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Original Article

Dietary Habits and Nutritional Status in Mentally Retarded Children and Adolescents: A study from North Western India

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ABSTRACT

Objective: To compare the dietary habits and nutritional status of mentally retarded (MR) and normal (NG) subjects and to examine the relationship between the dietary habits and nutritional status and the level of mental retardation in the MR group. **Method:** A case control design was utilized: 117 MR (random sampling) and 100 NG (quota sampling) subjects between 7-18 years matched for age (except in the 16-18 years age group) and socio-economic status were selected from a government and private institution, respectively. Nutritional status (energy, protein, fat, calcium, iron and vitamins A, B1, B2 and C) was assessed by the food diary method. Body Mass Index was recorded. Eating habits were obtained on a dietary habits proforma and blood samples were analyzed (hemoglobin, lymphocyte count and serum albumin). **Results:** More MR children were underweight, while more normal children wee overweight. MR group was significantly more likely to have difficulty in chewing and swallowing; and the tendency to spit out and vomit food. Based on a cutoff of 2/3rd RDA (Recommended Dietary Allowance), diets were deficient in iron and possibly riboflavin in 10-18 year old MR males; and in iron in the normal group; however, a direct comparison of the MR and normal groups revealed that male MR subjects had significantly lower intake of most nutrients. Level of retardation was associated with self-feeding deficits. **Conclusion:** Diets of MR and normal group subjects were inadequate with regard to mean iron consumption; and boys with MR had significantly lower consumption of all nutrients in comparison to normal boys.

INTRODUCTION

Mental retardation (MR) is one of the major clinical and socially relevant conditions that affects 3% of the total pediatric population.[1] The deleterious effect of early malnutrition on later intellectual development in children in developing countries has been clearly documented.[2] It is also known that severely mentally disabled children are at a high risk for developing malnutrition which may partly explain the growth retardation generally encountered in such children and associated complications in later life.[3] Malnutrition as revealed by anthropometric variables is highly prevalent among children with MR; and the prevalence of malnutrition increases with age, deterioration of mental functioning and cerebral palsy.[4]

In a study on nutrient intake in MR children, non-obese subjects with Down's syndrome were reported to consume several micronutrients at <80% of the Recommended Dietary Allowances (RDA) and to have a low energy intake; though their body composition did not differ in comparison to the control group.[5] Another study showed that male and female individuals with MR differed significantly with regard to their energy intake;

however, energy intake was not related to the degree of the mental handicap or body mass index.[6] It has been stated that children and adolescents with MR who receive comprehensive interdisciplinary nutritional services, can have a nutrient intake that meets their nutritional requirements.[7]

Feeding and mealtime behaviour problems like food refusal, food selectivity, mealtime aggression, rumination, pica and insufficient feeding skills; are commonly observed among individuals with developmental disabilities.[8] In a study conducted on eating behaviour of children and adolescents (2-18 years) with Down's syndrome and other developmental and chromosomal disorders, and their siblings, most children including the preschool children were reported to have some level of self-feeding skills. However, many affected children as well as their siblings lacked chewing skills.[9] Feeding behavior is reported to have a significant influence on nutritional status both in biochemical and anthropometric parameters in mentally retarded children and biochemical parameters were also influenced by variation of socio-economic status.[1] The factors contributing to the nutritional disorders in mentally retarded children include inadequate nutrient intake due to poor feeding techniques; gross motor self-feeding impairment, swallowing difficulties, regurgitation, and gastro-esophageal reflux; limited appetite, food aversion and food refusal; and coughing, choking or vomiting during eating.[3] Obesity and low activity level, constipation and nutrient drug interactions and allergies were also reported to have an impact on overall nutritional status of MR children.[3] Since feeding problems may reduce food consumption in mentally retarded children, dietary counseling of the parents and other family members may be useful to counter the intake deficit.[10]

Only one study on nutritional status in mentally retarded children (all subjects had Down's syndrome) is available from India.[11] These children were shorter than normal children. Children in the age range of 4-9 years weighed less and had deficient calorie intake and those in the range of 10-16 years weighed more and had surplus calorie intake than normal children. Children in all age groups had insufficient intake of protein, and vitamins A, C, and B complex, and excessive intake of fat. Many children had problems in dentition like crowding of teeth and missing teeth but only about 20% required alteration in the consistency of food. Hand-to-mouth coordination was poor in a quarter of the children.[11]

The present study was designed to determine if the nutrient intake or dietary habits of children with MR differed significantly from those of normal school going children. The study also explored the relationship between the severity of mental retardation and dietary habits and food consumption.

