

Feeding behavior and nutritional status of children with celiac disease residing in rural areas of Haryana

Mittal. A^{*}, Gupta. S^{**}

^{*}Diabetes and obesity educator, Department of endocrinology, Medanta-The Medicity

^{**}Assistant Professor, Department of Food and Nutrition, Lady Irwin College

Abstract- Lifelong compliance to gluten free diet is a prerequisite for maintaining well-being of children with celiac disease. It becomes very difficult to restrict wheat based food items from the North Indian diets predisposing children to micronutrient and micronutrient deficiencies and may impair physical and cognitive growth of these children. A cross-sectional study was carried out among 40 children (5-12 years) already diagnosed with celiac disease and were following gluten free diet from last three months. The data was collected from a health facility at Gurugram, Haryana catering to children residing in nearby villages. Anthropometric measurements and 24-hour recall was used to assess nutritional status of the children. Feeding behavior was recorded on a pretested questionnaire. One-fifth of the children were underweight, one-fourth were stunted and all but one had normal BMI [1]. The intakes of all food groups were inadequate by the children as compared with balanced diet [2]. Comparison with the RDA [2] indicated that the intake of all nutrients except protein, fat and calcium were inadequate. Regular diet counseling would help in alleviating symptoms, improvement in nutritional status and quality of life of children with celiac disease

Index Terms- celiac disease, dietary adequacy, gluten free diet, stunting, underweight.

I. INTRODUCTION

Celiac disease (CD) is intolerance to gluten present in cereals like wheat, barley and rye. CD is an inflammatory small intestinal disorder that can lead to severe villous atrophy, malabsorption, and malignancy. The symptoms are diverse, and may be absent or very subtle. Nearly 3-10 patients remain undiagnosed for every one patient diagnosed with celiac disease showcasing as an iceberg phenomenon [3]. It was previously believed that CD is a disease of Europe. In India, it was reported for the first time in children and adults in 1966. It was observed that CD is prevalent among predominantly wheat consuming states such as Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar and Madhya Pradesh [4].

Celiac disease, also known as gluten-sensitive enteropathy, is an autoimmune disorder caused by ingestion of gluten in genetically sensitive individuals who cannot tolerate gluten protein, a mixture of storage proteins contained in several cereals (wheat, rye, barley and derivatives). The most commonly known protein causing celiac disease is gluten. It contains two types of proteins, gliadin and glutenin, which contain disease causing peptides [5]. The increase in number of these peptides in the gut causes inflammatory reactions followed by a series of symptoms associated with CD like diarrhea, constipation, vomiting, dyspepsia and mouth ulcers etc.

The only effective treatment for the disease is a life-long adherence to a Gluten Free Diet (GFD) that excludes any products derived from wheat, barley and rye grains. The compliance to GFD is an important part of the management of CD. A study conducted on 60 children reported that strict dietary compliance is difficult to adhere to with wheat being a staple cereal in India [6]. Other factors affecting compliance included lack of awareness and non availability of gluten free diets as well as contamination of other items with wheat at grocery shops. Dietary compliance has been reported to vary from 42% to 91% depending on the method of assessment, with the lowest compliance amongst ethnic minorities and those who are diagnosed during childhood [7]. Furthermore, adolescents also have difficulty with dietary compliance [8]. The different eating pattern of these children may have implications on their physical and cognitive growth. The present study was undertaken to assess the nutritional status and feeding behavior of children with celiac disease who are on gluten free diet from last three months.

II. MATERIALS AND METHODS

The study sample comprised of 40 children (23 boys and 17 girls) aged 5-12 years residing in rural areas. All children were already diagnosed with celiac disease by gastroenterologists/pediatricians and were following GFD from at least last three months. After seeking permissions, the data was collected at a health facility, Gurgaon, Haryana, where children and their parents were coming for the follow ups with gastroenterologists/pediatricians from December 2013 to March 2014.

Data collection in this phase included socioeconomic-demographic profile of families of children, medical profile, anthropometry (weight and height), dietary survey and feeding behavior. The socio-economic demographic data was collected from primary caregivers (mothers/fathers) at their follow-up visit at health facility and recorded in the pre-tested questionnaire. Medical profile was collected from the medical records of children and recorded in the questionnaire by the investigator. Data on anthropometry was collected using standardized procedures. The equipments were calibrated from time to time. Current dietary intake was collected by using 24-hour recall method from mothers of the children using standardized utensils and recipes.

