

# Consumption Pattern and Promotion of Green Leafy Vegetables' Intake among Adolescent Girls of Valparai Hills

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## 1. INTRODUCTION

The growth and prosperity of a nation depend heavily on the nutritional status and development of the adolescent girls because as future mothers they have an important role in shaping the nation builders of tomorrow [1]. Adolescents in India suffer from gross nutritional inadequacies. Socio-economic status, food habits and environment affect their nutritional status to a great extent. Any nutritional deprivation during this period compromises their growth and intellectual potential. [2]. The global prevalence of micronutrient deficiency which is often referred as “**Hidden hunger**” is estimated to be about two billion and most of the afflicted people are in the developing countries. The most viable manifestation of the nutritional deficiency is the high prevalence of iron deficiency anemia. [3]. Studies have indicated that diets of Indian adolescent girls are inadequate in terms of quality and quantity. Their iron and calcium intakes are less than 70 percent of the RDA because their diets are grossly deficient in green leafy vegetables and it is available and eaten only as a side dish and that too in limited quantities. [1]. In this scenario there is an urgent need to promote awareness on green leafy vegetables and enhance their intake to mitigate anemia prevalence and its consequences. Hence the present study “**Consumption pattern and promotion of green leafy vegetables' intake among adolescent girls of Valparai hills**” was taken up To assess the awareness of adolescents on green leafy vegetables' nutritional value, to quantify the green leafy vegetables' intake among adolescent girls and to impart nutrition education with special reference to green leafy vegetables.

## 2. METHODOLOGY

The present study was done at Government Higher Secondary School Valparai after getting prior permission from the school and health department authorities. Adolescent girls (11-14 years) studying in the school were oriented on the purpose and benefit of participation in the study and their role as study participants and their consent was obtained. A total of 171 participants volunteered for the study. A special questionnaire was developed in the vernacular language The questionnaire consisted of general background information, general dietary practices, nutrition knowledge with respect to green leafy vegetables was collected. “Twenty four hour recall, anthropometric measurements, clinical assessment with special reference to anemia and biochemical assessment were done. Nutrient intake of the adolescents was calculated with the help of nutrient calculator software “**Diet cal** – a tool for dietary assessment and planning” software version 3.0 © 2014 of Profound Tech Solutions. Nutrition education reiterating the health benefits of green leafy vegetables was given using appropriate tools.

### 3. RESULTS AND DISCUSSIONS

#### General background information of the adolescent girls:

One third (33.3 percent) of the participants (Fig.1) were 14 years of age. Almost an equal number 23.4 and 25.1 percent had completed 12 and 13 years of age, only 18.1 percent of the participants belonged to 11 years age group.

Distribution of volunteers as per their completed age

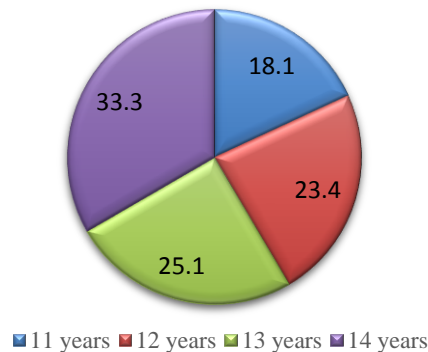


Figure-1

The average monthly income of the selected girls' parents ranged from Rs.5000-15,000. Majority (70.7 percent) of the girls' parents earned Rs.10,000-15,000 per month. Less than one third (29.2) of the parents income was between Rs. 5000 and 10,000. While 40.4 percent of the participants' parents spend between Rs.2000 and 3000 on food, 57.8 percent of the participants spend Rs.3000 to 4000 to purchase food items like groceries, vegetables and fruits.

