

## Quantitative Analysis of Food Habits and Nutrient Intake of Adolescents in Two Different States in South India

K Hemamalini, B. Babitha, B. Lalitha Kumari,

Asst. Prof, Department of Food Technology Koneru Lakshmaiah Education Foundation, Vad-deswaram, Andhra Pradesh, India

Asst. Prof, Acharya Nagarjuna University, Guntur Dist, Andhra Pradesh, India  
Lecturer Loyola Jr College Guntur

### Abstract

All minerals are necessary for the overall growth of the child. Two minerals are special namely calcium necessary for rapid growth of bones and developing teeth and iron necessary for the formation of hemoglobin. In case of girls menstrual iron losses may predispose to simple iron deficiency anemia and need for iron are more. Since the rate of BMR (Basal Metabolic Rate) is high the iodine requirement also increased. Adequate water soluble and fat soluble vitamins should be included in adequate amount in the children's diet for their different functions. So after vast qualitative assessment, research continued on quantitative study which includes diet pattern of adolescents and intake of various biochemicals data taken in two regions of South India. Adolescent girls and boys of Andhra Pradesh and Tamilnadu were taken up study and their habits of taking their food and type of nutrients they were consuming were identified and analysed using Quantitative methods.

**Key words:** Dietary pattern, biochemicals, RDA, critical ratio test etc.

### Introduction

Irregular dietary habits have negative

consequences not only on health but on academic performance, concentration and memory. Enlightening the adolescent children on healthy dietary behavior should be put in the front position. To search the association between occurrence of intake of chosen foods and dental caries, a cross-sectional study was carried out. Adolescence is a period with rapid growth drive and demands higher nutrition. Improving nutritional status of rural adolescent girls becomes the cornerstone of community's nutritional status and target intervention for breaking inter generation cycle of nutritional deficiencies. There is high prevalence of under nutrition among adolescent girls and is under nutrition is associated with micronutrient deficiencies like anemia. There is need to create awareness to improve the nutritional needs of adolescent girls in rural areas (4). Nutrition Education is an essential component to improve the nutritional status of a population and is crucial for the well being of the people in general. Nutrition is an integrated part of many projects. In the past nutrition education process mainly consists of face to face conversation between health or community workers and individual person. People were informed what to do, rather encourage about health, fitness and nutrition. But in recent years,

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more effective nutrition education programs have been approached, with well-defined strategies in communication and behavioral psychology have been used, technical project staff with knowledge in nutrition and nutrition specialist with good communication skills. A global approach to nutrition based causes malnutrition, culturally determined norms and social communication of a community to bring long term behavioral change in the population (5). Hence, keeping all these problems of adolescents in mind, quantitative awareness has been created in the present article.

**Materials and Methods**

**Assessment of food habits, dietary and nutrient intake of subjects**

To understand the nutrient intake of an individual it is important to make dietary analysis. It is not a procedure to calculate adequate nutrition, it helps in evaluating intake and not the amount of nutrients absorbed or utilized for body mechanism.

Diet is a vital determinant of health and nutritional status of people. The dietary habits of individuals vary according to socio-economic factors, regional customs and traditions. Precise information on food consumption pattern of people, through application of appropriate methodology if often needed not only for assessing the nutritional status of people but also for elucidating the relationship of nutrient intake with deficiencies as well as degenerative diseases. An understanding of nutrient or excesses in the dietaries would help in planning diets to overcome diet related morbidities and thus promote health of people. Information on

food consumption pattern is also essential for assessing the food needs of population / groups al regional and national level Mahtab Bamji, (1996).

**Quantitative assessment**

Quantitative nutritional assessment was carried by the combination of 24-hr recall method and weighment method. The nutrient intake for each subject was calculated using nutrient composition table on the basis of 24-hours recall method. The intake of nutrients were compared with the recommended dietary allowance (RDA) for Indians 1CMR, (2010) (3) as to know deficit or excess intakes of the respondents and to compared among the children intakes of the two places.

**Results and Discussion**

**Common dietary pattern**

The information regarding the subject’s common dietary pattern was inquired in the questionnaire (Table 1). Majority of boys and girls of Vijayawada were consuming 5 meals followed by 4, 6 and 3meals per day. None of the subjects were observed in 2 and 7 meals pattern, 50 percent of boys and 56 percent of girls were taking 5 meals per day. 28percent of boys and 22.66 percent of girls were taking 4 meals per day and very less percent of children were taking 3meals. From Chennai same pattern was observed 46% of boys and 40.66% of girls were taking 5 meals per day. 40% of boys and 28% of girls were taking 6 meals per day. Only 13.33% boys and 28.66% girls were taking 4 meals per day. A few children were taking 3 meals per day. None of the subjects were observed in 2 meal pattern.

