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FREQUENCY OF CELIAC DISEASE IN CHILDREN WITH SEVERE ACUTE MALNUTRITION PRESENTING TO MARDAN MEDICAL COMPLEX, MARDAN

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ABSTRACT

Background: Severe acute malnutrition remains a significant cause of child morbidity and mortality in the developing world. In children resistant to standard nutrition therapy, diseases such as celiac disease may be overlooked. Due to overlapping symptoms, celiac disease often goes unrecognized among malnourished children, especially in resource-poor zones with limited diagnostic facilities.

Objective: To determine the frequency of celiac disease in children with severe acute malnutrition presenting to MMC Mardan. Study Design: Descriptive cross-sectional study. Duration and Place of Study: This study was conducted from 2nd November 2024 to 1st May 2025 at the Department of Paediatrics, Mardan Medical Complex. Methodology: A total of 103 children aged 1–5 years with diagnosed SAM were enrolled using consecutive sampling. Anti-tTG IgA antibodies were measured via ELISA, and biopsy-confirmed cases were classified using Marsh criteria. Data were collected on age, weight, gender, malnutrition duration, socioeconomic status, parental education, and residential location. Results: Celiac disease was confirmed in 12.6% (n=13) of children with SAM. A significantly higher prevalence was found in children >3 years (21.3%) compared to ≤3 years (5.4%) (p=0.019), in females (23.8%) compared to males (4.9%) (p=0.006), in children weighing >12 kg (28.0%) vs ≤12 kg (7.7%) (p=0.008), and in those with SAM duration >12 months (28.1%) vs ≤12 months (5.6%) (p=0.003). Conclusion: Celiac disease is relatively prevalent among children with SAM and shows significant association with specific clinical and demographic factors.

***Keywords**: Severe Acute Malnutrition, Celiac Disease, Anti-tTG, Gluten Sensitivity, Paediatric Undernutrition*

INTRODUCTION

Child malnutrition continues to characterize the largest global health challenge, particularly in the developing world where hunger, poverty, and lack of proper medical care are the norm.[1] Child malnutrition consists of a host of nutritional disorders that obstruct mental as well as physical maturation, speed up susceptibility to infection, and increase the risk of mortality.[2] Child malnutrition does not just impede the growth and the immune system, but provide lasting consequences for school attainment and economic potential.[3] Children under the age of five are the most affected, and malnutrition at an early age has lasting consequences later in life.[4] Treating the disease requires a multi-faceted approach through nutrition education, improved prenatal as well as paediatric medical care, and stable systems of food.[5]

Severe acute malnutrition (SAM) refers to the deadliest and most serious expression of undernutrition, which occurs as severe wasting, reduced weight-for-height, or nutritional edema.[6] SAM is a global phenomenon, which affects millions of children, and unless it's promptly diagnosed and addressed, it is highly likely to result in mortality.[7] SAM children are susceptible to several complications such as hypoglycaemia, hypothermia, electrolytic disturbances, and opportunistic infections.[8] SAM treatment includes therapeutic feeding programs, medical stabilization, as well as infection treatment.[9] Some children fail to improve following such treatment, which suggests the presence of co-morbid medical conditions, which deter the healing process.[9]

One such condition, which has wider recognition now among children with SAM, is celiac disease, an immune disorder brought about by the ingestion of gluten by genetically susceptible individuals.[10] Celiac disease's clinical expression, such as chronic diarrhea, retardation of growth, and malnutrient deficiencies, can mimic or contribute to the symptoms of severe malnutrition.[11] Where both SAM and the use of gluten-based diets are ubiquitous, the celiac disease prevalence among malnourished children could be misrepresented, as overlapping symptoms conceal the disease, and little diagnostic proficiency exists.[12] Diagnosis of celiac disease among the at-risk population is extremely warranted, as correction through the usual nutrition may have limited benefit without the implementation of a gluten-free diet.[13] Prompt diagnosis and specially designed diet therapy can radically alter the course and reduce morbidity among children affected.[14]

A study conducted by Beniwal N et al. reported a celiac disease prevalence of 15.38% among children diagnosed with severe acute malnutrition.[15]

Conducting the study in Mardan was warranted due to the region's rampant prevalence of malnutrition among children, despite the absence of medical facilities and awareness regarding subclinical illness such as celiac disease. Most children with severe acute malnutrition had not improved sufficiently after standard therapy, and suspicion of coexistent occult illness warranted investigation. Due to localized dietetic practices and hereditary tendency, exploration of the prevalence of celiac disease among malnourished children facilitated earlier diagnosis, guiding selective management, and improved health delivery in the disadvantaged area.

