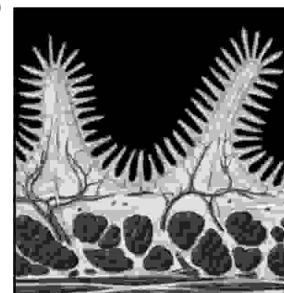


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NUTRITIONAL STATUS AND MICRONUTRIENT LEVELS OF CHILDREN WITH CELIAC DISEASE BEFORE AND AFTER GLUTEN FREE DIET

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ABSTRACT... hinaayesha62@yahoo.co.uk **Introduction:** Celiac disease is an autoimmune inflammatory disorder of small intestine precipitated by ingestion of gluten. Clinical and histological improvement occurs on withdrawal of gluten from the diet. **Objectives:** The present study were to identify the trace mineral deficiency in newly diagnosed celiac children and to assess how far these deficiencies are corrected after strict gluten free diet. The study also assessed the nutritional status of celiac children compared to the healthy controls before and after Gluten Free Diet. **Setting:** Department of Pediatrics Punjab Medical College Faisalabad. **Duration:** January 2004 to March 2005. **Study Design:** Interventional case control study. **Patients and Methods:** 22 children aged 2 to 14 years diagnosed as Celiac disease on the basis of typical intestinal biopsy findings were included. 15 healthy children served as controls. Anthropometric measurements and serum Zinc Copper Magnesium and Iron along with albumin were done for both patients and controls initially and repeated after 6 months while patients were receiving strict GFD and controls receiving normal diet. The general linear model was used for the analysis of variance using SPSS (2004). **Results:** Serum Zinc was below the reference range in 68%. Serum copper and Magnesium in 31%, Iron in 95% and albumin in 59% of the patients. There was a statistically significant increase in serum zinc, iron and magnesium levels (p value, < 0.05) while serum copper and albumin did not show any significant rise after Gluten free diet. Control group did not show any

significant change in their trace mineral levels. Celiac patients gained more weight (mean 4.47 versus 2.91 cm) and height (3.34cm versus 1.022 cm) as compared to the control group. **Conclusion:** Celiac children receiving strict Gluten free diet and showing good clinical response probably do not need mineral supplementation.

Key words: Celiac disease, children, Trace minerals, Gluten free diet, serum zinc Serum iron

INTRODUCTION

Celiac Disease is a disorder of small bowel malabsorption characterized by mucosal inflammation, villous atrophy and crypt hyperplasia, which occurs on exposure to dietary gluten. Clinical and histological improvement occurs on withdrawal of gluten from the diet¹.

The gliadin fraction of Gluten found in cereals like wheat, Rye and barley, triggers a T cell mediated immune response initiating a damaging inflammatory process in the lining of small intestine that blunts or destroys intestinal villi reducing the surface area for absorption, limiting absorption of nutrients².

Celiac disease patients have nutrient deficiencies until proved otherwise.³ Sub-optimal levels of vitamins and minerals have been observed in active celiac disease. Studies indicate that nutrient deficiencies are common not only in active but also silent or sub clinical celiac disease^{4,5}.

The objectives of this study were to identify the degree of mineral deficiencies and nutritional status of children with active celiac disease and to assess the degree of correction of these deficiencies after six months of strict gluten free diet.

PATIENTS AND METHODS

The study was carried out at Department of Pediatrics Punjab Medical college Allied Hospital Faisalabad from January 2004 to March 2005. Out of the 47 children diagnosed, 22 children completed the study. Children aged 2 to 14 years were included in the study. Endoscopic deep duodenal biopsy was performed in all children. Three to four biopsies were taken from the second part of duodenum. 08 children also had

serological tests done viz Anti endomysial antibody IgA, Anti tissue trans-glutaminase IgA. All patients and controls were subjected to fasting serum zinc, copper, magnesium, iron and albumin levels. Anthropometric measurements like Height and weight were also measured. Mineral levels were done on atomic absorption spectrophotometer in University of Agriculture Faisalabad. All patients were followed for a period of six months after starting gluten free diet. Neither the patients nor controls were given mineral or B complex supplements. Celciacs with rickets were given injectable Vitamin D3 and those with signs of Vitamin A deficiency were given vitamin A. Children below 2 years were excluded because of the fact that at this age many other conditions mimic biopsy findings of celiac disease. Patients who became non compliant or were only partially compliant were excluded from the study. Children with incomplete resolution of symptoms were also excluded. Patients having acute infections at the time of sample collection were also deferred and sampled after their recovery. All parameters were repeated after 6 months. 15 healthy children receiving normal diet were taken as controls. The general linear model was used for the analysis of variance using SPSS (2004). The model included weight, Height and age as co-variants and group, time of observation and sex as fixed variants.

