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CORRELATES OF MACRONUTRIENTS INTAKE OF URBAN ADOLESCENT GIRLS OF VARANASI

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ABSTRACT

Among modifiable factors of nutritional status dietary adequacy in terms of macronutrients is of paramount importance. Under nutrition has been a significant problem in adolescent girls primarily due to food gap. Any effort to tackle this problem calls for pinpointing correlates of macronutrient intake by them. Objectives of the study are to assess macronutrients intake of study subjects and to pinpoint correlates of macronutrients intake. A community based cross sectional study was undertaken on 400 adolescent girls (10-19 years) of urban Varanasi, selected by adopting appropriate sampling technique. Their socio-demographic and other relevant information were obtained by interviewing parents or other responsible family member. Dietary intake of subjects was assessed by 24 hours recall oral questionnaire method and macronutrient intake was computed by using nutritive value for Indian foods. Average intake of energy, protein and fat was 1212 ± 38.10 Kcal, 34.20 ± 9.78 gm and 22.16 ± 13.96 gm/day, respectively. These values were 56.03%, 67.19% and 67.12 % of respective estimated RDAs. Of the several associates (viz age, type of family, subject's literacy status and number of siblings) only type of family and number of siblings correlated with energy intake on logistic model having correct predictability of 72.5% .AORs for joint family and number of siblings >7 were 0.54 (CI: 0.32-0.92) and 4.38(CI: 1.19-16.12), respectively. Menstrual status and fat intake were significantly associated with each other. Age, caste, family size, SES, family and per capita income, nutrition information were significant associates of fat consumption; effect of these parameters (except age and family size) got eliminated in logistic model. Macronutrients deficiency prevailed in the urban adolescent girls and had a socio demographic gradient.

Key words: Adolescent girls, Macronutrients, Nutrient intake, Recommended Dietary Allowances.

INTRODUCTION

According to World Health Organization (2000) an adolescent is any person between the ages of 10 and 19 years. This is the phase of life when important changes occur in different dimensions of life, such as physical, biological and emotional growth and maturity. Adolescence is an intense anabolic period when requirements for all nutrients increase. During this period, 20% of final adult height and 50% of adult weight attained (Mulugeta et al, 2009) .Meeting the increased demands for energy and nutrients is critical around the time of puberty if sexual development and the adolescent growth spurt are to be sustained. It has been suggested that protein might be specially important in this regard (Mitchell,1964). In general adolescent girls are the worst sufferers of the ravages of various forms of malnutrition because of their increased nutritional need and low social power.

Adolescent nutritional problems are common throughout the country. They have to encounter a series of serious nutritional challenges not only affecting their growth and development but also their livelihood as adults.

Yet adolescents remain largely neglected and hard to reach population. Thus it is not surprising that adolescent girl population who are “mother to be” are the most important section on which the future of nation depends. The poor nutritional status of girls has important implication in terms of physical work capacity and adverse reproductive outcome (Gupta and Kochar, 2008).

Adolescent mothers are at a higher risk of miscarriages, maternal mortality and give birth to stillborn and under weight babies. The mother's condition before pregnancy is a key determinant of its outcome; half of adolescents (boys and girls) have below normal body mass index (BMI) and almost 56% of adolescent girls aged 15–19 years have anaemia. In India, 22% babies born each year have low birth weight, which has been linked to maternal under-nutrition and anaemia among other causes (Government of India, 2013). Diets of Indian adolescent girls are inadequate both in terms of quality and quantity (Gupta et al., 2001). Physical health of adolescent girls is basically determined by their nutrition. Eating habits and dietary behaviour picked up during adolescence have

lifelong impact. Adolescence is the last chance to correct the growth lag and malnutrition (Working Group on Development of Children, 2007).

Adolescent health has been a neglected area so far. Government initiatives only would not be sufficient to address their problems. Health of adolescents ultimately depends on their own actions, choices and behaviour. However, families, communities, governmental and nongovernmental organizations can not shrink from their responsibilities. Besides initiating several health and nutrition programmes empowerment of adolescents through family life and nutrition education is desired (Ministry of Youth Affairs & Sports, 2011).

Adolescence has traditionally been considered the most difficult period in an individual's development cycle. The changes that adolescents undergo are not only stressful but confusing since these changes occur simultaneously and rapidly in the absence of any kind of support and expert guidance to cope with the transition. (Ministry of Women and Child Development, 2006). Little attention has been paid to adolescent nutrition in developing countries even in the quantitative terms particularly in urban adolescent girls (Waslien and Stewart, 1994). This scientific communication attempts to examine correlates of macronutrient intake of urban adolescent girls of Varanasi.