METHODOLOGY

This descriptive cross-sectional study was carried out from 2nd November 2024 to 1st May 2025 in the Department of Paediatrics at Mardan Medical Complex following ethical clearance. A total of 103 children were enrolled using non-probability consecutive sampling. The sample size was computed with a 95% confidence interval, 7% margin of error, and an anticipated prevalence of celiac disease of 15.38% in children with severe acute malnutrition, based on prior research.[15]

Children between the ages of 1 and 5 years, of either gender, who met the diagnostic criteria for severe acute malnutrition were eligible. A diagnosis of severe acute malnutrition was made if the child had either a mid-upper arm circumference less than 115 mm or a weight-for-height z-score below -3. Excluded from the study were children already diagnosed with celiac disease or on a gluten-free diet, as well as those with comorbidities contributing to malnutrition, such as chronic hepatic, renal, or oncologic conditions, and those who were severely immunocompromised.

Following informed consent from caregivers, demographic and socioeconomic details such as age, gender, body weight, duration of malnutrition,

family income, education of parents, and place of residence were noted. Blood samples were collected to assess IgA anti-tissue transglutaminase antibodies using an ELISA method with human recombinant antigen. Children who tested positive for this serological marker were referred for upper GI endoscopy, during which at least four biopsy specimens were taken from the second part of the duodenum. The tissue samples were evaluated by a histopathologist and classified according to Marsh criteria; cases showing advanced villous atrophy consistent with grade 3 changes were classified as having celiac disease. All findings were documented on a structured form.

Statistical analysis was conducted using SPSS version 26. Categorical variables such as gender, socioeconomic background, education level, and urban or rural residency were summarized using frequency distributions and percentages. For numerical variables such as age, weight, and duration of malnutrition, means and standard deviations were calculated for normally distributed data, while medians and interquartile ranges were used for skewed variables, with normality checked through the Shapiro-Wilk test. Stratified analysis was performed to explore associations of celiac disease with various demographic and clinical parameters. Chi-square or Fisher's exact test was applied where appropriate, and p-values of 0.05 or less were considered significant.

RESULTS

The study included 103 patients with severe acute malnutrition (SAM) with a mean age of 2.99±1.11 years and mean weight of 9.91±2.47 kg, experiencing SAM for an average duration of 9.30±5.73 months. Males comprised 59.2% (n=61) of the cohort while females represented 40.8% (n=42). The majority of parents were uneducated (55.3%, n=57), followed by those with primary education (29.1%, n=30) and secondary education (15.5%, n=16). Socioeconomically, 84.5% (n=87) were classified as poor, 14.6% (n=15) as middle class, and only 1.0% (n=1) as rich. Most patients resided in rural areas (82.5%, n=85) compared to urban areas (17.5%, n=18) (as shown in Table-I)

TABLE- I: PATIENT DEMOGRAPHICS

Demographics		Mean ± SD / n (%)
Age (years)		2.99±1.11
Weight (kg)		9.91±2.47
Duration SAM (months)		9.30±5.73
Gender	Male n (%)	61 (59.2%)
	Female n (%)	42 (40.8%)
Parent Education	Uneducated n (%)	57 (55.3%)
	Primary n (%)	30 (29.1%)
	Secondary n (%)	16 (15.5%)
Socioeconomic Status	Poor n (%)	87 (84.5%)
	Middle n (%)	15 (14.6%)
	Rich n (%)	1 (1.0%)
Residential Status	Rural n (%)	85 (82.5%)
	Urban n (%)	18 (17.5%)

The overall prevalence of celiac disease was 12.60% (n=13) among the SAM patients, with 87.40% (n=90) testing negative (as shown in Table-II).

TABLE- II: FREQUENCY OF CELIAC DISEASE

Celiac Disease	Frequency	% age
Yes	13	12.60%
No	90	87.40%

Age demonstrated a significant association with celiac disease (p=0.019), with children >3 years showing a substantially higher prevalence of 21.3% (n=10 out of 47) compared to those ≤3 years who had a prevalence of only 5.4% (n=3 out of 56). Gender showed a highly significant association

