PRINT: ISSN 0970-9274 ONLINE: 2456-6608
J. Hum. Ecol., 15(2): 147-151 (2004)
DOI: 10.31901/24566608.2004/15.02.12

Seasonal Variations in Nutritional Status of Adolescent Girls

K. S. Deepa, Pushpa Bharati and Rama K. Naik

INTRODUCTION

Nutritional adequacy is one of the key determinants of the quality of human life. In the Indian sub-continent, female nutritional stress begins in childhood and continues through adolescence into adult. Attention to nutrition is therefore called for throughout the life cycle of females. Seasonal and climatic changes determine the agricultural cropping pattern and vary the production and availability of local foodstuffs, thus affecting the household food security, dietary practices in turn the nutritional security.

The problem of malnutrition in developing countries encompasses a spectrum of deficiencies of which the most devastating are that of micronutrients, especially iron deficiency anaemia and nutritional blindness. Anaemia is one of the glaring deficiencies in young adolescent girls, probably, due to low intake of haemopoietic nutrients since childhood, increased demand for nutrients coupled with menstrual loss of iron. A study was, thus, undertaken to examine the seasonal changes in nutritional status of adolescent girls from rural and urban areas of Dharwad, in terms of anthropometry and dietary adequacy.

MATERIAL AND METHODS

The study was carried out between June 2001 and May 2002 in the beginning and end of each season, viz., summer (February to May), rainy (June to September) and winter (October to January). Keeping Dharwad as centre, two villages of Dharwad taluka (Mugad and Hebballi) situated in opposite direction and within the radius of 8 to 10 km were selected for the study. Two areas of Dharwad city were included to serve as urban locality. A total of 80 adolescent girls were randomly selected with ages ranging from 13 to 15 years from the rural and urban areas of Dharwad taluka identifying 40 subjects from each area.

The nutritional status of the subjects was assessed by anthropometry and dietary intake in different seasons. Anthropometric measurements included height, weight, waist and hip circumferences, using which indices, viz., body mass index (BMI) and waist to hip ratio (WHR) were computed. The individuals were further classified into different classes of chronic energy deficiency based on BMI (Garrow, 1987) and WHR (Lean et al., 1995). The information on daily intake of food was collected by 24-hour recall method for one day using the proforma of National Institute of Nutrition and the intake of energy and blood forming nutrients were computed using Annapurna Software and were compared with ICMR recommendations. The data was analysed by Factorial Completely Randomised Design (CRD).

RESULTS AND DISCUSSION

The seasonal variations in anthropometric measurements of adolescent girls are shown in Table 1. The anthropometric measurements recorded were higher during winter than summer and rainy season. The girls irrespective of locality were taller and heavier (149.32 cm and 36.2 kg, respectively) during winter compared to rainy (148.21 cm and 35.45 kg, respectively) and summer (148.02 cm and 34.90 kg, respectively). However, these differences were statistically not significant. Similarly, irrespective of age and locality, the waist and hip circumferences were higher during winter (56.84 and 72.76 cm, respectively) than rainy (56.71 and 72.42 cm, respectively) and summer (56.46 and 72.39 cm, respectively).

Higher anthropometric measurements during winter and rainy seasons coincides with harvest and availability of foods. Further, these seasons are known for celebration of varied festivals, viz., *Nagara Panchami*, *Ganesha Chaturthi*, *Dasara*, *Deepawali* to name a few. It is a custom to prepare special foods like cereals, pulses and oilseed-based *laddus*, pulse *usalis*, several sweets like *godhi huggi*, *modaka*, *holige*, *karigadabu*, *karchikai* during these days. These foods are rich source of growth promoting nutrie-nts like calorie, protein and fat along with suppo-rting B-complex vitamins. The consumption of these foods during rainy and winter seasons might have resulted in increased height and weight, so also the waist and hip circumferences compared to summer.

The distribution of subjects based on body

Table 1: Seasonal variations in anthropometric measurements of adolescent girls

(n=80)

S. No.	Seasons	Height (cm)			Weight (kg)			Waist circumference (cm)			Hip Circumference (cm)		
		Rural	Urban	Mean	Rural	Urban	Mean	Rural	Urban	Mean	Rural	Urban	Mean
1.	Summer	147.06	148.98	148.02	34.11	35.70	34.90	56.00	56.91	56.46	71.16	73.62	72.39
2.	Rainy	147.27	149.15	148.21	34.70	36.20	35.45	56.38	57.04	56.71	71.19	73.64	72.42
3.	Winter	148.47	150.16	149.32	35.86	36.66	36.26	56.54	57.13	56.84	71.74	73.78	72.76