METHODS

Sample: The sample of subjects with mental retardation was drawn from Government Institute for Mentally Retarded Children (GIMRC), Chandigarh. The school serves 300 children (7-18 years) who are divided into 12 educational and 6 vocational classes, each consisting of 15-20 students. Approximately half of the students from each class were selected for the study with the help of a table of random numbers. Parents of the 150 subjects thus selected (including 20 hostellers) were contacted for informed consent. Twenty five parents (16.7%) did not provide consent; 3 (2%) withdrew their wards from the institute prior to data collection (reasons were not related to the study); and 5 (3%) returned incomplete forms. Normal subjects (NG) were selected from a private co-educational school through quota sampling to achieve age matching (115 children studying in classes II to X were selected). Informed consent was provided by 100 parents (87%). Normal subjects between

16-18 years of age could not be included in the study, since the school was only up to class X.

For analysis subjects were divided into subgroups based on age and gender: 7-9 years (boys and girls); 10-12 years (boys and girls); 13-15 years (boys and girls); 16-18 years (boys and girls) to correspond to RDA subgrouping followed by the National Institute of Nutrition (NIN), Indian Council of Medical Research (ICMR).[12] In the MR group 76% were boys and in the NG 49% were boys. Most subjects were from the middle socio-economic status.

Assessment: A semi structured demographic sheet was used to obtain information regarding age, sex and socio-economic status. A food consumption record sheet bearing comprehensive instructions for parents for recording the daily food consumption for three consecutive days was designed (food diary method). The record sheet included questions on the kind of milk consumed, fat/ oil consumption and use of vitamin/mineral supplements. A questionnaire to obtain information on dietary habits of subjects was also prepared. Face validity for these tools was established through critical reviews by 2 dieticians and 2 other senior faculty members external to the core group. Requisite modifications were carried out.

Height of all subjects was recorded to the nearest 1.0 mm by using a mobile stadiometer (Seca 214; Seca GMBH and Co. KG, Medical Scales and Measuring Systems, Germany; 2001). Body weight was measured in light clothing to the nearest 0.1 kg with an electronic scale (Avery H 311/L 112 A, Avery India Ltd., Calcutta, India). BMI was calculated by dividing body weight (in kg) by height^2 (in m). The Body Mass Indices were plotted on the BMI for age percentile charts.[13] A blood sample (5 ml) was obtained for estimation of blood haemoglobin (cyan-methaemoglobin method), absolute lymphocyte count (ALC) and serum albumin (bromocresol green dye-binding method). Recent IQ tests were available or were performed for MR subjects.

Data collection, referencing and interpretation: Parents of MR and NG subjects were addressed (in their respective institutes) after parent-teacher meetings regarding the purpose of the study and were explained how the 3-day food consumption was to be recorded. They were shown sample household measures (standard glass, cup, bowl, cooking ladle, serving spoon, tablespoon and teaspoon); and were provided hand outs bearing lucid instructions on the method for recording food consumption and drawings of sample household measures with their dimensions. Individual sessions were conducted for parents who missed the initial introductory session. Further clarification of information/data was done through face-to-face or telephonic (about 30% of each group) interviews by dieticians. The method of recording food consumption for subjects residing in the institute's hostel was explained and demonstrated to the hostel warden, and dieticians monitored the recording of one meal (lunch) for three consecutive days. The software Nutritrust Version Pro.02.00 (Nutritrust India Private Limited, New Delhi, India, 2000) was used to estimate the mean energy, protein, carbohydrate, fat, calcium, iron, vitamin A, thiamine, riboflavin and ascorbic acid intake of subjects. The RDA for Indians was used to calculate the percent difference in consumption of above nutrients.[12] A cut off of less than 2/3 of RDA (~33% deficit) was rated as an indicator of nutritient deficit.[14]

Statistical analysis: Group comparisons were done by applying t-test (quantitative data) and χ^2 test (qualitative data). Product moment correlation was used to examine the correlation between level of retardation and nutrient intake.

RESULTS

In the MR group 37% were mildly retarded, 39% moderately retarded, 22% severely retarded and 2% were profoundly retarded. A majority of subjects in both the groups had

normal BMI (between 10th and 90th percentile for age) but significantly more ($\chi 2=9.39$, df=2, $p<0.01$) MR compared to NG subjects were underweight (<10th percentile) (Table 1). When the mean BMI were compared among different age groups, significant difference between the groups was observed only in the 13-15 years category ($t=3.65$, df=51, $p<.001$, Table 1). There were no intra group gender differences in BMI.

