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Nutrient adequacy of school going children can be determined by dietary diversity scores within different food groups

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Abstract

The adequate amount of nutrient intake required at the age of pre-puberty in girls is the prerequisite for good health and overall development. The present cross sectional study was conducted to find nutrient intake adequacy in school going girls through dietary diversity score calculation. 10-12 years girls of HIG (high income group) and MIG (medium income group) of Allahabad were decided as population. 50 HIG and 50 MIG girls were drawn randomly after age based stratification. 24 hrs dietary recalls was taken for three days and the consumption of only home cooked food was recorded. DDS (dietary diversity scores) and NAR (nutrient adequacy ratio) were calculated. Student's t-test was applied for finding the significant difference. Pearson's correlation was applied to find the relation between DDS and NAR. Significant difference was found in the DDS of fruits, meat and vegetables of the two comparative groups. Maximum scores of dietary diversity were of vegetables (1.71) and grains (1.62) in MIG girls and of fruits (1.73) and meat (2.00) in HIG girls. The correlation between DDS and the NAR is significant and positive which concluded that on increasing dietary diversity within the food group, nutrient adequacy of nutrient was also increased.

Keywords: Dietary diversity, dietary diversity score,nutrient adequacy ratio, school going girls

Introduction

Inadequacy in diet results in deficiency of different nutrients which makes children malnourished and also affects their overall development as they were not getting sufficient nutrients according to their needs. One third of the population worldwide is affected by minerals and vitamin deficiencies [1]. There is slow progress of reducing the prevalence of micronutrient deficiencies in India.[2] Prevalence of underweight in urban areas is 38% and is higher in girls 48.9% than in boys 45.5%. In India more number of children was affected by macro and micro nutrient deficiencies [2]. Over 90% Indian women, adolescent girls and children are anemic [3].

The prime time to build up body stores of nutrients is the period of school age because it is the time of preparation for rapid growth of adolescence so nutritionally significant. Therefore, it becomes very important to know the nutrient adequacy of school going children. Children in growing age are more prone to diseases caused by various infections due to which there is decrease in absorption of essential nutrients and also in appetite. Several consequences related to health were seen in nutrient deficient children like stunted growth, retardation, blindness, physical deformities, reduced immune functions, lowered resistance to infection, psychosocial difficulties, impaired cognitive development and thus leads to poor academic performance. Food based strategies have recommended as the first priority to meet micro nutrients needs [4].

In girls the growth rate increases at the age of 10 or 11 and this rate is maintained till the age of 13. The protein requirements usually exceeds in this group so as to meet growth needs, for the pubertal changes and for

approaching menarche. Bone growth demands more calcium in children than adults and also the requirement of iron increases as there is increase in blood volume [5]. To fulfill this, diversification in daily diet is an essential food based approach because it contains combination of nutrients and other healthful substances, that no single food can supply alone in the amount needed.Dietary diversity is defined as the number of different food groups or food items that are eaten in a given period of time [6]. Scores for dietary diversity was given on the basis of food group count like grains, vegetables, fruits, milk and meat as mentioned in Food Guide Pyramid. A diet rich in variety items not only fills the mouth with water but also ensures inclusion of various essential nutrients in them. Nutrient adequacy defined as the required amount per day of the specific nutrient present in the diet in one day's meal of an individual [6]. NAR measure first developed by Madden and Yoder [7] and since then been used in both developed and developing countries [8, 9, 10, and 11]. Adult's and adolescent's nutrients adequacy can be indicated by dietary diversity which serves as useful indicator of it and this is proved by many researchers. [9, 12, 13, 14, 15, 16].Variety in diets not only attracts the children but it provides the bulk of nutrients required at this age of pre-puberty in them. The purpose of this study is to determine specific nutrients adequacy through calculation of dietary diversity scores within food group, based on nutrient intake in school going girls (10 to 12 years) belonging to HIG and MIG of urban Allahabad.

Materials and Methods

This is a descriptive, cross- sectional study which was carried out at the Centre of Food Technology; University Of Allahabad. The target populations selected for the study were the school going girls belonging to different socio economic groups- MIG and HIG families of Allahabad city. The Sample size of the study was comprised of 100 girls i.e. 50 MIG and 50 HIG girls of age 10-12yrs. Random sampling was applied for selecting the MIG and HIG families' .The sample units of the girls were drawn randomly after age based stratification. A comprehensive schedule was used to record the general information, dietary diversity of food, dietary intake etc. An observation and interview technique was used for data collection.A dietary survey was conducted described by Swaminathan [17], the consumption of food and nutrient intake was recorded through food frequency table and exchange list [18], was used to convert the amount of consumed food in to amount of specific nutrient.The intake of foods and nutrients was calculated using the Food Composition Table [19].For any item of the food group categories, consumer should consume at least 10 g at any time during the 2-day -survey period [20] and only home cooked food consumptions were recorded. Out of the 10 possible score points, maximum score of diversity that is 2 received by each of the five food groups categories. Calculation of nutrient adequacy ratio (NAR) for energy intake, vitamin A, riboflavin, thiamin, vitamin C, calcium, iron, zinc and protein was done for estimation of nutrient adequacy. NAR i.e. the ratio of daily individual intakes to its recommended dietary allowance was calculated for each nutrient [21] related to subject's gender and age category. DDS and NAR were calculated as described according to the formula below.