#### Dietary practices of the selected adolescent girls with special reference to green leafy vegetables:

On the whole 22.8 percent of girls' homes do have a kitchen garden and grow only a selected few green leafy vegetables. The rest (77.2 percent) do not have kitchen garden hence purchase all vegetables from the market. Over sixty percent (66.6) of adolescents grow *manathakali* and mint in their kitchen gardens. Forty one, 46.1 and 25.6 percent have *ponnangani*, *sirukeerai* and coriander plants in their home garden and they use them regularly. None of the houses had drumstick tree in their garden. Majority (95.4 percent) of participants purchase green leafy vegetables once a week. None of the adolescent girls' families of the present study procure green leafy vegetables daily.

In the present study 39.2 percent eat green leafy vegetables as they feel "green leafy vegetables are good for health." A similar opinion was quoted by the majority of the participants of the study conducted by Kotecha et al [4]. Fifteen (15.3) percent of the present study's participants consume green leafy vegetables because that is the only dish prepared at home. Only seven percent feel that green leafy vegetables are tasty but 5.3 percent finds it to be economical, 1.8 percent are used to it. Almost all (96.4 percent) consume curry leaves daily which is added (as flavoring agent) to the *sambar* and *rasam* prepared. Once a week *sirukeerai* is eaten by two third (66.7 percent) of the participants. When 65.5 percent of the participants' families use coriander for garnishing a food preparation daily, 8.8 percent consume it in the form of chutney once a week.

While roughly one third (30.4 percent) and 8.8 percent of participants prepare and eat *manathakali* and *ponnagani* once a week, 47.4 percent and 36.8 percent consume the same once in fortnight respectively. Mint is prepared as a *chutney* or added to rice by 6.4 and 47.4 percent of the respondents daily and weekly respectively. Monthly once *Agathi* (14 percent), amaranth (16.9 percent), *kuppakeerai* (11.7 percent), fenugreek leaves (25.7 percent), turnip leaves (25.1 percent) and *parrupukeerai* (21 percent) were used. *manathakali* (23.4 percent), *ponnangani* (22.2 percent), *sirukeerai* (23.4 percent) were liked equally by the participants. Around forty percent (39.1) opined that green leafy vegetables preparation is easy but for 30.4 percent it was a laborious process and 24.5 percent said that it is moderately easy but 5.8 percent found it to be time consuming.