Anova	Height			Weight		
Source of variation	F	SEM	CD (5%)	F	SEM	CD (5%)
Season	0.57^{NS}	-	-	0.44^{NS}	-	-
Locality	5.24*	0.69	1.91	0.23^{NS}	-	-
Age	3.71*	0.81	2.23	6.63*	0.90	2.49
Season x Locality	0.001^{NS}	-	-	0.03^{NS}	-	-
Sason x Age	0.02^{NS}	-	-	0.004^{NS}	-	-
Locality x Age	3.82*	1.10	3.04	0.08^{NS}	-	-
Season x Locality x Age	0.08^{NS}	-	-	0.02^{NS}	-	-

Note: *Significant at 0.05 level. NS - Not Significant

mass index during different seasons is indicated in figure 1. Irrespective of age and locality, more number of adolescent girls (47) belonged to CED grade-III in summer compared to rainy (40) and winter (36). Only two girls were categorised as normal during summer, which increased to three during rainy and winter seasons. This shift may be due to increase in body weight during winter and rainy seasons which improves the body mass index. However, the increment in body weight was not sufficient enough to pull the adolescent girls to normal category. Even though the variations were observed in the distribution of adolescent subjects according to body mass index,

Table 2: Waist to hip ratio classifcation of adolescent girls for abdominal obesity

S. No.	Seasons	Age (in years)	At Risk (>0.80)			No Risk (<0.80)		
			Rural	Urban	Total	Rural	Urban	Total
1.	Summer	13	3	1	4	10	12	22
			(23.1)	(7.7)	(15.4)	(76.9)	(92.3)	(84.6)
		14	7	3	10	18	13	31
			(28.0)	(18.7)	(24.4)	(72.0)	(81.3)	(75.6)
		15	1	2	3	1	9	10
			(50.0)	(18.2)	(23.1)	(50.0)	(81.8)	(76.9)
		C	11	6	17	29	34	63
			(27.5)	(15.0)	(21.3)	(72.5)	(85.0)	(78.7)
2.	Rainy	13	3	1	4	10	12	22
			(23.1)	(7.7)	(15.4)	(76.9)	(92.3)	(84.6)
		14	7	3	10	18	13	31
			(28.0)	(18.7)	(24.4)	(72.0)	(81.3)	(75.6)
		15	1	2	3	1	9	10
			(50.0)	(18.2)	(23.1)	(50.0)	(81.8)	(76.9)
		C	11	6	17	29	34	63
			(27.5)	(15.0)	(21.3)	(72.5)	(85.0)	(78.7)
3.	Winter	13	4	1	5	9	12	21
			(30.8)	(7.7)	(19.2)	(69.2)	(92.3)	(80.8)
		14	5	3	11	17	13	30
			(32.0)	(18.7)	(26.8)	(68.0)	(81.3)	(73.2)
		15	1	1	2	1	10	11
			(50.0)	(9.1)	(15.4)	(50.0)	(90.9)	(84.6)
		C	13	5	18	27	35	62
			(32.5)	(12.5)	(22.5)	(67.5)	(87.5)	(77.5)

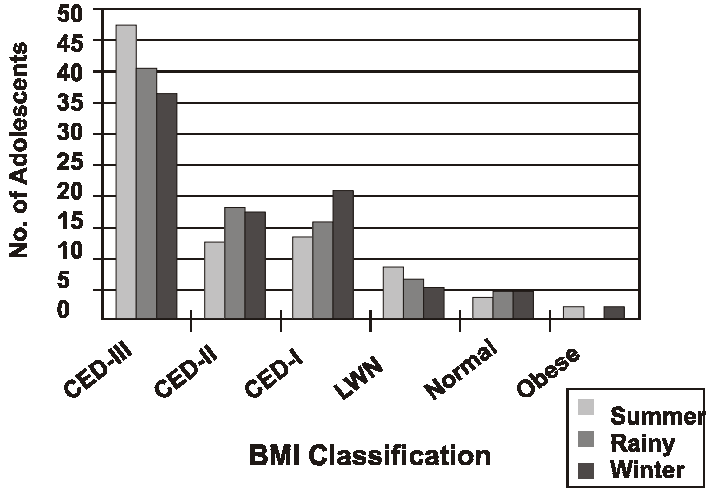

Fig. 1. Body mass index classification of adolescent girls

Table 2a: Analysis of variance for waist to hip ratio classfication of adolescent girsl

