Short Communications

Dietary Patterns in Urban School Children in South India

Sumathi Swaminathan, Tinku Thomas, Anura V. Kurpad and Mario Vaz

From the St. John's Research Institute, St. John's National Academy of Health Sciences, Bangalore, India.

Correspondence to: Sumathi Swaminathan, St. John's Research Institute, St John's National Academy of Health Sciences, Koramangala, Bangalore 560 034, India. E-mail: sumathi@iphcr.res.in

Manuscript received: December 11, 2006; Initial review completed: February 5, 2007; Revision accepted: April 27, 2007.

The dietary patterns and extent of overweight in 307 urban school-going children aged 7 to 15 years representing various socio-economic strata was evaluated at baseline of a 3 year longitudinal study. Dietary habits were recorded through interviewer-administered questionnaires. Height and weight were measured and 8.2% of the children were over-weight or obese. Children from higher socio-economic strata had higher total and saturated fat intakes and lower carbohydrate intakes (P <0.01). Daily energy intakes increased with increased frequency of eating out (P <0.001). Therefore, promoting healthy eating in schools is important.

Key words: *Children, Energy intake, Overweight.*

Childhood dietary habits are important because a food culture once adopted is apparently difficult to reverse(1). With obesity linked to an "obesogenic environment" in urban areas(2), knowledge of dietary patterns of our urban school children is important. Several cross-sectional studies in India indicate that the percentage of overweight children in cities is a matter of concern(3,4).

The aim of the study was to evaluate the dietary patterns and extent of overweight in urban school-going children in Bangalore.

Subjects and Methods

Data was collected at baseline of a cross-sequential 3 year longitudinal study from a purposive sample of 307 children. Approximately 30 children were recruited at each year between 7 to 15 years from 3 schools representing different socio-economic status (SES) based on fee structure. Ethical approval was obtained from the institutional ethical review board. Permissions of the school principals, parental consent and participant assent were obtained.

General dietary habits were collected using an interviewer-administered questionnaire. Household assets were used as a surrogate measure of SES; derived by ranking each possession based on its value, and using the sum to obtain the final socio-economic ranking. The values obtained were divided into tertiles of SES for analysis.

A semi-quantitative food frequency questionnaire, for which validation is on-going, was used to assess food intakes. The macro-nutrient composition was calculated using standard portion sizes and a composite of the food composition tables of National Institute of Nutrition, ICMR, India and the United States Department of Agriculture, a method used earlier(5).

Height was measured to the nearest 0.1 cm and weight to the nearest 0.1 kg. The body mass index (BMI) was derived and overweight and obesity defined using Cole's international cut-offs(6) (extrapolated to a BMI of 25 and 30 kg/m^2 at age 18).

Data was analyzed using SPSS version 13.0. Nutrient and anthropometric data was analyzed using the general linear model adjusted for age and sex.

Results

A total of 142 boys and 165 girls, (mean age 11.0 ± 2.5 years) were recruited; 73% were non-vegetarian. Of these, 7.2% of the children were overweight (7.7% boys and 6.7% girls) and 1% obese.

Daily energy and protein intakes were higher in boys than girls (1777 ± 452 kcal and 60 ± 15.6 g respectively for boys and 1588 ± 417 kcal and 52.7 ± 14.4 g respectively for girls). Daily fat intakes were significantly higher ($P = 0.029$) in boys than girls in the 7-9 yr (57.6 ± 17.2 g *vs* 50.7 ± 14.2 g) and 13-15 yr (54.8 ± 14.2 g vs 47.0 ± 18.7 g) age group while saturated fat intake was significantly higher ($P = 0.016$) in the 13-15 year old boys (20.4 g *vs* 16.8 g).

Fat and saturated fat expressed as a percentage of daily energy intake, increased with increasing level of SES (*Table I*), while percent energy from carbohydrates decreased with increase in SES, although overall energy intakes were not significantly different. The differences observed were significant between the 1st and 3rd tertile of SES. Children belonging to the 2nd tertile were significantly heavier than those in the first tertile of SES.

As age increased (especially in girls), step-wise regression indicated that the number of foods accounting for approximately 90% of variance in energy intake decreased, indicating that the variety of foods consumed decreased with increasing age. Contribution analysis for all age groups indicated that approximately 50% of energy intake was through milk, rice and dhal/ pulses. A little over 3% energy was from fruits and over 6% from sweets, chips and biscuits.