- $$\text{DDS} = \frac{\text{No. of food items of a specific food group consumed by the respondent}}{\text{Total no. food items in that specific food group}} \times 2$$

- NAR = Actual intake of nutrient by an individual

  RDA (specific)

Statistical Analysis: Student t -test was applied for finding the significant difference between the means -DDS and NAR of the two comparative income groups. Pearson's correlation (r) was applied to find the correlation

between DDS of particular food groups and NAR of the related nutrients. For statistical analysis, software SPSS (Statistical Package for Social Sciences) ver. 12 was used.

Results

Dietary diversity scores calculation is depicted in table. 1 which shows that HIG girls have maximum scores of dietary diversity from meat group (2.00) and fruit group (1.83) and minimum scores of diversity from milk group (0.40).Whereas in MIG girls' maximum dietary diversity score were from vegetable group (1.71) and grains group (1.62) and minimum from fruit group (0.36). t cal>t tab which shows that there is a significant difference in DDS of vegetable [t cal (2.809) and t tab (1.98)], fruit [t cal (4.280) and t tab (1.98)], meat [t cal (3.818) and t tab (1.98)]. We found that higher DDS within food groups were related to HIG girls in comparison to MIG girls. On the basis of nutrient intake of girls, nutrient adequacy ratio was calculated. Figure.1 shows that max NAR in HIG girls was observed in iron (1.06), vitamin A (1.05), followed by protein (1.05) and min of energy (0.66), and zinc (0.72). In MIG girls max NAR was of thiamine (0.99), riboflavin (0.98), followed by energy (0.98) and min NAR of iron (0.75), and zinc (0.66). Table.2 shows the association between DDS and NAR; we observed that there is a significant and positive correlation exists between them. It is evident from table.3 that max percent (%) of HIG girls were in the category of TDDS >5 and min % of HIG girls were in the category of TDDS<5. Relationship between total dietary diversity scores (TDDS) and NAR shows that max more numbers of HIG girls were there in TDDS more than 5 and these girls have higher NAR as compared to girls with TDDS below 5. Table.4 shows that max % of MIG girls were in the category of TDDS >5 and min % of MIG girls were in the category of TDDS <5 but this overall % is less than HIG girls.

Discussion

The study shows a positive and significant relation between NAR of selected nutrients and DDS. [8, 9, 15, 20, 22]. Some studies showed that the disease rate is reduced by intake of diversified diet, so results in decreased mortality rate [22, 23]. In this study, we found that HIG girls have max DDS from fruits and meat groups and min DDS from vegetable group which shows that consumption of fruit group was higher followed by meat group this is due to certain factors like high socioeconomic group; more availability of fruits in that season and cultural practice of eating it. Another study in Australia [24, 13] also showed similar results. On the other hand DDS of MIG girls were opposite to this as they were taking more variety of vegetables, so in MIG girls max DDS from vegetable group and min DDS from milk group, same findings was reported by Magarey [25]. The method used to score dietary diversity was similar as used by Mirmiran and Haines, [20, 26]. Calculation of nutrient adequacy ratio (NAR) based on nutrient intake of HIG and MIG girls. Max NAR in HIG girls was observed in iron (1.06), vitamin a (1.05) followed by protein (1.05) as the consumption of fruits and meat were higher in this group. Whereas in MIG girls, max NAR was observed in thiamine (0.99) and riboflavin (0.98) followed by energy (0.98) as the intake of vegetables was higher in them. Similar result was reported by Torheim, [14] who calculated NAR of particular nutrients to its RDA and observed that max values of NAR were related to protein, riboflavin and thiamine.Positive correlation between DDS and NAR concluded that as the variety of grains, vegetables, fruits, milk and meat within food groups increases, the NAR of related nutrients were also increases. Higher DDS shows more adequacies of nutrient, same findings were also been reported by Mirmiran, Steyn and Ogle, [20, 27, 28]. In people with a DDS of five or over, NAR was greater than in individuals with scores below five. The food group score diversity increased with increase in DDS. This result was observed in all food groups. In individuals whose score was more than five, the highest variety score was in fruits; this was also reported in the Bernstein's study, [13]. The girls with DDS higher than 5 may be because grain and fruit group scores were higher.