All the data was coded quantitatively and qualitatively in excel sheet frequencies and mean of required data was calculated. Anthropometric data was calculated using Anthro plus [1]. Mean intake of energy, protein, fat, calcium, vitamin A, vitamin C, iron, thiamine, niacin and dietary fiber. NSI Calculator was used to calculate dietary intake of each child and mean percent food and nutrient adequacy was computed.

III. RESULTS

The mean age of the study sample was 8.3 ± 2.41 years. All children were going to school. Nuclear families were higher (55%) than the proportion of joint families (45%). The mean family size was 5.7 ± 1.72 years. The mean numbers of the siblings were 3 siblings per family. None of the parents were illiterate however, nearly half of them had education upto senior secondary level. Majority of the mothers (95.0%) were housewives. More than half (57.5%) of the fathers were into private service as drivers, security guards, sales men, supervisors. Rest 42.5% of fathers were engaged in small businesses like owning a shop (ration, garment or small garage). The average monthly per capita income of the families was Rs. 2681.8 ± 1693.08 . All the children had undergone serological tests and 95% of them had intestinal biopsies for confirmation of CD. The mean age of diagnosis in the study sample was 5.6 ± 1.28 years. Symptoms commonly experienced prior to diagnosis, were diarrhea (70%), poor growth (62.5%), weight loss (55%), abdominal bloating (52.5%), excessive gas and fatigue (40%). Majority of children reported that failure in growth, weight loss, excessive gas and fatigue were relieved after initiating GFD. All but two families had medical history of CD. Follow-up visits to the doctors for medical advice was very poor among the group.

Nutritional status of the children

Mean weight of the boys (n=23) was 20.9 ± 3.59 kg and of girls (n=17) was 28.1 ± 9.08 kg. The mean height of boys and girls were 116.2 ± 8.84 cm and 129.3 ± 14.07 cm, respectively. It was seen that girls were taller and heavier than boys. The mean BMI for boys and girls was 15.4 ± 0.75 kg/m² and 16.3 ± 2.03 kg/m², respectively.

Z- scores for weight, height and BMI of the children were computed using WHO MGRS, 2007 standards (Table 1). Nearly one third of the children were stunted (< -2SD). Height-for-age reflects attained growth in length or height at the child's age at a given visit. This indicator helps in identifying children who are stunted due to prolonged under nutrition or repeated illness. Stunting is irreversible process in nature and reflects cumulative frequencies of retarded growth over the years, which could be due to acute or

chronic illness as well as inadequate intake. One fifth were underweight (<-2SD WAZ). Weight-for-age reflects body weight relative to the child's age on a given day.

Only one child was found to be tall (>2SD HAZ) and one was overweight (>2SD WAZ). All had normal BMI for age (-2SD and 2SD) except one child who was wasted (<-2SD BAZ) as shown in Table 1.

Table: 1 Anthropometric assessment of the children (n=40)

Height for age (HAZ)			
z-scores	BOYS	GIRLS	TOTAL
	n (23)	n(17)	n(40)
Stunted(< -2SD)	9(22.5)	4(10)	13(32.5)
Normal(-2SD and 2SD)	13(32.5)	13(32.5)	26(65)
Tall (>2SD)	1(2.5)	-	1(2.5)
*Weight for age (WAZ) (n=31)			
	n(21)	n(10)	n(31)
Underweight(< -2SD)	5(12.5)	2(5)	7(17.5)
Normal(-2SD and 2SD)	15(37.5)	8(20)	23(57.5)
Overweight(>2SD)	1(2.5)	-	1(2.5)
BMI for age (BAZ)			
	n (23)	n (17)	n (40)
Wasted(< -2SD)	-	1(2.5)	1(2.5)
Normal(-2SD and 2SD)	23(57.5)	16(40)	39(97.5)
Overweight(>2SD)	-	-	-
<i>Numbers in parentheses denote percentages</i>			
<i>*WHO 2007 gave WAZ scores only up to 10 years of age</i>			

A study conducted on 50 children (4-9 years) in Chandigarh had shown that low weight and stunting were significantly more frequent in children with CD [9]. Studies had shown that the consumption of gluten free diet improves growth and nutritional status amongst children with CD [10, 11].

Feeding behaviour

All children were prescribed gluten free diet soon after diagnosis of CD. All children and their parents were counseled about GFD by the doctor as well as the dieticians.. Nearly ninety percent were using gluten free flours like pearl millet, benagla gram flour, finger millet, soya flour etc to make Indian breads as wheat substitutes but only 15% used separate utensils to cook and store the food. Only half of the parents were giving prescribed vitamin and mineral supplements to their children. Only one child was taking omega-3 supplement whereas 25% were prescribed these supplements.