Table: 1 Dietary pattern of adolescents in Vijayawada and Chennai

S. No.	Category	Dietary Pattern			
		3 Meals	4 Meals	5 Meals	6 Meals
Vijayawada					
1	VNB	0 (0.00)	21(30.43)	37 (53.62)	11(15.94)
2	VOB	0 (0.00)	3(12.00)	27 (48.21)	11(44.00)
3	VUB	1(1.78)	18(32.14)	11 (44.00)	10(17.85)

	Total	1(0.66)	42(28.00)	75 (50.00)	32(21.33)
4	VNG	0 (0.00)	21(23.59)	48 (53.93)	20(22.47)
5	VOG	1(3.44)	7(24.13)	17 (58.62)	4(13.79)
6	VUG	1(3.12)	6(18.75)	19 (59.37)	6(18.75)
	Total	2(1.33)	34(22.66)	84 (56.00)	30(20.00)
Chennai					
1	CNB	0 (0.00)	12(14.81)	38 (46.91)	31(38.27)
2	COB	0 (0.00)	4(14.81)	9 (33.33)	14(51.85)
3	CUB	0 (0.00)	4(9.52)	22 (52.38)	15(35.71)
	Total	0 (0.00)	20(13.33)	69 (46.00)	60(40.00)
4	CNG	3(3.57)	23(27.38)	31 (36.90)	27(32.14)
5	COG	0 (0.00)	11(29.72)	17 (45.94)	9(24.32)
6	CUG	1(3.44)	9(31.03)	13 (44.82)	6(20.68)
	Total	4(2.66)	43(28.66)	61 (40.66)	42(28.00)
	Grand Total	7(1.16)	139 (23.16)	289 (48.16)	164 (27.33)

Note: Figures in parenthesis indicate percentages

#### **Mean intake of energy, carbohydrate and fat by adolescents**

The details of macro nutrient intake were presented in table 2 and Fig 1. The body needs energy for maintaining body temperature, metabolic activities, supporting growth and for physical activity. The energy intake of all adolescents in the study was low than their recommended allowances standards.

The high intake of energy from Vijayawada was observed in overweight boy 85.11% and in overweight girls 85.84% from Chennai. The least intake of energy was (71%) seen in underweight boys and underweight girls of Vijayawada. Standard error values (SE) had been higher in Vijayawada than Chennai. The carbohydrate intake was less when compared with RDA. The highest intake of carbohydrate in boys and girls was observed from Vijayawada in normal weight boys (67.38%) and (80.5%) in normal weight girls. The least intake was in underweight boys and underweight girls of Chennai (54.67% and 68.7%). SE values

had been higher in Vijayawada children than Chennai.

As per the RDA the fat intake was high in all subjects both from Vijayawada and Chennai. Even underweight children showed high intake of fat. Maximum percent of intake was observed in overweight boys (193.51%) from Vijayawada and overweight girls from Chennai (185.87%). Overall, fat intake was less in underweight boys and girls of Vijayawada (154%) as compared to others. The SE value was maximum in overweight girls (13.45) of Vijayawada and was least in overweight boys (2.77) of Chennai. The excess of fat intake was due to regular consumption of junk foods. The critical ratio test shows that the calculated value was less than table value at both the levels for all the groups. Hence, the hypothesis ( $H_4$ ) was accepted. Significant difference was observed between the mean intake of carbohydrate in normal weight boys and girls of Vijayawada ( $p < 0.05$ ) and Chennai ( $p < 0.01$ ) thus hypothesis ( $H_4$ ) was partially rejected.

Table: 2 Mean Values of energy, carbohydrate and fat intake of adolescents in Vijayawada and Chennai