MATERIAL AND METHODS

SETTING

This study was conducted in urban areas of Varanasi district having a population of 1599260 which is 43.43% of total population of Varanasi (3682194). Sex ratio of the district was 909 (Rural: 926; Urban: 887). Overall literacy rate was 77.08%: corresponding value for male and female subjects was 85.12% and 68.2%, respectively (Census, 2011).

STUDY DESIGN

A community based cross sectional design was adopted for this study.

STUDY SAMPLE

Adolescent girls age group 10-19 years were considered for this study. Subjects not available even after 3 visits were excluded from this study.

SAMPLE SIZE

Sample size estimation for this study was based on the consideration of prevalence of under nutrition in adolescent girls to the extent of 60 percent and permissible level of error as 10 percent. This worked out to be 256. Taking design effect of 1.5 the required sample size became 384. Thus the total sample size was fixed to 400.

SAMPLING METHODOLOGY

Following steps were involved in the selection of study sample:

Step 1: Varanasi city comprises of five zones (Kotwali, Dashaswamedh, Bhelupur, Adampur and Varunapar). Out of these zones of Varanasi city, two zones

(Bhelupur and Varunapar) were selected by simple random sampling technique.

Step 2: In the second stage, in each selected zone one ward was selected by the same procedure.

Step 3: In each selected ward two mohallas were selected by simple random procedure. The selected mohallas were Sunderpur, Naria, Teliabag and Englishaline, respectively.

Step 4: In the selected mohallas household were selected according to their probability proportion to size adopting simple random sampling. In a household with more than one family, a family was selected by random technique. From each selected family an adolescent girl was selected by random technique. In case of non availability of adolescent girl in the selected family a nearby family having adolescent girl was taken.

TOOLS OF STUDY

Predesigned and pretested proforma was used for this study

TECHNIQUES OF STUDY

This study had approval of the Academic Bodies of Banaras Hindu University. Prior consent of study subjects and her parents was taken before interviewing them. Sociodemographic information of study subjects was assessed by Interview technique. Dietary intake of study subjects was assessed by 24 Hours dietary recall method. Macronutrients intake was estimated by using Nutritive value of Indian Food (Gopalan et al, 1989). Information about nature of diet, frequency of meal and timing of meal was also elicited by interviewing them using predesigned and pretested proforma.

ANALYSIS OF DATA

Data thus generated were analyzed with the help of Microsoft excel 2007 and SPSS version 16th software. Appropriate tables were generated. Statistical tests χ^2 , and logistic regressions were applied; AOR and CI were computed for inference.

RESULTS AND DISCUSSION

Average macronutrient intake of study subjects is given in table 1. Average calorie consumption (1212 \pm 381.10 Kcal/day) of the study subjects was 56.03 % of the estimated RDA. Although several studies have reported lower intake of energy in comparison to RDA, in this study energy intake was less than that reported by NIN (2000) whereas Sharma et al (2005) reported less average intake than the present study. Energy deficit has been also reported in a study conducted in urban Bangladesh (Khan et al, 2005). Mean protein and fat intake of the subjects were 34.20 \pm 9.78 gm and 22.15 \pm 13.96 gm per day, respectively; these values were about two-third of the respective estimated RDAs. The mean protein intake of adolescent girls included in this study had been much lower than the figure of 44.09 \pm 20.9 gm/day in students of Delhi (Sharma et al, 2005). However, in both the studies intake was less in comparison to RDA values. A study conducted in Bangladesh by Khan et al (2005) reported similar findings. In contrast a study on urban adolescent

girls of the same country (Kurshid et al, 2010) reported more intakes of macronutrients. The findings of this study were similar to that of Uma et al (2011) in terms of energy and protein intake. In nutshell the views expressed by Parimalavalli et al (2011) regarding nutritional inadequacy as reason of malnutrition can be endorsed on the basis of figure of the study as well. Adverse dietary intake in general and in low income group in particular has been established fact in case of urban adolescent girls. (Devadas, 1986; Gopaldas, 1983; Thakore, 1989; Satyanarayana, 1981) predominantly due to less access to food and inadequate knowledge about dietary requirements.

