Thiamin (mg)	Ribo-flavin (mg)	Niacin (mg)	Vit. C (mg)
60-69	1975-79	276	Mean	56	25	1982	538	28	283	1.5	0.8	13.8	38
			Median	52	19	1889	374	24	132	1.3	0.7	12.3	26
	1996-97	312	Mean	57	33	2187	554	27	306	1.3	1.0	13.9	46
			Median	52	26	2049	402	24	161	1.0	0.9	12.8	37
70-79	1975-79	110	Mean	50	25	1876	574	25	268	1.3	0.8	12.7	41
			Median	46	20	1762	380	22	128	1.0	0.9	10.9	26
	1996-97	100	Mean	56	35	2169	569	25	307	1.2	1.0	13.0	42
			Median	54	28.2	2171	459	23	177	1.0	1.0	11.8	32
≥80	1975-79	26	Mean	54	26	1968	565	27	229	1.5	0.9	14.8	34
			Median	48	21	1803	418	21	121	1.3	0.7	12.9	12
	1996-97	22	Mean	45	28	1860	594	23	410	1.0	0.9	10.2	60
			Median	45	25	1719	423	20	227	0.9	0.8	10.1	33
Pooled	1975-79	412	Mean	54	25	1953	549	27	276	1.4	0.8	13.6	38
			Median	50	19	1843	375	23	131	1.2	0.7	11.9	25
	1996-97	434	Mean	56	33	2167	559	26	311	1.2	1.0	13.5	46
			Median	52	27	2080	412	24	168	1.0	0.9	12.3	35
Non-elderly (18-59)	1975-79	3921	Mean	62	27	2243	590	31	277	1.6	0.9	16.0	41
	1996-97	3713	Mean	64	34	2521	573	30	340	1.4	1.1	15.6	46
'F' Ratios for Elderly	Between ages			2.8	0.3	1.6	0.2	2.7	1.0	2.1	0.1	2.4	0.4
	Between Periods			0.03	6.9**	2.7	0.05	1.7	2.4	10.1**	4.7*	3.8	6.3

*** p<0.05; ** p<0.01**

Table 14 INTAKE OF NUTRIENTS AMONG ELDERLY FEMALES BY AGE AND PERIOD OF SURVEY

Age (Yrs.)	Year	N		Protein (g)	Total fat (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (μg)	Thia-min (mg)	Ribo-flavin (mg)	Niacin (mg)	Vit. C (mg)
60-69	1975-79	316	Mean	47	21	1691	444	23	237	1.2	0.7	11.6	31
			Median	45	16	1618	328	20	112	1.0	0.6	10.3	23
	1996-97	325	Mean	48	28	1847	459	22	262	1.0	0.8	11.3	39
			Median	44	23	1783	389	20	135	0.8	0.8	10.8	32
70-79	1975-79	100	Mean	44	21	1574	401	21	209	1.1	0.7	11.6	34
			Median	38	16	1433	310	18	131	0.9	0.6	9.2	24
	1996-97	121	Mean	43	27	1649	459	20	327	0.9	0.8	10.4	40
			Median	40	22	1541	381	18	146	0.7	0.7	9.4	27
≥80	1975-79	30	Mean	38	18	1435	358	19	158	1.1	0.6	9.6	39
			Median	33	15	1272	218	15	77	0.8	0.5	8.3	34
	1996-97	42	Mean	37	23	1447	428	17	176	0.8	0.7	8.8	35
			Median	37	20	1436	335	17	137	0.7	0.7	8.9	33
Pooled	1975-79	446	Mean	46	21	1648	429	22	225	1.2	0.7	11.5	32
			Median	42	16	1553	316	19	113	1.0	0.6	9.9	23
	1996-97	488	Mean	46	27	1764	456	21	271	1.0	0.8	10.9	39
			Median	42	22	1667	371	19	137	0.8	0.8	10.2	31
Non-elderly (18-59)	1975-79	4080	Mean	51	38	1847	496	25	241	1.3	0.8	13.0	35
	1996-97	4050	Mean	55	30	2155	511	26	302	1.2	0.9	13.2	41
'F' Ratios for elderly	Between ages			9.8***	1.6	12.4***	0.9	7.7***	1.8	4.1*	4.3*	5.7**	0.3
	Between Periods			1.0	8.8**	1.9	1.7	2.0	2.1	13.9**	7.7**	2.3	1.1

*p<0.05; ** p<0.01; *** p<0.001

Table 15 DISTRIBUTION (%) OF ELDERLY ACCORDING TO BMI BY AGE AND SEX

Sex	Age	BMI 1975-79			BMI 1996-97		
		<18.5	18.5-25.0	≥25.0	<18.5	18.5-25.0	≥25.0
Males	60-69	62.8	35.0	2.2	53.2	42.7	4.1
	70-79	62.3	34.2	3.5	53.4	42.1	4.5
	≥ 80	56.2	42.4	1.4	57.7	38.5	3.8
	Pooled	62.3	35.2	2.5	53.5	42.3	4.2
	Non-elderly	54.3	38.8	1.9	44.2	51.8	4.0
$\chi^2 = 0.96$ (NS)					$\chi^2 = 6.93$ (NS)		
Females	60-69	62.3	33.1	4.5	48.7	43.4	7.9
	70-79	66.8	30.2	3.0	52.3	41.3	6.4
	≥ 80	71.0	27.1	1.9	48.3	42.5	9.2
	Pooled	63.8	32.2	4.0	49.4	42.9	7.7
	Non-elderly	51.2	45.9	2.9	46.8	47.3	5.9
$\chi^2 = 7.53$ (NS)					$\chi^2 = 2.34$ (NS)		

5. EFFECT OF SOCIO-ECONOMIC STATUS

5.1 BODY MASS INDEX

A comparison of the prevalence of CED (BMI <18.5) among elderly males and females between the two periods indicates that there was evidence of reduction in the prevalence in 1996-97 as compared to 1975-79 among the elderly belonging to SC + ST communities, illiterates, those living in kutcha houses and among landless (Table-16). The distribution of the individuals according to BMI is presented in the (Tables 17 to 22). The proportion of CED (BMI: < 18.5) was much higher among the elderly belonging to SC+ST communities (64.6%), than other communities (36.5%) (Table-17). On the other extreme the extent of overweight was much higher in others (7.1%) than among the SC+ST (2.6%). There were no differences in grade III CED between nuclear and joint families (16.6%). (Table-18). CED was higher in illiterates (57.3%) than among the literates (41%) (PO.001) (Table-19).

There was an association between BMI and family size ($p<0.05$), though the differences were small. The prevalence of CED with III degree was more among the larger families (18.1%), where the mean family size was seven and above than smaller families (15.4%) ($P<0.05$) (Table-20). The extent of CED was higher among the elderly living Kutcha houses (60.0%) was almost twice as those residing in pucca houses (35%). The proportion of normal (13.1%) was also similarly higher in pucca houses than those living in other types of houses ($p<0.05$) (Table-21).

As expected, the elderly of the labourers families were at a disadvantage with higher prevalence of CED as compared to agriculturist's (52%) and Others (47%) ($p<0.001$) (Table-22). The prevalence of CED was highest (53.4%) among the elderly belonging to the households who had no land. The extent of CED was the lowest among individuals who had owned more than 10 acres ($p<0.001$) (Table-23).

Table 16 PREVALENCE (%) OF CED (BMI < 18.5) AMONG ELDERLY ACCORDING TO HOUSEHOLD SOCIOECONOMIC CHARACTERISTIC AND PERIOD OF SURVEY - SEXES POOLED

Household Particulars	Percent of BMI < 18.5	
	1975-79	1996-97
SC&ST	75.7	64.6
Head of Household Illiterate	63.5	57.3
Family Size >7	53.0	53.0
Type of House 'Kutcha'	68.2	59.8
Head of Household Labourers	60.5	60.6
Head of Household Landless	72.1	53.4

Table 17 DISTRIBUTION (%) OF ELDERLY BY BMI AND COMMUNITY

Community	BMI					
	<16	16-17	17-18.5	18.5-20	20-25	≥25
SC + ST	20.4	16.9	27.3	18.7	18.1	2.6
Others	15.4	10.6	20.5	18.1	28.3	7.1

χ^2= 118.56; P< 0.001

Table 18 DISTRIBUTION (%) OF ELDERLY BY BMI AND TYPE OF FAMILY

Type of family	BMI					
	<16	16-17	17-18.5	18.5-20	20-25	≥25
Nuclear	16.6	12.5	21.8	17.7	25.2	6.0
Joint	16.6	11.8	23.6	17.9	24.5	5.6

χ^2 = 1.84; P< 0.05

Table 19 DISTRIBUTION (%) OF ELDERLY BY BMI AND LITERACY STATUS

Literacy Status	BMI					
	<16	16-17	17-18.5	18.5-20	20-25	≥25
Illiterates	19.4	13.2	24.7	18.5	20.2	4.0
Literates	12.1	10.7	18.2	16.3	33.4	9.2

χ^2= 146.1; P< 0.001

Table 20 DISTRIBUTION (%) OF ELDERLY BY BMI AND FAMILY SIZE

Family Size	BMI					
	<16	16-17	17-18.5	18.5-20	20-25	≥25
≤4	15.4	11.7	23.7	18.2	24.5	6.5
5-6	16.4	10.4	23.4	16.9	26.6	6.4
≥7	18.1	14.4	20.5	18.0	24.0	4.9

χ^2 = 21.1; P < 0.05

Table 21 DISTRIBUTION (%) OF ELDERLY BY BMI AND TYPE OF HOUSE

Type of House	BMI					
	<16	16-17	17-18.5	18.5-20	20-25	≥25
Kutcha	20.0	14.5	25.3	18.2	18.5	3.5
Semi pucca	13.8	10.3	20.9	18.0	30.2	6.8
Pucca	11.7	8.6	14.4	14.8	37.4	13.1

χ^2= 199.5; P < 0.001

Table 22 DISTRIBUTION (%) OF ELDERLY BY BMI AND OCCUPATION

Occupation	BMI					
	< 16	16-17	17-18.5	18.5-20	20-25	≥25
Labourers	21.4	13.6	25.6	18.6	18.8	2.0
Agriculture	16.6	12.6	22.8	19.4	23.6	5.0
Others	14.9	11.4	20.6	15.6	29.0	8.4

$\chi^2 = 80.9$; $P < 0.001$

Table 23 DISTRIBUTION (%) OF ELDERLY BY BMI AND LAND HOLDING

Total Land	BMI					
	< 16	16-17	17-18.5	18.5-20	20-25	≥25
No land	17.4	11.6	24.4	16.8	24.1	5.8
0.01-5 acres	16.3	13.3	22.3	18.1	24.5	5.5
5-10 acres	15.3	11.8	22.9	20.6	24.4	5.0
≥ 10 acres	17.8	10.9	12.3	16.7	33.0	9.4

$\chi^2 = 35.5$; $P < 0.01$

TIME TRENDS

NUTRITIONAL STATUS

ANTHROPOMETRY

- 54% of males and 49% of females had CED (BMI <18.5), white about 42% of males and 43% of females were normal
- The extent of CED declined from 63% in 1975-79 to 53% in 1996-97

5.2 FOOD INTAKES

The average daily intakes of various foods and nutrients were compared according to socio economic parameters, such as community, type of house, type of family, occupation of head of HH and landholdings, the results are presented in Tables 24 - 30.

5.2.1 Community

The consumption of most of the food stuffs, except cereals & millets and GLV, was lower among elderly of SC & ST community ($P<0.05$) (Table 24).

5.2.2 Type of Family

The average intakes of majority of foods were comparable among the elderly of nuclear families and those from the joint families (Table 25).

5.2.3 Type of house

The type of house is considered as an index of socio economic status. The current intakes of almost all the food stuffs were higher among the elderly who were staying in *pucca* type of houses except for cereals & millets (448 g) and GLV (20 g)

(Table 26). The consumption of mean food stuffs, except pulses, other vegetables and roots & tubers and fats & oils were different between type of houses in all the foods ($p<0.05$)

5.2.4 Land holdings

The consumption of pulses, other vegetables, milk & milk products, fats & oils and sugar & jaggery was higher among the households, which had more than 10 acres of land. Significant differences were observed between the elderly of the households with different sizes of land holdings with respect to cereals, pulses, nuts & oil seeds, fish and milk **a**nd milk products ($p<0.05$) **(Table 27).**

5.2.5 Occupation

The consumption of all food stuffs, except cereals & millets (433 g) and GLV (23 g), was lower among the labourers compared to those who were engaged in agriculture and services. The mean intakes of majority foods except fruits, other flesh foods and sugar & jaggery were significantly different between occupational groups ($p<0.05$) **(Table 28).**

5.2.6 Family size

The consumption of cereals & millets (436 g) and pulses (36 g) was higher among the elderly living in households with family size 7 or more compared to small families (≤ 4 members). However the consumption of milk and milk products was higher among small families **(Table 29).**

5.2.7 Literacy Status

Literacy of the head of the household seems to play an important part in determining food intakes. Among the illiterates the current consumption of cereals & millets (421 g), and GLV (17 g) was higher. However, among the illiterates the consumption of milk, fish and other flesh foods, fruits, other vegetables and nuts and oil seeds was lower than those of literate. It was also observed that the mean intakes of all the foods except GLV, other flesh foods and sugar & jaggery were significantly and positively associated with educational status of the head of the household ($p<0.05$) **(Table 30).**

Table 24 MEAN INTAKE OF FOOD STUFFS (g/day) BY COMMUNITY

Community	N	Cereals	Pulses	Green Leafy Veg.	Other veg.	Roots & tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh Foods	Milk & Milk Prod.	Fats& Oils	Sugar & Jaggery
SC+ST	269	436	29	23	46	37	7	19	8	4	50	12	18
Others	653	383	28	13	53	56	23	26	24	3	95	12	25
"t" Value		4.5***	0.5	3.3**	1.4	3.4**	6.2***	1.8	4.5**	0.8	4.1***	0.2	2.6**

p<0.01;*p<0.001

Table 25 MEAN INTAKE OF FOOD STUFFS (g/day) BY TYPE OF FAMILY

Type of Family	N	Cereals	Pulses	Green Leafy Veg.	Other veg.	Roots & tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh Foods	Milk& Milk Prod.	Fats& Oils	Sugar & Jaggery
Nuclear	691	399	28	16	51	51	19	26	20	2	80	12	22
Joint	231	396	30	14	50	47	15	20	16	4	85	12	25
F ratio		0.1	0.8	0.3	0.03	0.5	2.9	2.1	1.4	2.1	0.2	0.0	1.1**

** p<0.01

Table 26 MEAN INTAKE OF FOOD STUFFS (g/day) BY TYPE OF HOUSE

Type of House	N	Cereals	Pulses	Green Leafy Veg.	Other veg.	Roots & tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh Foods	Milk& Milk Prod.	Fats& Oils	Sugar & Jaggery
Kutcha	437	448	30	20	51	4	7	22	11	2	53	12	19
Semi - pucca	360	364	26	13	49	55	26	20	22	2	90	12	26
Pucca	125	323	30	7	55	52	35	45	39	9	156	12	26
F ratio		43.7***	1.0	6.4**	0.4	1.4	44.8***	11.6***	19.1***	9.2***	23.4***	0.1	4.2**

p<Q.01;*p<0.001

Table 27 MEAN INTAKE OF FOOD STUFFS (g/day) BY TOTAL LAND HOLDING

Total Land (acres)	N	Cereals	Pulses	Green Leafy Veg.	Other veg.	Roots & tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh Foods	Miik& Milk Prod.	Fats& Oils	Sugar & Jaggery
No land	351	378	25	16	53	49	23	23	28	2	65	12	19
1-5	416	417	28	17	45	55	17	26	15	4	86	12	24
5-10	82	403	31	13	54	39	5	23	1	0	85	11	25
≥10	73	388	42	08	61	42	15	17	15	2	126	15	29
F ratio		3.7*	4.9***	1.1	1.4	1.5	6.1***	0.7	8.6***	1.8	3.5*	1.3	2.1

*p<0.05; *** p<0.001

Table 28 MEAN INTAKE OF FOOD STUFFS (g/day) BY OCCUPATION

Total Land (acres)	N	Cereals	Pulses	Green Leafy Veg.	Other veg.	Roots & tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh Foods	Miik& Milk Prod.	Fats& Oils	Sugar & Jaggery
Occupation	196	433	21	23	41	42	11	17	10	2	41	9.4	19
Labourers	364	430	31	15	47	46	11	26	13	4	97	13	23
Agriculture	362	348	30	12	60	60	29	26	31	2	88	12	24
F ratio		29.5***	6.3***	3.8*	6.0**	4.7**	26.9***	2.3	18.6***	1.1	8.8***	3.7*	1.0

*p<0.05; ** p<0.01; *** p<0.001

Table 29 MEAN INTAKE OF FOOD STUFFS (g/day) BY FAMILY SIZE

Family size	N	Cereals	Pulses	Green Leafy Veg.	Other veg.	Roots & tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh Foods	Miik& Milk Prod.	Fats& Oils	Sugar & Jaggery
≤4	282	387	23	18	58	54	27	25	25	4	90	12	25
5-6	403	384	28	13	47	47	16	27	19	4	91	12	22
≥7	237	436	36	17	48	52	10	19	13	1	56	11	21
F ratio		8.4***	9.5**	1.0	2.6	0.8	15.4**	1.6	5.3**	2.6	4.4*	0.3	0.8

* p<0.05; ** p<0.01; *** p<0.001

Table 30 MEAN INTAKE OF FOOD STUFFS (g/day) BY LITERACY STATUS

Literacy Status	N	Cereals	Pulses	Green Leafy Veg.	Other veg.	Roots & tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh Foods	Milk& Milk Prod.	Fats& Oils	Sugar & Jaggery
Illiterates	605	421	31	17	43	45	8	20	9	2	63	12	21
Literates	125	323	30	7	55	52	35	45	39	9	156	12	26
F ratio		23.0**	7.5**	2.6	27.1***	13.5**	197.3***	10.4**	88.9**	2.4	22.4**	0.0	5.6*

*p<0.05; ** p<0.01; *** p<0.001

SOCIO ECONOMIC and NUTRITIONAL STATUS

- Overweight was higher among other communities than SCs & STs
- CED was more among elderly of Scheduled Castes & Scheduled Tribes, illiterate, landless and those living in *kutcha* houses.