It was observed that 32.5% of children found difficult to follow gluten free diet. A study[12] on a total of 70 CD patients stated that 53.8% of children found it fairly difficult to maintain GFD.

Data on dietary pattern of the children (n=40) was collected from the mothers/caregivers using structured interview method to understand the current meal pattern and food habits of children with celiac disease. The information obtained on meal pattern, skipping meals, eating out, food likes and dislikes of the children.

Majority of the children (87.5%) were consuming 4-5 meals a day like breakfast, mid-morning, lunch, tea time and dinner. In the present study, 32.5% missed one or the other meal daily, 22.5% missed their meals sometimes and 45% children reported that their children never missed meals. Majority of the children (95%) carried school tiffin daily but 10% of the children did not eat their school tiffin 2-4 times a week. Parents /caregiver stated that 12.5%-15% of children skipped lunch 2-4 times a week and dinner was skipped by 5-10% of the children 2-4 times a week. The reasons for skipping meals were loss of appetite (42.5%), disliked the taste of GF food items (32.5%), angry and anxiety (2.5%).

Eating pattern of the children in the present study was majorly restricted at home only. Majority of the parents (75%) never go out for eating with friends and family. Eating out in wedding (80%) and parties (37.5%) was restricted by the families. The main reason stated that the concern about quality of gluten free items and temptation amongst children towards gluten containing food item refrained them from eating out frequently (75%).

Food Group	5-6 year(n=11)			7-9 year(n=17)			10-12 year(n=12)		
	Food intake(g/d) (Mean ±SD)	%adequacy (Mean ±SD)	RDA (gram)	Food intake(g/d) (Mean ±SD)	%adequacy (Mean ±SD)	RDA (gram)	Food intake(g/d) (Mean ±SD)	%adequacy (Mean ±SD)	RDA (gram)
Cereals	45.5±14.37	37.8±11.98	120	58.8±18.67	32.6±10.37	180	60.8±22.62	24.5±9.63	300
Pulses	24.5±32.85	81.8±109.51	30	16.7±16.53	27.9±27.56	60	32.5±15.61	54.1±26.02	60
Green leafy vegetables	0.00	0.00	50	11.7±21.76	11.7±21.76	100	9.1±18.35	9.1±18.35	100
Roots and tubers	45.0±42.59	45.0±42.59	100	37.0±19.93	37.0±19.93	100	27.0±21.06	27.0±21.06	100
Other vegetables	0.00	0.00	100	15.8±20.88	15.8±20.88	100	1.6±3.72	0.8±1.86	200
Fruits	54.5±77.27	54.5±77.27	100	61.7±46.75	61.7±46.75	100	8.7±7.10	8.7±7.10	100
Fish	0.00	0.00	50	0.00	0.00	50	0.00	0.00	100
Meat/egg	0.00	0.00	50	0.00	0.00	50	0.00	0.00	50
Milk	444.0±212.78	88.8±42.56	500	470.9±80.55	94.12±16.11	500	310.0±119.89	62.0±23.97	50
Fats	7.73±2.49	30.9±9.96	25	13.2±6.40	44.1±21.34	30	16.9±3.70	56.39±12.35	35
Sugar	12.2±8.36	61.3±41.78	20	12.0±4.87	60.29±24.34	20	12.5±4.78	41.6±15.95	30

The mean daily intake of different food groups by the subjects were tabulated and compared with the balanced diet for children of different age groups as recommended by the ICMR (2011) in Table 2. The mean percentages adequacy of all the food groups was low among all the children. The mean percentage adequacy of protein, fat and calcium was higher than RDA. The intake of fat was high due to the consumption of full cream milk or buffalo milk by most of the children. High intake of calcium could be attributed to high intake of milk, ragi and jowar. Low intake of vegetables, fruits and pulses among children had resulted in very low intake of iron, vitamin A, vitamin C, and folic acid.

The percent adequacy of fat, calcium and protein was high in the age group of 5-9 years whereas in 10-12 years the intake of all nutrients was inadequate. It was noticed that the elder group shows much inadequacies in the diet as they become independent and eat food of their choices and therefore the intake of various food groups was not included in the diet. The intake of fat was high due to the consumption of full cream milk or buffalo milk by most of the children. High intake of calcium could be attributed to high intake of milk, ragi and jowar. Low intake of vegetables, fruits and pulses among children had resulted in very low intake of iron, vitamin A, vitamin C, and folic acid. The dietary intake of the children was not appropriate which leads to nutrient deficiencies in the body. Dietary counseling should stress on the need for a balanced diet through consumption of variety of food groups to meet nutrient requirements.