Table.1 Average macronutrient intake of study subjects

Nutrient	Nutrient intake Mean ± SD	Estimated RDA	% of RDA
Calorie (Kcal/day)	1212 ± 381.10	2163.2	56.03
Protein (gm/day)	34.20 ± 9.78	50.9	67.19
Fat (gm/day)	22.15 ± 13.96	33	67.12

Energy requirement varies according to age. Therefore, adequacy of energy at different age point requires a consideration of respective recommended dietary allowances (RDAs). Age wise energy intake and percentage intake with respect to RDA are given in figure 1. Mean energy intake as percentage of RDA was maximum (72.63%) for the age group 18 to 19 years. Average intake of energy were 1066±330.97, 1129±332.29 and 1258±415.93Kcal per day in the age group 10-12 , 13-15 and 16-17 years, respectively. These values were 53.03%, 48.45% and 51.56% of the respective RDA values.

Adolescence is period of extensive growth and therefore protein intake at different age points have significant impact on physical health. Average protein intake in the age group 10-12 years and 18-19 was 30.57±8.25 and 38.38±9.33 gm/day, respectively. These values

were 75.67% and 72.63% of the respective RDA values. Protein intake as percentage of RDA was 61.91% in the age group 13-15 years and 51.56 %in the age group 16-17 years (Table 2).

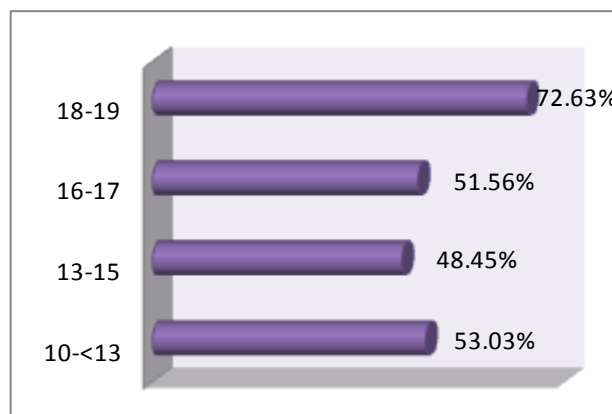


Figure.1: Age wise (years) Energy intake of study subjects

Fat is the rich source of energy and it serves as an important vehicle for fat solvent vitamins. Average fat intake of study subjects, given in table 3, reveals that percentage intake of fat with respect to RDA was maximum in the age group 18-19 years. Two processes have contributed to this situation. These are (a) Higher intake in this age group and (b) Lower RDA value (i.e. 20 gm per day) set for this age group (ICMR). Average fat intake (27.09 ±14.35 gm/day) of subjects belonging to age group 18-19 years was 135.45 % of the RDA. Daily mean intake of fat as percentage of respective RDAs was 51.11% in 10-12 years, 50.22% in 13-15 years and 65.63 % in 16-17 years. Percentage intake with respect of RDA were computed for macronutrients (Table 4) Energy, protein and fat intakes were ≤60% of RDA in 69.5%, 38.5% and 54.7% subjects, respectively. Energy, protein and fat intake were more than 80% in 8.7%, 23.5% and 33.2% subjects, respectively.

Table: 2.Age wise Protein intake of study subjects

Age group(years)	N	Mean intake (Gm/day)	RDA	Percentage intake	Range
10-12	94	30.57±8.25	40.4	75.67	9.86-52.86
13-15	104	32.13±9.10	51.9	61.91	11.605-53.88
16-17	93	35.29 ±10.55	55.5	51.56	11.605-59.361
18-19	109	38.38±9.33	55.0	72.63	18.79-57.375
Overall	400	34.20±9.78	50.9	67.19	9.86-59.361

Table: 3- Age wise Fat intake of study subjects

Age group(years)	N	Mean intake (Gm/day)	RDA	Percentage intake	Range
10-12	94	17.89±11.98	35	51.11	2.495-56.915
13-15	104	20.09 ±13.03	40	50.22	2.205-51.55
16-17	93	22.97 ±14.67	35	65.63	4.35-61.498
18-19	109	27.10 ±14.35	20	135.45	2.17-58.142
Overall	400	22.15 ± 13.96	33	67.12	2.17-58.142

Table 4- Macronutrient intake of adolescent girls as percentage of Recommended Dietary Allowances n = (400)

Percentage intake of RDA	Energy		Protein		Fat	
	No	%	No	%	No	%
<50	182	45.5	76	19.0	193	48.2
50.1-60	96	24.0	78	19.5	26	6.5
60.1-70	55	13.8	78	19.5	19	4.8
70.1-80	32	8.0	74	18.5	29	7.2
80.1-90	24	6.0	41	10.2	26	6.5
90.1-100	10	2.5	27	6.8	25	6.2
>100	01	0.2	26	6.5	82	20.5