5.3 NUTRIENT INTAKES

The average daily intakes of various nutrients according to socio-economic parameters were given in **Tables 31- 38.**

5.3.1 Community

There were no perceptible differences in the nutrient intakes between the households of SC & ST communities and others. The mean intakes of calcium, iron and riboflavin were higher in others than among SC & ST ($p<0.05$) **(Table-31).**

5.3.2 Type of family

The intakes of majority of nutrients, though were more among the nuclear families than those in joint families, were not significantly different between type of families ($p>0.05$) **(Table 32).**

5.3.3 Type of House

The consumption of nutrients like energy, iron, vitamin A and niacin was surprisingly more among individuals who are staying in *kutcha* type of houses compared to those individuals who are staying in *semi-pucca* and *pucca* type of houses **(Table 33).**

5.3.4 Land holdings

The nutrient intakes were more among the individuals who had land holdings 10 acres and above **(Table 4).**

5.3.5 Occupation

It was observed that the consumption of all the nutrients except that of vitamin A and vitamin C was more among the individuals where the occupation of head of the households was agriculture. The intakes of a majority of nutrients, except vitamin A and vitamin C were significantly different ($P<0.05$) between occupations **(Table 35).**

5.3.6 Family size

Surprisingly the consumption of nutrients like protein (53 g), energy (2025 Kcal), iron (25 mg) and niacin (13.1 mg) was more among the families with 7 or more members, compared to smaller families. This may be because of higher number of earning members. The mean intakes of calcium, iron, thiamin and vitamin 'C' were statistically significant between different family size **(Table 36).**

5.3.7 Literacy

The mean intakes of majority nutrients except iron (24.1 mg), vitamin A (295 µg), thiamin (1.1 mg) and niacin (12.1 mg) were more among literates than those among the illiterates. The mean intakes of protein, calcium, iron, thiamin, riboflavin, and vitamin 'C' were significant ($p<0.05$) by literacy status **(Table 37).**

5.3.8 Per capita Income

The consumption of most of the nutrients were more among the individuals who had per capita income of more than Rs. 3000 **(Table 38).**

Time trends in socio-economic status versus food and nutrient intakes and nutritional status are presented in **Annexures 1-14.**

Table 31 MEAN INTAKE OF NUTRIENTS (per day) BY COMMUNITY

Community	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Ribofl-avin (mg)	Niacin (mg)	Vit.C (mg)
SC + ST	269	50	1962	424	24	325	1.13	0.8	12.1	41
Others	653	51	1949	538	23	275	1.08	0.9	12.1	43
F ratio		0.8	0.1	12.2***	4.0*	2.8	1.4	6.2*	0.0	0.2

*p<0.05; *** p<0.001

Table 32 MEAN INTAKE OF NUTRIENTS (per day) BY TYPE OF FAMILY

Type of family	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit.A (µg)	Thiamin (mg)	Ribofl-avin (mg)	Niacin (mg)	Vit.C (mg)
Nuclear	691	51	1957	514	24	296	1.1	0.9	12.1	43
Joint	231	51	1943	476	23	273	1.1	0.9	12.1	41
F ratio		0.0	0.1	1.2	0.8	0.5	0.2	0.1	0.0	0.7

Table 33 MEAN INTAKE OF NUTRIENTS (per day) BY TYPE OF HOUSE

Type of House	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Ribofl-avin (mg)	Niacin (mg)	Vit.C (mg)
Kutcha	437	51	2023	476	25	320	1.1	1.0	12.4	43
Semi Pucca	360	50	1889	491	22	267	1.1	1.0	12.1	40
Pucca	125	52	1892	645	19	252	1.0	1.0	11.1	46
F ratio		0.4	4.4*	7.1***	19.3***	2.3	7.4	4.6**	2.7	1.5

*p < 0.05; ** p < 0.01; *** p < 0.001

Table 34 MEAN INTAKE OF NUTRIENTS (per day) BY TOTAL LAND HOLDING

Total land holding (acres)	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit.A (µg)	Thiamin (mg)	Ribofl-avin (mg)	Niacin (mg)	Vit.C (mg)
No land	351	49	1877	488	23	290	1.0	0.8	11.9	42
1-5	416	51	2014	520	24	304	1.1	0.9	12.2	43
5-10	82	49	1889	453	24	251	1.3	0.9	11.5	40
≥10	73	58	2041	553	26	254	1.5	1.0	13.5	40
F ratio		2.8*	3.2*	1.0	4.5**	0.3	17.4***	4.3*	2.2	5.3***

*p < 0.05;**p < 0.01;***p < 0.001

Table 35 MEAN INTAKE OF NUTRIENTS (per day) BY OCCUPATION

Occupation	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit.C (mg)
Labourers	196	48	1928	401	24	319	1.1	0.8	12.3	40
Agriculture	361	54	2051	552	25	300	1.3	1.0	12.8	41
Others	362	49	1869	513	21	264	1.0	0.9	11.4	45
F ratio		7.1***	6.8***	7.3***	13.1***	1.3	18.9***	8.4***	6.1**	1.3

*p<0.05;**p<0.01;***p<0.001

Table 36 MEAN INTAKE OF NUTRIENTS (per day) BY FAMILY SIZE

Family Size	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	VitA (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit.C (mg)
≤ 4	282	50	1973	528	23	309	1.0	0.9	12.0	47
5-6	403	49	1897	527	23	281	1.2	1.0	11.6	40
≥7	237	53	2025	439	25	283	1.2	0.8	13.1	41
F ratio		2.5	2.8	3.3*	4.1*	0.4	7.9***	0.9	5.7**	3.7**

*p < 0.05; **p <0.01;***p <0.001

Table 37 MEAN INTAKE OF NUTRIENTS (per day) BY LITERACY STATUS

Literacy Status	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit.C (mg)
Illiterate	605	50	1944	452	24	295	1.1	0.9	12.1	39
Literate	317	52	1972	605	22	280	1.0	1.0	12.0	49
F ratio		4.2*	2.0	26.3***	4.6*	0.2	7.9**	10.6***	0.01	16.2***

*p<0.05;**p<0.01;***p<0.001

Table 38 MEAN INTAKE OF NUTRIENTS (per day) BY PERCAPITA INCOME

Per capita Income (Rs.)	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	VitA (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit.C (mg)
≤1500	177	48	1941	441	25	402	1.1	0.8	12.0	48
1500-3000	263	49	1926	432	23	259	1.1	0.08	12.2	37
≥3000	482	52	1963	562	22	267	1.1	0.9	12.1	43
F ratio		3.5*	0.3	8.9***	5.7**	7.9***	0.2	7.8**	0.1	5.1**

*p<0.05;**p<0.01;***p<0.001

SOCIO ECONOMIC STATUS Vs. FOOD AND NUTRIENT INTAKE

- Higher intakes of cereals and GLV reported in SC & ST communities.
- Higher intakes of income-elastic foods observed among HHs having more than 10 acres.
- Intakes of Energy, Iron, Vitamin A and Niacin were more in households living in kutcha houses.
- Intakes of Protein, Energy, Iron and niacin were more in households with large family size.

6. CONCLUSIONS

The objective of the study was to assess the current diet and nutritional status of the elderly utilizing the data collected by NNMB during 1996-97 and to study the time trends since 1975-79. This information could perhaps be considered as the first large database on diet and nutritional status of the elderly in India.

The results of the study indicated that, the overall intake of various foods except cereals & millets was less than RDI in males. Similarly, the average intake of all the nutrients except calcium, thiamin and Vitamin C was less than RDI.

The consumption of foods increased during 1996-97 except in pulses from that observed in 1975-79. The prevalence of CED decreased over the period, with a concomitant increase in the prevalence of overweight among males and females. There is however, a need to conduct comprehensive surveys including information on diet related chronic diseases and behavioral and psychosocial aspects, in addition to diet and nutritional status.

Annexure 1 MEAN INTAKE OF FOOD STUFFS (g/day) BY COMMUNITY

Community	Year	N	Cereals & Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Milk& Milk Prod.	Fats & Oils	Sugar & Jaggery
SC+ST	1975-79	130	418	23	19	41	38	3	7	7	1	25	6	12
	1996-97	269	436	29	23	46	37	7	19	8	4	50	12	18
Others	1975-79	728	380	34	11	45	53	9	12	8	3	67	10	20
	1996-97	653	383	28	13	53	56	23	26	24	3	95	12	25
F-Ratio	Between yrs.		0.99	0.01	1.02	2.76	0.04	25.83***	21.66***	14.5***	1.90	11.59***	22.16***	6.64**
	Between Communities		0.2	18.89***	5.13*	10.82***	1.85	11.35***	37.50	4.64*	9.10***	0.27	32.4***	3.89*

*p<0.05; ** p<0.01; *** p<0.001

Annexure 2 MEAN INTAKE OF FOOD STUFFS (g/day) BY FAMILY SIZE

Family Size	Year	N	Cereals & Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Miik& Milk Prod.	Fats & Oils	Sugar & Jaggery
<4	1975-79	427	381	33	13	43	54	10	10	10	2	62	10	18
	1996-97	282	387	23	18	58	54	27	25	25	4	90	12	25
5-6	1975-79	310	387	33	10	47	52	6	14	6	3	56	9	19
	1996-97	403	384	28	13	47	47	16	27	19	4	91	12	22
>7	1975-79	120	401	31	16	41	39	4	10	8	2	65	9	22
	1996-97	237	436	36	17	48	52	10	19	13	1	56	11	21
F-Ratio	Between Yrs.		3.7*	1.89	2.58	1.62	4.82*	0.51	54.13***	***	*** 32.29	0.09	7.23**	14.31***
	Between Family Size		0.2	4.69**	2.13	2.00	1.21	1.26	19.21***	2.08	5.06***	1.22	1.71	0.44

*p<0.05; ** p<0.01; *** p<0.001

Annexure 3 MEAN INTAKE OF FOOD STUFFS (g/day) BY TYPE OF HOUSE

Type of House	Year	N	Cereals & Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Milk& Milk Prod.	Fats & Oils	Sugar & Jaggery
Kutcha	1975-79	471	400	30	13	41	53	5	10	8	2	44	8	15
	1996-97	437	448	30	20	51	4	7	22	11	2	53	12	19
Semi - pucca	1975-79	268	364	36	13	47	47	14	13	11	4	64	9	22
	1996-97	360	364	26	13	49	55	26	20	22	2	90	12	26
Pucca	1975-79	112	381	37	9	52	52	5	16	5	2	121	16	27
	1996-97	125	323	30	7	55	52	35	45	39	9	156	12	26
F-Ratio	Between Yrs.		0.11	6.26*	0.61	1.79	0.01	83.48***	37.23***	64.16***	4.24*	10.90***	1.59	1.32
	Between Type of house		29.72***	0.77	4.26*	1.09	0.14	51.95***	10.06***	13.66***	4.70**	48.50***	8.83***	13.52***

*p<0.05; ** p<0.01; *** p<0.001

Annexure 4 MEAN INTAKE OF FOOD STUFFS (g/day) BY LITERACY STATUS

Literacy Status	Year	N	Cereals & Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Milk& Milk Prod.	Fats & Oils	Sugar & Jaggery
Illiterate	1975-79	583	388	33	13	39	48	7	8	6	2	56	8	16
	1996-97	605	421	31	17	43	45	8	20	9	2	63	12	21
Literate	1975-79	275	380	33	11	54	57	9	19		4	70	11	24
	1996-97	317	355	24	12	67	61	40	32	38	4	117	12	27
F-Ratio	Between Yrs.		0.18	7.42**	1.59	5.00*	0.01	*** 112.54	28.25***	64.21***	0.32	17.69**	*** 10.63	4.08*
	Between Literacy Status		7.30***	3.18	3.23	32.41***	9.28**	146.22***	25.69***	85.44***	6.43*	28.75***	5.15*	14.14***

*p<0.05; ** p<0.01; *** p<0.001

Annexure 5 MEAN INTAKE OF FOOD STUFFS (g/day) BY OCCUPATION

Occupation	Year	N	Cereals & Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Milk& Milk Prod.	Fats & Oils	Sugar & Jaggery
Labourers	1975-79	204	393	21	14	37	51	8	4		1	26	5	14
	1996-97	196	433	21	23	41	42	11	17	10	2	41	9.4	19
Agriculture	1975-79	403	402	38	13	43	52	6	11	7	2	89	6	21
	1996-97	364	430	31	15	47	46	11	26	13	4	97	13	23
Others	1975-79	251	355	34	10	52	49	10	18	9	4	73	10	20
	1996-97	362	348	30	12	60	60	29	26	31	2	88	12	24
F-Ratio	Between Yrs.		5.64*	3.59	3.85*	2.69	0.11	38.64***	26.72***	25.74***	0.23	9.04**	14.22**	5.97*
	Between Type of house		26.01***	15.89***	2.96	8.12***	1.18	25.49***	7.46***	13.76***	1.50	21.95***	14.28***	4.21*

*p<0.05; ** p<0.01; *** p<0.001

Annexure 6 MEAN INTAKE OF FOOD STUFFS (g/day) BY TYPE OF FAMILY

Type of Family	Year	N	Cereals & Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Milk& Milk Prod.	Fats & Oils	Sugar & Jaggery
Nuclear	1975-79	574	366	31	13	44	53	9	10	10	3	61	9	17
	1996-97	691	399	28	16	51	51	19	26	20	2	80	12	22
Joint	1975-79	284	425	36	12	45	46	5	14	5	1	60	9	22
	1996-97	231	396	30	14	50	47	15	20	16	4	85	12	25
F-Ratio	Between Yrs.		0.03	4.32*	1.47	3.10	0.004	39.62***	18.02	30.07***	2.48	10.97***	12.75***	4.41*
	Between Type of Family		8.97**	2.69	0.18	0.001	1.46	8.39	0.10	5.22*	0.07	0.07	0.002	5.20*

*p<0.05; ** p<0.01; *** p<0.001

Annexure 7 MEAN INTAKE OF FOOD STUFFS (g/day) BY TOTAL LAND HOLDING

Total Land (acres)	Year	N	Cereals & Millets	Pulses	Green Leafy Veg.	Other Veg.	Roots & Tubers	Nuts & Oil Seeds	Fruits	Fish	Other Flesh foods	Milk & Milk Prod.	Fats & Oils	Sugar & Jaggery
No land	1975-79	210	383	32	12	40	42	3	13	6	2	46	8	16
	1996-97	351	378	25	16	53	49	23	23	28	2	65	12	19
1-5	1975-79	382	372	27	11	46	61	14	11	12	2	44	7	15
	1996-97	416	417	28	17	46	55	17	25	15	4	86	12	24
5-10	1975-79	137	405	36	14	45	47	4	12	6	3	76	10	21
	1996-97	82	403	31	13	54	39	6	23	1	0	85	11	25
≥ 10	1975-79	129	410	46	16	44	39	3	9	2	2	116	14	32
	1996-97	73	388	42	8	61	42	15	17	15	2	126	15	29
F-Ratio	Between Yrs.		0.09	18.53***	1.10	0.38	1.76	78.31***	24.33***	50.95***	2.83	1.15	0.62	0.09
	Between Land Holding		4.72**	12.24***	0.09	3.12*	2.86*	26.18***	3.41*	15.24	1.54	12.75***	9.82***	9.47***