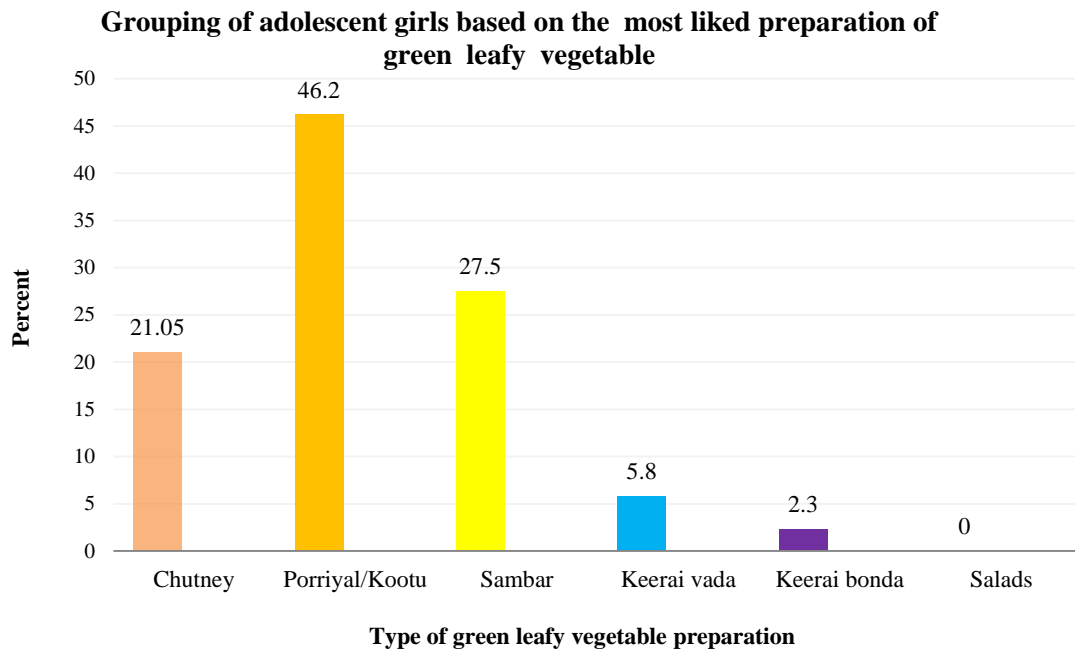


Figure 2

While 46.2 percent of the participants (Fig-2) liked green leafy vegetables as a *porriyal*, 27.5 percent relish green leafy vegetables in *sambar*, one fifth (21.05 percent) of the participants liked certain green leafy vegetables such as mint or coriander in *chutney* form, less than ten percent like to eat green leafy vegetables in the form of *vada* (5.8 percent) or *bonda* (2.3 percent)

#### Nutrient intake of the study participants:

The intake of energy, carbohydrate, protein, fat, (TABLE-1) was higher among 13-15 years old girls compared to that of 10-12 years. While 10-12 year old girls energy intake was 60.89 percent of ICMR RDA [5], it was 64.90 percent in 13-15 years old girls. Maliye et al [6] had recorded the average energy intake as  $1239.6 \pm 176.4$  kcal/day and 39% calorie deficit but Rao et al [7] had reported a deficit of 10-40 percent (energy) and 20-30 percent (protein) in adolescent girls

TABLE 1 Mean macronutrients intake of the selected adolescent girls

Criteria	Energy	Carbohydrate	Protein	Fat	Fibre
Age in years	(K cal)	(g)	(g)	(g)	(g)
	Mean±SD				
10-12 (N=71)	1223.98 ±182.91	174.49 ±33.57	35.07 ±9.95	38.30 ±9.08	7.82 ±4.13
RDA*	2010	Nil	40.4	35	30
Percent RDA	60.89	-	86.80	109.42	26.06
Percent deficit / excess	-39.11	-	-13.20	+9.42	-73.94
	Mean±SD				
13-15 (N=100)	1512.77 ±277.85	210.46 ±51.47	52.27 ±10.91	46.22 ±7.01	10.37 ±5.07
RDA*	2330	Nil	54.3	40	30
Percent RDA	64.92	-	96.26	115.56	34.57
Percent deficit / excess	-35.08	-	-3.74	+15.56	-65.43

\*ICMR (2010)

While the energy deficit of the present study was similar to the above findings, the protein deficit is much lower than the above quoted value. Choudhary, Mishra and Shukala [1] revealed that two-thirds and one-third of adolescent girls of Varanasi were either under nourished or had chronic grade III energy deficiency. NNMB [8] had also disclosed that still 70 percent of the adolescent girls consume food below RDA Chaturvedi et al [9] reported that the calorie intake was deficient by 36%, 34% and 26% in the age group 10-12 years, 13-15 years and 16-18 years respectively but Yadav and Singh[10] had revealed only 29% calorie deficiency among adolescents. The 10 to 12 and 13 to 15 year old girl participants of the present study consumed  $35.07 \pm 9.95$  and  $52.27 \pm 10.91$ g of protein against the ICMR [5]. dietary recommendation of 40 and 54.3g Maliye et al [6] had quoted an average protein intake of  $39.5 \pm 7$  gm/day which was deficient by 36% in their study population Chaturvedi *et al*[9] reported that in the age group 10-12 years, 13-15 years and 16-18 years, the protein deficit was 29%, 32% and 23% respectively.

In the present study fat consumption was above the RDA and it was 109.42 and 115.67 percent in 10-12 and 13-15 years old girls respectively. This was the only major nutrient consumed in excess of RDA. This could be because of the regular practice of eating fried snacks like *vada / pakkoda / bonda* in the evenings after school hours by the participants. Varsha et al. [11] stated that the rural adolescent girls of Marathwada region were consuming almost one-third of the requirement of fat and was slightly satisfactory, but in the present study it was much above the recommended intake.