As much as 57.0% and 52.4% subjects belonging to the age group 10-14 years and 15-17 years had calorie consumption < 50% of RDA ; corresponding value for 18-19 years was 20.2 % (p<0.001). Less than 50% calorie consumption was significantly (p<0.001) more in adolescent girls belonging to SC caste (60.9%) than OBC (44.5%) and others (40.9%). Eighty six (41.5%) subjects

having family size 3-6 had calorie consumption < 50% of RDA; corresponding value for subjects with family size 7-9 and 10-12 were 57.7% and 50.0% , respectively (p<0.001). In case 42.6% subjects with number of sibling ≤4 energy deficit was >50%; corresponding value for subjects having sibling 5-7 was 56.0% (p<0.05). Total income of the family as well as per capita income was significantly (p<0.05) associated with energy intake. In case of 52.8% subjects with per capita income ≤Rs780 per month, calorie consumption was <50%; this was significantly more than subjects having per capita income >Rs780 per month. Subjects with calorie consumption <50% were maximum (62.3%) for those having literacy status as middle; this was least (16.3%) in subjects being in graduation (p<0.001). There existed no significant (p>0.05) association among energy consumption and religion, type of family, menstrual status, socioeconomic status, literacy , occupation of parents, nature of diet, frequency and timing of meal (Table 5).

Table 5 - Energy consumption of adolescent girls according to their socio demographic and personal characteristics

Parameters		n	Calorie consumption as percentage of RDA						x ²	df	p
			<50%		50-80%		>80%				
			No.	%	No.	%	No.	%			
Age (Years)	10 – 14	165	94	57.0	61	37.0	10	6.1	40.93	4	0.000
	15 – 17	126	66	52.4	52	41.3	8	6.3			
	18 - 19	109	22	20.2	70	64.2	17	15.5			
Religion	Hindu	377	172	45.6	174	46.2	31	8.2	2.33	2	0.311
	Muslim	23	10	43.5	9	39.1	4	17.4			
Caste	SC	64	39	60.9	23	35.9	2	3.1	12.45	4	0.014
	OBC	155	69	44.5	76	49.0	10	6.5			
	Others	181	74	40.9	84	46.4	23	12.7			
Type of family	Nuclear	256	112	43.8	121	47.3	23	9.0	0.88	2	0.644
	Joint	144	70	48.6	62	43.1	12	8.3			
Family size	≤ 3-6	207	86	41.5	103	49.8	18	8.7	17.72	6	0.007
	7-12	149	83	55.7	51	34.2	15	10.1			
	>12	44	13	29.5	29	65.9	2	4.5			
Sibling	≤4	270	115	42.6	130	48.1	25	9.3	12.89	4	0.012
	5-7	116	65	56.0	44	38.0	7	6.0			
	>7	14	2	14.2	9	64.3	3	21.4			
Menstrual status	Non -menstruating	77	41	53.2	31	40.2	5	6.4	2.44	2	0.295
	Menstruating	323	141	43.7	152	47.0	30	9.3			
Total income of family (Rs. / Month)	≤ 4000	130	70	53.8	54	41.5	6	4.6	29.96	8	0.000
	4001-8000	101	40	39.6	51	50.5	10	9.9			
	8001-12000	53	25	47.2	26	49.1	2	3.8			
	12001-16000	30	21	70.0	8	26.7	1	3.3			
	>16000	86	26	30.2	44	51.2	16	18.6			
Per capita income	≤780	163	86	52.8	68	41.7	9	5.5	7.44	2	0.024
	>780	237	96	40.5	115	48.5	26	11.0			
Socio economic status	Low	36	15	41.7	18	50.0	3	8.3	10.54	8	0.229
	Lower middle	64	38	59.4	22	34.4	4	6.2			
	Middle	170	70	41.2	88	51.8	12	7.1			
	Upper Middle	75	35	46.7	30	40.0	10	13.3			
	High	55	24	43.6	25	45.5	6	10.9			