S No	Category	Energy (Kcal)			CHO (g)			Fat (g)				
		Mean ±SD	SE	RDA#	Mean ±SD	SE	RDA#	Mean ±SD	SE	RDA#		
Macro Nutrient												
Vijayawada												
1	VNB	2259.98±793.53	95.53	2750	82.18	15.62	530	67.38	81.56±40.18	4.84	45	181.24
					346.83			87.08±				
					±106.97		65.43	40.01	8.0		193.51	
					1.67			1.10				
					302.6 ±72.9		57.09	±29.99	4.00		154.51	
					0.77			1.59				
1	VNG	1924.32±523.82	204.06		82.58	32.43	380	80.5	70.09 ±31.68	3.35	40	175.23
					±123.63			72.41	0.19			
					2.63**			±30.33				
2	VOG	1994.23±571.51	370.67	2330	298.24		78.48	±0.21	13.45		181.02	
					±80.26			61.79				
					0.48		70.36	±23.48	4.15		154.47	
3	VUG	1673.16±490.51	86.81		267.37			0.81				
					±84.82							
					0.30							
	Total	2022.06±640.33			315.6				73.38±33.93			
					±111.33							
Chennai												
1	CNB	2144.32±723.22	80.53		77.97	10.92	530	56.6	81.9±	3.97	45	182
					299.98±			76.8±	35.79			
					98.36		56.51	24.93	2.77		170.66	
					2750			80.23±				
					74.82		54.67	34.93	5.39		178.28	
					76.30							
3	CUB	2098.25±654.62	101.02		289.76±							
					87.11							
1	CNG	1821.78±580.19	63.33		78.18	8.09	380	69.83	71.06±	3.65	40	177.65
					265.37±			74.23±	33.52			
					7415		75.81	38.71	6.36		185.57	
					2330			68.19±				
					85.84		68.7		6.64		170.47	
					78.89							
3	CUG	1838.23±650.18	120.85		261.06±			35.75				
					76.15							
	Total	1992.41±660.16			283.59			75.91±				
					±57.59			34.66				

CR Values compared between two cities (Two states) Table Value for 1%, 5% reported in Appendix \*\* (p<0.01, \*p<0.05), (p>0.01, p>0.05) RDA Values from ICMR 2010

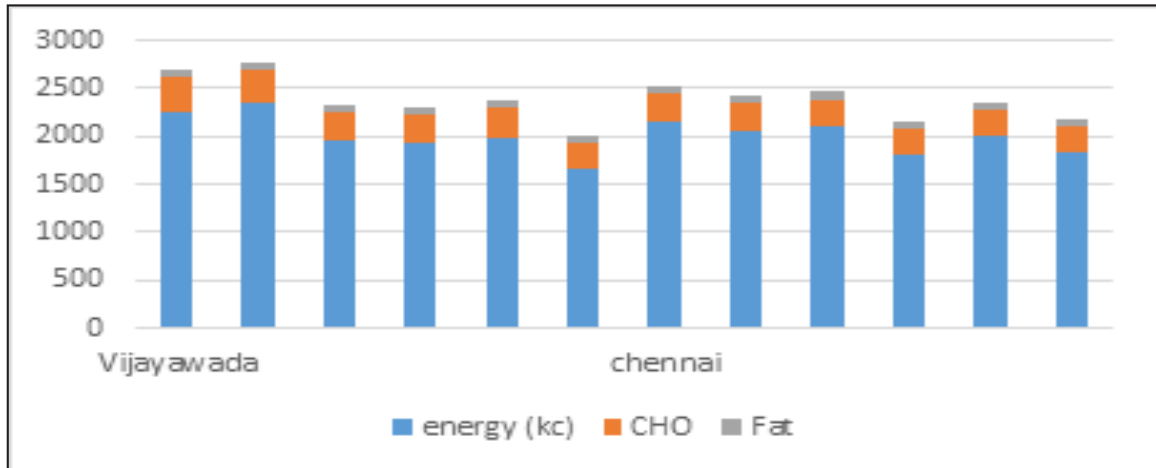


Fig: 1 Mean intake of energy, CHO and fat among adolescents in Vijayawada & Chennai

**Mean values of protein and fiber intake of adolescents**

The mean protein intake was higher than the recommended intake in all the adolescents (Table 3 and Fig 2). Maximum percent of intake was observed in overweight boys (147.21%) from Vijayawada and among girls it was overweight category from Chennai (135.29%). The least was reported in underweight girls (101.90%) from Vijayawada and overweight boys of Chennai (126.42%). Overall, protein intake was less in girls than boys from both the places. The SE value was maximum in

overweight boys (13.22) of Chennai and was least in underweight girls (2.43) of Vijayawada.

The fiber intake was deficit than the recommended intake in all the children. The least percent deficit of intake was observed in normal weight boys (69.6%) and (52.05%) normal weight girls from Vijayawada. Maximum deficit was reported in normal weight boys (35.5%) and overweight girls from Chennai (38.15%). Overall, fiber intake was less in Chennai than Vijayawada. The SE value was maximum in overweight boys (2.06) of Vijayawada and was least in normal weight boys, (0.41) of Chennai.