Table 2 shows that MR subjects had significantly more difficulty in chewing food properly ($\chi 2=13.0$, df=1, $p<.001$) and swallowing ($\chi 2=5.4$, df=1, $p<.05$) and had a greater tendency to spit out ($\chi 2=16.49$, df=1, $p<.001$) and vomit food ($\chi 2=4.5$, df=1, $p<.05$) than NG. Compared to normal subjects, MR subjects displayed a significantly greater preference for solid foods ($\chi 2=5.15$, df=1, $p<.05$). Significantly more parents of NG subjects reported excessive food intake by their children as compared to parents of MR subjects who felt that they were eating significantly less ($\chi 2=8.56$, df=2, $p<.05$).

Table 1: Body mass index of mentally retarded and normal group subjects

Age Group (in years)	Body Mass Index				t-test
	MR[a] (n=117)		NG[b] (n=100)		
	Mean±SD[c]	(n)	Mean ±SD	(n)	
7-9	17.12±3.98	(11)	15.03±2.06	(22)	2.06
10-12	17.53±4.56	(61)	18.82±3.72	(38)	0.21
13-15	18.03±3.86	(13)	21.17±4.02	(40)	3.65***
16-18	19.16±3.76	(32)	-	-	-
BMI[d] for age percentile	**frequency**	**(%)**	**frequency**	**(%)**	**X^{2e}**
<10th percentile	40	(34)	17	(17)	9.39**
10th – 90th percentile	67	(57)	67	(67)	
>90th percentile	10	(9)	16	(16)	

[a]Mentally retarded, [b]Normal group, [c]Standard deviation, [d]Body mass index, [e]Chi square.
**p < .01, ***p < .001

Table 2: Dietary habits of mentally retarded and normal group subjects

Eating Pattern	MR[a] (n = 117)	NG[b] (n = 100)	$\chi^{2\,c}$
	f[d] (%)	f (%)	
Able to indicate when hungry	115 (98.3)	97 (97)	.02
Able to indicate when full	106 (90.6)	91 (91)	.01
Able to consume food on his own	110 (94.0)	94 (94)	.00
Likes consuming liquid/soft foods	97 (82.9)	73 (73)	3.12
Likes eating solids better	85 (72.6)	58 (58)	5.15*
Difficulty in swallowing	20 (17.0)	7 (7)	5.04*
Tendency to spit out food	23 (19.6)	2 (2)	16.49***
Tendency to vomit food	14 (12.0)	4 (4)	4.50*
In general fussy about food	28 (23.9)	34 (34)	2.67
Frequent stomach upsets	15 (12.8)	13 (13)	.002
Do you think consumption of child is			
Normal	92 (78.6)	75 (75)	
Less	9 (7.7)	19 (19)	8.56*
Excessive	16 (13.7)	6 (6)	
Takes normal time to finish meals			
Normal	75 (64.1)	73 (73)	
Excessive	42 (35.9)	27 (27)	1.97
Does he/she chew properly	82 (70.1)	90 (90)	13.00***

[a] Mentally retarded, [b]Normal group, [c]Chi square, [d]Frequency.
*p<.05, **p<.01, ***p<.001

The mean nutrient intake for each age group in MR and NG was calculated to find out the percent difference from the RDA (Table 3). In the MR group the diet of 10-18 years old boys was deficient in energy (25%) and protein (15%-29%) while the diet of 10-15 year old girls was deficient in proteins (15%-25%). The diet of MR subjects of all age groups and in both sexes was deficient in iron (25%-65%) and riboflavin (29%-49%). The diet of NG subjects was deficient only for iron (22% to 55%) with the maximum deficit seen in 13-15 years old boys. MR subjects (all age groups, both sexes) consumed significantly less calcium, and vitamin A, B_1, and B_2. MR boys in the age group of 10-15 years consumed significantly less protein, carbohydrate and fat than corresponding normal subjects. MR girls in the 13-15 year age group consumed significantly less protein in comparison to the relevant controls. At a cutoff of 2/3rd RDA, diets of both MR and NG were found to be adequate for all nutrients except for iron and possibly riboflavin in 10-18 year old MR boys.