RESULTS

22 children aged two to fourteen years fulfilled the criteria of the study. 12 were male and 10 females. The signs and symptoms at the time of presentation are given in Table I. The mean age of onset of symptoms was 15.8 months while mean age of diagnosis was 6.8 years. Delay in the onset of symptoms and diagnosis ranged from 6 to 150 months with the mean delay in diagnosis 61.77 months. Thirteen patients were born to

consanguineous couples nine were products of non consanguineous marriage. Family history was positive in five patients. 15 were predominantly breast fed for the first two years of life and 07 were on artificial feeding.

Biopsy revealed partial blunting of villi with crypt hyperplasia and lymphocytic infiltration of lamina propria in all patients. Eight patients had positive serological tests in addition.

Serum Zinc was below normal reference range in 15 (68%), Serum magnesium in 7 (31%), Serum Copper in 7 (31%), albumin in 13 (59%) and Iron in 21(95%) patients.

DISCUSSION

Zinc was the mineral found deficient in majority (68%) of newly diagnosed celiac children. Mean serum zinc level was 58.85µg/dl in celiacs as compared to 81.47 µg/dl in healthy controls. There was a statistically significant increase in serum zinc after six months of gluten free diet without any mineral supplement (p value <.05).

In celiac disease, zinc deficiency is not only due to malabsorption of the trace element but also increased loss arising from coexistent malnutrition, catabolism of lean tissue, increased bone turnover and protein losing enteropathy.⁶ Correction of all these factors after strict gluten free diet probably contributed towards normalization of serum levels of this micronutrient.

Clinical Feature	Frequency N (%)
Dairrhea	21(95)
Failure to thrive	17(77)
Lethargy	15(68)
Vomiting	08(36)
Abdominal distention	19(86)
Anorexia	14(63)
Constipation	06(27)
Excessive appetite	08(36)
Rectal prolapse	01(04)
Pallor	22(100)
Wt < 25th Centile	22(100)
Ht < 25th Centile	22(100)
Clubbing	09(40)
Wested Buttocks	12(54)
Signs of vitamin A deficiency	17(77)
Rickets	04(18)
Odema	02(09)
Angular cheilosis	10(45)
Flat tongue	08(36)

Table-II. Comparison of micro nutrient levels in celiac children before and after free diet.

Time	Mean ± Std. Error Mean	t	P-value
Zn (ug/dl) Before gluten free diet After gluten free diet	58.85±4.03 84.77±4.31	4.338	0.000
Cu (ug/dl) Before gluten free diet After gluten free diet	97.27±5.27 99.05±3.73	0.729	0.464
Fe (ug/dl) Before gluten free diet After gluten free diet	22.78±2.67 66.81±9.41	4.501	0.000
Mg (ug/dl) Before gluten free diet After gluten free diet	1.645±0.087 1.973±0.058	3.097	0.003
Albumin (G/dl) Before gluten free diet After gluten free diet	4.132±0.854 3.645±0.666	0.568	0.573

Time	Mean \pm Std. Error Mean	t	P-value
Zn (ug/dl) Initial Reading After 06 Months	81.47 \pm 5.38 88.93 \pm 6.96	0.894	0.403
Cu (ug/dl) Initial Reading After 06 Months	96.60 \pm 7.58 105.20 \pm 8.84	0.738	0.466
Fe (ug/dl) Initial Reading After 06 Months	86.87 \pm 16.20 100.00 \pm 13.98	0.614	0.544
Mg (ug/dl) Initial Reading After 06 Months	1.88 \pm 0.07 1.93 \pm 0.07	0.508	0.616
Albumin (G/dl) Initial Reading After 06 Months	3.74 \pm 0.09 3.84 \pm 0.07	0.748	0.461

Source of Variance	Df	Zn	Cu	Fe	Mg	Albumin
Weight	1	0.001NS	2.169NS	3.242NS	0.050 NS	2.937 NS
Height	1	0.355NS	0.028NS	0.345NS	0.073 NS	0.009 NS
Age	1	0.165NS	1.391NS	0.163NS	0.0137 NS	7.284**
Group	1	2.855NS	2.173NS	2.173NS	0.269 NS	1.092 NS
Time of observation	1	8.621*	1.679NS	5.727*	4.795*	0.104 NS
Sex	1	2.843NS	1.866NS	2.906 NS	0.811 NS	0.206 NS
Group* Time	1	2.074NS	0.001NS	1.348 NS	2.962 NS	0.135 NS
Group* Sex	1	0.652NS	0.026NS	0.215 NS	0.001 NS	1.580 NS
Tie* Sex	1	0.172NS	0.002NS	0.073 NS	0.694 NS	0.688 NS
Group* time* Sex	1	0.034NS	0.008NS	0.699 NS	0.412 NS	1.013 NS

NS=Non significant, (p>0.05)**=highly significant (p>0.01),*=significant (p<0.05)

As plasma zinc may conversely fall during periods of rapid tissue synthesis;

(zinc being taken quickly from plasma rather than other tissues) plasma zinc was tested after 6 months of starting GFD in order to allow for complete healing of the mucosa and to skip the period of rapid tissue anabolism following GFD⁷. Hencker and Gabsh studied serum zinc level in different phases of celiac disease. They found abnormally low serum zinc (<2SD) in 50% of newly

diagnosed but not in those receiving Gluten free diet.⁸

Serum copper was lower than the reference range in 7(31%) of patients. There was a non significant difference in mean serum copper in celiacs (97.27 μ g/dl) and healthy controls (96.60 μ g/dl). The site of copper absorption in humans is upper duodenum although noticeable amounts can also be taken up by the stomach. Moreover, metallothionin plays an important

role in absorption of both copper and zinc. Both minerals share the same transporter. Metallothionin has greater affinity for copper than zinc⁹. This might explain normal mean copper levels in celiacs most of them being deficient in zinc. Increase in serum copper after GFD was statistically significant.