*p<0.05; ** p<0.01; *** p<0.001

Annexure 8 MEAN INTAKE OF NUTRIENTS (per day) BY COMMUNITY

Community	Year	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)
SC + ST	1975-79	130	47	1750	464	25	256	1.3	0.7	12.0	34
	1996-97	269	50	1962	424	24	325	1.1	0.8	12.1	41
Others	1975-79	728	50	1802	491	25	248	1.3	0.8	12.6	35
	1996-97	653	51	1949	538	23	275	1.1	0.9	12.1	43
F-Ratio	Between Yrs.		1.40	18.85***	0.02	1.93	3.47	15.44***	27.33***	0.25	10.4**
	Between Community		2.47	0.23	6.56**	1.59	1.27	0.15	9.65**	0.61	0.36

p<0.05; ** p<0.01; *** p<0.001

Annexure 9 MEAN INTAKE OF NUTRIENTS (per day) BY FAMILY SIZE

Family Size	Year	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)
≤4	1975-79	427	50	1797	492	24	251	1.3	0.8	12.4	36
	1996-97	282	50	1973	528	23	309	1.0	0.9	12.0	47
5-6	1975-79	310	49	1779	476	24	232	1.3	0.7	12.4	35
	1996-97	403	49	1897	527	23	281	1.2	1.0	11.6	40
≥7	1975-79	121	51	1825	496	27	287	1.4	0.8	12.9	33
	1996-97	237	53	2025	439	25	283	1.2	0.8	13.1	41
F-Ratio	Between Yrs.		0.89	21.17***	0.18	6.09*	2.31	25.60***	30.23***	1.15	15.58***
	Between Family Size		2.09	1.89	0.88	4.96**	0.68	3.89*	1.02	3.18*	3.17*

*p<0.05; ** p<0.01; *** p<0.001

Annexure 10 MEAN INTAKE OF NUTRIENTS (per day) BY TYPE OF HOUSE

Family Size	Year	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)
≤ 4	1975-79	471	49	1772	478	25	237	1.3	0.7	12.2	34
	1996-97	437	51	2023	476	25	320	1.1	1.0	12.4	43
5-6	1975-79	268	50	1789	494	24	264	1.3	0.8	12.7	37
	1996-97	360	50	1889	491	22	267	1.1	1.0	12.1	40
≥7	1975-79	112	53	1917	491	25	262	1.4	0.9	13.3	36
	1996-97	125	52	1892	645	19	252	1.0	1.0	11.1	46
F-Ratio	Between Yrs.		0.02	8.06***	3.75	11.97***	1.08	40.59***	25.99***	6.65**	11.39***
	Between Type of House		1.70	1.50	3.66	7.34***	0.33	0.82	8.71***	0.10	0.41

** p<0.01;***p<0.001

Annexure 11 MEAN INTAKE OF NUTRIENTS (per day) BY LITERACY STATUS

Literacy Status	Year	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit.C (mg)
Illiterate	1975-79	583	50	1768	460	25	240	1.4	0.8	12.8	33
	1996-97	605	50	1944	452	24	295	1.1	0.9	12.1	39
Literate	1975-79	275	50	1851	544	25	269	1.2	0.8	11.8	40
	1996-97	317	52	1972	605	22	280	1.0	1.0	12.0	49
F-Ratio	Between Yrs.		1.21	18.06***	1.33	7.41	2.28	27.04	40.82	0.69	14.25
	Between Literacy Status		0.42	2.54	26.39***	3.16	0.10	17.69***	3.66	4.69	1849

*** p< 0.001

Annexure 12 MEAN INTAKE OF NUTRIENTS (per day) BY OCCUPATION

Occupation	Year	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit.C (mg)
Labourers	1975-79	204	45	1695	469	23	216	1.1	0.7	11.1	32
	1996-97	196	48	1928	401	24	319	1.1	0.8	12.3	40
Agriculture	1975-79	403	53	1867	496	26	254	1.4	0.8	13.3	36
	1996-97	361	54	2051	552	25	300	1.3	1.0	12.8	41
Others	1975-79	251	49	1759	487	24	269	1.2	0.8	12.3	37
	1996-97	362	49	1869	513	21	264	1.0	0.9	11.4	45
F-Ratio	Between Yrs.		1.66	26.63***	0.05	2.08	5.06*	21.46***	34.67***	0.08	13.71***
	Between Types of Occupation		15.81***	9.73	4.95**	11.04***	0.12	21.31***	14.52***	9.31***	1.75

***p<0.05; ** p<0.01; *** p<0.001**

Annexure 13 MEAN INTAKE OF NUTRIENTS (per day) BY TYPE OF FAMILY

Type of family	Year	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	Vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)
Nuclear	1975-79	574	48	1727	472	23	236	1.2	0.7	12.0	36
	1996-97	691	51	1957	514	24	296	1.1	0.9	12.1	43
Joint	1975-79	284	53	1930	516	27	277	1.5	0.8	13.5	34
	1996-97	231	51	1943	476	23	273	1.1	0.9	12.1	41
F-Ratio	Between Yrs.		0.02	11.17	0.002	10.65	1.54	34.07***	25.46***	3.67	10.82***
	Between Type of Family		5.04*	6.74**	0.01	5.67*	0.17	10.26**	3.57	5.65*	0.72

***p<0.05; ** p<0.01; *** p<0.001**

Annexure 14 MEAN INTAKE OF NUTRIENTS (per day) BY TOTAL LAND HOLDING

Size of Land Holding	Year	N	Protein (g)	Energy (Kcal)	Calcium (mg)	Iron (mg)	vit. A (µg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit. C (mg)
No Land	1975-79	210	49	1724	417	24	256	1.3	0.8	12.6	31
	1996-97	351	49	1877	488	23	290	1.0	0.8	11.9	42
1 -5	1975-79	382	46	1732	500	23	213	1.1	0.7	11.4	37
	1996-97	416	51	2015	520	24	304	1.1	0.9	12.2	43
5-10	1975-79	137	53	1874	529	26	282	1.5	0.8	12.7	36
	1996-97	82	49	1889	453	24	251	1.3	0.9	11.5	40
≥10	1975-79	129	59	2010	514	29	311	1.7	0.9	15.3	35
	1996-97	73	58	2041	553	26	254	1.5	1.0	13.5	40
F-Ratio	Between Yrs.		3.38	6.33*	0.28	16.28***	0.33	78.77***	5.65*	10.98***	11.35***
	Between Size of Land Holding		11.69***	7.97***	2.27	9.66***	0.85	25.81***	11.83***	11.72***	5.10**

*p<0.05; ** p<0.01; *** p<0.001

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NATIONAL NUTRITION MONITORING BUREAU

REPORT ON
FOOD & NUTRIENT INTAKES OF INDIVIDUALS

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SUMMARY

The report presents the results of the analysis of 24-hour dietary recall data on individuals of different ages, collected by the National Nutrition Monitoring Bureau. The current dietary status was assessed based on the data collected in 1996-97 as a part of second repeat survey in the same villages, which were visited in 1975-79. In addition, time trends in the food and nutrient intakes were assessed by comparing the above two sets of data, collected about two decades apart. The data of about 15100 individuals in 1996-97 and 17938 in 1975-79, belonging to different age, sex, physiological and physical activity groups formed the material of the analysis.

The results indicated that there was considerable variation in the intakes of both foods and nutrients, with a very high coefficient of variation, ranging from about 40% to more than 100%. The variation was particularly high in the intakes of foods like millets, green leafy vegetables, other vegetables, milk and milk products and fats and oils. Even in the case of nutrients, the variation was high especially in the case of micronutrients, fat, and relatively to a lesser degree in the case of energy and protein. The median intakes of food and nutrients, in general, were below the RDI. There were no differences between the intakes of non-pregnant & non-lactating (NPNL) females and pregnant women, despite the increased requirements due to pregnancy and lactation. About 30-40% of the individuals in different age groups had cereal intakes comparable to RDI. The children appeared to be worse off and about 10% had cereal-millet intakes less than half of RDI. About 83-90% of individuals consumed less than 30% of RDI of GLV.

About 13 to 55% of individuals consumed energy more than or equal to RDI. Only about 11% of the population were consuming adequate amounts of Vitamin A, and 50-70% had intakes less than 30% of RDI. Iron consumption was inadequate in more than 90% of the individuals in almost all the age groups. There was an increase in the consumption of mean cereal intakes in all age groups in 1996-97, except in children of 1-3 years of age, as compared to those of 1975-79. The changes in the consumption of pulses and GLV were negligible (<5% of 1975-79 intakes). Median test revealed that there were no significant differences, between the periods, in the intakes of energy, vitamin A and fat in 1-3 year old children. However, there was significant improvement in the intakes of the above nutrients in the other age groups. But, in the case of iron, there were significant changes only in the intakes of adult males, adult females (NPNL) and lactating women. These results, based on comparison of median intakes of individuals, are different from those reported earlier, which did not reveal any changes in the mean intakes of foods and nutrients of households

1. INTRODUCTION

The National Nutrition Monitoring Bureau (NNMB) has been continuously collecting information on diet and nutritional status of the communities in 10 States since the year 1972. Every year, the bureau collected information in selected households on dietary intakes at the household level using one-day weighment method, and of individuals of different ages by 24-hour dietary recall method. While the results of household diet surveys have been reported in the annual reports of the NNMB, the information on individual intakes has not been regularly presented, particularly since the year 1988. In this report, the results of analysis of data on 24 hour recall diet survey, conducted in 8 States, to assess the dietary pattern of individuals of different ages and physiological groups obtained in 8 States are presented.

1.1 Objectives

i) To assess the current food and nutrient intakes of individuals of different physiological and age groups in the States surveyed.

ii) To assess the time trends, if any, in the dietary pattern, by comparing the data collected in 1996-97 on dietary status of individuals with that from the same villages which were surveyed during 1975-79.

2. MATERIALS AND METHODS

The current dietary status was assessed based on the data collected during 1996-97 as a part of second repeat survey[1]. This survey was carried out in the States of Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Orissa and Tamil Nadu. A total of 120 villages were selected for survey in each State, of which 90 were from those covered in 1975-79 and the remaining were new. In each village, 20 HHs were selected from which 10 were selected for diet survey. In five of these 10 HHs, 24-hour recall diet survey was done on all the members.

2.1 Analysis

The mean, median and SD were calculated for the data, collected as a part of second repeat survey. The data collected in 1975-79 were similarly analysed and compared with that collected in 1996-97 to assess time trends. Moving averages were calculated to pool data collected during 1988-1992.

Distribution of individuals of different age and sex groups according to food and nutrient intakes expressed as percentage of Recommended Dietary Intakes (RDI)2,3 was calculated.

3. RESULTS

3.1 Sample

The sample covered in different ages in different States according to the period of survey is presented in Table-1. During 1996-97, about 15094 individuals belonging to different age and physiological groups were surveyed, while 17938 individuals were covered during 1975-79.

Table 1 SAMPLE COVERAGE ACCORDING TO AGE, SEX AND PERIOD OF SURVEY

Age	Year of Survey	
	1996-97	1975-79
1-3 Pooled	1313	1764
4-6 Pooled	1336	2089
7-9 Pooled	1187	1859
10-12 boys	522	801
10-12 girls	524	725
13-15 boys	404	528
13-15 girls	435	462
16-18 boys	333	399
16-18 girls	361	393
Adult males	4147	4324
Adult females NPNL Pregnant Lactating	3488 136 908	3559 111 924
	15094	17938

COVERAGE		
	1975-79	1996-97
DIET SURVEY		
• Households :	6497	6551
• Individuals :	17,938	15,100

3.2 Food Intakes

The mean, SD and median of intakes of most of the foods were below the RDI levels **(Tables-2 to 4)**. The coefficient of variation of all food intakes was very high. The median values were less than those of means.

Cereals (rice/wheat) were the staples in all the States surveyed. The mean intakes of millets ranged from about 31 g in 1-3 year old children to 120 g in adult males. The median intakes however revealed that less than 50% of the individuals were consuming millets. The intakes of protective foods like GLV, fruits, fats and oils, and milk and milk products were woefully inadequate in almost all the ages.

Table 2 FOOD INTAKES (g/day) BY AGE GROUPS

	Age Groups (Years)					
Food Stuffs	1-3		4-6		7-9	
	Mean	SD	Mean	SD	Mean	SD
Millets	32	76.6	59	100.7	86	142.2
Cereals	124	90.3	185	113.9	225	139.9
Pulses	13	16.6	20	23.8	25	30.6
GLV	5	19.6	10	38.1	12	41.6
Other vegetables	14	29.7	25	39.1	30	48.3
Roots and Tubers	17	31.6	29	90.1	32	46.1
Nuts & Oil seeds	3	11.3	6	15.3	8	21.6

(Contd..)

Table 2 FOOD INTAKES (g/day) BY AGE GROUPS (Contd..)

Age Groups (Years)						
Food Stuffs	1-3		4-6		7-9	
	Mean	SD	Mean	SD	Mean	SD
Condiments & spices	6	7.1	9	8.8	10	9.8
Fruits	14	52.8	22	123.4	18	47.9
Fish	4	25.7	6	21.9	8	28.3
Other flesh Foods	2	11.2	2	12.3	2	12.5
Milk & Milk Products	67	110.5	60	104.4	53	86.0
Fats	5	6.5	8	14.3	9	12.2
Sugar & Jaggery	14	25.2	16	23.4	17	20.9

Table 3 FOOD INTAKES (g/day) BY AGE GROUPS

	Age Groups (Years)											
	10-12				13-15				16-18			
Food Stuffs	Boys		Girls		Boys		Girls		Boys		Girls	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Millets	98	166.7	99	154.3	120	206.8	92	161.5	118	229.7	88	169.1
Cereals	273	159.1	249	150.2	308	185.5	307	168.7	397	210.9	355	183.2
Pulses	26	28.7	25	27.9	28	30.6	26	31.3	32	35.0	27	28.9
GLV	15	40.2	14	46.6	12	35.5	16	41.7	23	61.8	14	36.0
Other vegetables	35	48.8	38	54.2	47	71.7	44	59.0	58	73.4	50	64.1
Roots and Tubers	39	53.0	41	53.4	49	65.7	54	153.5	53	62.0	57	67.0
Nuts & Oil seeds	11	22.0	11	22.6	15	28.4	11	23.1	20	42.6	18	34.9
Condiments& spices	12	11.0	11	10.5	13	12.5	11	9.9	16	31.7	13	14.6
Fruits	20	47.1	22	52.3	35	254.3	16	30.7	24	50.1	22	48.0
Fish	15	42.5	12	35.8	18	45.1	14	45.2	24	55.1	18	47.4
Othe flesh Foods	3	14.0	3	17.4	4	18.6	3	21.8	5	26.1	4	21.5
Milk & Milk Products	66	102.5	53	83.4	65	105.5	56	89.3	68	100.8	71	110.1
Fats	11	15.3	9	9.5	11	10.3	10	9.0	13	14.6	11	9.7
Sugar & Jaggery	19	22.4	19	20.1	19	19.3	18	23.5	19	19.0	19	20.0

Table 4 FOOD INTAKES (g/day) BY AGE GROUPS

Food Stuffs	Age Groups							
	Adult males		Females (NPNL)		Pregnant Woman		Lactating Mothers	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Millets	120	219.7	89	171.2	102	170.0	136	217.8
Cereals	421	239.1	345	196.4	360	193.7	382	234.6
Pulses	35	42.0	29	35.9	29	41.0	34	39.8
GLV	17	47.9	16	45.9	17	60.1	11	36.7
Other vegetables	54	74.9	49	66.7	42	59.7	42	65.6
Roots and Tubers	56	73.9	53	75.7	34	40.1	42	112.1
Nuts & Oil seeds	17	36.8	17	31.3	11	26.3	9	22.6
Condiments & spices	17	19.0	14	14.4	15	13.7	18	21.4
Fruits	31	164.6	24	98.7	26	48.3	34	179.8
Fish	18	46.6	18	44.4	9	35.8	11	40.4
Other flesh Foods	5	27.2	4	21.9	8	41.6	4	21.1
Milk & Milk Products	74	123.8	72	118.5	70	103.7	67	103.3
Fats	15	17.5	13	15.1	12	13.3	13	13.4
Sugar & Jaggery	21	30.2	21	25.2	15	15.3	19	35.5

NPNL : Non Pregnant & Non Lactating

FOOD INTAKES OF INDIVIDUALS

- Intake of most of the food was below the RDI in all ages, except adults.
- Protective foods like GLV, fruits, fats and oils and milk and milk products were inadequate in almost all ages.
- Half of the individuals among different age groups the intake of pulses was grossly less than 30% of RDI.
- Pregnant and lactating women did not consume any additional quantities of foods over and above the NPNL.