Table 3 shows group comparisons between MR and NG subjects regarding consumption of nutrients. Boys with MR consumed significantly less nutrients (except iron); while MR girls consumed significantly less vitamin A and C compared to relevant NG subjects *(t-tests, df and p values not shown in text because of multiple comparisons)*. Between group difference in riboflavin consumption was found to be significant ($p<.001$) with NG subjects in almost all age groups meeting the RDA for the vitamin). The proportion of energy derived from protein, fat and carbohydrates did not differ between the two groups (MR: 11%, 33% and 56%; NG: 11%, 35% and 54%). Subgroup analysis within the MR group showed that children within higher IQ categories consumed more fat ($r=0.19$, $p<0.5$) and calcium ($r=0.19$, $p<.05$).

It was observed that the mean blood hemoglobin level, absolute lymphocyte count and serum albumin were within the normal range for all age groups and in both the sexes in both MR and NG.

DISCUSSION

We found relatively less problems related to dietary intake and eating habits in our sample of MR children in comparison to the other Indian report.[11] The differences in sample characteristics (Seena et al had selected a purposive sample of children with Down's syndrome, with about half having problems of dentition) of the two studies could explain these differences.[11] In our study, more MR subjects were underweight while more NG subjects were overweight. The ability to independently procure food especially 'tasty' food which is often high in calories and rich in sugars and fats may explain this finding; since both groups belonged to comparable (middle) socioeconomic status; the MR children (mild to moderate retardation) did not need assistance in feeding; and the food intake of hostellers (15 students in the MR group) is monitored regularly. In line with the above result, MR children within higher IQ categories consumed more fat (tastier food) and calcium. The finding in relation to calcium is difficult to explain. It is possible that children with higher IQ are able to understand and comply with parental instructions regarding consumption of milk and leafy vegetables which are important sources of calcium in Indian diets.

The between-group difference in BMI was highly significant in the 13-15 years age group (the period of growth spurt), when the energy and protein requirements are high and there is need for proportionate increase in the quantity and improvement in quality of food consumed. It is possible that the feeding problems observed in MR subjects (improper chewing, difficulty in swallowing, spitting out, vomiting) affected their nutrient intake adversely as reported in earlier studie.[3,11]