Anova	*At Risk (>0.80)*			*No Risk (<0.80)*		
Source of variation	*F*	*SEM*	*CD (5%)*	*F*	*SEM*	*CD (5%)*
Season	2.21^{NS}	-	-	0.013^{NS}	-	-
Locality	4.32*	0.006	0.016	3.47^{NS}	-	-
Age	0.21^{NS}	-	-	5.82*	0.005	0.014
Season x Locality	2.72^{NS}	-	-	0.12^{NS}	-	-
Sason x Age	7.31**	0.057	0.158	1.61^{NS}	-	-
Locality x Age	2.56^{NS}	-	-	0.16^{NS}	-	-
Season x Locality x Age	2.18^{NS}	-	-	0.07^{NS}	-	-

Note: *Significant at 0.05 level. **Significant at 0.01 level. NS - Not Significant

Table 3: Mean intake of energy and blood forming nutrients of adolescent girls

(n=80)

S.	*Nutrients*	*RDA*	*Summer*			*Rainy*			*Winter*			*F*	*SEM*	*CD 5%*
No.			*Rural*	*Urban*	*Mean*	*Rural*	*Urban*	*Mean*	*Rural*	*Urban*	*Mean*	*Rural*	*Urban*	*Mean*
1.	Energy (Kcal)	2060	1331	1574	1452	1565	1697	1631	1329	1418	1374	19.45 **	29.85	82.49
2.	Protein (g)	63	36.1	41.6	38.9	41.9	43.7	42.8	34.7	35.8	35.3	20.54 **	0.83	2.30
3.	Iron (mg)	30	15.9	17.3	16.6	17.8	19.5	18.7	12.7	18.1	15.4	1.36 ns	-	-
4	Folic acid (µg)	100	81.5	11.9	91.7	117.2	110.5	113.9	73.2	87.2	80.2	7.85 **	6.10	16.87
5.	Vitamin B_{12} (µg)	0.2-1.0	0.19	0.12	0.16	0.12	0.13	0.13	0.19	0.12	0.16	0.55 ns	-	-
6.	Ascorbic acid (mg)	40	13.2	30.1	21.7	42.2	69.6	55.9	32.4	91.9	62.2	3.13 *	12.32	34.05
7.	B-carolene (µg)	2400	204.9	1047.4	626.2	1748.7	1390.3	1569.5	743.5	1024.3	883.9	4.67	225.65	623.61
8.	Vitamin B6 (mg)	2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	2.48 ns	-	-
9.	Copper (mg)	2.2	1.3	1.8	1.6	2.7	3.0	2.9	1.2	2.2	1.7	3.79 *	0.36	1.003
10.	zinc (mg)	15.5	3.3	4.7	4.0	4.5	5.3	4.9	3.8	3.7	3.8	17.54 **	0.15	0.40

Note: figures in parenthesis indicate percent adequacy
RDA- Rcommended dietary allowances **-Significant at 0.01 level *-Significant at 0.05 level NS - Not significant

seasonal variations were statistically not significant.

Categorisation of adolescent girls for abdominal obesity based on waist to hip ratio is presented in Table 2. In both summer and rainy seasons, 27.5 per cent of rural adolescent girls were at risk with waist to hip ratio of more than 0.8 but 72.5 per cent were not having this kind of risk. But during winter, the number of girls at risk augmented to 32.5 per cent. Similarly, in urban area the number of girls at risk was the same (15.0%) during summer and rainy seasons, which decreased to 12.5 per cent during winter. Correspondingly, the girls categorised as no risk increased from 83.0 per cent during summer and rainy to 87.5 per cent in winter. However, the analysis of variance revealed that seasonal variations were statistically not significant.

The mean intake of energy and blood forming nutrients in rural and urban adolescent girls is shown in table 3. The intake of all the nutrients among selected rural and urban adolescent girls was significantly less than the ICMR recommendations during all the seasons except folic acid, ascorbic acid and copper.

The energy and protein intake among rural and urban subjects was found to be significantly higher during rainy seasons compared to summer and winter, which can be attributed to increased food intake, specially, cereals, pulses, fats and oils, nuts and oilseeds, sugar and jaggery during rainy season.

The intake of iron could be met to the extent of slightly above 50 per cent in all the seasons with higher intake during rainy seasons (17.8 and 19.5 g) compared to summer (15.9 and 17.3 g) and winter (12.7 and 18.1 g) among rural and urban adolescent girls, respectively. The protective foods like green leafy vegetables were available at affordable cost during rainy season, which might have influenced higher intake of iron, but these differences in iron intake were statistically not significant as indicated by ANOVA. Similarly, the daily intake of vitamin B_{12} and B_6 among adolescent girls was significantly less than the recommendations and the differences existed were not statistically significant.