#### Minerals intake of the selected adolescent girls:

The iron, calcium and phosphorus intake (Table-2) was less than the RDA. Of the three minerals; intake of iron was quite low compared to that of calcium and phosphorus. The iron intake was less than 50 percent of the RDA in 10-12 years age group, whereas in 13-14 years it was 55.67 percent. A 70-80 percent deficit in iron intake was reported by Rao et al [7] in the tribal adolescents of their study. Maliye et al [6] had communicated that the average iron intake was  $13.2 \pm 2.5$  mg/day and was deficient by 48.2%. in rural adolescent girls Whereas in the present study it was between 45 and 55 percent and the calcium (63.13 percent) and phosphorus (12.34 percent) intake were also higher in 13-15 years old girls than their counterparts of 10-12 years. Phosphorus intake was comparatively higher at 86.42 (10-12 years) and 87.66 (13-15 years) than other minerals.

**TABLE- 2** Mean intake of minerals of the selected adolescent girls

Criteria	Iron (mg)	Calcium (mg)	Phosphorus (mg)
Age in years			
	Mean $\pm$ SD		
10-12 (N=71)	12.19 $\pm 4.70$	417.45 $\pm 124.22$	691.37 $\pm 181.30$
RDA*	27	800	800
Percent RDA	45.18	52.18	86.42
Percent deficit/ excess	-54.82	-47.82	-13.50
	Mean $\pm$ SD		
13-15 (N=100)	15.02 $\pm 4.47$	505.08 $\pm 106.79$	701.33 $\pm 210.15$
RDA*	27	800	800
Percent RDA	55.62	63.13	87.66
Percent deficit / excess	-44.38	-36.87	-12.34

ICMR (2010)

The vitamin C intake (Figure-3) was the highest (93.02 and 107.82 percent) and riboflavin intake was the lowest (25 and 28.57 percent) among the 10-12 and 13-15 year old girls of the study. It is also clear that girls of 13-15 years seem to derive considerable vitamins from their diet compared to that of their 10-12 year old counterparts.

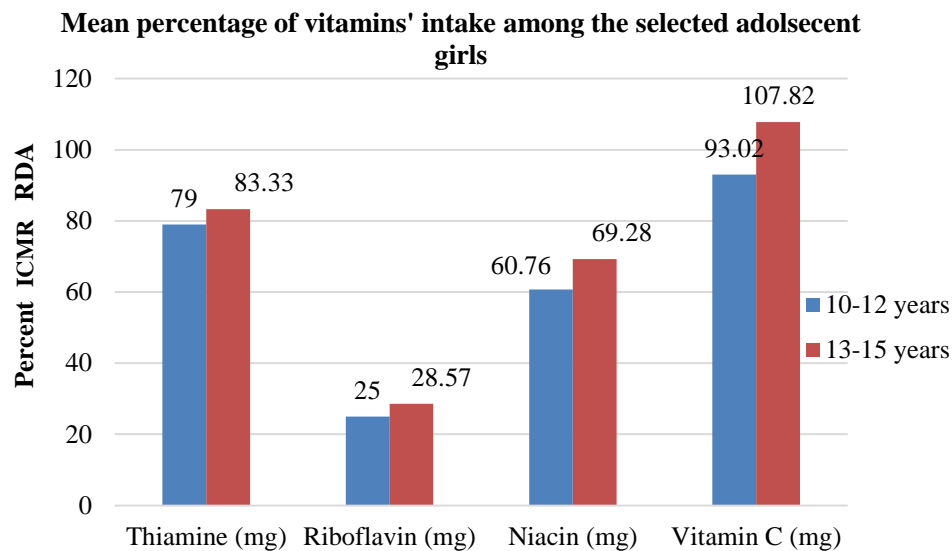


Figure 3

NNMB [8] from an earlier survey expressed that although the intake of vitamin A and vitamin C had increased (in most surveyed Indian states) among the rural adolescent girls it is not up to the recommended levels.

