

ORIGINAL ARTICLE

Etiological spectrum of non-celiac malabsorption in pediatric population in a tertiary care hospital.

Sahar Sharif¹, Arit Parkash², Wajid Hussain³, Shawal Sajid⁴

ABSTRACT... Objective: To determine the etiological spectrum of non-celiac malabsorption in pediatric population at a tertiary care hospital. **Study Design:** Analytical, cross-sectional study. **Setting:** Department of Gastroenterology, National Institute of Child Health (NICH), Karachi, Pakistan. **Period:** July 2025 to November 2025. **Methods:** Children aged 2–10 years presenting with symptoms of malabsorption for more than two weeks were enrolled through consecutive sampling. Stool analysis were performed to confirm etiology. Data were analyzed using SPSS version 26.0. **Results:** In a total of 220 children, 124 (56.4%) were males, and median age of 6.0 years (IQR 4.0–8.0). Chronic diarrhea 194 (88.2%) and steatorrhea 107 (48.6%) were the most common clinical manifestations. Giardiasis was the most frequent etiology 72 (32.7%), followed by carbohydrate malabsorption 54 (24.5%), fat malabsorption 41 (18.6%), protein malabsorption 27 (12.3%), and chronic intestinal infection 26 (11.8%). Age ($p=0.041$), residence ($p=0.021$), parental education ($p=0.029$), and hemoglobin levels ($p=0.004$) showed significant associations with etiology of non-celiac malabsorption. Chronic diarrhea was most frequent in Giardiasis (95.8%) and chronic intestinal infection (96.2%) with a significant association ($p=0.032$). Steatorrhea was strongly linked to fat malabsorption (87.8%, $p<0.001$). Fatigue or pallor was more common in infective etiologies, seen in Giardiasis (45.8%) and chronic intestinal infection (42.3%) ($p=0.018$). **Conclusion:** Infectious causes, particularly Giardiasis, remain the leading etiology of non-celiac malabsorption among children. Infective etiologies were associated with anemia, chronic diarrhea, and nutritional compromise, whereas non-infective causes were linked with specific nutrient malabsorption profiles.

Key words: Children, Diarrhea, Giardiasis, Malabsorption, Steatorrhea.

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INTRODUCTION

Malabsorption is a disorder in which the body fails to absorb nutrients from any point of the gastrointestinal system, resulting in deficiencies and other health problems.¹ Malabsorption can be a result of a variety of small intestinal diseases, as well as pancreatic, biliary tract, liver, and digestive tract diseases.² There are several conditions that can lead to malabsorption in children, such as celiac disease, pancreatic insufficiency, bile acid malabsorption and lactose intolerance.³

Malabsorption is typically found in underdeveloped countries with limited access to basic healthcare services. Around the world, millions of individuals, including children, suffer from malabsorption. Malabsorption syndromes have several etiologies, which makes it difficult to determine their actual frequency and prevalence.^{4,5} In the United States,

the cumulative prevalence of malabsorption is 1 in 133, but the prevalence of malabsorption due to Crohn's disease ranges from 20 to 100 per 100,000.⁵ In developed countries, the most commonly reported reason behind malabsorption is celiac disease, which affects approximately 1% of the patients.^{6,7} In developing countries like Pakistan, the actual burden of malabsorption and its etiology are not fully known.⁸

Different studies from the world reports the celiac disease as the most common cause of malabsorption. A recent study by Baciu et al evaluated the different sign and symptoms and etiologies of malabsorption in children and reported the celiac disease in 51.7% of children as most common cause of malabsorption followed by cystic fibrosis in 31% children, and Cow's milk protein allergy in 17.3% children.⁹

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A recent study from Pakistan by Masood et al also evaluated the different sign and symptoms and risk factors of malabsorption in adults and reported the tuberculosis in 57.14% of adults as most common cause of malabsorption followed by celiac disease in 23.8%.¹⁰

Early diagnosis is critical for children with malabsorption syndromes, as this maximizes the possibility of the best possible child-specific outcome. The data regarding etiological spectrum of non-celiac malabsorption in children is very limited in Pakistan. Therefore, we will conduct this study to review the various etiologies of non-celiac malabsorption syndromes in children presenting at Gastroenterology Department of NICH Hospital. The results of this study could help developing local data about malabsorption syndromes and their causes in pediatric population and ultimately help physicians to treat patients earlier in order to prevent complications, morbidity and mortality. The aim of this study was to determine the etiological spectrum of non-celiac malabsorption in pediatric population at a tertiary care hospital.