Further, increased frequency of eating out (*Table II*), resulted in increased daily energy intakes ($P < 0.001$) while BMI did not ($P = 0.573$). with mean daily energy intakes lower in children in the

TABLE I–*Nutrient Intake and Anthropometry of Children from Different Socio-Economic Groups*

Parameter	Socio-economic group			P value*
	1st tertile (n = 110)	2nd tertile (n = 105)	3rd tertile (n = 92)	
Nutrient Intake				
Energy (kcal)	1684.9 (± 453.3)	1642.9 (± 434.5)	1703.1 (±443.3)	0.802
Protein (% energy)	13.2 (±1.3)	13.5 (± 1.2)	13.6 (± 1.4)	0.066
Fat (% energy)	27.8 (± 5.2)	28.9 (± 3.9)	29.9 (± 4.5)	0.006
Carbohydrate (% energy)	59.0 (± 6.1)	57.6 (± 4.7)	56.6 (± 5.4)	0.006
Saturated fat (% energy)	10.2 (± 3.1)	10.7 (± 2.2)	11.4 (± 2.9)	0.010
Anthropometry				
Height (cm)	142.8 (± 13.1)	143.5 (± 14.6)	143.3 (± 14.3)	0.101
Weight (kg)	33.8 (± 10.0)	35.8 (± 12.0)	34.7 (± 11.1)	0.030

All values provided are means (± standard deviation).
*General linear model controlled for age and sex.

TABLE II–*Relation Between Energy Intake and BMI with Monthly Frequency of Eating Out*

	Frequency of eating out		
	0 to 2 times (n = 160)	3 to 4 times (n = 83)	> 4 times (n = 64)
Body mass index	16.5 ± 2.9	16.8 ± 2.6	17.0 ± 3.1
Energy intake (kcal)*	1575 ± 390.8	1728 ± 497.7	1862 ± 426.2

*In a general linear model adjusting for age and sex, significant at $p < 0.001$.

What this Study Adds

- In urban school children, with increase in socio-economic status the proportion of energy contributed by fat and saturated fat increases, while that of carbohydrate decreases. Concurrently, energy intake increases with increased frequency of eating out.

lowest category of eating out compared to the other two groups. No significant correlation between the frequency of eating out and the SES was evident (r = 0.091, P = 0.113).

Discussion

8.2% of children studied were overweight or obese, which is comparable to data obtained by Kapil, *et al.*(8). As SES increased the percent energy derived from fats and saturated fats increased, while that from carbohydrates decreased, similar to a study on children in Thailand(9). That frequency of eating out has an impact on energy intake of children is a major concern since the cumulative effects of an excess energy intake could in the long-term contribute to weight gain. Between 7 to 15 years of age, an excess of approximately 165 kcal (daily difference in energy intake between extreme groups of eating out) could lead to a theoretical 3 kg excess weight largely as fat per year. World-wide eating foods away from home have been implicated as a cause for increased energy intakes(10-13). In cross-sectional studies, increase in energy intake associated with increased frequency of eating out does not always translate into increases in BMI(11,12), although this could be more evident in longitudinal studies where the cumulative effects of small daily increases in energy intake can be documented(14).

With dietary patterns of urban children being influenced by their socio-economic status and the frequency of eating out, promoting healthy eating in schools in important.

Acknowledgement

We thank the principals of the three schools who permitted and cooperated with us to conduct the study, and all the children who participated in the study. We acknowledge Parimala R. for helping in data entry.

Contributors: SS was involved in conceptualization, data collection and analysis of the study and writing the first draft of the manuscript. She will act as the guarantor of the study. TT conducted the analysis and reviewed and approved the final manuscript. AVK interpreted the data, critically reviewed, and finally approved the manuscript. MV was involved in conceptualization of the study, interpretation of data and critically reviewed and edited the manuscript.

Funding: None.

Competing interests: None stated.