3.2.1 Nutrient Intakes

The energy consumption among adults was comparable to RDI. Interestingly, in the case of females there was no difference between the intakes of non-pregnant & non-lactating (NPNL) females and pregnant women despite the increased requirements due to pregnancy. **(Tables- 5 to 7).** Though, in general, the median nutrient intakes in all the age groups were below the RDI, these were particularly poor in the case of micronutrients like iron and vitamin A. It may be pointed out that food iron values have been revised and, as per these the median iron intakes were 50% of RDI, contrary to the earlier apparently normal intakes. In this report, iron intakes according to the old as well as revised values are presented.

Table 5 AVERAGE DAILY INTAKE OF NUTRIENTS BY AGE GROUP

Nutrients	Age Groups (Years)								
	1-3			4-6			7-9		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Protein (g)	22.4	20.4	11.3	31.4	29.4	12.9	38.5	36.2	15.7
Tot Fat (g)	13.5	10.1	11.4	17.6	13.9	15.3	19.6	15.1	15.2
Energy (Kcal)	867	815	370	1215	1154	424	1473	1418	480
Calcium (mg)	250	168	244	300	224	266	352	262	306
Iron (mg) - Old	9.4	8.4	5.4	14.3	12.9	7.5	18.2	16.4	8.9
Iron (mg) - New	5.5	4.3	4.4	8.4	6.9	5.6	10.8	8.7	7.5
Vit A (µg)	145	72	251	205	96	460	231	108	436
Thiamin (mg)	0.40	0.00	0.30	1.00	0.60	0.00	0.90	1.00	0.50
Ribo (mg)	0.40	0.00	0.30	1.00	0.50	0.00	0.70	1.00	0.30
Niacin (mg)	5.0	5.0	2.8	7.0	6.6	3.0	9.2	8.0	4.1
Vit C (mg)	16.5	10.0	22.1	25.0	17.5	32.0	28.6	20.0	31.9
Folic acid (µg)	44.6	37.0	33.9	65.0	55.1	41.0	79.0	66.0	52.5

NUTRIENT INTAKES OF INDIVIDUALS

- **Median intake of all the nutrients in all the ages was below the RDI.**
- **Intakes were very poor in case of micronutrients like iron and vitamin A in all ages.**
- **50% of individuals had protein calorie adequacy status.**

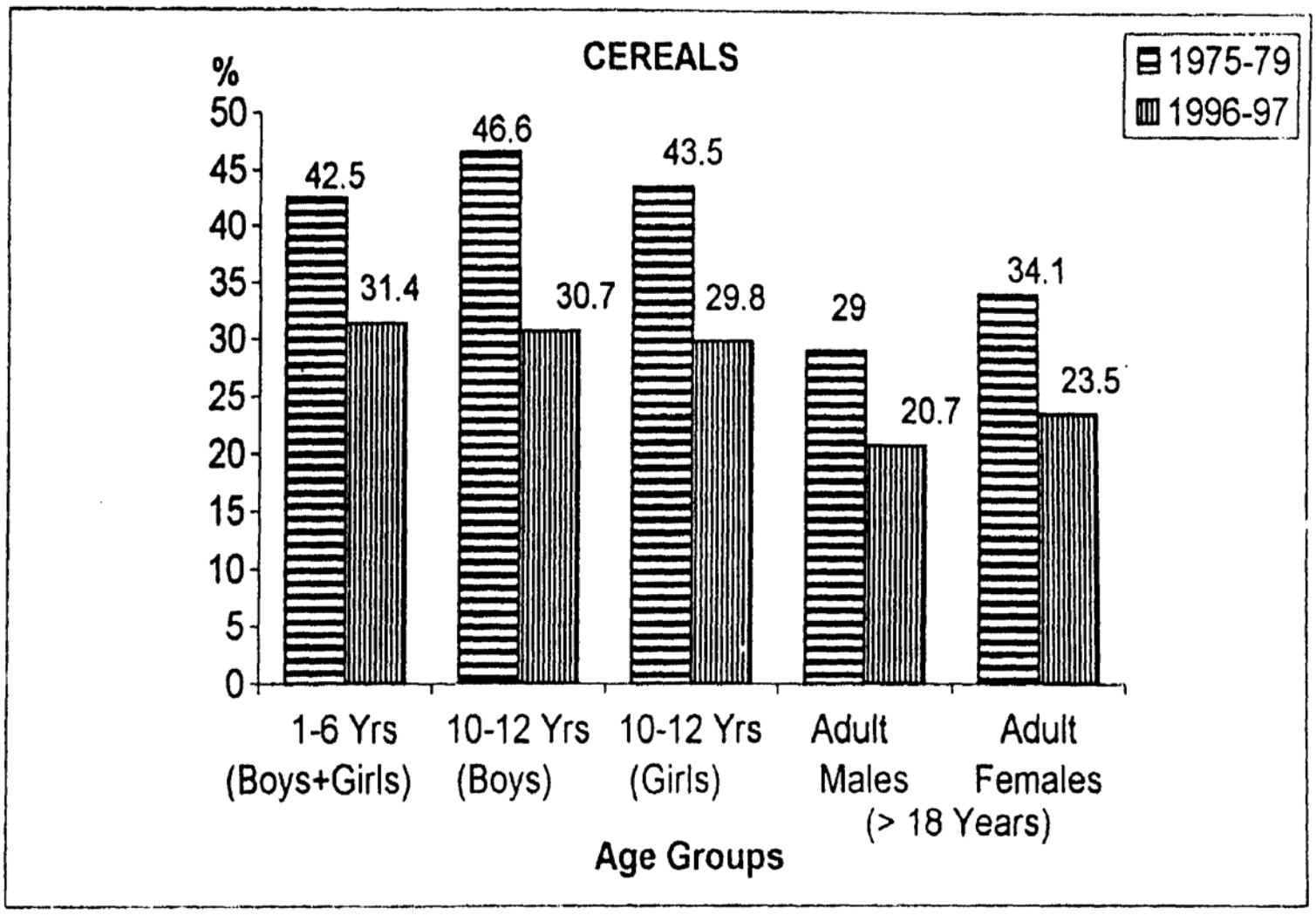
3.3 Distribution of intakes as % RDI

3.3.1 Foods

The distribution of individuals of different age and sex groups according to intakes of different foods expressed as percent RDI is presented in Tables 8 & 9 and proportion of Households consuming various foods below 70% of RDI are shown in Figs. 1 & 2. In general, about 30-40% of the individuals in different age groups consumed more than or equal to RDI of cereals. The proportion of individuals consuming more than RDI was higher among adult males and females, and also among those involved in moderate physical activity. The children however, appeared to be worse off, as about 10% had poor intakes (<50% of RDI) of cereals and millets. With respect to pulses, while the adults of both the sexes had adequate intakes, only 10-18% of children had intakes comparable to or more than RDI. The consumption of pulses was so poor that about 40-50% of individuals in different groups consumed less than 30% of RDI of pulses. The consumption of GLV was woefully inadequate. The proportion of individuals of different age groups having adequate GLV intake varied from 5% in 1-3 years age group to 14% in adult males. The intakes among females were 4-5% of RDI. About 83-90% of individuals consumed less than 30% of RDI of GLV.

Fig. 1

PERCENT DISTRIBUTION OF INDIVIDUALS WITH CEREALS & PULSES INTAKES BELOW 70% OF RDI BY AGE GROUP & SEX



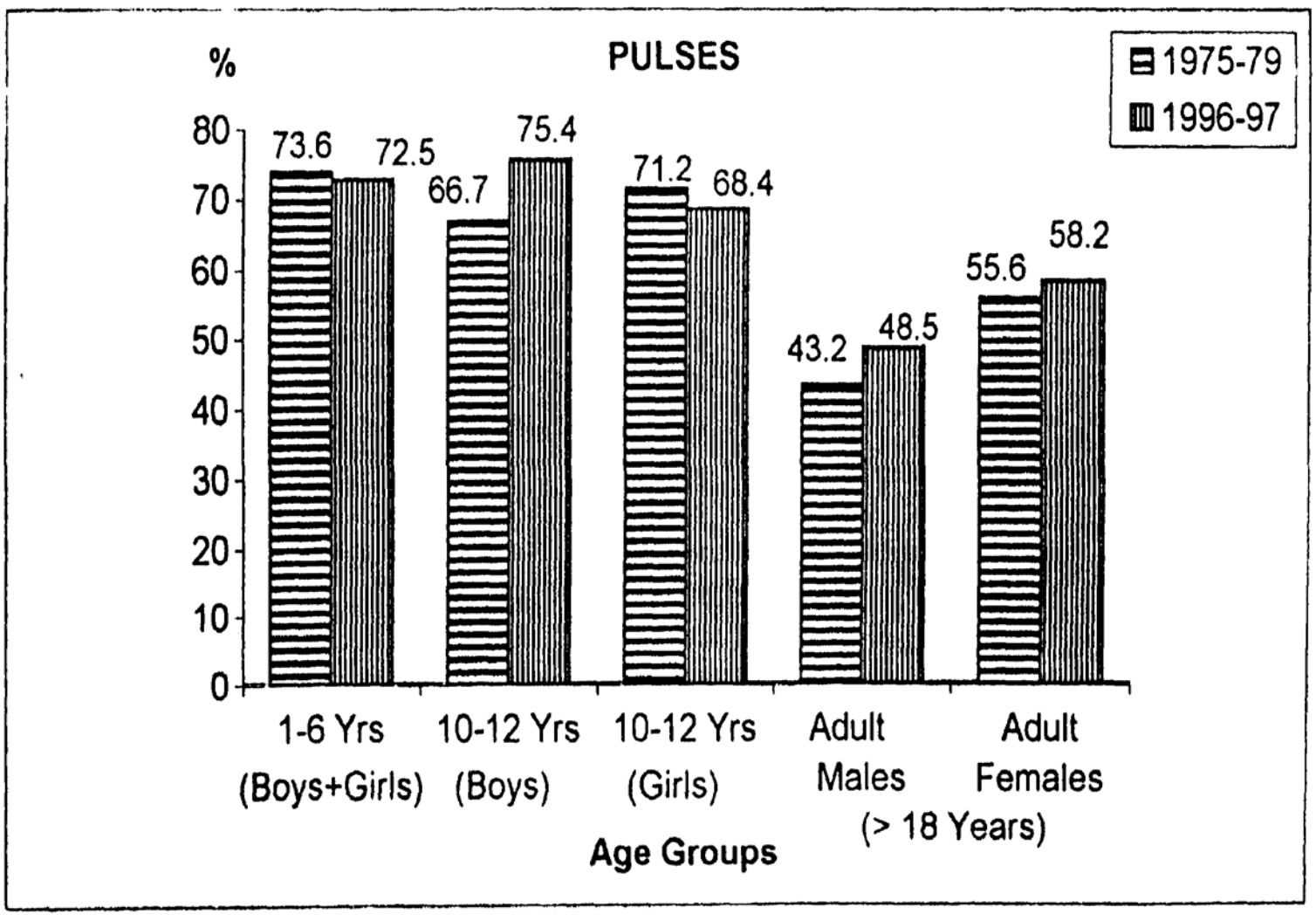
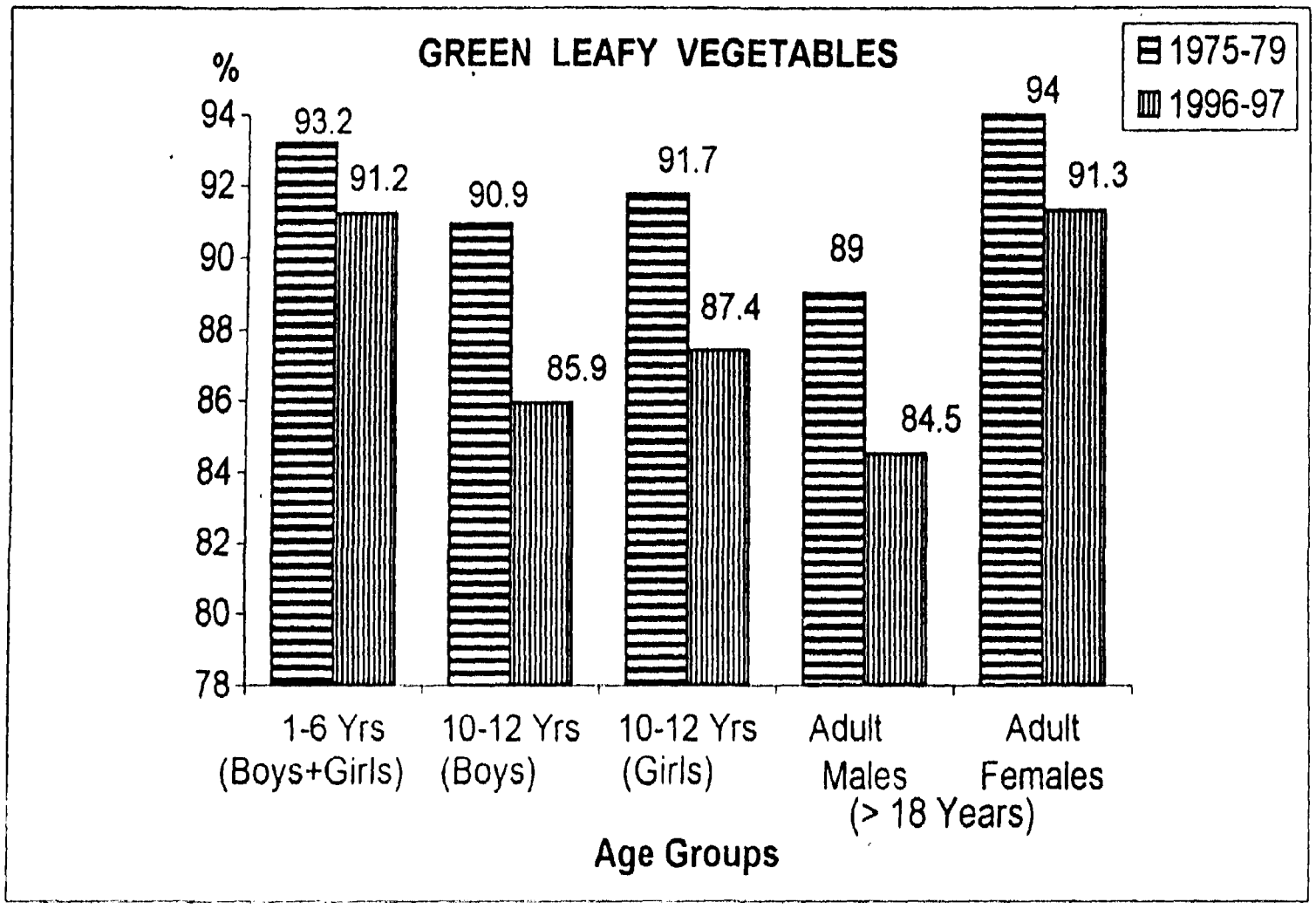