Literacy status of Father	Illiterate	6	3	50.0	3	50.0	0	0.0	8.60	6	0.197
	Up to middle	79	34	43.0	40	50.6	5	6.3			
	Up to intermediate	226	94	41.6	110	48.7	22	9.7			
	Graduation to above	89	51	57.3	30	33.7	8	9.0			
Mother Literacy	Illiterate	109	51	46.8	52	47.7	6	5.5	3.53	6	0.740
	Just literate to middle	138	59	42.8	64	46.4	15	10.9			
	High school to intermediate	135	62	45.9	61	45.2	12	8.9			
	Graduation and above	18	10	55.6	6	33.3	2	11.1			
Literacy status of subject	Primary	76	40	52.6	32	42.1	4	5.3	43.53	8	0.000
	Middle	77	48	62.3	24	31.2	5	6.5			
	High school	102	53	52.0	43	42.2	6	5.9			
	intermediate	96	33	34.4	55	57.3	8	8.3			
	Graduation	49	8	16.3	29	59.2	12	24.5			
Father occupation	Dead	15	7	46.7	7	46.7	1	6.7	1.41	6	0.965
	Job	171	83	48.5	73	42.7	15	8.8			
	Business	167	71	42.5	81	48.5	15	9.0			
	Farmer/labour	47	21	44.7	22	46.8	4	8.5			
Mother occupation	Dead	14	5	35.7	9	64.3	0	0.0	7.46	6	0.280
	Job	28	12	42.9	12	42.9	4	14.3			
	Business	20	12	60.0	5	25.0	3	15.0			
	House wife	338	153	45.3	157	46.4	28	8.3			
Nature of diet	Vegetarian	137	62	45.3	57	41.6	18	13.1	7.00	4	0.136
	Non-Vegetarian	193	84	43.5	97	50.3	12	6.2			
	Eggetarian	70	36	51.4	29	41.4	5	7.1			
Frequency of meal	2 times	31	17	54.8	12	38.7	2	6.5	5.79	4	0.215
	3times	259	122	47.1	111	42.9	26	10.0			
	4times	110	43	39.1	60	54.5	7	6.4			
Timing of meal	Fixed	241	106	44.0	116	48.1	19	7.9	1.57	2	0.454
	Irregular	159	76	47.8	67	42.1	16	10.1			

Table: 6 Result of Logistic Regression Analysis (risk of less energy intake verses Socio demographic characteristics)

Particulars	Variables	Percentage of observation	Beta	P-value	AOR	95.0% C.I.
Age (years)	10-14	40.2	-	-	-	-
	15-17	31.5	0.05	0.90	0.95	0.47-1.92
	18-19	27.2	0.51	0.22	1.66	0.73-3.78
Type of family	Nuclear	64.0	-	-	-	-
	Joint	36.0	0.62	0.02	0.54	0.32-0.92
Subject Literacy	Primary	19.0	-	-	-	-
	Middle	19.2	0.32	0.44	0.73	0.32-1.63
	High school	25.5	0.30	0.47	1.35	0.59-3.09
	Intermediate	24.0	0.09	0.858	0.92	0.37-2.31
	Graduation	12.0	0.63	0.27	1.87	0.62-5.59
Sibling	≤4	67.5	-	-	-	-
	5-7	29.0	0.28	0.32	0.76	0.44-1.32
	>7	3.5	1.48	0.03	4.38	1.19-16.12

Table: 7. Protein consumption of adolescent girls according to their socio demographic and personal characteristics

Parameters	n	Protein consumption as percentage of RDA						x ²	df	p	
		<50%		50-80%		>80%					
		No.	%	No.	%	No.	%				
Age (Years)	10 – 14	165	30	18.2	95	57.6	40	24.2	9.255	4	0.055
	15 – 17	126	30	23.8	71	56.3	25	19.8			