Table 3: Nutrient consumption of mentally retarded and normal group subjects

Nutrients	7-9 years	10 -12 years		13 – 15 years		16 – 18 years	
	Boys + Girls	Boys	Girls	Boys	Girls	Boys	Girls
	MR[a] (n=11) NG[b] (n=22)	MR (n=23) NG (n=18)	MR (n=6) NG (n=20)	MR (n=35) NG (n=20)	MR (n=10) NG (n=20)	MR (n=24)	MR (n=8)
	Mean (SD[c])	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Energy MR	1821.7	1597.1	1945.8	1817.8	1879.3	1998.9	2275.1
(Kcal)	(415.8)	(1246.7)	(414.7)	(455.9)	485.7	(539.7)	(475.9)
NG	1947.8	2121.9	2166.7	(2408.5)	2266.2		
	(537.3)	(405.3)	(722.3)	(501.8)	(614.1)		
RDA[d]	{1950[e]}	{2190}	{1970}	{2450}	{2060}	{2640}	{2060}
MR Vs. NG[g]				***			
Protein MR	48.5	40.7	48.1	50.0	48.6	55.0	61.9
(g)	(9.6)	(15.0)	(9.9)	(13.4)	(14.5)	(18.2)	(13.6)
NG	53.5	59.3	57.0	65.3	63.6		
	(13.9)	(10.5)	(16.0)	(16.6)	(15.4)		
RDA	{41}	{54}	{57 }	{70}	{65}	{78}	{63}
MR Vs. NG		***		***	*		
Fat[e] MR	66.9	54.8	74.1	62.0	73.8	70.7	87.3
(g)	(21.0)	(23.3)	(22.1)	(22.5)	(26.5)	(24.5)	(32.2)
NG	73.7	86.1	86.7	91.6	88.3		
	(25.7)	(22.5)	(31.6)	(28.4)	(23.5)		
RDA	{54-65}	{61-73}	{55-66)	{68-82}	{57-69}	{73-88}	{57-69}
MR Vs. NG		***		***			
CHO[f] MR	239.6	219.0	268.2	253.9	243.5	280.0	295.7
(g)	(64.9)	(56.2)	(57.1)	(63.3)	(55.3)	(67.7)	(58.3)
NG	249.1	259.2	268.6	307.6	285.1		
	(71.1)	(45.4)	(99.8)	(57.5)	(96.6)		
MR Vs. NG		*		**			
Calcium MR	825.0	623.2	609.1	671.2	769.0	725.3	911.9
(mg)	(504.5)	(420.1)	(260.1)	(394.2)	(362.4)	(429.2)	(630.5)
NG	1159.6	1105.9	1168.2	1143.0	1254.2		
	(381.7)	(390.2)	(336.3)	(352.2)	(345.5)		
RDA	{400 }	{600}	{600}	{600}	{600}	{500}	{500}
MR Vs. NG	*	**	**	***	**		
Iron MR	11.1	12.5	14.0	14.1	13.6	20.2	18.6
(mg)	(2.4)	(10.3)	(3.5)	(3.7)	(3.3)	(25.2)	(3.0)
NG	13.5	15.8	14.9	18.2	16.5		
	(5.2)	(14.9)	(6.0)	(5.3)	(4.1)		
RDA	{26}	{34}	{19}	{41}	{28}	{50}	{30}
MR Vs. NG	*			**			
Vitamin A MR	2845.0	2146.5	3077.3	2196.3	2458.2	3792.2	3596.3
(beta-	(2538.6)	(2719.3)	(1157.4)	(1065.4)	(1130.0)	(6422.5)	(1428.4)
carotene) NG	4861.1	4466.5	4642.3	5273.2	5299.6		
	(2408.7)	(1643.7)	(2497.2)	(32.9)	(2268.5)		
RDA	{2400}	{2400}	{2400}	{2400}	{2400}	{2400}	{2400}
MR Vs. NG	*	*	*	***	***		
Vitamin C MR	50.3	39.7	40.3	60.2	55.0	68.7	73.4
(mg)	(35.3)	(48.3)	(21.4)	(40.0)	(23.8)	(63.4)	(39.0)
NG	80.6	63.0	70.1	80.3	176.2		
	(46.3)	(28.5)	(28.4)	(32.9)	(318.7)		
RDA	{40}	{40}	{40}	{40}	{40}	{40}	{40}
MR Vs. NG			*				
Vitamin B_1 MR	1.9	1.2	1.3	1.3	1.4	1.5	1.8
(mg)	(0.4)	(0.3)	(0.3)	(0.3)	(0.5)	(0.5)	(0.3)
NG	1.2	1.5	1.4	1.8	1.5		
	(0.3)	(0.3)	(0.4)	(0.4)	(0.3)		
RDA	{1.0}	{1.1}	{1.0}	{1.2}	{1.0}	{1.3}	{1.0}
MR Vs. NG	**	**	*	***			
Vitamin B_2 MR	0.9	0.8	0.8	0.8	0.8	1.0	1.0
(mg)	(0.4)	(0.3)	(0.1)	(0.3)	(0.4)	(0.4)	(0.4)
NG	1.2	1.3	1.2	1.4	1.3		
	(0.4)	(0.3)	(0.4)	(0.4)	(0.4)		
RDA	{1.2}	{1.3}	{1.2}	{1.5}	{1.2}	{1.6}	{1.2}
MR Vs. NG	*		***	***	***		

[a]Mentally retarded, [b]Normal group, [c]Standard deviation, [d]Recommended dietary allowance, values are given in {} parentheses, [e]Optimum fat requirement based on 25-30% of total energy requirement, [f]Carbohydrate, [g]Group comparison between MR and NG

*p<.05, **p<.01, ***p<.001

The diet of MR subjects was deficient only in iron and possibly riboflavin for 10-18 years males when 2/3rd of RDA was used as a cutoff. Dietary iron was deficient even in NG subjects. An earlier study reported deficiencies in the consumption of calcium, iron, and vitamins A, C, B_1 and B_2 in subjects with Down syndrome.[11] Differences in sampling characteristics as mentioned above could be the reason for the observed differences. The mean consumption of all the nutrients (except iron) among MR males was significantly lower than their normal counterparts but this was not observed in respect of female subjects .The reason for this is not very clear.

Hemoglobin levels were normal despite deficits in iron intake. The diets of our subjects were sufficient in vitamins C and A. Vitamin C increases the absorption of iron thereby increasing its availability for hemoglobin synthesis and Vitamin A assists in the production of erythropoietin (EPO), a stimulant of erythropoiesis.[15] However, it is possible that haemoglobin levels might be normal even when tissue reserves are depleted. We could not estimate serum ferritin (a better indicator of iron status than haemoglobin)[16,17] because of the expense involved in this test.

In conclusion, it may be stated that the diets of our subjects were adequate in all the nutrients except iron at 2/3rd RDA cut off. The consumption of all the nutrients in MR boys was found to be significantly lower than their normal counterparts although this was not the case for female subjects. Regular assessment of nutritional status of MR population may be of value in correcting nutrient deficiencies promptly, as nutrient intake has a bearing on the growth, development and stature of an individual.

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