Table: 3 Mean values of protein and fiber intake of adolescents of Vijayawada and Chennai

S.No	Category	Macro Nutrient							
		Protein (g)			Fiber (g)				
		Mean ±SD	SE	RDA#	%of intake	Mean ±SD	SE	RDA#	%of intake
Vijayawada									
1	VNB	72.09± 27.68 0.56	3.33	54.3	132.76	13.92±16.12 3.43**	1.94	20	69.6
2	VOB	79.94 ± 27.45 1.46	5.49		147.21	10.37±8.77 1.15	2.06		51.7
3	VUB	69.03 ±29.33 0.14	3.92		127.12	9.18± 8.31 1.29	1.11		45.9
1	VNG	60.03 ±17.56 1.02	6.36	51.9	115.66	10.41±17.76 0.80	1.88	20	52.05
2	VOG	65.11 ±22.80 0.70	12.10		125.45	8.32± 3.28 0.82	1.54		41.6
3	VUG	52.89 ± 13.75 1.38	2.43		101.90	8.19 ±4.93 0.33	0.87		40.95

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	Total	65.87 ±24.65				10.54±13.3			
Chennai									
1	CNB	75.25 ±40.53	4.50	54.3	138.58	7.1± 3.72	0.41	20	35.5
2	COB	68.65 ±28.20	13.22		126.42	8.17 ±3.95	0.43		40.85
3	CUB	69.85 ±27.26	4.20		128.63	7.59 ±3.44	0.53		37.95
1	CNG	56.73 ±24.16	2.63	51.9	109.30	8.79 ±6.74	0.73	20	43.95
2	COG	70.22 ±35.61	5.85		135.29	7.63 ±3.45	0.56		38.15
3	CUG	66.49 ±51.40	9.55		128.11	7.83 ±3.28	0.60		39.15
	Total	67.25 ±34.98				7.87 ±4.71			

CR Values compared between two cities (Two states) Table Value for 1%, 5% reported in Appendix \*\* (p<0.01, \*p<0.05) RDA Values from ICMR 2010

The critical ratio test shows that calculated value was less than table value at both the levels for all the groups, hence the hypothesis (H<sub>4</sub>) was accepted. But significant difference was observed between the mean intake of fiber in normal weight boys of Vijayawada and Chennai as p<0.05, p<0.01. Thus hypothesis (H<sub>4</sub>) was partially rejected.

percent of intake was observed in normal weight boys (53.15%) and (43.37%) normal weight girls from Vijayawada. Maximum deficit was reported in underweight boys (28.47%) and overweight girls from Chennai (38.15%). Overall, vitamin A intake was less in Chennai than Vijayawada. The SE values were maximum in underweight girls (461.46 %) of Chennai and was least in overweight boys (125.92 %) of Chennai.

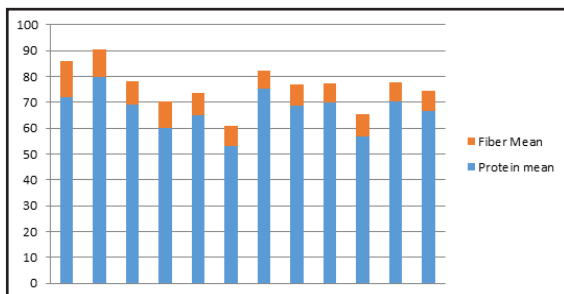


Fig: 2 Mean intakes of protein and fiber among adolescents in Vijayawada

**Mean values of vitamin a and thiamine**

The mean vitamin A and Thiamine intake was deficit than the recommended intake in all the adolescents (table 4 Fig 3 and 4). The least

The thiamine intake was high than the recommended intake in all the adolescents from Vijayawada. From Chennai it was reported deficit in normal weight and overweight boys but high in rest of the groups. Maximum intake was in underweight boys (466.42%) and in girls (299.16%) of normal weight category both from Vijayawada city. The least deficit percent of intake was observed in overweight boys (95%) and maximum deficit was reported in normal weight boys (89.28%) both from Chennai. thiamine intakes of only underweight girls were as per the RDA (100%). Overall, vitamin intake was less in Chennai than Vijayawada. The SE value was maximum in underweight boys (3.82) of Vijayawada and was least (0.06) in normal weight and overweight boys of Chennai

Table: 4 Mean Values of Vitamin A and Thiamine intake of adolescents in Vijayawada and Chennai

S. No	Category	Micro Nutrient							
		Vitamin A β Carotene (µg)				Thiamine(mg)			
		Mean ±SD	SE	RDA#	%of intake	Mean ±SD	SE	RDA#	%of intake