	18 - 19	109	10	9.2	69	63.3	30	27.5			
Religion	Hindu	377	67	17.8	222	58.9	88	23.3	0.757	2	0.685
	Muslim	23	3	13.0	13	56.5	7	30.4			
Caste	SC	64	8	12.5	44	68.8	12	18.8	3.351	4	0.501
	OBC	155	30	19.4	87	56.1	38	24.5			
	Others	181	32	17.7	104	57.5	45	24.9			
Type of family	Nuclear	256	41	16.0	153	59.8	62	24.2	1.086	2	0.581
	Joint	144	29	20.1	82	56.9	33	22.9			
Family size	≤ 3-6	207	32	15.5	125	60.4	50	24.2	2.876	4	0.579
	7-12	149	32	21.5	82	55.0	35	23.5			
	>12	44	6	13.6	28	63.6	10	22.7			
Sibling	≤ 4	270	41	15.2	165	61.1	64	23.7	7.822	4	0.098
	5-7	116	28	24.1	63	54.3	25	21.6			
	>7	14	1	7.1	7	21.6	6	42.9			
Menstrual status	Menstruating	323	61	18.9	189	58.5	73	22.6	2.790	2	0.248
	Nonmenstruating	77	9	11.7	46	59.7	22	28.6			
Total income of family (Rs. / Month)	≤ 4000	130	23	17.7	79	60.8	28	21.5	6.503	6	0.369
	4001-8000	101	21	20.8	58	57.4	22	21.8			
	8001-12000	53	12	22.6	31	58.5	10	18.9			
	12001->16000	116	14	12.1	67	57.8	35	30.2			
Per capita income	≤780	163	29	17.8	99	60.7	35	21.5	0.799	2	0.671
	>780	237	41	17.3	136	57.4	60	25.3			
Socio economic status	Low + Lower middle	100	18	18.0	61	61.0	21	21.0	1.205	4	0.877
	Middle	170	30	17.6	101	59.4	39	22.9			
	Upper Middle+ High	130	22	16.9	73	56.1	35	26.9			
Literacy status of Father	Illiterate	6	0	0.0	4	66.7	2	33.3	5.705	6	0.457
	Up to middle	79	18	22.8	44	55.7	17	21.5			
	Up to intermediate	226	36	15.9	130	57.5	60	26.5			
	Graduation to above	89	16	18.0	57	64.0	16	18.0			
Mother Literacy	Illiterate	109	22	20.2	63	57.8	24	22.0	4.628	6	0.592
	Just literate to middle	138	27	19.6	75	54.3	36	26.1			
	High school to intermediate	135	17	12.6	87	64.4	31	23.0			
	Graduation and above	18	4	22.2	10	55.6	4	22.2			
Literacy status of subject	Primary	76	10	13.2	47	61.8	19	25.0	7.867	8	0.447
	Middle	77	15	19.5	47	61.0	15	19.5			
	High school	102	19	18.6	62	60.8	21	20.6			
	intermediate	96	21	21.9	52	54.2	23	24.0			
	Graduation	49	5	10.2	27	55.1	17	34.7			
Father occupation	Dead	15	3	20.0	9	60.0	3	20.0	2.713	6	0.844
	Job	171	30	17.5	96	56.1	45	26.3			
	Business	167	27	16.2	105	62.9	35	21.1			
	Farmer/labour	47	10	21.3	25	53.2	12	25.5			
Mother occupation	Dead	14	2	14.3	8	57.1	4	28.6	7.297	6	0.294
	Job	28	4	14.3	16	57.1	8	28.6			
	Business	20	1	5.0	10	50.0	9	45.0			
	House wife	338	63	18.6	201	59.5	74	21.9			
Nature of diet	Vegetarian	137	28	20.4	74	54.0	35	25.5	3.040	4	0.551
	Non-Vegetarian	193	33	17.1	115	59.6	45	23.3			
	Eggetarian	70	9	12.9	46	65.7	15	21.4			
Frequency of	2 times	31	9	29.0	16	51.6	6	19.4	3.806	4	0.433

meal	3times	259	45	17.4	154	59.5	60	23.2	0.034	2	0.983
	4times	110	16	14.5	65	59.1	29	26.4			
Timing of meal	Fixed	241	42	17.4	141	58.5	58	24.1	0.034	2	0.983
	Irregular	159	28	17.6	94	59.1	37	23.3			

Table: 8 Fat consumption of adolescent girls according to their socio demographic and personal characteristics