(p=0.006), with females demonstrating a markedly elevated prevalence of 23.8% (n=10 out of 42) compared to males who had a much lower prevalence of 4.9% (n=3 out of 61). Weight category was significantly associated with celiac disease (p=0.008), where children weighing >12 kg exhibited a higher prevalence of 28.0% (n=7 out of 25) compared to those weighing ≤12 kg who showed a prevalence of 7.7% (n=6 out of 78). Duration of SAM demonstrated a significant association (p=0.003), with children experiencing SAM for >12 months displaying a considerably higher prevalence of 28.1% (n=9 out of 32) versus those with ≤12 months duration who had a prevalence of 5.6% (n=4 out of 71). In contrast, parent education level showed no significant association with celiac disease (p=1.000), with relatively similar prevalence rates across uneducated parents (12.3%, n=7 out of 57), primary education (13.3%, n=4 out of 30), and secondary education (12.5%, n=2 out of 16). Similarly, socioeconomic status demonstrated no significant association (p=1.000), with poor families showing 12.6% prevalence (n=11 out of 87), middle-class families 13.3% (n=2 out of 15), and the single rich family having no cases (0%, n=0 out of 1). Residential status also showed no significant association (p=1.000), with rural residents having a prevalence of 12.9% (n=11 out of 85) compared to urban residents at 11.1% (n=2 out of 18). All non-significant associations were analyzed using Fischer's Exact Test (as shown in Table-III).

TABLE-III: ASSOCIATION OF CELIAC DISEASE WITH DEMOGRAPHIC FACTORS

Demographic Factors		Celiac Disease		p-value
		Yes n(%)	No n(%)	
Age (years)	≤3	3 (5.4%)	53 (94.6%)	0.019*
	>3	10 (21.3%)	37 (78.7%)	
Gender	Male	3 (4.9%)	58 (95.1%)	0.006*
	Female	10 (23.8%)	32 (76.2%)	
Weight (Kg)	≤12	6 (7.7%)	72 (92.3%)	0.008
	>12	7 (28.0%)	18 (72.0%)	
Duration (months)	≤12	4 (5.6%)	67 (94.4%)	0.003*
	>12	9 (28.1%)	23 (71.9%)	
Parent Education	Uneducated	7 (12.3%)	50 (87.7%)	1.000*
	Primary	4 (13.3%)	26 (86.7%)	
	Secondary	2 (12.5%)	14 (87.5%)	
Socioeconomic Status	Poor	11 (12.6%)	76 (87.4%)	1.000*
	Middle	2 (13.3%)	13 (86.7%)	
	Rich	0 (0.0%)	1 (100.0%)	
Residential Status	Rural	11 (12.9%)	74 (87.1%)	1.000*
	Urban	2 (11.1%)	16 (88.9%)	

***Fischer Exact Test**

DISCUSSION

This study attempted to establish the prevalence of celiac disease among children with severe acute malnutrition and identified a prevalence of 12.60%, which considerably exceeded the general population prevalence of celiac disease that is frequently reported as 1-2%. Such a higher prevalence reveals a probable two-sided association of celiac disease and severe acute malnutrition, such that untreated celiac disease may be a reason for the development of SAM through chronic malabsorption and lack of several nutrients, while chronic malnutrition may predispose children to autoimmunity like celiac disease.

The significant association between older age (>3 years) and higher celiac disease prevalence (21.3% vs 5.4%) can be explained by the cumulative effect of gluten exposure over time, as celiac disease typically develops after prolonged gluten consumption and may take months to years to

manifest clinically. The striking gender disparity, with females showing nearly five times higher prevalence than males (23.8% vs 4.9%), aligns with the known female predominance in autoimmune diseases, including celiac disease, which is attributed to hormonal influences, particularly estrogen's role in enhancing immune responses and autoantibody production. The association between higher weight (>12 kg) and increased celiac disease prevalence (28.0% vs 7.7%) may reflect that children with milder forms of celiac disease or those with better compensatory mechanisms maintain relatively higher weights despite ongoing malabsorption, whereas those with more severe malnutrition may have multiple underlying causes beyond celiac disease alone. The significant correlation between prolonged SAM duration (>12 months) and higher celiac disease prevalence (28.1% vs 5.6%) suggests that undiagnosed celiac disease may be an underlying cause of persistent malnutrition, as continued gluten exposure in these children would perpetuate intestinal damage and malabsorption, leading to treatment-resistant malnutrition.

Our findings align closely with several studies examining celiac disease in malnourished children. Kumar P et al. [16] reported a similar prevalence of 13.1% (95% CI 6.5-22.9) in 76 children with SAM aged 9-59 months at Kalawati Saran Children's Hospital, New Delhi, demonstrating remarkable consistency across different populations and geographic regions. This parallel finding strengthens the evidence that celiac disease is a significant underlying cause of SAM in paediatric populations.