Vijayawada									
1	VNB	2551.52± 2708.26 130	326.35	4800	53.15	4.49±10.77 0.73	1.29	1.4	320.71
2	VOB	1648.48 ±1304.2 0.82	260.83		34.34	3.27±6.85 1.41	1.37		233.57
3	VUB	1602.07 ±2338.33 0.72	312.61		33.37	6.53 ±28.57 1.20	3.82		466.42
1	VNG	2082.21 ±2513.73 1.20	220.80	4800	43.37	3.59±17.51 1.15	0.38	1.2	299.16
2	VOG	1584.64 ±2019.36 0.15	294.72		33.03	1.73±0.63 2.85**	0.32		144.16
3	VUG	1736.21 ±1698.26 053	300.57		36.170	2.74 ±6.64 1.30	1.17		228.33
	Total	1979.46 ±2342.55				4.05 ±16.6			
Chennai									
1	CNB	1978.99 ±2624.64	291.62	4800	41.22	1.25± 0.58	0.06	1.4	89.28
2	COB	1366.77 ±1133.28	125.92		28.47	1.33± 0.55	0.06		95
3	CUB	1953.19 ±2408.16	371.63		40.69	1.89± 3.67	0.56		135
1	CNG	1660.01 ±2069.99	225.98	4800	34.58	1.44± 1.43	0.15	1.2	120
2	COG	1516.32 ±1256.09	206.59		31.59	1.31± 0.54	0.08		109.16
3	CUG	2029.16 ±2482.67	461.46		42.27	1.2 ±0.43	0.08		100
	Total	1778.75 ±2180.75				1.4 ±1.62			

CR Values compared between two cities (Two states) Table Value for 1%, 5% reported in Appendix \*\* (p<0.01, \*p<0.05) RDA Values from ICMR 2010

The critical ratio test shows that calculated value was less than table value at both the levels for all the groups, hence the hypothesis(H<sub>4</sub>) was accepted in case of vitamin A and in case of thiamine hypothesis(H<sub>4</sub>) was rejected among overweight girls of school going adolescents of Vijayawada and Chennai as (p<0.05, p<0.01) thus significant difference was observed between the mean intake of thiamine in over weight girls.

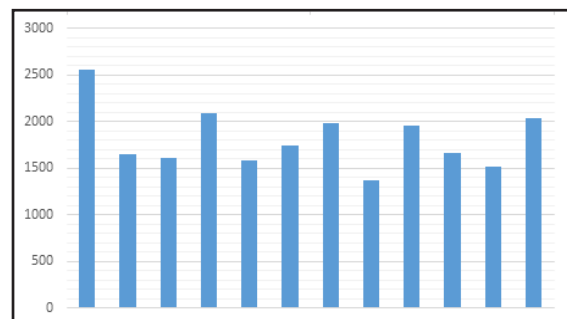


Fig: 3 Mean intake of vitamin A among adolescents

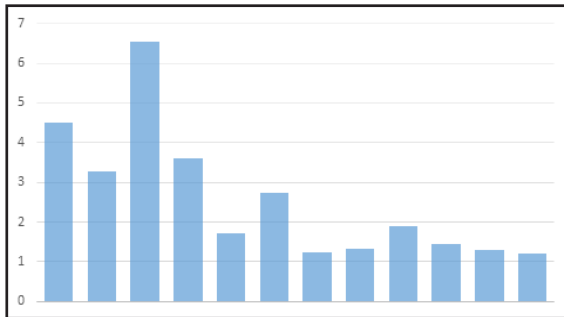


Fig: 4 Mean intake of thiamine among adolescents

**Mean values of ascorbic acid, dietary folate and iron**

The mean intakes of Ascorbic acid of adolescents are given in table 5 and Fig 5. According to RDA, the intake of ascorbic acid should be 40mg/d. The average percent intake observed from the table was higher than the recommended values in all categories. The maximum intake of 153.84mg/d was observed in overweight girls followed by 152.43mg/d in boys of Vijayawada. The minimum intake of 107.25mg/d has been observed in normal weight boys of Chennai. The critical ratio test applied on mean intake of ascorbic acid shows that calculated value was more than table value at both the levels for normal weight boys-boys of Vijayawada and Chennai. Hence, the hypothesis ( $H_4$ ) was rejected that there was a significant difference between the mean intakes of ascorbic acid.