Table 3. Mean nutrient intake and mean percent adequacies of various nutrients by children (n=40), as compared to RDA (ICMR, 2010)

Nutrients	5-6 year (n=11)			7-9year (n=17)			10-12year (n=12)		
	Mean nutrient intake Mean \pm SD	Mean adequacy Mean \pm SD	% RD A	Mean nutrient intake (g/d) Mean \pm SD	Mean adequacy Mean \pm SD	% RD A	Mean nutrient intake (g/d) Mean \pm SD	Mean adequacy Mean \pm SD	% RDA
Energy (Kcal)	721.8 \pm 224.07	53.4 \pm 16.60	1350	782.9 \pm 118.21	46.0 \pm 7.00	1690	741.5 \pm 142.55	36.4 \pm 7.34	2190
Protein(g)	32.1 \pm 16.05	160.0 \pm 79.83	20.1	33.0 \pm 7.63	111.9 \pm 25.85	29.5	27.3 \pm 5.69	67.7 \pm 14.64	39.9
Fat(g)	42.4 \pm 18.13	169.9 \pm 72.53	25	48.5 \pm 8.66	161.4 \pm 28.87	30	40.7 \pm 6.25	116.4 \pm 17.87	35
Zinc(mg)	2.1 \pm 0.62	30.2 \pm 8.80	7	2.7 \pm 0.83	33.7 \pm 10.33	8	2.7 \pm 1.56	30.9 \pm 17.4	9
Calcium(mg)	1042.4 \pm 498.74	173.7 \pm 83.12	600	1079.7 \pm 175.10	134.9 \pm 21.89	600	742.8 \pm 247.92	92.8 \pm 30.99	800
*Vitamin A (μ g)	485.6 \pm 174.53	10.1 \pm 3.64	3200	474.0 \pm 283.68	9.8 \pm 283.68	4800	384.7 \pm 144.37	8.0 \pm 3.0	4800
Thiamine(mg)	0.5 \pm 0.23	72.4 \pm 32.36	0.7	0.5 \pm 0.13	63.3 \pm 16.84	0.8	0.4 \pm 0.10	46.4 \pm 10.57	1.1
Riboflavin(mg)	0.6 \pm 0.26	80.1 \pm 33.07	0.8	0.6 \pm 0.13	67.9 \pm 12.50	1.0	0.5 \pm 0.12	42.4 \pm 10.67	1.3
Niacin(mg)	2.6 \pm 1.09	24.4 \pm 9.94	11	2.7 \pm 0.43	21.0 \pm 3.34	13	2.8 \pm 1.00	21.7 \pm 8.01	15
Vitamin C(mg)	19.9 \pm 11.49	49.8 \pm 28.72	40	22.3 \pm 9.35	55.9 \pm 23.39	40	13.1 \pm 6.77	32.7 \pm 16.94	40
Iron(mg)	5.7 \pm 2.85	44.3 \pm 21.94	13	6.8 \pm 2.00	42.8 \pm 12.48	16	6.6 \pm 2.94	25.2 \pm 10.30	21
Folic acid(μ g)	68.4 \pm 44.33	68.4 \pm 44.33	100	81.8 \pm 32.69	68.2 \pm 26.74	120	79.0 \pm 27.39	56.4 \pm 19.56	140
Carbohydrate(g)	99.0 \pm 23.42	-	-	110.6 \pm 15.09	-	-	98.8 \pm 27.89	-	-
Fiber(g)	2.0 \pm 0.97	-	-	2.2 \pm 0.99	-	-	2.0 \pm 6.58	-	-

*NSI calculator have taken the value of Beta carotene therefore beta carotene values were used for calculating the mean % adequacy

Conclusion

It can be concluded from the study that such region specific study would help in analyzing the nutritional status of children having celiac disease using 24 hour recall and anthropometric measurements. In the present study, the intake of all the food groups was inadequate and one fifth of the children were underweight. Regular diet counseling would help in alleviating symptoms, improvement in nutritional status and quality of life of children with celiac disease.

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AUTHORS

First Author –Apeksha Mittal, M.Sc (Food and Nutrition), Diabetes and obesity educator, Medanta-The Medicity, Gurgaon,
Email-id: apeksha5rmittal@gmail.com

Second Author – Dr. Shavika Gupta, PhD., M.Sc (Food and Nutrition), Assistant professor, Lady Irwin College, University of Delhi
Email-id: shavika@gmail.com