SOV	Df	F Value	
		Height (cm)	Weight (kg)
Weight/Height	1	0.212 NS	2.50 NS
Age	1	0.111 NS	0.08 NS
Group	1	8.24*	53.144**
Sex	1	0.851 NS	0.157 NS
Group Sex	1	1.54 NS	0.18 NS

Group	Height gain (cm)	Weight gain (kg)
Control	2.91	1.022
Celiac	4.47	3.345

Low serum iron was almost universal in celiacs. It was observed in 95% of Celiac children. In our study, mean serum iron in untreated celiac disease was 22.7ug/dl as compared to 86.8ug/dl in healthy controls. Iron deficiency anemia is a frequent and sometimes the sole manifestation of celiac disease. 200 consecutive patients presenting with anemia were screened for celiac disease by serological tests in one of the studies. Those who were positive were confirmed by intestinal biopsy 8.5% of those presenting with microcytic hypochromic anemia were having celiac disease¹⁰. In addition to impaired absorption of iron from the gut, occult blood loss has been demonstrated as a cause of iron deficiency in celiac disease. In a carefully controlled study, it was found that occult blood loss was seen in 25 and 50% of celiac patients with partial and total villous atrophy

respectively¹¹. In our study, mean serum iron rose to 66.8ug/dl in Celiac children after 6 months of strict gluten free diet without iron therapy. This could be due to better absorption of dietary iron or stoppage of blood loss if any.

All the Celiac children in our study were below 25th centile for weight and height initially. After six months of gluten free diet, they grew at a rapid rate as compared to their normal counterparts. This was probably due to catch up growth. Final height they are going to achieve needs long term follow up.

CONCLUSION

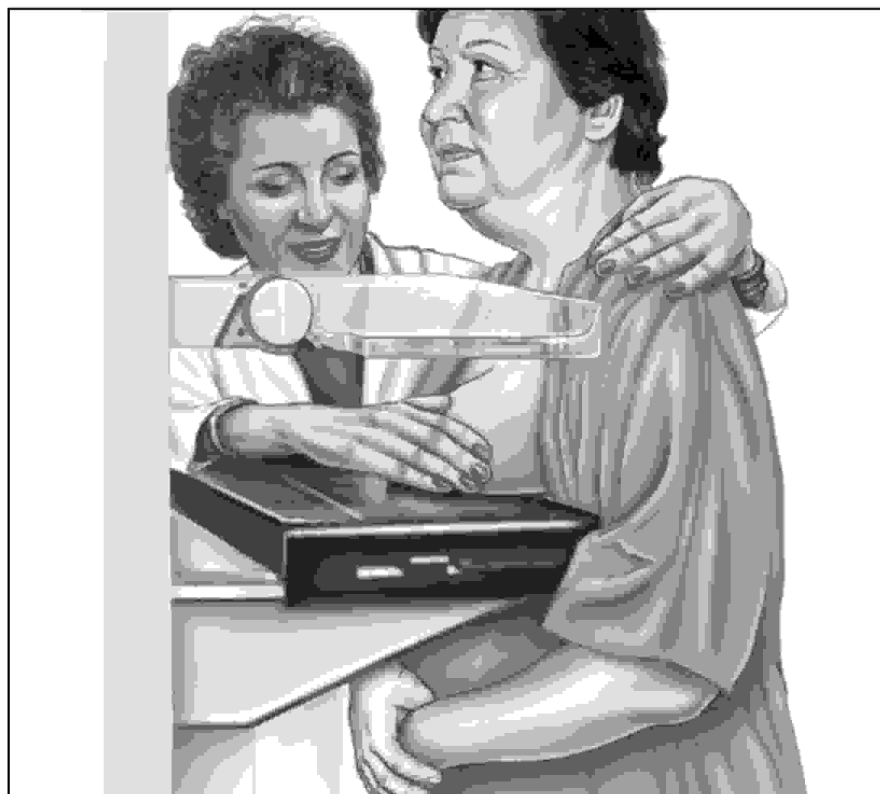
Zinc and Iron are the trace minerals most affected in celiac disease. Copper and Magnesium were less affected. These deficiencies were corrected adequately in patients with complete clinical response even without supplementation. Celiac children receiving strict Gluten free diet and showing good clinical response probably do not need mineral supplementation.

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