Fig. 2

PERCENT DISTRIBUTION OF INDIVIDUALS WITH GLV AND MILK & MILK PRODUCTS INTAKES BELOW 70% OF RDI BY AGE GROUP & SEX



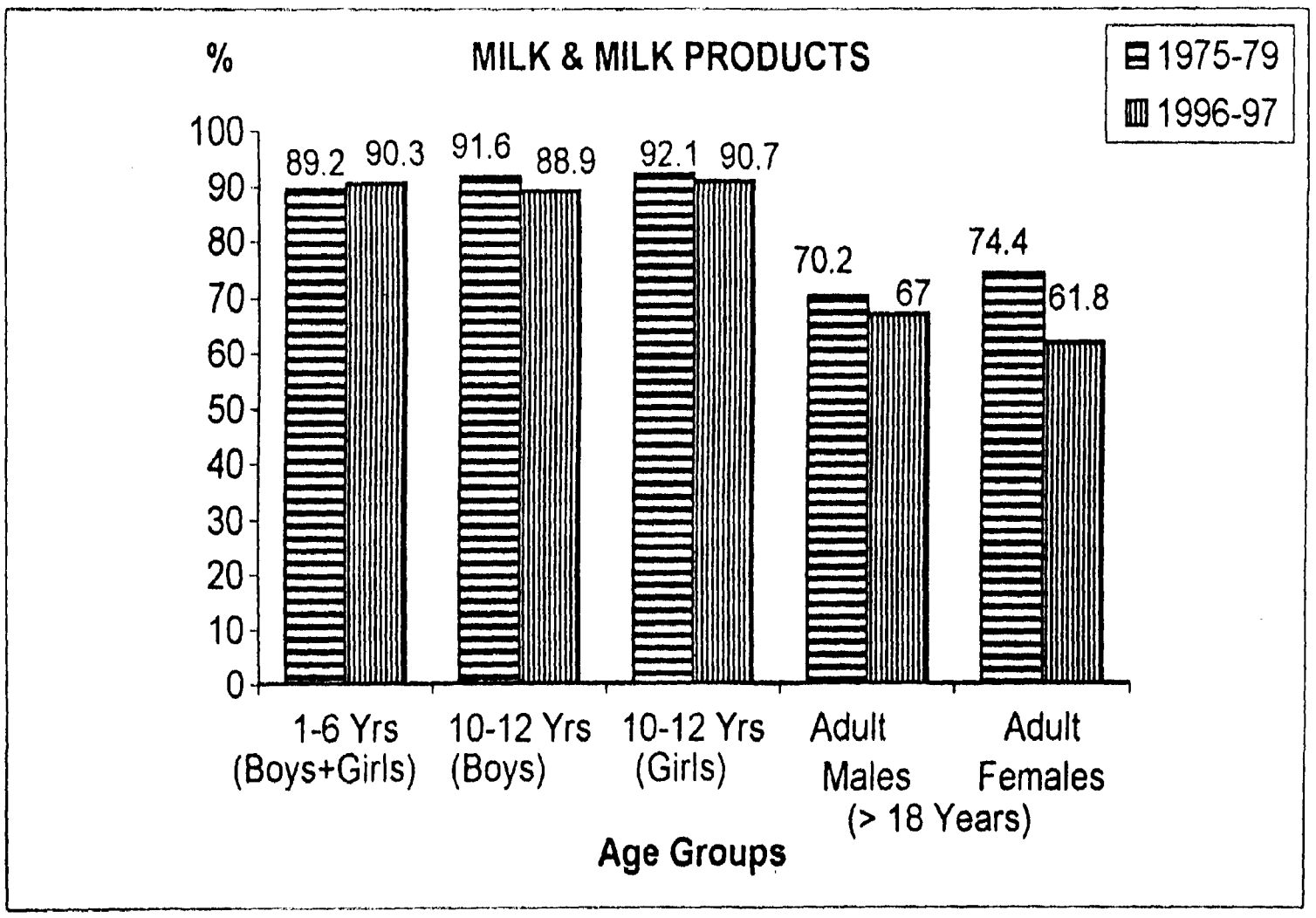


Table 6 AVERAGE DAILY INTAKE OF NUTRIENTS BY AGE GROUPS AND SEX

Nutrients	Age Groups (Years)																	
	10-12						13-15						16-18					
	Boys			Girls			Boys			Girls			Boys			Girls		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Protein (g)	46.0	43.1	17.8	42.6	40.5	16.1	52.3	48.9	19.3	47.8	44.4	18.7	61.8	58.1	23.5	52.5	50.1	18.1
Tot Fat (g)	24.2	19.3	17.8	22.1	17.9	15.9	27.5	22.0	18.7	23.4	19.5	16.6	32.8	26.4	24.0	28.8	23.7	19.7
Energy (Kcal)	1749	1719	551	1643	1614	501	1990	1899	643	1853	1812	563	2371	2276	741	2069	2019	573
Calcium (mg)	439	320	361	419	313	356	491	368	420	452	324	402	579	438	456	496	361	415
Iron (mg)- Old	21.4	19.8	9.2	20.3	18.5	9.7	23.8	21.4	10.6	22.5	20.8	9.2	29.0	25.7	12.5	23.7	21.7	8.8
Iron (mg) - New	12.8	10.2	8.6	12.0	9.8	7.4	14.1	11.5	9.4	12.9	10.3	8.5	16.8	12.7	12.8	13.2	10.4	8.1
Vitamin A (µg)	276	131	428	243	111	479	275	138	461	265	133	360	426	184	1102	258	145	325
Thiamin (mg)	1.10	0.90	0.60	1.00	0.80	0.60	1.20	1.00	0.70	1.10	0.90	0.60	1.40	1.10	0.80	1.10	0.90	0.70
Riboflavin (mg)	0.80	0.70	0.40	0.70	0.70	0.30	0.90	0.80	0.40	0.80	0.70	0.40	1.10	1.00	0.50	0.90	0.80	0.40
Niacin (mg)	11.1	10.3	4.9	10.3	9.3	4.5	12.5	11.6	5.4	11.5	10.6	4.7	14.9	13.6	6.2	12.6	11.9	5.0
Vitamin C (mg)	33.6	23.9	33.0	33.5	24.4	36.7	37.8	27.0	40.3	38.4	28.2	37.8	46.7	37.2	40.0	40.8	32.4	33.6
Folic acid (µg)	92	76	59	85	73	53	101	86	61	94	76	62	118	101	80	99	85	57

Table 7 AVERAGE DAILY INTAKE OF NUTRIENTS BY AGE GROUPS AND SEX

Nutrients	Adult Males			Adult Females (NPNL)			Pregnant Women			Lactating Mothers		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Protein (g)	63.2	60.1	22.3	52.5	49.9	19.1	53.0	47.2	23.4	59.2	56.5	20.6
Tot Fat (g)	33.6	27.4	24.8	29.6	24.5	20.9	26.1	21.5	20.1	27.9	24.6	18.3
Energy (Kcal)	2482	2418	728	2059	1983	635	2082	1994	734	2329	2243	677
Calcium (mg)	569	421	484	505	382	422	514	339	495	504	373	478
Iron (mg) - Old	29.4	27.3	12.0	24.4	22.2	11.1	25.4	23.0	13.3	27.5	25.4	11.5
Iron (mg) - New	16.7	13.6	10.8	13.8	11.3	9.0	13.2	11.0	8.8	15.4	12.4	9.9
Vitamin A (µg)	336	172	726	306	148	767	288	142	512	272	162	364
Thiamin (mg)	1.40	1.10	0.80	1.20	0.90	0.70	1.20	0.90	0.70	1.30	1.10	0.80
Riboflavin (mg)	1.10	1.00	0.50	0.90	0.80	0.40	0.90	0.80	0.40	1.00	0.90	0.40
Niacin (mg)	15.4	14.4	6.2	12.6	11.7	5.1	13.0	11.2	6.5	14.2	13.5	5.0
Vitamin C (mg)	46.0	35.9	45.9	41.7	32.0	40.3	37.6	28.4	41.5	38.8	29.4	57.6
Folic acid (µg)	123	107	79	101	86	62	98	84	55	120	106	89

NPNL: Non Pregnant Non Lactating

Table 8 PERCENT FREQUENCY DISTRIBUTION OF INDIVIDUALS ACCORDING TO FOOD INTAKE (AS % OF RDI) BY AGE GROUPS & SEX

Per cent of RDI		1-3 Years	4-6 Years	10-12 years		Adult Males		Adult Females	
				Boys	Girls	Sed.	Mod.	Sed.	Mod.
Cereals	<30	4.3	1.3	1.9	1	0.8	0.8	0.9	0.8
	30-40	5.8	3.7	4.4	2.9	1.5	1.4	1.7	0.8
	40-50	6	6	4.4	4.2	3	2.3	3.7	1.2
	50-60	9.1	7	7.9	10.1	7.4	3.9	6.6	4.1
	60-70	8.1	11.5	12.1	11.6	8	5.8	10.6	4.7
	70-80	8.9	13.2	12.8	10.5	12.3	8.1	10.2	6.3
	80-90	8.5	12.4	13.4	10.5	9	10.3	12	7.9
	90-100	9	11.4	11.1	12.8	10.3	9.7	9.8	9.2
	≥100	40.3	33.5	32	36.4	47.7	57.7	44.5	65
Pulses	<30	53.9	39.7	36.2	37.4	32.7	40.5	37.3	39.8
	30-40	8.4	6.1	7.9	7.3	3	3.9	5	3.3
	40-50	6.2	7	7.1	9.4	3.5	4.2	4.8	4
	50-60	5.9	7.5	7	6.7	3.5	5.9	4.5	4.6
	60-70	4.1	6.1	10	7.6	5.8	4.4	6.6	4.7
	70-80	4.9	5.5	4.6	4.4	6.2	5.1	5.5	5.8
	80-90	3.4	4.9	4.8	6.3	5	3.4	3.6	4
	90-100	2.6	4.1	3.8	3.8	4.6	5	3.7	3.7
	≥100	10.6	19.1	18.6	17.1	35.7	27.6	29	30.1
Green Leafy Veget.	<30	90.1	85	81.4	83.6	82.5	82.7	84.4	85.9
	30-40	1	1	0.6	1	0.4	0.2	1.5	1.4
	40-50	0.9	0.7	1.1	1	0.1	0.3	1.4	1.3
	50-60	0.5	1.2	1.3	1	0.6	0.6	2.3	1.7
	60-70	0.5	1.6	1.5	0.8	0.9	0.3	1.6	1.2
	70-80	0.8	0.8	0.2	0.6	0.3	0.6	1.9	1.3
	80-90	0.5	1.4	1.3	1	0.5	0.4	1.7	1.3
	90-100	0.5	0.8	0.8	0.5	0.8	0.8	0.8	1
	≥100	5.2	7.5	11.8	10.5	13.9	14.1	4.4	4.9

Table 9 PERCENT FREQUENCY DISTRIBUTION OF INDIVIDUALS ACCORDING TO FOOD INTAKE (AS % OF RDI) BY AGE GROUPS & SEX

Per cent of RDI		1-3 Years	4-6 Years	10-12 Years		Adult Males		Adult Females	
				Boys	Girls	Sed.	Mod.	Sed.	Mod.
Other vegetables	<30	64.7	55.8	54.8	51.9	41.2	54.2	43.4	59.5
	30-40	1	1.3	1.7	1.5	1.6	1.4	0.7	0.5
	40-50	1.1	1.2	2.3	2.1	1.1	1.5	0.9	0.5
	50-60	1.2	1.6	1.5	2.7	1.9	2.5	1	0.6
	60-70	1.1	1.3	2.1	2.9	2.8	1.9	1.5	1
	70-80	1.5	1.5	1	2.1	2.9	2.3	1.6	0.9
	80-90	1.3	1.9	3.3	3.2	3.7	3.4	1.4	1.5
	90-100	2.5	1.6	4	2.7	2.5	2.5	2	0.9
	≥100	25.6	33.8	29.3	30.9	42.3	30.3	47.5	34.6
Milk& Milk products	<30	74.5	75	70.3	76.3	41	70.3	43.6	66.7
	30-40	5.5	5.2	6.3	5.3	6.1	6.6	4.6	7.2
	40-50	3.7	4.2	5.4	3.4	7.4	4.2	5.4	4.8
	50-60	3.4	3	3.3	3.4	5.3	2.2	2.9	2.6
	60-70	3.3	2.7	3.6	2.3	7.2	2.4	5.3	2.8
	70-80	1.8	2.5	1.7	2.5	3.3	1.9	3.1	1.2
	80-90	2.3	1.1	3.6	1.9	4	1.8	2.6	1.7
	90-100	0.9	1.6	1	1	2.9	1.6	4.6	0.9
	≥100	4.6	4.7	4.8	3.9	22.8	9	27.9	12.1
Fats& Oils	<30	57.8	64.6	75.5	36.8	53	65.7	31.5	40.2
	30-40	12.8	11.8	9.8	14.9	14.8	12.7	12.5	15.6
	40-50	8.8	7.7	4.6	12.8	9	6.8	10.7	11.3
	50-60	5.5	5	3.6	8.2	6.1	4.7	9.3	8.3
	60-70	3.7	3.4	1.1	5.4	4.7	3.2	7.3	6.2
	70-80	2.4	2.2	1.5	5.2	3.4	1.6	4.8	4.1
	80-90	2.1	1.2	1.1	3.5	2	0.7	3.8	2.7
	90-100	1.7	1	0	3	1.7	1.3	3.8	2.1
	≥100	5.2	3.1	2.8	10.2	5.3	3.3	16.3	9.5
Sugar & Jaggery	<30	45.8	47.8	47.5	44.7	22.5	43.4	26	36.9
	30-40	9.8	11.5	10	14.1	5.8	6	2	2.2
	40-50	7.9	10.7	10	11.1	8.4	9.5	5.1	4.1
	50-60	6.9	5.3	6.5	5	7.5	8.3	2.9	2.7
	60-70	6.5	6.4	7.3	5.7	10.2	4.2	4	4.3
	70-80	2.5	3.7	5.9	5.5	5.8	5.4	6.6	4.6
	80-90	4.1	3.4	3.4	4.8	7.4	3.2	5.5	5.5
	90-100	3.7	2.8	1.1	1	5.7	4.5	7.1	5.6
	≥100	12.8	8.4	8.3	8.1	26.7	15.5	40.8	34.1

Consumption of other vegetable was also much less than the RDI in almost half of the population surveyed. Milk consumption was unsatisfactory in almost 70% of the individuals, particularly in young children. Over 75% of preschool children consumed less than 30% of RDI of milk. The pregnant and lactating women did not consume any additional quantities of milk over and above those of NPNL. Only 15% of individuals had fat intakes comparable to RDI. About 50% of preschool children had low intakes of sugar (<30% of RDI). The consumption of flesh foods though was low in all the ages, in general, in the State of Kerala the intake of fish and meat was better than that in all the other States.

3.3.2 Nutrient Intakes

The distribution of individuals according to percent of RDI for different nutrients is presented in Tables-10 & 11 and proportion of Households consuming various Nutrients below 70% of RDA are shown in Figs. 3 to 5.

Only 12-24% of individuals between 1-6 years and 13-15 years had adequate energy intakes. In the other ages 13 to 55% of individual were consuming more than or equal to RDI of energy. Protein adequacy was also observed in about a half of the individuals. Only a very small proportion (11%) of the population was consuming adequate amount of vitamin A. The intakes were so poor that about 50-70% had intakes less than 30% of RDI. Iron consumption was inadequate in more than 90% of the individuals in almost all the ages. Calcium intake was also very low in most of the age groups, especially in the children of 1-3 years, pregnant and lactating women.

The mean intake of foods and nutrients for 1988-92 (moving average) are given in **Tables 12 & 13.** The consumption of all the foods was less than RDI in all the age groups. The nutrient intakes were, in general less than RDI.