As per the recommendations of RDA, the folic acid requirement of children should be

150µg/d. The average percent intake observed from the table was higher than the recommended values in all categories. The maximum mean intake of 303.45µg/d was observed in overweight boys, followed by normal weight girls (296.9µg/d) of Vijayawada. The minimum mean intake was observed as 230.06 µg/d in normal weight girls of Chennai. The SE value highest was observed in normal weight girls (31.48 µg/d) of Vijayawada. As per critical ratio ( $p < 0.05$ ,  $p < 0.01$ ) the mean intake of folic acid in normal weight girls - girls of Vijayawada and Chennai thus the hypothesis ( $H_4$ ) was rejected that there was a significant difference between the mean intake of folic acid.

The RDA of Iron was 32mg/d for boys and 27mg/day for girls. The intake of iron was showing deficit in both boys and girls categories of Chennai. Whereas in Vijayawada the intake was high in underweight girls (108.18%) and normal weight boys (198.75%) but low in rest of the groups. The least percent of intake was observed in normal weight girls (83.5%) from Vijayawada and maximum deficit was reported in overweight boys (45%) from Chennai. From the results it can be stated that iron intake of Vijayawada children was better than the Chennai. As per critical ratio ( $p < 0.05$ ,  $p < 0.01$ ) the mean intake of iron in over weight boys - boys of Vijayawada and Chennai thus the hypothesis ( $H_4$ ) was rejected that there was a high significant difference between the mean intake of iron. Significant difference in mean intake of iron was also observed in normal weight girls of Vijayawada and Chennai as  $P < 0.05$ .

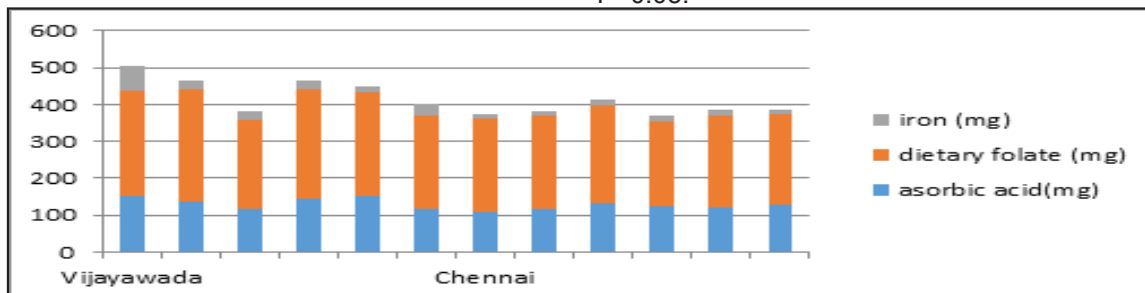


Fig: 5 Mean intakes of ascorbic acid, dietary folate and iron among adolescents



Table: 5 Mean values of ascorbic acid, dietary folate and Iron intake of adolescents in Vijayawada and Chennai

S.No	Category	Micro Nutrient											
		Ascorbic acid (mg)				Dietary Folate (µg)				Iron (mg)			
		Mean ±SD	SE	RD A#	%of intake	Mean ±SD	SE	RDA #	%of intake	Mean ±SD	SE	RDA #	%of intake
Vijayawada													
1	VNB	152.43±105.00 2.79**	12.65		381.07	286.66±143.53 1.50	17.29		191.10	63.6±309.63 1.30	37.30		198.75
2	VOB	137.24±83.25 0.90	16.65	40	343.1	303.45±128.74 1.66	25.74	150	202.3	25.2±18.71 2.73**	3.74	32	78.75
3	VUB	116.15±66.01 1.23	8.82		290.37	243.66±109.73 0.87	14.67		162.44	21.4±17.05 0.84	2.27		66.85
4	VNG	144.47±72.43 1.80	15.32		361.17	296.9±131.38 3.76*	31.48		197.93	22.57±17.35 2.53*	2.39		83.59
5	VOG	153.84±97.74 1.56	28.59	40	384.6	277.51±133.71 0.91	51.58	150	185.00	19.65±6.47 0.94	3.65	27	72.77
6	VUG	115.91±60.98 0.58	10.79		289.77	255.61±104.77 0.35	18.54		170.40	29.21±74.91 1.13	13.25		108.18
	Total	138.27±83.16				278.87±128.74							
Chennai													
1	CNB	107.85±87.88	9.76		269.62	252.88±128.12	14.23		168.58	15.06±7.47	0.83		47.06
2	COB	118.71±61.73	6.85	40	296.77	249.78±100.60	11.17	150	166.52	14.4±6.44	0.71	32	45
3	CUB	132.97±67.03	10.34		332.42	264.68±123.47	19.05		176.45	15.19±7.09	1.09		47.46
4	CNG	124.56±72.86	7.95		311.4	230.06±101.16	11.04		153.37	16.85±12.02	1.31		62.40
5	COG	120.65±66.49	10.93	40	301.65	249.29±112.23	18.45	150	166.19	17.53±11.45	1.88	27	64.92
6	CUG	126.92±73.85	13.72		317.3	245.5±114.65	21.31		163.66	14.12±9.22	1.71		52.29
	Total	120.43±74.86				246.71±114.39				15.73±9.52			