However, this may result in higher intakes of vitamin C, vitamin A. Ogle, [28] also mentioned the importance of high variety scores in these food groups. It could therefore be concluded that DDS is an appropriate indicator for nutrient assessment of 10 - 12 year old school going girls.

Conclusion

High dietary diversity scores show more variety of food groups in the diet. Significant positive correlation concluded that by incorporating variety of food items within the food groups in the diet of girls, the adequacy of different nutrients was achieved by them. From the present study it can be concluded that dietary diversity score calculation is an appropriate method which is associated with nutrient adequacy in this group of girls.

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TABLES

Table.1: Dietary diversity scores within food groups of HIG and MIG girls.

FOOD GROUPS	HIG				MIG					
	MEAN	St. Err	MIN	MAX	MEAN	St. err	MIN	MAX	t tab (0.05 level)	t cal
GRAINS	1.0652	.049	.51	1.62	1.0361	.038	.50	1.62	1.98	.563
VEGETABLES	.9437	.047	.57	1.71	1.1469	.052	.47	1.71	1.98	2.809*
FRUITS	.9490	.067	.58	1.83	.6282	.028	.36	.90	1.98	4.280*
MEAT	1.2449	.068	.50	2.00	.9314	.054	.50	1.50	1.98	3.818*
MILK	1.1592	.078	.40	1.81	1.0824	.056	.40	1.60	1.98	.834

Sig*

HIG-High income group, MIG-Medium income group,MIN-Minimum, MAX-Maximum, St err-Standard error, t tab- tabulated, t cal- calculated

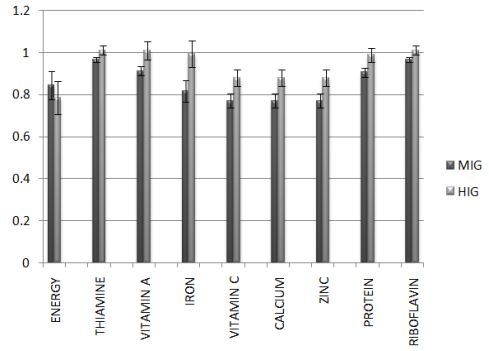

Fig.1: Nutrient adequacy ratio in HIG and MIG girls.

HIG- High income group, MIG- Medium income group.

Table.2: Correlation between DDS and NAR of selected nutrients.

Nutrient Adequacy Ratio	Pearson Correlation(r) With Dietary Diversity Score
GRAINS -	
Energy	.890**
Thiamine	.878**
Calcium	.709**
Protein	.830**
Zinc	.669**
Iron	.691**
VEGETABLES -	
Vitamin A	.861**
Iron	.775**
Vitamin C	.711**
Calcium	.721**
Riboflavin	.685**
FRUITS -	
Vitamin A	.851**
Vitamin C	.834**
Energy	.663**
MILK -	
Protein	.857**
Calcium	.820**
Riboflavin	.746**
MEAT -	
Protein	.861**
Calcium	.775**
Riboflavin	.711**
Iron	.721**
Zinc	.685**

** Correlation is significant at the 0.01 level (2-tailed).

Table.3 Percentage (%) of HIG girls in relation to TDDS and NAR.

TDDS→ Nutrients	< 2		2-4		5-7	
	NAR	%	NAR	%	NAR	%
ENERGY(kcal)	.66	13	.76	65	.91	22
PROTEIN (g)	.87	18	.97	52	1.03	30
IRON(mg)	.75	21	.84	66	1.06	13
CALCIUM(mg)	.72	15	.88	60	.92	25
THIAMINE(mg)	.95	22	.98	51	1.04	.27
VITAMIN A(µg)	.87	21	.94	56	1.05	23
VITAMIN C(mg)	.72	12	.83	59	.92	29
ZINC(mg)	.72	15	.87	47	.92	38
RIBOFLAVIN (mg)	.95	19	.97	46	1.04	35

Table.4 Percent (%) of MIG girls in relation to TDDS and NAR.

TDDS→ Nutrients	< 2		2-4		5-7	
	NAR	%	NAR	%	NAR	%
ENERGY(kcal)	.72	23	.82	54	.95	23
PROTEIN (g)	.87	21	.89	49	.94	30
IRON (mg)	.72	18	.84	62	.93	20
CALCIUM (mg)	.72	32	.76	55	.82	13
THIAMINE (mg)	.95	25	.96	51	.98	24
VITAMIN A (µg)	.87	27	.92	58	.94	15
VITAMIN C (mg)	.72	22	.77	47	.82	31
ZINC (mg)	.72	19	.75	50	.82	31
RIBOFLAVIN (mg)	.95	22	.96	44	.98	34