Figure - 3

PERCENT DISTRIBUTION OF INDIVIDUALS WITH INTAKES OF ENERGY BELOW 70% OF RDA BY AGE GROUPS AND SEX

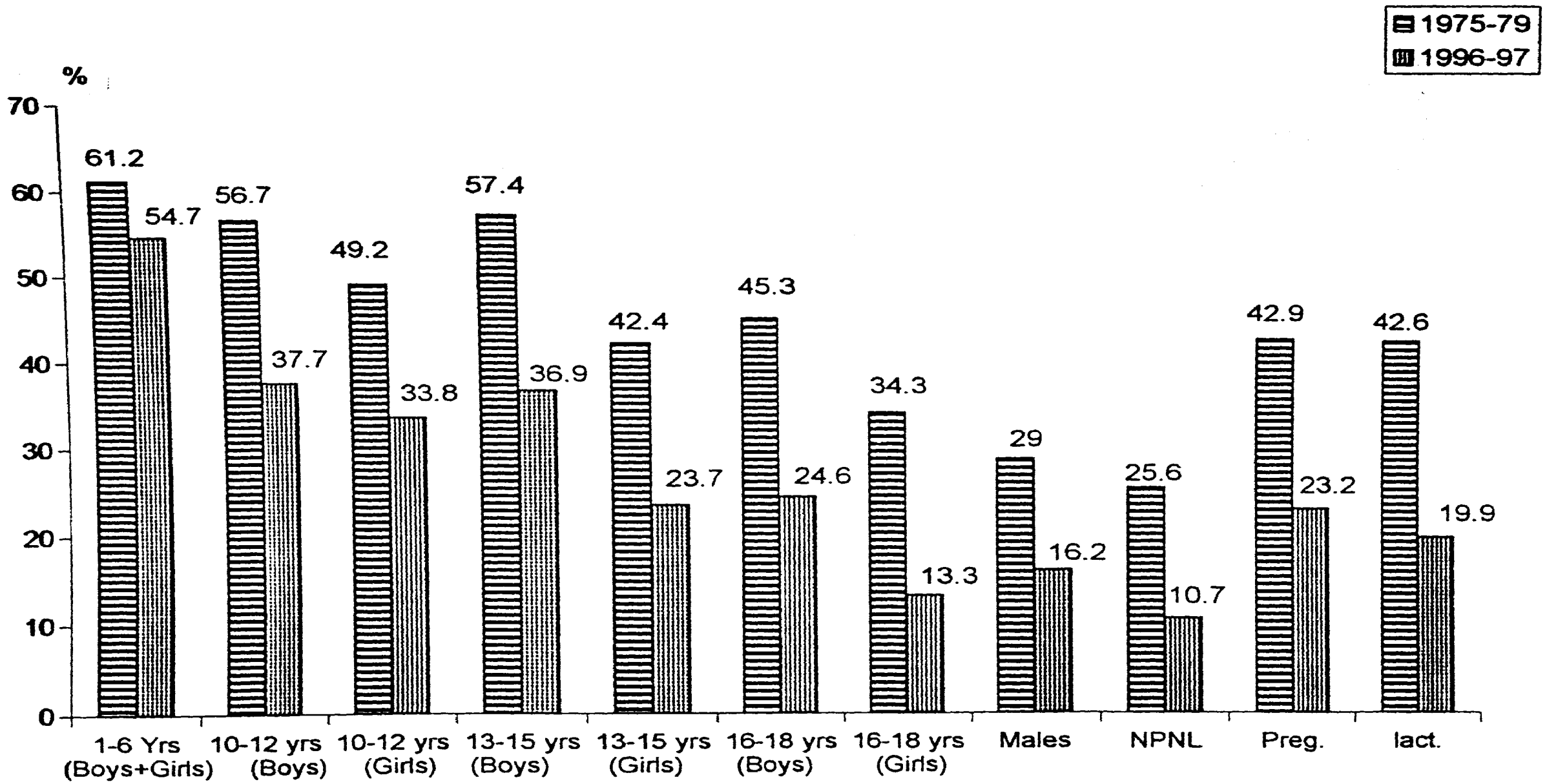


Figure - 4

PERCENT DISTRIBUTION OF INDIVIDUALS WITH INTAKES OF PROTEIN BELOW 70% OF RDA BY AGE GROUPS AND SEX

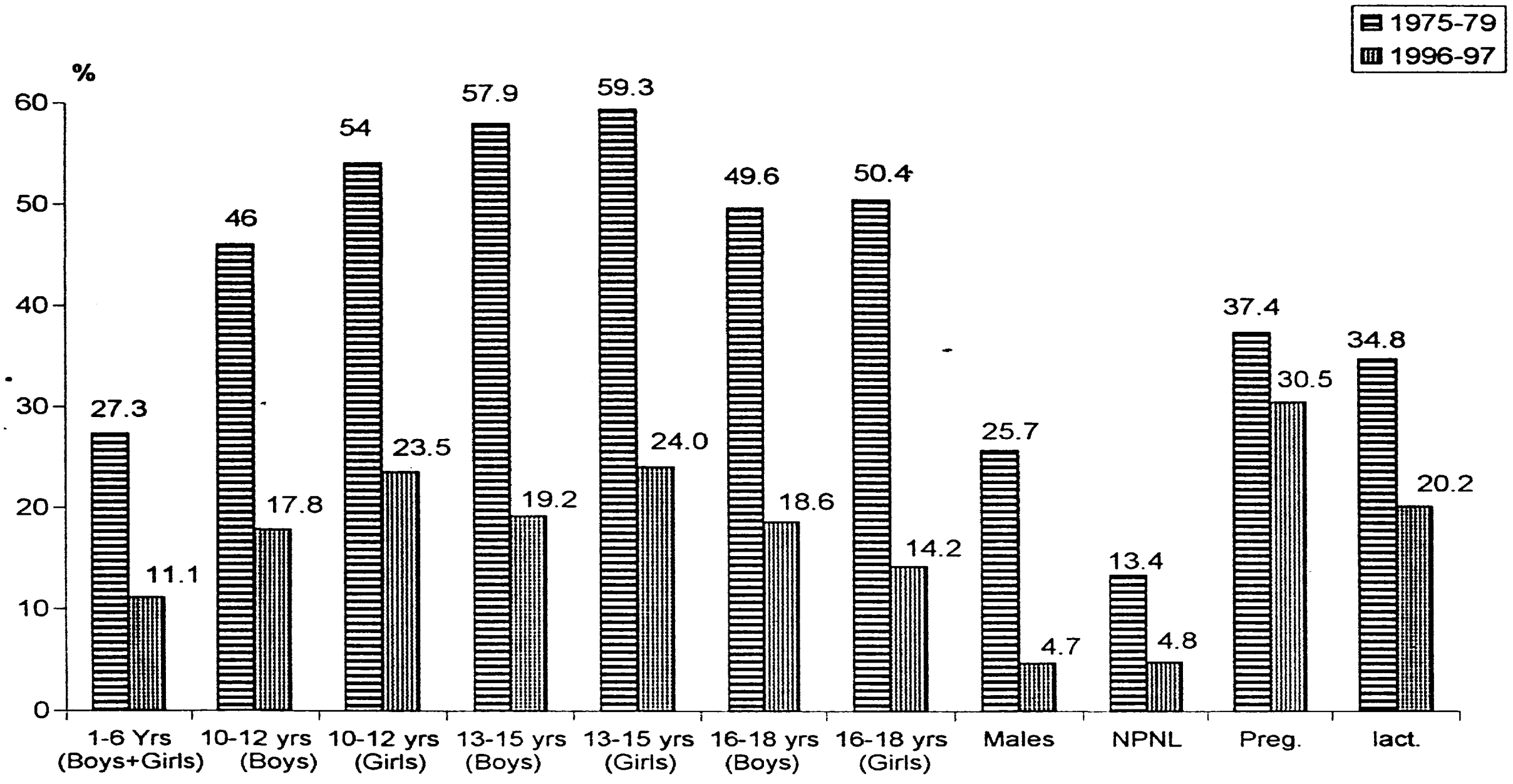
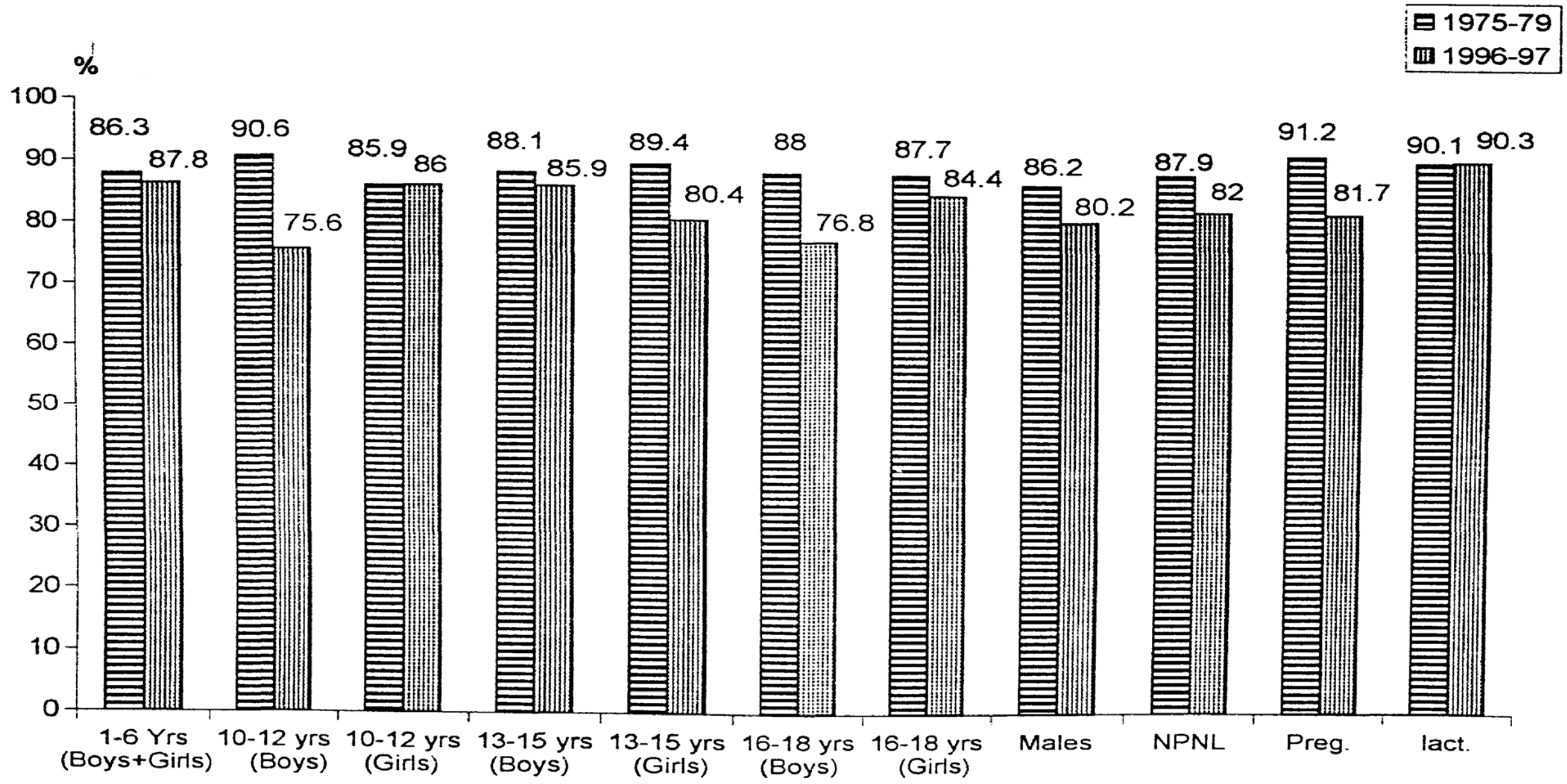


Figure - 5

PERCENT DISTRIBUTION OF INDIVIDUALS WITH INTAKE OF VITAMIN 'A' BELOW 70% OF RDI BY AGE GROUPS AND SEX



Age and Sex physiological groups

Table 10 PERCENT FREQUENCY DISTRIBUTION OF INDIVIDUALS ACCORDING TO NUTRIENT INTAKE (AS % OF RDI) BY AGE GROUPS & SEX

Percent of RDI		1-3 Yrs	4-6 Yrs	7-9 Yrs	10-12 Years		13-15 Years		16-18 Years		Adult Males		Adult Females (NPNL)		Preg.		Lact.	
					Boys	Girls	Boys	Girls	Boys	Girls	Sed.	Mod.	Sed.	Mod.	Sed.	Mod.	Sed.	Mod.
Energy	<30	5.1	1.5	1.3	1.1	0.6	0.2	0	0.6	0	0.1	0.6	0.1	0.2	0	1.9	0.4	0.9
	30-40	10.6	5.3	2.7	1.7	1	1	1.1	0.6	0.3	0.7	1.5	0.3	1.3	1.2	1.9	1.3	0.9
	40-50	12.3	11.4	9.5	7.9	6.3	9.7	4.4	3.9	1.1	2.6	3.5	1.9	2.3	3.7	9.4	3.4	3.5
	50-60	13.8	15.7	14.8	12.1	9.9	11.9	6.9	6.9	3.6	5.7	7.9	3	4.8	9.8	1.9	3.8	5.6
	60-70	14.4	19.2	16.6	14.9	16	14.1	11.3	12.6	8.3	7.1	10.8	5.4	8.2	8.5	11.3	11	10.8
	70-80	12.8	16.1	16.7	15.3	13.4	15.8	13.1	16.8	12.2	11.3	15.4	8.1	13.6	23.2	15.1	12.8	20.8
	80-90	9.6	11.3	12.9	13.4	17.6	15.1	17.7	15.3	12.5	14.9	15.8	12.9	13.5	9.8	13.2	18.9	14.8
	90-100	6.7	6.7	9.6	15.3	11.2	8.4	14.3	10.9	14.1	14.6	14.1	13.9	13.9	7.3	9.4	16.2	15.8
	≥100	14.7	12.8	15.9	18.3	24	23.8	31.2	32.4	47.9	43	30.4	54.4	42.2	36.5	35.8	32.2	26.9
Protein	<30	0.2	0.1	0.3	0.4	0.2	0	0.5	0.6	0	0.2	0	0.1	0.2	0	1.9	0	0.9
	30-40	1.2	0.4	0.8	1.5	1.7	0.7	1.4	0.9	0.6	0.2	0.4	0.4	0.1	0	3.8	1.6	0.7
	40-50	2.5	1.4	2.1	1.9	4	5	4.4	3	1.7	0.7	0.4	0.9	0.7	2.4	1.9	3.6	2.2
	50-60	5.2	2	3.1	4	9.2	7.9	6.9	4.2	4.4	2.2	1.6	2.2	1.6	11	5.7	5.2	4.3
	60-70	5.8	3.4	6	10	8.4	10.1	10.6	9.9	7.5	3.4	2.4	2.9	2.3	17.1	7.5	9.9	6.5
	70-80	6.9	6.2	7.6	9	11.5	12.6	13.8	12.9	10.2	4.6	3.8	4.4	4.9	11	1.9	13.0	8.9
	80-90	7.5	6.5	8.8	12.1	13.4	13.4	14.5	10.5	11.4	6.8	5.1	6.1	5.2	9.8	9.4	12.1	11.5
	90-100	6.7	7.5	10.1	8.6	12	11.4	11.3	12.6	11.4	6.1	7.3	8.6	6.2	8.5	15.1	12.6	13.9
	≥100	64	72.5	61.2	52.5	39.6	38.9	36.6	45.4	52.8	75.8	79	74.4	78.8	40.2	52.8	42.0	51.2
Total Fat	<30	35.8	19.1	15.9	7.1	8.4	4.7	7.8	4.5	4.7	1.2	2.4	2.6	5.5	22	9.4	19.8	19.5
	30-40	13.8	12.9	10.6	7.5	9	5.9	9	3.3	4.7	1.6	3.7	3.2	5.2	6.1	9.4	12.4	18.0
	40-50	10.7	11.2	11.2	7.9	10.1	6.4	7.4	5.1	5.8	2.3	4.7	4.6	6.4	6.1	5.7	10.6	12.1
	50-60	8.5	11.5	12	5.9	7.1	6.7	7.1	5.7	8.9	3.2	5.2	4.7	7.1	7.3	11.3	6.7	10.4
	60-70	5.5	7.2	7.1	8.4	7.8	6.9	7.8	6	5	3.3	5.8	4.8	5.3	8.5	11.3	10.8	9.5
	70-80	5.8	6.5	6.8	7.3	6.3	5.7	4.6	5.4	4.2	3.3	6.4	5	6.4	7.3	11.3	7.4	7.8
	80-90	2.7	6.4	5.6	6.9	9.7	7.7	8.3	5.7	5.5	3.6	6.4	4.7	6.4	4.9	11.3	8.5	9.5
	90-100	3.9	5.2	5.6	5.2	4	6.2	4.8	4.5	7.2	4	5.4	4.4	6	4.9	3.8	4.7	4.6
	≥100	13.3	20	25.2	43.8	37.6	49.8	43.2	59.8	54	77.5	60	66	51.7	32.9	26.4	19.1	8.5