#### Anthropometric details of the selected adolescent girls:

The selected adolescent girls' mean height (Table-3) ranged from 122.98±6.4 (11 years) to 150.07±3.20 cms (14 years). When the individual height of the present study's girls was compared with that of the standard 96.77, 95, 93.02 and 92.98 percent of the 11, 12, 13 and 14 years old girls were below the standard height for their age indicating long term malnutrition. While Nagamani (10) had reported that tribal girls' stature was below the ICMR standards, Ashok Kumar (11) had indicated a much lower prevalence of stunting (19.2 percent) in adolescent girls of rural Kancheepuram district. The mean height of the adolescent girls was 142.9 cm. Overall, 57% of the adolescents were thin (BMI for age <5<sup>th</sup> percentile for CDC 2000 reference) and 43% of the adolescents were normal (BMI for age between 5<sup>th</sup> – 85<sup>th</sup> percentile for CDC 2000 reference).

The average weight (TABLE-4) of the participants increased from 11 years (29.45±4.62 kg) to 14 years (40.01±5.43 kg). Gross underweight was observed in 79.53 percent of selected girls. Overall; the number of individuals whose weight was normal for their height was only a meager 6.43 percent. Prashant and Chandrashaw

TABLE- 3 Height means of selected participants as per age

Criteria	Age in years				Total
	11 (n=31)	12 (n=40)	13 (n=43)	14 (n=57)	
Height (cms) Mean ±SD	122.98 ±6.40	133.86 ±6.59	138.21 ±8.57	150.07 ±3.204	-
Standard height *	145.3	150.2	153.8	157	-
Less than normal Number Percent	30 96.77	38 95	40 93.02	53 92.98	161 94.15
Normal Number Percent	1 3.23	2 5	2 4.67	2 3.57	7 4.09
More than normal Number Percent	Nil	Nil	1 2.32	2 3.57	3 1.75

\*ICMR (2010)

**TABLE- 4 Weight means of the selected adolescent girls as per age**

Criteria	Age in years				Total (n=171)
	11 (n=31)	12 (n=40)	13 (n=43)	14 (n=57)	
Weight (kg) Mean $\pm$ SD	29.45 $\pm$ 4.62	32.7 $\pm$ 6.53	37.87 $\pm$ 6.70	40.01 $\pm$ 5.43	-
Standard Weight*	34.8	39.0	43.4	47.1	-
Less than normal Number Percent	22 12.82	32 18.71	33 19.29	49 85.96	136 79.53
Normal Number Percent	4 2.33	2 1.16	2 1.16	3 1.75	11 6.43
More than normal Number Percent	5 2.92	6 3.50	8 4.67	5 2.92	24 14.03

\*ICMR (2010)

[14] from their study indicated a high prevalence of under nutrition leading to stunting (28.3 percent) and underweight (22.9 percent) among adolescent girls of slum community. However a high prevalence of underweight (51.7 percent) among adolescent girls of Wardha city was reported by Dambhare et al [15], but the present study's finding is higher than the above quoted values.

Two-thirds (64.9 percent) of the selected girls were grossly undernourished and had a BMI of <18.5. One third of the girls' BMI was between 18.5 and 23.9 which is considered as normal BMI as per WHO. A meager (1.16 percent) were only overweight with a BMI of above 24-25. It could be understood that undernourishment is highly prevalent among the selected girls of Valparai hills. The result also indicated the need to educate the adolescent girls' on balanced diet, importance of nutrients, ill effects of undernourishment, consequences of the deficiency, prevention of deficiency of micronutrients, healthy height and weight then measures to prevent malnutrition. NNMB technical report [8] acknowledged that the under nutrition in girls increases up to the age of 12 years and in adolescence it progresses and results in 40 percent adolescent girls being stunted indicating that the proportion of stunting increased with age. A similar trend was observed in the current study.