Parameters		n	Fat consumption as percentage of RDA						x ²	df	p
			<50%		50-80%		>80%				
			No.	%	No.	%	No.	%			
AGE (Years)	10 – 14	165	102	61.8	33	20.0	30	18.2	46.152	4	0.000
	15 – 17	126	60	47.6	24	19.0	42	33.3			
	18 - 19	109	30	27.5	17	15.6	62	59.9			
Religion	Hindu	377	182	48.3	71	18.8	124	32.9	1.222	2	0.543
	Muslim	23	10	43.5	3	13.0	10	43.5			
Caste	SC	64	36	56.2	14	21.9	14	21.9	7.333	4	0.119
	OBC	155	79	51.0	27	17.4	49	31.6			
	Others	181	77	42.5	33	18.2	71	39.2			
Type of family	Nuclear	256	120	46.9	44	17.2	92	35.9	2.111	2	0.348
	Joint	144	72	50.0	30	20.8	42	29.2			
Family size	≤ 3-6	207	92	44.4	36	17.4	79	38.2	15.850	4	0.003
	7-12	149	87	58.4	27	18.1	35	23.5			
	>12	44	13	29.5	11	25.0	20	45.5			
Sibling	≤ 4	270	119	44.1	55	20.4	96	35.6	8.358	4	0.079
	5-7	116	67	57.8	18	15.5	31	26.7			
	>7	14	6	42.9	1	7.1	7	50.0			
Menstrual status	Nonmenstruating	77	47	61.0	19	24.7	11	14.3	15.852	2	0.000
	Menstruating	323	145	44.9	55	17.0	123	38.1			
Total income of family (Rs. / Month)	≤ 4000	130	77	59.2	25	19.2	28	21.5	19.149	6	0.004
	4001-8000	101	44	43.6	22	21.8	35	34.7			
	8001-12000	53	27	50.9	9	17.0	17	32.1			
	12001->16000	116	44	37.9	18	15.5	54	46.6			
Per capita income	≤780	163	93	57.1	32	19.6	38	23.3	13.412	2	0.001
	>780	237	99	41.8	42	17.7	96	40.5			
Socio economic status	Low+ Lower middle	100	56	56.0	22	22.0	22	22.0	12.630	4	0.013
	Middle	170	85	50.0	30	17.6	55	32.4			
	Upper Middle+ High	130	51	39.2	22	16.9	57	43.8			
Literacy status of Father	Illiterate	6	3	50.0	2	33.3	1	16.7	9.260	6	0.159
	Up to middle	79	41	51.9	20	25.3	18	22.8			
	Up to intermediate	226	106	46.9	34	15.0	86	38.1			
	Graduation to above	89	42	47.2	18	20.2	29	32.6			
Mother Literacy	Illiterate	109	54	49.5	26	23.9	29	26.6	9.328	6	0.156
	Just literate to middle	138	60	43.5	20	14.5	58	42.0			
	High school to intermediate	135	70	51.9	25	18.5	40	29.6			
	Graduation and above	18	8	44.4	3	16.7	7	38.9			
Literacy status of study subject	Primary	76	49	64.5	15	19.7	12	15.8	49.233	8	0.000
	Middle	77	47	61.0	19	24.7	11	14.3			
	High school	102	47	46.1	18	17.6	37	36.3			
	intermediate	96	38	39.6	14	14.6	44	45.8			
	Graduation	49	11	22.4	8	16.3	30	61.2			
	Dead	15	6	40.0	4	26.7	5	33.3	3.298	6	0.771

Father occupation	Job	171	80	46.8	28	16.4	63	36.8			
	Business	167	85	50.9	33	19.8	49	29.3			
	Farmer/labour	47	21	44.7	9	19.1	17	36.2			
Mother occupation	Dead	14	8	57.1	2	14.3	4	28.6	4.163	6	0.655
	Job	28	11	39.3	4	14.3	13	46.4			
	Business	20	8	40.0	3	15.0	9	45.0			
	House wife	338	165	48.8	65	19.2	108	32.0			
Nature of diet	Vegetarian	137	66	48.2	19	13.9	52	38.0	4.911	4	0.297
	Non-Vegetarian	193	89	46.1	43	22.3	61	31.6			
	Edgetarian	70	37	52.9	12	17.1	21	30.0			
Frequency of meal	2 times	31	17	54.8	6	19.4	8	25.8	4.292	4	0.368
	3times	259	127	49.0	51	19.7	81	31.3			
	4times	110	48	43.6	17	15.5	45	40.9			
Timing of meal	Fixed	241	111	46.1	49	20.3	81	33.6	1.578	2	0.454
	Irregular	159	81	50.9	25	15.7	53	33.3			

Table: 9 Result of Logistic Regression Analysis (risk of less fat intake status verses Socio demographic characteristics)