CR Values compared between two cities (Two states) Table Value for 1%, 5% reported in Appendix \*\* (p<0.01, \*p<0.05) RDA Values from ICMR 2010

**Mean values of zinc, calcium and magnesium intake**

Adolescents incorporate twice the amount of calcium during the years of spurt than at other nutrients. The requirement of calcium in adolescence is on needs for skeletal growth, 455 of which occur during this period Krause, (1996).

The mean values of zinc requirement for adolescents should be 11mg/d. The average percent intake was observed (Table 6 Fig 6) insufficient from the recommended values in all categories. The maximum mean intake of 8.6mg/d was observed in overweight boys followed by normal weight girls (7.72mg/d) from Vijayawada. The minimum mean intake was observed as 6.27mg/d in underweight girls of

Chennai. The SE value highest was observed in overweight girls (1.34) of Vijayawada. As per critical ratio ( $p < 0.05$ ,  $p < 0.01$ ) the mean intake of zinc in normal weight girls - girls of Vijayawada and Chennai thus the hypothesis ( $H_4$ ) was rejected only for Vijayawada normal girls and Chennai normal girls that there was a significant difference between the mean intake of zinc.

The average percent intake observed from the table was high from the recommended values in all categories. The maximum mean intake of 479.29mg/d was observed in normal weight boys, followed by normal weight girls (437.55mg/d) from Vijayawada. The minimum mean intake was observed as 313.5mg/d in underweight girls of Chennai. The SE value highest was observed in normal weight girls (46.39) of Vijayawada.

The critical ratio test applied on mean intake of magnesium shows  $p < 0.05$  in normal weight, overweight boys-boys and underweight girls- girls of Vijayawada and Chennai. Thus the hypothesis

( $H_4$ ) was rejected that there was a significant difference between intakes of magnesium in two groups. Significant difference was also seen in normal weight girls-girls of Vijayawada and Chennai as ( $p < 0.05$ ,  $p < 0.01$ ).

As per the RDA recommendations the intakes of calcium was on the higher side 842.32mg/d in overweight boys of Vijayawada where as in all the other groups the intake was observed on the lower side. The minimum intake was 265.58mg/d observed in underweight girls of Vijayawada. The highest SE (137.45) was of overweight girls from Vijayawada. The study reported that the calcium intake was more in Vijayawada children than in Chennai. This was mainly because maximum children from Vijayawada mentioned that they take 2 glasses milk per day where as in Chennai few mentioned the same. Significant difference in mean intake of calcium was observed in normal weight boys -boys and overweight boys -boys of Vijayawada and Chennai as  $p < 0.05$  for both the groups. Thus, hypothesis ( $H_4$ ) was partially rejected.

Table: 6 Mean values of zinc, calcium and magnesium intake of adolescents in Vijayawada and Chennai

S.N	Category	Micro Nutrient											
		Zinc (mg)				Calcium(mg)				Magnesium(mg)			
		Mean $\pm$ SD	SE	RD A#	%of intake	Mean $\pm$ SD	SE	RD A#	%of intake	Mean $\pm$ SD	SE	RDA #	%of intake
Vijayawada													
1	VNB	7.49 $\pm$ 3.15	0.07	0.37	72.18	730.69 $\pm$ 305.92 2.01*	36.85	800	91.33	479.29 $\pm$ 23 5.66 2.28*	28.39	165	290.47
2	VOB	8.6 $\pm$ 2.81	1.95	0.56	78.18	842.32 $\pm$ 26 7.05 2.64*	53.41	800	105.29	455.47 $\pm$ 18 3.81 2.34*	36.76	165	276.04
3	VUB	6.97 $\pm$ 2.48	0.58	0.33	63.36	626.24 $\pm$ 18 2.431.02	24.38	800	78.28	410.04 $\pm$ 16 2.67 0.85	21.74	165	248.50
4	VNG	7.72 $\pm$ 2.57 3.61**	0.81	0.81	70.18	708.49 $\pm$ 260.65 1.55	75.11	800	88.54	437.55 $\pm$ 17 9.49 4.68**	46.39	165	208.35
5	VOG	7.23 $\pm$ 2.58	0.61	1.34	65.72	739.49 $\pm$ 300.71 0.67	137.45	800	92.43	422.02 $\pm$ 214.23 1.69	78.44	210	200.96
6	VUG	6.38 $\pm$ 2.48	0.19	0.43	62.09	701.39 $\pm$ 265.58	38.44	800	75.72	406.98 $\pm$ 226.16 2.15	40.02	165	193.8
	Total	7.56 $\pm$ 2.74				701.39 $\pm$ 265.58				438.75 $\pm$ 199.76			
Chennai													
1	CNB	7.45 $\pm$ 3.35	0.37	0.37	67.72	643.75 $\pm$ 20 1.77	22.41	800	80.46	395.5 $\pm$ 208. 22	23.13	165	239.69