#### Prevalence of anemia:

**TABLE- 5 Haemoglobin means of the selected participants' age**

Criteria	Age in years			
	11 (n=31)	12 (n=40)	13 (n=43)	14 (n=57)
Haemoglobin Mean $\pm$ SD	10.13 $\pm$ 1.51	11.05 $\pm$ 1.55	11.4 $\pm$ 1.3	11.70 $\pm$ 1.00

The mean Hb (table-5) of all the four age groups was below the WHO standard of 12g% the cutoff point for anemia. However among these age groups, 14 year adolescent girls had better mean haemoglobin compared to the rest. The statistical analysis indicated non-significant positive correlation between iron intake and haemoglobin level among the 10-12 ( $r=0.03$ ) and 13 -15 ( $r=0.07$ ) year old girls. A considerable number (65.58 percent) suffer from anemia in the study area (Valparai hills). On the whole a little over half (51.46 percent) of girls had their Hb in the borderline of WHO standard hence recorded as mild anemic, whereas 15.78 and 2.34 percent have moderate and severe anemia, their haemoglobin being 8-10 and less than 8 grams percent.

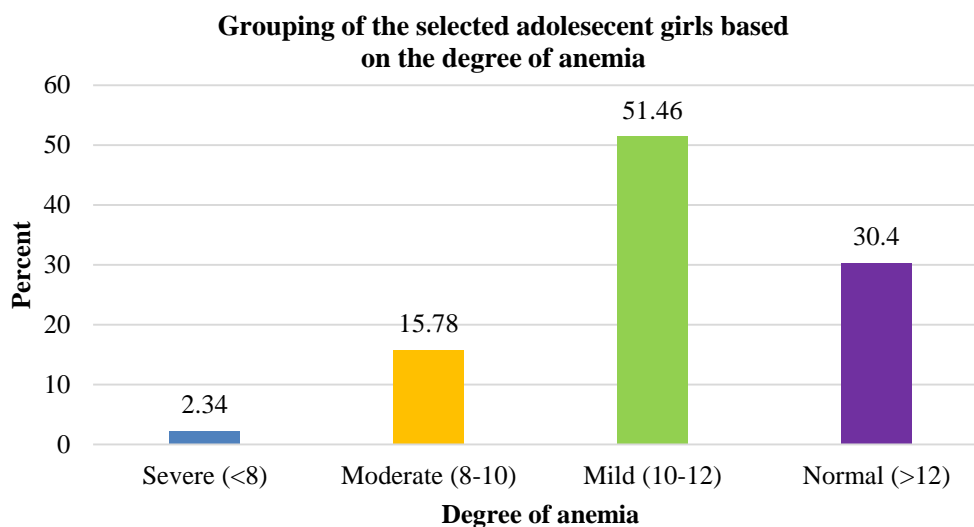


Figure 4

Premalatha et al [16] found a high (78.75 percent) prevalence of anemia among school girls of 13-17 years in Chennai, but Rajarathnam et al [17] had reported the prevalence of anemia in rural Tamil Nadu as 44.8 percent. Of which severe, moderate and mild were 2, 6.3 and 36.5 percent respectively. The findings of the present study are much higher than the latter, but lower than the former quoted studies.

**Before nutrition education** half of the participants (53.8 percent) scored 30-40 marks which is an indicator of poor nutritional knowledge. **After nutrition education** the performance of the adolescent girls in the nutritional knowledge test was slightly better. The number of girls, who scored 40-50, 60-70 and above 70 increased from 21.6, 0.6 and zero (before education) to 37.4, 9.9 and 15.8 percent (after education) respectively. The paired t test indicated a significant difference in the nutritional knowledge before and after the nutrition education ( $p < 0.001$ ) among the selected girls.

#### 4. CONCLUSION

Green leafy vegetables consumption is lower in general among the adolescent girls of Valparai hills. Traditional green leafy vegetables namely *Seppamkeerai*, *Sallakkeerai* are not available in plenty and some are not known to the participants. Anemia is still prevalent in spite of prophylaxis program that supply iron and folic acid tablets

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