NPNL: Non Pregnant non lactating Sed. : Sedentary Mod. : Moderate

Table 11 PERCENT FREQUENCY DISTRIBUTION OF INDIVIDUALS ACCORDING TO NUTRIENT INTAKE (AS % OF RD1) BY AGE GROUPS AND SEX

Percent RDI		1-3 Years	4-6 Years	7-9 Years	10-12 Years		13-15 Years		16-18 Years		Adult males		Adult Females (NPNL)		Preg.		Lact.	
					Boys	Girls	Boys	Girls	Boys	Girls	Sed.	Mod.	Sed.	Mod.	Sed.	Mod.	Sed.	Mod.
Vitamin A	<30	69.8	60.8	70.8	62.3	68.5	61.9	61.8	48.6	60.9	48	54.2	58.7	60.7	52.4	64.2	75.5	75.9
	30-40	7.5	10.3	6.3	9.2	8.6	10.6	10.6	12.6	10.8	13.2	12.2	11.4	11	8.5	11.3	6.7	7.8
	40-50	5.8	5.4	5.5	6.1	4.4	6.4	4.1	6.3	6.6	10.2	7.2	5.9	5.6	11	7.5	4.3	3.7
	50-60	2.9	3.9	3	2.9	3.4	3.5	1.8	5.7	2.5	5.2	4.4	3.4	4.2	9.8	5.7	2.7	3.5
	60-70	3.6	2.5	1.9	2.3	1.1	3.5	2.1	3.6	3.6	3.6	3.4	2.6	2.2	0	0	1.1	1.1
	70-80	1.6	2.1	0.9	2.5	1.7	1.5	2.8	3.9	1.1	3	2.4	2.2	1.3	3.7	0	2.2	1.5
	80-90	1.2	1.6	1.5	1.9	1.7	1.2	2.3	1.8	1.4	2.2	1.4	1.5	1.5	2.4	0	1.6	1.1
	90-100	1	1.7	1.2	1	1.2	1	2.3	2.7	2.3	1.9	1.5	1.8	1.6	2.4	0	1.4	1.3
	≥100	6.6	11.7	8.9	11.8	9.4	10.4	12.2	14.8	10.8	12.7	13.3	12.5	11.9	9.8	11.3	4.5	4.1
Iron (Revised Values)	<30	40.1	36.8	43.5	50.2	16.2	56.2	35.6	59.5	36.0	17.7	18.4	36.1	29.6	53.7	52.8	30.3	28.0
	30-40	18.5	16.6	17.4	17.4	18.1	14.1	18.9	15	23	17.7	18.8	20.2	21	22	13.2	18.2	19.7
	40-50	11.6	11.5	11.3	9.8	13.7	11.6	14.3	11.1	10.8	14.3	16.4	14.4	11.3	9.8	13.2	13.5	15.2
	50-60	6.7	10.7	9.4	7.7	11.3	7.4	9.7	4.8	8.6	12.8	10.4	9.7	12	7.3	5.7	9.7	8.9
	60-70	5.3	7.3	5	5.4	8.8	3.2	5.5	2.1	7.8	10.9	8.4	7	6.5	0	7.5	9.9	5.2
	70-80	4.5	5	4.5	2.6	7.3	2.7	4.8	3	4.7	7.1	7	3.6	5.3	1.2	1.9	4.5	5.0
	80-90	3.7	3.9	2.7	1.9	5.9	0.7	3.2	0.9	3.3	5	4.3	2.7	3.9	1.2	0	2.0	5.0
	90-100	2.1	2.1	2.2	1.9	4.4	2.1	1.8	0.3	1.1	3.8	3.8	1.5	3.3	2.4	1.9	2.7	3.7
	≥100	7.5	6.1	4	3.1	14.3	2	6.2	3.3	4.7	10.7	12.5	4.8	7.1	2.4	3.8	9.2	9.3
Ribo-flavin	<30	23.8	22.3	10.3	4.4	5.3	8.2	3.7	1.8	0.8	2.4	2.3	1.8	1.7	1.2	11.3	3.6	3.0
	30-40	0	19.9	16.4	21.8	12.6	23.3	4.8	12	3.3	3.5	11.8	4.1	12.4	20.7	28.3	5.2	12.8
	40-50	23.1	16.2	33	17.8	29.8	14.1	28	24.9	20.8	16.3	22	7.3	12	13.4	7.5	23.4	25.2
	50-60	15.9	12.8	11.8	12.1	14.5	23	15.9	11.1	15.5	10.7	12.4	10.7	15.9	12.2	18.9	14.6	15.0
	60-70	0	8.8	8	18.8	10.7	5.9	11.5	20.4	12.7	10	20.8	13.6	26.5	18.3	7.5	12.6	20.2
	70-80	12.4	7.9	5.1	6.9	7.3	10.4	9.9	6.3	12.5	18.2	7.5	13.3	7.9	4.9	11.3	16.1	6.5
	80-90	8.1	3.4	5.4	3.8	4.8	3.5	7.6	9.3	8.6	8.8	8.5	11	5.3	4.9	5.7	6.5	5.2
	90-100	5.7	2.4	5.3	6.7	8.2	5	8.5	5.1	11.4	12.1	5.3	17.5	8.2	7.3	1.9	6.5	5.4
	≥100	11	6.3	4.7	7.7	6.8	6.6	10.1	9.1	14.4	18	9.4	20.7	10.1	17.1	7.5	11.5	6.7

NPNL : Non Pregnant non lactating

Table 12 MEAN INTAKE OF FOODSTUFFS* (per day) FOR 1988-92.

	Age Groups (Years)										
Food stuffs	1-3	4-6	7-9	10-12 Boys	10-12 Girls	13-15 Boys	13-15 Girls	16-18 Boys	16-18 Girls	Adult Males	Adult Females
N	1915	2042	1664	634	693	497	488	442	484	5261	5644
Cereals& Millets	170	258	319	383	365	445	406	509	425	531	445
Pulses	14	20	23	25	24	24	27	28	27	32	32
Leafy vegetables	3	6	7	6	7	8	8	7	9	9	8
Other vegetables	19	31	34	38	37	58	39	50	56	53	45
Roots & tubers	12	19	29	37	32	38	34	52	50	51	40
Nuts & oil seeds	5	6	8	11	21	10	14	16	27	17	17
Cond. & spices	5	8	10	14	12	12	13	14	19	17	15
Fruits	16	22	26	25	50	37	26	96	21	23	30
Fish	4	5	7	9	9	11	10	19	12	16	17
Other flesh foods	2	3	3	3	4	2	2	5	4	6	4
Milk & milk prod.	71	67	76	73	67	93	76	96	110	86	92
Fats & Oils	5	7	8	11	8	13	24	14	12	16	14
Sugar & Jaggery	15	17	18	20	21	20	22	20	24	23	23

* Moving Average for the years 1988-89, 1989-90 and 1990-92.

Table 13 MEAN DAILY INTAKE OF NUTRIENTS* BY AGE GROUPS AND SEX

	Age Groups (Years)										
	1-3	4-6	7-9	10-12 Boys	10-12 Girls	13-15 Boys	13-15 Girls	16-18 Boys	16-18 Girls	Adult Males	Adult Females
N	1915	2042	1664	634	693	497	488	442	484	5261	5644
Protein (g)	23.2	33.4	40.2	47.5	47.0	56.4	49.2	63.9	56.7	64.5	57.0
Tot Fat (g)	13.4	17.4	20.8	26.4	27.9	31.3	40.9	34.7	37.6	36.4	32.9
Energy (Kcal)	876	1248	1516	1816	1793	2090	2024	2448	2140	2467	2151
Calcium (mg)	259	327	391	435	440	500	472	528	535	574	540
Iron (mg)	10	15	18	22	22	25	22	28	25	29	26
Vit A (µg)	121	166	197	238	212	207	232	260	300	274	257
Thiamin (mg)	0.50	0.80	0.90	1.10	1.10	1.30	1.10	1.40	1.30	1.40	1.30
Ribo (mg)	0.40	0.50	0.60	0.70	0.70	0.90	0.70	0.90	0.90	0.90	0.80
Niacin (mg)	5	8	10	12	12	14	13	17	14	16	14
Vit C (mg)	14	24	29	30	36	41	31	46	41	38	35

* Moving Average for the years 1988-89, 1989-90 and 1990-92. N = Pooled for 3 time points.

4.TIME TRENDS

4.1 Food Consumption

The changes in mean intakes between 1975-79 and 1996-97 are presented in **Tables 14 to16.** There was an increase in the consumption of mean cereal intakes in all the age groups, except in 1-3 years of age. The increase ranged from about 12 g (7%) in 4-6 year old children to about 104g (25%) in pregnant women. The median intake of millets did not show any change (zero), indicating that about a half of them did not consume millets at all at both points of time. The changes in pulse consumption were negligible. Like the millets intakes, the median intakes of GLV at both time points was poor with at least 50% of them not consuming GLV at all at both points of time. There was an increasing trend in the consumption of the mean intakes of milk and milk products, though the magnitude of increase was small (<20 g). It was interesting that the milk consumption showed an increasing trend in all age groups except 1-3 years and pregnant women, though these were much below the RDI.

Table-14
TIME TRENDS IN MEAN FOOD INTAKES (g/day)

Food Stuffs	Age Groups (Years)					
	1-3		4-6		7-9	
	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)
Millets	50	32	81	59	98	86
Cereals	120	124	152	185	186	225
Pulses	16	13	20	20	23	25
Leafy Vegetables	6	5	6	10	7	12
Other Vegetables	19	14	27	26	35	30
Roots & Tubers	20	17	30	30	34	32
Nuts & Oil seeds	4	3	4	6	5	8
Condi. & Spices	6	6	8	9	8	10
Fruits	10	14	10	22	10	18
Fish	3	5	4	7	5	8
Other Flesh foods	3	2	2	2	1	2
Milk & Milk prod.	72	67	56	60	52	53
Fats & Oils	4	5	5	8	7	9
Sugar & Jaggery	13	14	13	16	14	17

Table 15 TIME TRENDS IN MEAN FOOD INTAKES (g/day)

Food Stuffs	Age Groups (Years)											
	10-12				13-15				16-18			
	Boys		Girls		Boys		Girls		Boys		Girls	
	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)
Millets	120	98	121	99	120	120	134	92	150	118	128	88
Cereals	220	273	207	249	258	308	233	307	313	397	256	355
Pulses	27	26	24	25	26	28	25	26	35	32	28	27
GLV	9	15	8	14	12	12	8	16	10	23	10	14
Other veg	41	35	43	38	51	47	40	44	48	58	55	50
Roots & tubers	43	39	40	41	51	49	50	54	61	53	58	57
Nuts & oil seeds	6	11	5	11	8	15	7	11	6	20	9	18
Condi. & spices	9	12	10	11	9	13	10	11	11	16	10	13
Fruits	10	20	10	22	10	35	9	16	10	24	15	22
Fish	7	15	6	12	9	18	8	14	9	24	9	18
Other flesh foods	1	3	1	3	1	4	1	3	1	5	1	4
Milk & milk prod.	47	66	45	53	51	65	49	56	54	68	53	71
Fats & oils	7	11	7	9	9	11	7	10	10	13	9	11
Sugar & jaggery	14	19	14	19	15	19	16	18	16	19	15	19

'Table 16 TIME TRENDS IN MEAN INTAKE OF FOODS BY AGE GROUPS & SEX

Food Stuffs (g/day)	Adult males		Adult Females (NPNL)		Pregnant Women		Lactating Mothers	
	1975-79	1996-97	1975-79	1996-97	1975-79	1996-97	1975-79	1996-97
Millets	171	120	128	89	129	103	161	136
Cereals	323	421	258	345	230	360	275	382
Pulses	37	35	31	29	34	29	30	34
GLV	13	17	11	16	12	17	15	11
Other vegetables	55	54	47	49	44	42	45	42
Roots & Tubers	59	56	51	53	58	34	48	43
Nuts & Oil seeds	8	17	8	17	2	11	6	9
Condi. & Spices	13	17	12	14	9	15	13	18
Fruits	14	31	11	24	11	26	13	34
Fish	9	18	8	18	6	10	8	11
Other Flesh foods	10	5	2	4	1	8	1	4
Milk & Milk prod.	66	74	56	72	75	70	58	67
Fats & Oils	11	15	9	13	12	12	10	13
Sugar & Jaggery	18	21	16	21	19	15	16	19

NPNL: Non Pregnant Non Lactating

TIME TRENDS

FOODS INTAKE :

- **Increase in consumption of cereals was observed in all ages.**
- **Intakes among pregnant and lactating women were marginally increased over a period of time.**
- **A marginal increase was observed in consumption of qualitative foods such as GLV, Fruits, Milk and sugar & Jaggery.**

4.2 Nutrient Consumption

As already indicated, the coefficient of variation of nutrient intakes was high and ranged from about 40% in energy to about 70% in total fat. Hence, to assess the time trends, the median intakes obtained in 1996-97 among different groups were compared with those of 1975-79. Interestingly, the results are different from those reported earlier based on the mean intakes of one day weighment family diet survey, which had indicated no change in dietary consumption. In general, there was an increasing trend with respect to protein (1 g in 4-7 years to 8.9 g in lactating women) and energy (36 Kcal in 1-3 years to 446 Kcal in lactating women). Similar changes were noticed in fat (1.4 g in 1-3 years to 7.4 g in NPNL) and vitamin A (5 µg in 1-3 years to 64 µg in 16-18 years old girls). The results are presented in Tables 17 to 19 and Figs. 6 to 9. Median test revealed that there is significant improvement in the intakes of vitamin A and fat in all age groups except 1-3 year children and pregnant women. Energy intake was improved in all age groups except 1-3 year children (Table 20).