Particulars	Variables	Percentage of observations	Beta	P-value	AOR	95.0% C.I.
Age (years)	10-14	40.2	-	-	-	-
	15-17	31.5	0.22	0.53	1.25	0.62-2.50
	18-19	27.2	1.20	0.01	3.33	1.39-7.96
Caste	SC	16.0	-	-	-	-
	OBC	38.7	0.47	0.19	0.63	0.31-1.25
	Others	45.3	0.19	0.47	0.82	0.49-1.39
Per capita income(Rs)	<780	40.8	-	-	-	-
	≥780	59.2	0.71	0.45	0.49	0.08-3.17
Subject Literacy	Primary	19.0	-	-	-	-
	Middle	19.2	0.45	0.28	0.63	0.28-1.45
	High school	25.5	0.25	0.60	1.28	0.50-3.28
	Intermediate	24.0	0.19	0.73	1.21	0.42-3.52
	Graduation	12.0	0.23	0.73	1.26	0.34-4.66
Menstrual-status	Menstruating	80.7	-	-	-	-
	Non menstruating	19.3	0.23	0.58	0.79	0.35-1.78
Family-Size	≤6	51.8	-	-	-	-
	7-12	37.2	0.80	0.16	0.45	0.15-1.38
	>12	11.0	-1.13	0.02	0.32	0.12-0.84
Family-income	<4000	32.5	-	-	-	-
	4001-8000	25.2	0.15	0.85	0.86	0.167-4.42
	8001-12000	13.2	0.15	0.78	1.16	0.40-3.41
	>12000	29.0	0.49	0.31	0.61	0.24-1.58
Socio economic status	Low-Lower middle	25.0	-	-	-	-
	Middle	42.5	0.46	0.37	1.59	0.57-4.40
	Upper	32.5	0.32	0.45	1.37	0.60-3.13
	Middle+ High					

In comparison to adolescent girls from nuclear families, risk of less energy intake was less (AOR 0.54; CI: 0.32-0.92) in those from joint families. Risk of less energy intake was significantly more (AOR 4.38; CI: 1.19-16.12) in subjects having family size >7. In logistic model effect of age and subjects literacy were not significant for

less energy intake. The appropriateness of the model for correct prediction of energy intake was 72.5% which is acceptable.

As much as 18.2% (10-14 years), 23.8% (15-17 years) and 9.2% (18-19 years) subjects had protein consumption less than 50 percent of RDA (p>0.05).

Protein consumption as percentage of RDA did not differ significantly in subjects having different religion, caste, type of family, family size, number of siblings, total family income, per capita income, socio economic status, literacy status of subjects and parents and occupation of parents. ($p > 0.05$). In case of 18.9% menstruating and 11.7% non menstruating subjects protein consumption was <50 percent of the RDA. Protein consumption as percentage of RDA were similar in vegetarian, nonvegetarian and eggetarian subjects ($p > 0.05$). Subjects with protein consumption <50% of RDA were 20.4%, 17.1% and 12.9% in respective categories. As much as 29.0%, 17.4% and 14.5% subjects having frequency of meal twice, thrice and 4 times a day, respectively, had protein consumption <50% of RDA ($p > 0.05$). There existed no significant ($p > 0.05$) association between timing of meal of study subjects and their protein consumption as percentage of RDA.

In case of 61.8% subjects in the age range 10-14 years fat consumption was <50% of RDA; corresponding value in the age group 15-17 and 18-19 years were 47.6% and 27.5%, respectively ($p < 0.01$). There existed no significant ($p > 0.05$) association between fat consumption and religion, caste, type of family, nature of diet, siblings, parents literacy and occupation of study subjects. Fat consumption (as percentage of RDA) did not differ significantly ($p > 0.05$) in vegetarian, nonvegetarian and eggetarian subjects. In case of 48.2% vegetarian, 46.1% nonvegetarian and 52.9% eggetarian subjects fat consumption as percentage of RDA was less than 50 percent of RDA. There existed no significant ($p > 0.05$) association between fat consumption of study subjects and their frequency and timing of meals (Table 8).

In compression to subjects ≤ 14 years of age risk of less fat intake was more (AOR=3.33; CI: 1.39-7.96) in subjects 18-19 years. Taking family size ≤ 6 as reference category it was found that odds of less fat intake was less in subjects having family size > 12 . Effect of significant association of caste, PCI, subject's literacy, menstrual status, family income and SES and less fat intake in univariate analysis got eliminated in logistic model (Table-9). The appropriateness of the model for correct prediction of energy intake was 68.5% which is acceptable.

CONCLUSION

Macronutrient deficiency in the study subject had been conspicuous both in terms of average and percentage intake of RDA. Energy deficit as indicated by percentage intake with respect to the RDA prevailed in all age groups. Higher intake of the age group 18-19 years is a mere reflection of lower RDA value of energy set for this age group in comparison to other groups. Protein deficiency (percentage intake with reference of RDA) varied with the age; being least in the age group 10-12 years and maximum in 16-17 years. Fat intake as percentage of RDA varied according to the age. Highest value observed in the age group 18-19 years is due to lower RDA set for this nutrient. Risk of less energy intake was less in joint family

and with number of siblings > 7 . Variations in fat intake prevailed according to age and size of family.

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