However, daily intake of folic acid and ascorbic acid by adolescent girls of rural and urban areas exceeded the ICMR recommendation during rainy season and was significantly higher than during other two seasons where the intake could meet only 35 to 80 per cent adequacy, respectively. The intake of β-carotene showed significant seasonal variations among rural and urban girls with a lower adequacy during summer and higher in rainy and winter seasons. Occasional consumption of vegetables like carrot and pumpkin, fruits like mango and papaya in summer might have resulted in lower adequacy of β-carotene. Concurrent increase in availability and consumption of green leafy vegetables, carrot, orange, guava, amla during rainy and winter seasons improved the ascorbic acid and β-carotene intake.

With regard to copper and zinc intake, seasonal variations were observed with the intake being higher during rainy season compared to summer and winter.

CONCLUSION

From the results of the present study, it can be concluded that the selected adolescent girls of rural and urban areas of Dharwad had higher values of all the anthropometric measurements during winter followed by rainy and summer seasons. The adolescents had inadequacy of intake of energy and blood forming nutrients compared to ICMR recommendations in all the seasons, except folic acid, ascorbic acid and copper which exceeded the recommendations during rainy season. The identification of seasonal changes in the nutritional status of a population may suggest the implementation of specific season related interventions to improve health.

KEYWORDS Seasonal Variation. Nutritional Status. Adolescents.

ABSTRACT The investigation focussing on "Seasonal variations in nutritional status of adolescent girls" was carried between June 2001 to May 2002. 80 girls were selected between the age group of 13 to 15 years from rural and urban areas of Dharwad. The nutritional status of the subjects was assessed by anthropometry and dietary intake. Irrespective of locality, the selected subjects recorded higher values for height, weight, waist and hip circumference during winter followed by rainy and summer. The adolescent had inadequate intake of energy and blood forming nutrients compared to ICMR recommendations in all the seasons.

REFERENCES

Abdullah, M.: Modernization of agricultural and seasonality in food intake. *Nutrition Report International*, **37**: 1305-1313 (1988).

Adams, A.M.: Seasonal variations in nutritional risk among children in central Mail. *Ecology of Foods and Nutrition*, **33(1/2):** 93-106 (1994).

Bates, C.J.: Folate status during pregnancy and lactation in

a West African Rural Community. *Human Nutrition: Clinical Nutrition*, **40**: 3-19 (1982).

Branca, G., Pastore, T. Demissie and Ferro-Luzzi.:The nutritional impact of seasonality in children and adults of rural Ethiopia. *European Journal of Clinical Nutrition*, **47(12):** 840-850 (1993).

Brown, K.H., Black, R.E. and Becker, S.: Seasonal changes in nutritional status and the prevalence of malnutrition in a longitudinal study of young children in rural Bangladesh. *American Journal of Clinical Nutrition*, **36(8):** 303-313 (1982).

Kingutha, H.N., Staveren, W.A.V., Wijnhoven. T.M. and Hautavast, J.G.A.J.: Maternal nutritional status may be stressed by seasonal fluctuations in food availability: evidence from rural women in Kenya. *International Journal of Food Sciences and Nutrition*, **46(3):** 247-255 (1995).

Leonard, W.R.: Protection from seasonal nutritional stress in an Andean agricultural community. *Euro pean Journal of Clinical Nutrition*, **43(9):** 597-602 (1989).

Schultink, W.J., Mark. L., Joop, M.A., Van, R. and Joseph, G.H.: Body composition of rural Beninese women in different seasons assessed by skin fold thickness and bio electrical impedance measurements and by deuterium oxide dilution technique. *American Journal of Clinical Nutrition*, **55(2):** 321-326 (1992).

Schultink, W.J., Raaij, J.M.A., Van. and Hautvast, J.G.A.: Seasonal weight loss and metabolic adaptation in rural Beninese women: the relationship with body mass index. *British Journal of Nutrition*, **70(3):** 689-700 (1993).

Tomkins, A.M., Dunn, D.T., Hayes, R.J. and Bradley, A.K.: Seasonal variations in the nutritional status of urban Gambian children. *British Journal of Nutrition*, **56(6):** 533-543 (1986).

Authors' Address: **K. S. Deepa, Pushpa Bharati and Rama K. Naik,** Department of Foods and Nutrition, University of Agricultural Sciences, Dharwad 580 005, Karnataka, India

Corresponding Author: **Pushpa Bharati**

E-mail: vyp1@satyam.net.in