Fig. 6

TIME TRENDS IN (Median) DIETARY ENERGY INTAKE

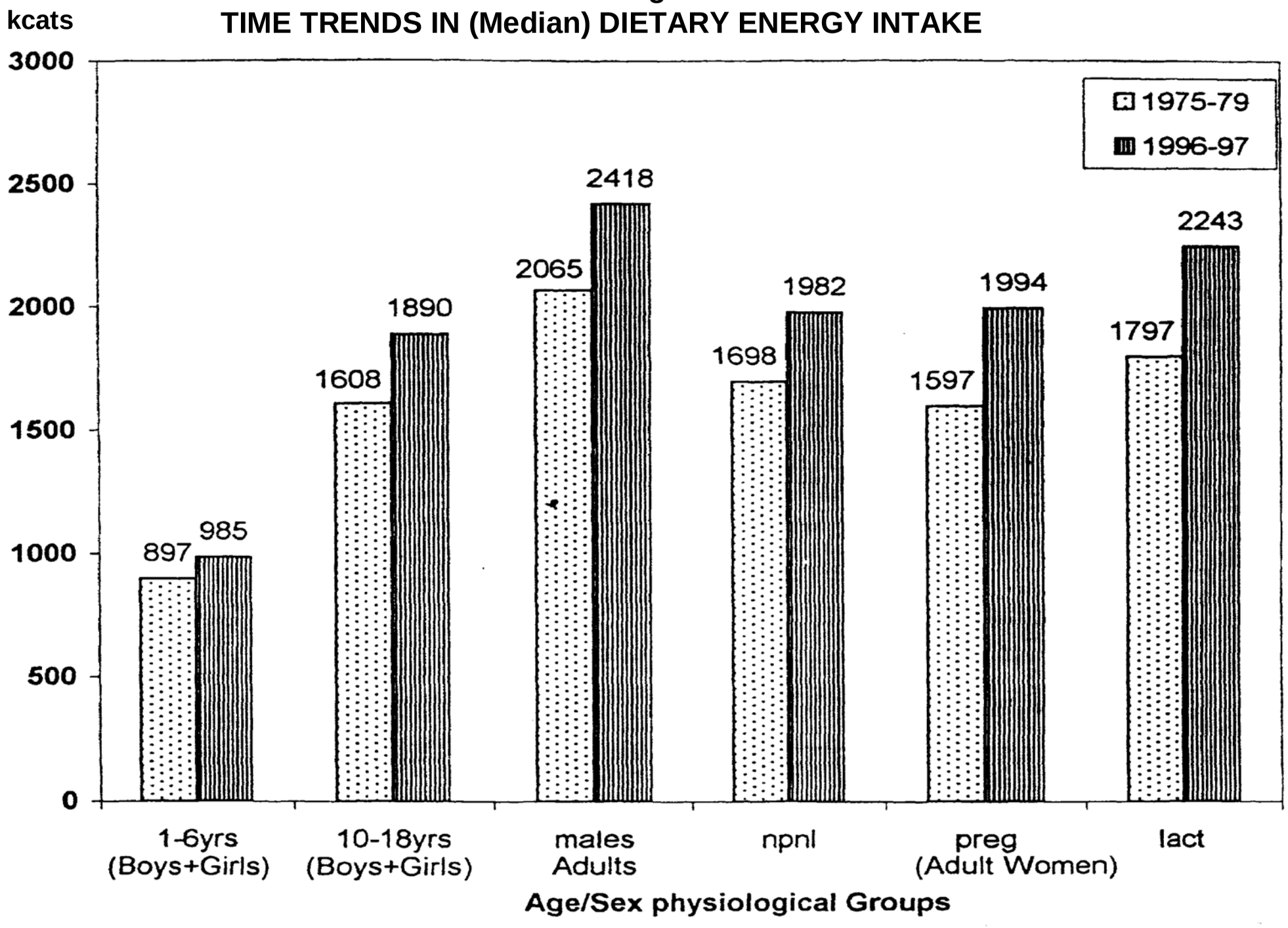


Fig. 7

TIME TRENDS IN (Median) PROTEIN INTAKE

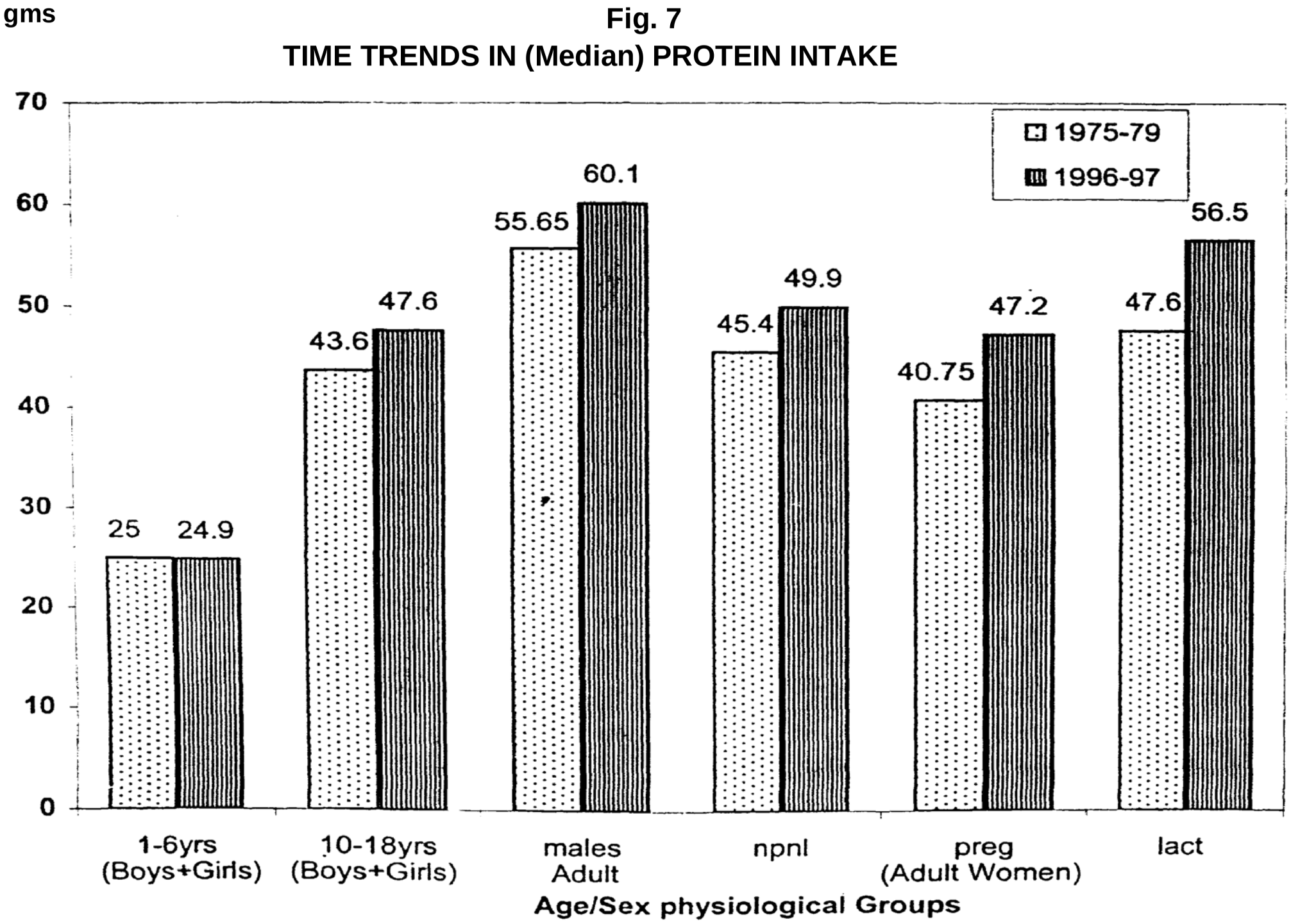


Fig. 8

TIME TRENDS IN (Median) TOTAL FAT INTAKE

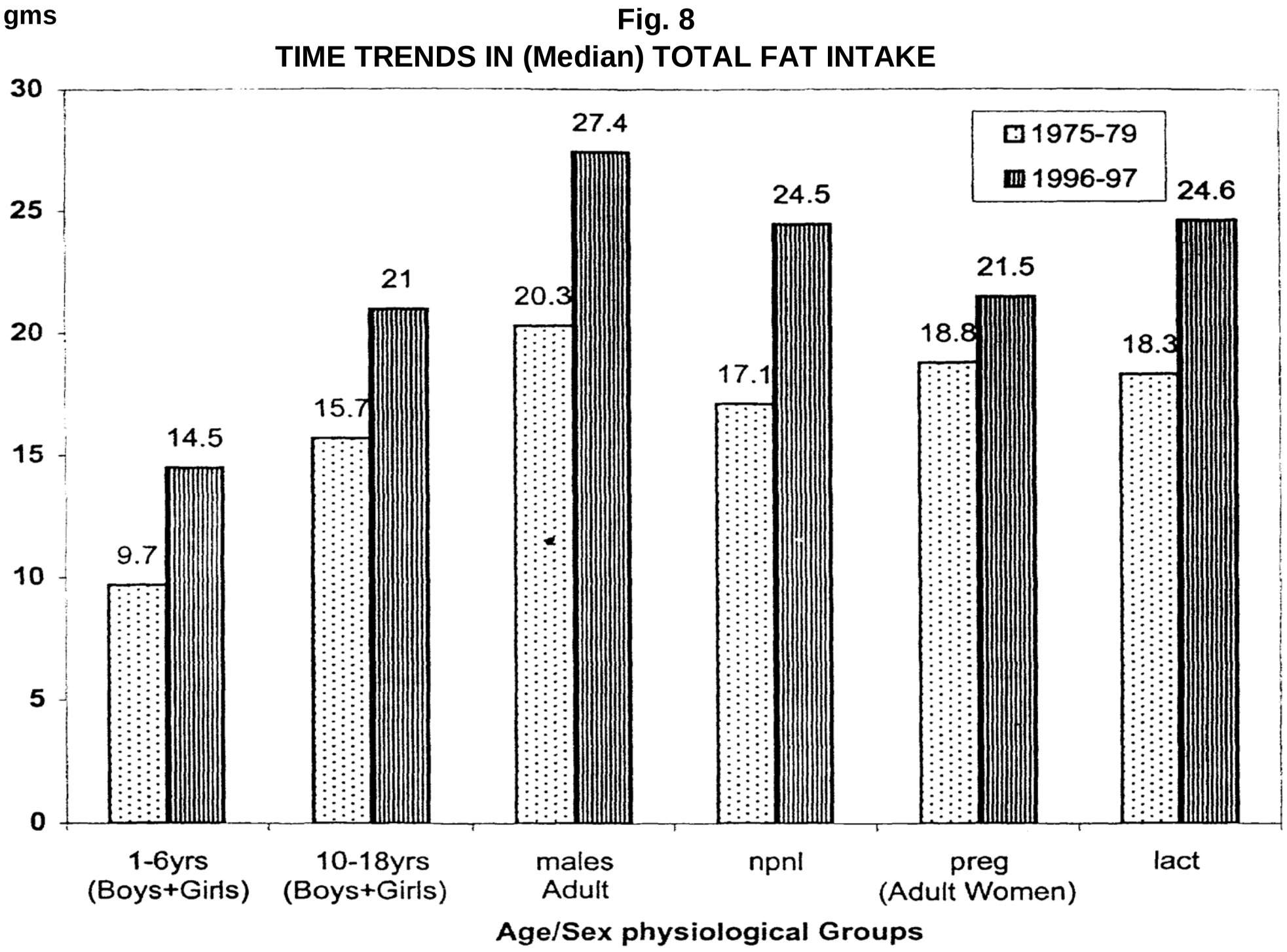


Fig. 9
TIME TRENDS IN (Median) VITAMIN A INTAKE

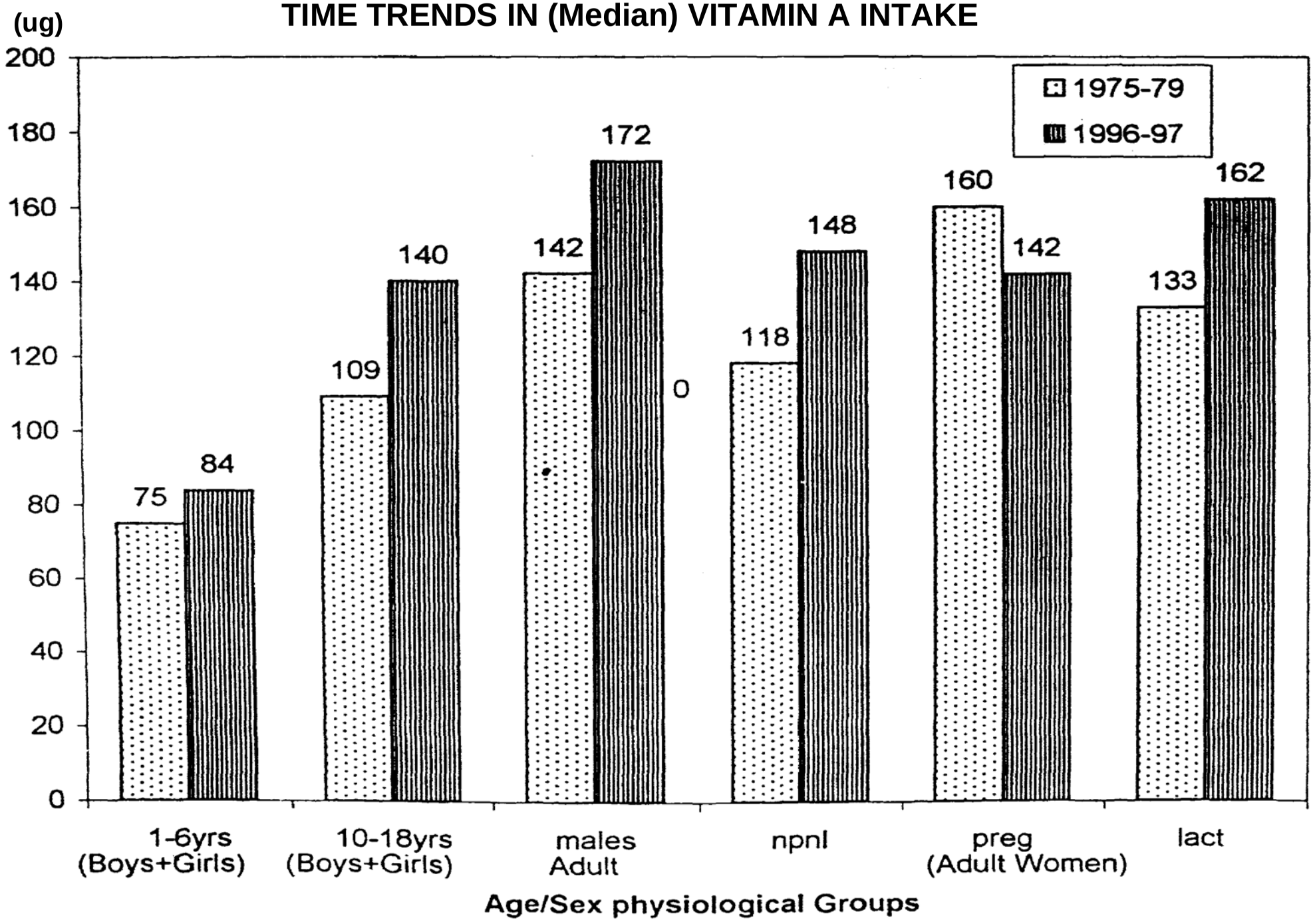


Table 17 TIME TRENDS IN AVERAGE DAILY INTAKE OF NUTRIENTS (Median) BY AGE GROUPS AND SEX

Nutrients (per day)	Age groups (years)					
	1-3		4-6		7-9	
	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)
Protein (g)	21.5	20.40	28.4	29.40	33.6	36.20
Tot fat (g)	8.7	10.10	10.7	13.90	12.2	15.10
Energy (Kcal)	779.3	815.40	1015.2	1154.20	1240.4	1417.7
Calcium (mg)	192.7	167.60	223.7	224.00	240.7	261.50
Iron (mg)	10	8	13	13	16	16
Vitamin A (ug)	67	72	83	96	90	108
Thiamin (mg)	0.40	0.40	0.60	0.60	0.80	0.70
Ribo. (mg)	0.30	0.40	0.40	0.50	0.50	0.60
Niacin (mg)	5	5	7	7	8	8
Vitamin C (mg)	10	10	14	18	18	20

Table 18 TIME TRENDS IN AVERAGE DAILY INTAKE OF NUTRIENTS (Median) BY AGE GROUPS/SEX

Nutrients	Age Groups (years)											
	10-12				13-15				16-18			
	Boys		Girls		Boys		Girls		Boys		Girls	
	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)
Protien (g)	39.5	43.1	39.1	40.45	43.3	48.85	41.25	44.4	54.8	58.1	44	50.1
Tot Fat (g)	14	19.3	13.9	17.85	16.7	21.95	15.9	19.5	17.1	26.4	16.7	23.7
Energy (Kcal)	1438.8	1719.1	1393.5	1613.95	1618.45	1899.1	1565.55	1811.8	1926.5	2275.8	1704.3	2018.8
Calcium (mg)	270.5	319.95	268.2	312.7	304.45	367.55	299.4	324.2	327.7	437.6	317.3	361.3
Iron (mg)	19	20	18	19	21	21	20	21	25	26	22	22
Vit A (µg)	101	131	105	111	114	138	103	133	120	184	115	145
Thiamin (mg)	1.00	0.90	0.90	0.80	1.00	1.00	1.00	0.90	1.30	1.10	1.00	0.90
Ribo. (mg)	0.60	0.70	0.60	0.70	0.60	0.80	0.60	0.70	0.80	1.00	0.60	0.80
Niacin (mg)	10	10	9	9	10	12	10	11	14	14	11	12
Vit.C (mg)	22	24	20	24	24	27	22	28	24	37	26	32

Table 19 TIME TRENDS IN AVERAGE DAILY INTAKE OF NUTRIENTS (Median) BY AGE GROUPS/SEX

Nutrients	Adult Males		Adult Females (NPNL)		Pregnant Women		Lactating Women	
	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)	(1975-79)	(1996-97)
Protien (g)	55.7	60.1	45.4	49.9	40.8	47.2	47.6	56.5
Tot fat (g)	20.3	27.4	17.1	24.5	18.8	21.5	18.3	24.6
Energy (Kcal)	2065	2418	1698	1983	1597	1994	1797	2243
Calcium (mg)	98	421	330	382	390	339	358	373
Iron (mg)	26	27	21	22	20	23	23	23
Vit A (ug)	142	172	118	148	160	142	133	162
Thiamin (mg)	1.30	1.10	1.00	0.90	1.00	0.90	1.10	1.10
Ribo (mg)	0.80	1.00	0.70	0.80	0.60	0.80	0.70	0.90
Niacin (mg)	13	14	11	12	10	11	12	14
Vit C (mg)	28	36	24	32	21	28	23	29

NPNL: Non Pregnant Non Lactating

TIME TRENDS

NUTRIENT INTAKE :

- **Increase in intakes of protein and energy was observed in all ages.**
- **Increase was also noticed in the micronutrient intakes from 1976-79 to 1996-97.**

TABLE 20 STATISTICAL COMPARISION OF INTAKE OF NUTRIENTS # BETWEEN PERIODS (1975-79,1996-97) AMONG DIFFERENT AGE GROUPS/SEX

AGE	PROTEIN	TOTAL FAT	ENERGY	IRON	VIT A.
1-3	**↓	NS↑	NS↓	**↓	NS↓
4-6	NS↑	**↑	**↑	NS↓	**↑
7-9	**↑	**↑	**↑	P<0.06↑	**↑
10-12 Boys	**↑	**↑	**↑	P<0.06↑	**↑
10-12 Girls	NS↑	**↑	**↑	NS↑	NS↑
13-15 Boys	**↑	**↑	**↑	NS↑	**↑
13-15 Girls	**↑	**↑	**↑	NS↑	**↑
16-18 Boys	NS↑	**↑	**↑	NS↑	**↑
16-18 Girls	**↑	**↑	**↑	NS↓	**↑
Adult Males	**↑	**↑	**↑	**↑	**↑
NPNL	**↑	**↑	**↑	**↑	**↑
Pregnant	NS↑	NS↑	**↑	NS↑	NS↓
Lactating	**↑	**↑	**↑	**↑	**↑

MEDIANS HAVE BEEN COMPARED USING NON-PARAMETRIC MEDIAN TEST
NPNL: Non Pregnant Non Lactating
↑ : Increase ↓ : Decrease NS : Not Significant ** : p < 0.01

5. COMMENTS

The report presents intakes of individuals of different ages and physiological status. The variation in food and nutrient intakes was very high, making comparison of mean intakes different. In general, the food and nutrient intakes were much below the RDI. Specifically, the intake of protective foods like pulses, GLV, flesh foods and milk & milk products was unsatisfactory. In fact, the variation in the intakes was large, indicating that the percent of individuals consuming these foods was small. Similarly, the consumption of micronutrients were poor. For example, only about 10% of the individuals were consuming adequate amounts of vitamin A, iron or riboflavin. The results indicated that, by and large, the improvements in the median intakes are at variance with those reported earlier based on family diet survey. While improvement in individual intake is in tune with improvement in nutritional status, there is a need to examine the reasons for the differences between household diet survey and 24 hour recall diet survey.

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