In contrast, Rajeev Ranjan et al. [17] found a notably higher seropositivity rate of 30% among 100 Indian children aged 1-5 years with SAM, though this study measured seropositivity rather than confirmed celiac disease. The discrepancy may reflect methodological differences, as seropositivity does not always correlate with histologically confirmed celiac disease, and some children may have transient antibody elevations due to intestinal inflammation associated with malnutrition itself.

Lamyaa Imran Ali et al. [18] reported an 11% prevalence of positive tTG antibodies in 100 malnourished children aged 6-60 months in Baghdad, closely matching our findings. This study similarly found that celiac disease was significantly associated with older age groups (37-60 months showing 54.5% vs 12.3% in non-CD patients), which mirrors our observation of higher prevalence in children >3 years (21.3% vs 5.4% in ≤3 years).

Conversely, Gazi MA, et al. [19] found a much lower prevalence of 0.6% in 818 malnourished slum residents in Dhaka, Bangladesh, with only one confirmed case. This categorical variation may be a consequence of genetic and environmental factors, as the celiac disease prevalence strongly differs among individuals due to HLA-DQ2/DQ8 genetic susceptibility and diet.

Our study revealed a significant association of celiac disease with age (p=0.019) such that children older than 3 years had considerably higher prevalence (21.3%) compared with younger children (5.4%). We obtained the same evidence as Ali et al. [18] which found celiac disease highly associated with age 37-60 months (p=0.001). Ranjan et al. [17] similarly reported that seropositive children had significantly higher mean age (2.65±1.54 vs 1.69±1.24 years, p=0.02). The age-related increase likely reflects cumulative gluten exposure and the time required for autoimmune processes to develop and manifest clinically.

Our study revealed a highly significant female predominance (p=0.006), with females showing 23.8% prevalence compared to 4.9% in males. This finding contrasts with several studies that reported either male predominance or no significant gender differences. Ali et al. [18] found a male: female ratio of 2.6:1 among celiac-positive children, while Babar et al. [20] reported 60% female prevalence in their case series. The gender differences across studies may reflect population-specific factors, sample sizes, or methodological variations in patient selection.

Our study found significant associations between celiac disease and higher weight (>12 kg showing 28.0% prevalence vs 7.7% in ≤12 kg) and longer duration of SAM (>12 months showing 28.1% vs 5.6% in ≤12 months). These findings suggest that celiac disease may be associated with more chronic forms of malnutrition rather than acute presentations.

Kumar et al. [16] noted that celiac disease patients were more likely to have abdominal distension (40% vs 13.6%, p=0.04), while other clinical features overlapped with non-CD SAM. Ali et al. [18]

reported abdominal distension in 81.9% of CD patients, diarrhea in 63.6%, and failure to thrive in 100%. Ranjan et al. [17] found that recurrent diarrhea (52.9%) and blood in stool (54.5%) were more common in seropositive cases, along with folic acid deficiency (30% vs 6.3%, $p<0.05$).

Unlike some studies, our research found no significant association between celiac disease and parental education or socioeconomic status. This suggests that within populations already experiencing SAM, celiac disease occurs across all socioeconomic strata, possibly because the underlying malnutrition masks typical socioeconomic patterns seen in general populations.

Our findings, along with those of Kumar et al. [16] and Ali et al. [18] support routine celiac disease screening in children with SAM. The consistent prevalence rates of 11-13% across different populations indicate that celiac disease is a significant treatable cause of SAM. Early identification is crucial because management requires strict gluten-free diet rather than standard nutritional rehabilitation alone.

The higher prevalence of celiac disease among older children with longer SAM history shows the need for celiac disease screening as a priority for children aged >3 years with chronic malnutrition. But the overlapping of celiac disease with other SAM causes clinically makes serological screening a required measure for all SAM patients regardless of age. Differing prevalence rates of the disease among disparate populations necessitate population-oriented studies as well as standardization of the diagnostic parameters. Future studies must focus on long-term consequences of celiac disease patients diagnosed as a result of SAM screening as well as the effectiveness of the gluten-free diet while ensuring nutritional rehabilitation. There must be genetic studies of HLA-DQ2/DQ8 prevalence among diverse populations as a way of accounting for Geographic variation of celiac disease prevalence among malnourished children observed herein.

CONCLUSION

Our study has identified celiac disease as relatively common among children with severe acute malnutrition. There were significant associations with celiac disease and age, sex, weight, and history of malnutrition, which suggest that several subgroups are perhaps at higher risk. But significant association was not encountered with parental education, socioeconomic status, and place of stay. These results warrant the use of targeted screening for celiac disease among malnourished children, particularly children with prolonged illness and other risk factors.

Conflict of interest: None

Disclaimer: None

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