2	COB	7.2± 2.32	0.25		65.45	672.91±18 4.82	20.53		84.11	±353.31±1 20.82	13.42		214.12
3	CUB	7.3± 2.99	0.46		66.36	665.26±18 9.72	29.27		83.15	378.93±18 9.13	29.18		229.65
4	CNG	6.39± 2.27	0.24	11	58.09	646.93±59. 80	28.36	800	80.86	324.21±13 7.17	14.97	210	154.38
5	COG	6.82±2.79	0.46		62	688.58±30 5.38	50.22		86.07	344.17±14 0.81	23.16		163.89
6	CUG	6.27± 2.03	0.37		57	670.93±33 9.41	63.08		83.86	313.5±91.7 0	17.04		149.11
	Total	6.92± 2.77				658.43±24 4.54				355.13±16 4.77			

CR Values compared between two cities (Two states) Table Value for 1%, 5% reported in Appendix \*\* ( $p < 0.01$ ,  $*p < 0.05$ ) RDA Values from ICMR 2010

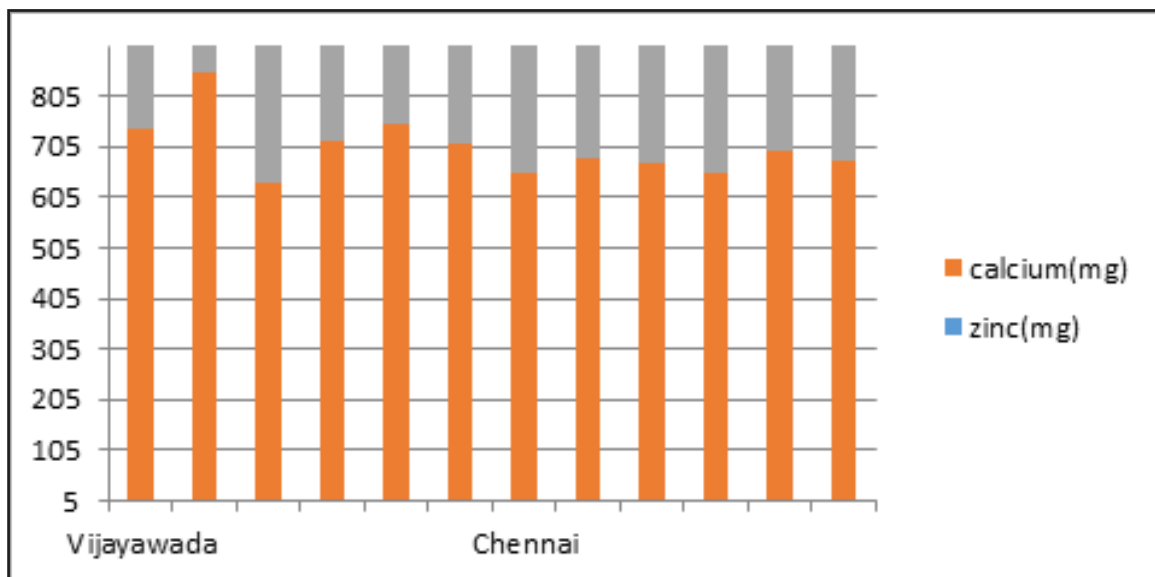


Fig: 6 Mean intakes of calcium and magnesium among adolescents

## Conclusion

Good nutrition and dietary behavior are important during adolescence to achieve full growth potential and appropriate body composition and to promote health and well being. There is an immediate need to address the high burden of under-nutrition in adolescents of both sexes in schools by routine annual monitoring of nutritional status, appropriate management of affected child and providing nutritional counseling for underweight adolescents as said by Anantha Narayana Gowda *et al.*, 2018. Adolescents need to spend considerable time on academics, prepare for various competitive examinations, functions at the highest level

of concentration and achievement. Hence, biochemical analysis was done successfully in the selected regions.

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