REFERENCES

1. Brunner E. Inequalities in diet and health. In Diet, nutrition and chronic disease: An Asian perspective. London: Smith-Gordon Nishimura 1998: 77-94.
2. Chopra M, Galbraith S and Darnton-Hill I. A global response to a global problem: the epidemic of over-nutrition. Bull World Health Organization 2002; 80: 952-958.
3. Ramachandran A, Snehalatha C, Vinitha R, Thayyil M, Kumar CK, Sheeba L, *et al.* Prevalence of overweight in urban Indian adolescent school children. Diabetes Res Clin Pract 2002; 57: 185-190.
4. Chhatwal J, Verma M, Riar SK.Obesity among pre-adolescent and adolescents of a developing country (India). Asia Pac J Clin Nutr 2004; 13: 231-235.
5. Cade J, Thompson R, Burley V, Warm D. Development, validation and utilisation of the food frequency questionnaires–A review. Public Health Nutr 2002; 5: 567-587.
6. Cole TJ, Bellizzi MC, Katherine M Flegal KM and Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000. 320: 1240-1246.
7. Tokudome S, Ikeda M, Tokudome Y, Imaeda N, Kitagawa I, Fujiwara N. Development of data based semi-quantitative food frequency questionnaire for dietary studies in middle-aged Japanese. Japn J Clin Oncol 1998; 28: 679-687.
8. Kapil U, Singh P, Pathak P, Dwivedi SN, Bhasin S. Prevalence of obesity amongst affluent adolescent school children in Delhi. Indian Pediatr 2002; 39: 449-452.

9. Egger RJ, Hofhuis EH, Sukonthanyakorn B, Van der Ven EM, Scriboonlue P, Wedel M, *et al,* Food intake and socioeconomic status in children in northeast Thailand. Trop Geogr Med 1991; 43: 42-50.

10. Adair LS, Popkin BM. Are child eating patterns being transformed globally? Obes Res 2005; 13: 1281-1299.

11. French SA, Story M, Neumark-Sztainer D, Fulkerson JA, Hannan P. Fast food restaurant use among adolescents: associations with nutrient intake, food choices and behavioral and psycho-social variables. Int J Obes Relat Metab Disord 2001; 25: 1823-1833.

12. St-Onge MP, Keller KL, Heymsfield SB. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. Am J Clin Nutr 2003; 78: 1068-1073.

13. Nicklas TA, Demory-Luce D, Yang SJ, Baranowski T, Zakeri I, Berenson G. Children’s food consumption patterns have changed over two decades (1973-1994): The Bogalusa Heart Study. J Am Diet Assoc 2004; 104: 1127-1140.

14. Taveras EM, Berkey CS, Rifas-Shiman SL, Ludwig DS, Rockett HRH, Field AE, Colditz GA, Gillman MW. Association of consumption of fried food away from home with body mass index and diet quality in older children and adolescents. Pediatrics 2005. 116: e 518-e524.

Estimation of True Incidence of Polio: Overcoming Misclassification Errors due to Stool Culture Insensitivity

V. Sreenivas and Jacob M. Puliyel*

*From the Department of Biostatistics, All India Institute of Medical Science, New Delhi;110 029 and *Department of Pediatrics, St Stephens Hospital, Delhi 110 054, India.*

Correspondence to: Dr Jacob M. Puliyel, Department of Pediatrics, St Stephens Hospital, Tis Hazari, Delhi, India. E mail: puliyel@gmail.com

Manuscript received: April 24, 2007; Initial review completed: June 6, 2007; Revision accepted: July 12, 2007.

The diagnosis of polio dependents on culturing the virus in stool samples of children with AFP. Using data obtained under the "Right to Information Act" of instances where only one of the two samples was positive for polio, it was possible to estimate the sensitivity of the system to detect cases of polio. The calculations suggest that there were 1625 (95% CI 1528 to 1725) cases of polio in India in 2006 rather than the 674 reported widely!

Key words: *Polio, Stool culture.*

In the past polio was identified as cases of acute flaccid paralysis (AFP) with residual paralysis on follow up after 60 days. Of late we are depending on virological culture of polio virus in stool samples of children with AFP to identify cases of polio. There is concern that some cases of polio may be missed because of imperfect sensitivity of this system of identification. Sensitivity of the system is improved by taking two samples of stools from each case of AFP.

To investigate how many cases are likely to have been missed in the year 2006 we wrote to the Government of India (GOI) under the Right to Information Act. We sought data on instances of polio AFP where two samples were obtained and culture was positive in only one sample. According to the GOI there were 674 polio cases of 2006 of whom 14 had only one sample received for testing. 643 cases had two samples received for testing and of these 484 had polio virus grown in both samples and 148 had polio virus grown in only one sample. This suggests that in 148 cases of polio one of the two samples did not culture polio virus. Although the figures suggest that there were some missing numbers, we used the data to estimate the sensitivity of the system and to calculate numbers of polio likely to have been missed in the sample of AFP reported in 2006.