METHODS

This cross-sectional analytical study was conducted at the Department of Gastroenterology, National Institute of Child Health (NICH), Karachi, Pakistan during July 2025 to November 2025 after approval from the Institutional Ethical Review Committee (letter number: IERB-14/2025). The sample size was determined using the OpenEpi online calculator. The prevalence of cow's milk protein allergy as an etiological cause of malabsorption reported by Baciu et al. (17.3%) was taken as the reference proportion⁹, with a 95% confidence interval and a 5% margin of error, the calculated sample size was 220 children. Non-probability consecutive sampling was adopted. Children of either gender, aged between 2 and 10 years who presented with symptoms of malabsorption persisting for more than two weeks, such as chronic diarrhea, steatorrhea, abdominal pain, abdominal distension, cramping, or failure to gain weight, were included. Only those children who met the diagnostic confirmation criteria of non-celiac malabsorption, as defined by stool analysis, were enrolled. Exclusion criteria included children previously diagnosed with celiac disease confirmed

by positive anti-tissue transglutaminase IgA (>10 U/mL), those who had taken antiparasitic medication in the preceding three months, or those suffering from acute gastroenteritis, chronic pancreatitis, or exocrine pancreatic insufficiency. Children with clinically diagnosed lactose intolerance were also excluded to eliminate potential overlap with other carbohydrate malabsorption disorders. Pediatric malabsorption was defined as the presence of one or more of the following symptoms; chronic diarrhea, steatorrhea, abdominal pain, distension or cramping, and failure to gain weight, with confirmatory stool test findings. Written informed consent was sought from the parents / caregivers of all participants.

Demographic information like age, gender, residence, and parental educational status were noted at the time of enrollment. Height and weight of all children were obtained using standardized equipment. Clinical assessment was performed about the duration and frequency of diarrhea, stool consistency and character, presence of abdominal distension or cramps, vomiting, and signs of failure to thrive or weight loss. Assessment of nutritional status, degree of dehydration, and other systemic manifestations of chronic malabsorption were also performed. Stool samples from each child were collected under aseptic conditions in sterile, wide-mouthed containers, and then immediately transported to the institutional laboratory for analysis regarding pH, presence of fat droplets, and detection of pathogens. Carbohydrate malabsorption was confirmed as stool pH < 5.5, identified using pH indicator paper. Fat malabsorption (steatorrhea) was verified as > 60 fat droplets / hpf on Sudan III staining. Protein malabsorption was verified as the presence of α 1-antitrypsin in stool using enzyme-linked immunosorbent assay (ELISA). Parasitic and infective causes were established by microscopic detection of *Giardia*, *Clostridium difficile*, or *Cryptosporidium* species on wet mount preparations and antigen detection methods.

Data entry and analysis were done by IBM-SPSS Statistics, version 26.0. Quantitative variables were summarized as mean \pm SD or median and interquartile range, depending on the normality distribution of data. Categorical variables were shown as frequencies and percentages. Effect

modifiers including age, gender, residence, and hygiene practices were controlled through stratification. Associations between demographic factors and etiological findings were assessed using a chi-square test or fisher’s exact test (whichever was appropriate). Numeric data comparisons were carried out using analysis of variance or Kruskal-Wallis test. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Among a total of 220 children, the median age was 6.0 years (IQR 4.0–8.0). There were 124 (56.4%) male, and 96 (43.6%) female children. In terms of residence, 132 (60.0%) children belonged to rural areas, whereas 88 (40.0%) were from urban settings. With respect to parental education, 57 (25.9%) children had parents with no formal education, 84 (38.2%) had parents with primary education, and 79 (35.9%) had parents who had attained secondary education or above. The median body weight of the participants was 17.0 kg (IQR 14.5–20.0), and the median hemoglobin concentration was 10.1 g/dL (IQR 9.2–11.0), indicating mild to moderate anemia across the study population (Table-I).

TABLE-I

Demographic and baseline characteristics of study population (n=220)

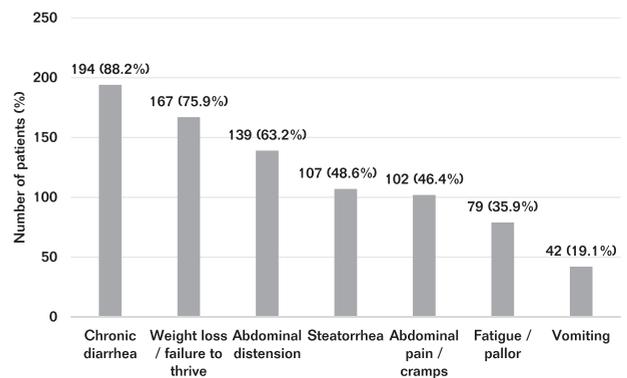
Characteristics		Frequency (%)
Gender	Male	124 (56.4%)
	Female	96 (43.6%)
Age group (years)	2 to 5	94 (42.7%)
	>5 to 10	126 (57.3%)
Residence	Rural	132 (60.0%)
	Urban	88 (40.0%)
Parental education	No formal education	57 (25.9%)
	Primary	84 (38.2%)
	Secondary or above	79 (35.9%)

Among the presenting clinical features (Figure-1), chronic diarrhea was the most frequently observed symptom and was reported in 194 children (88.2%), followed by weight loss or failure to thrive in 167 (75.9%). Abdominal distension was documented in 139 (63.2%) participants, steatorrhea in 107 (48.6%), and abdominal pain or abdominal cramps in 102 (46.4%). Fatigue or pallor suggestive of anemia

was noted in 79 (35.9%) cases, whereas vomiting was present in 42 (19.1%).

FIGURE-1

Frequency of clinical manifestations in non-celiac malabsorption (N=220)



Among children with non-celiac malabsorption, Giardiasis was found in 72 (32.7%), carbohydrate malabsorption in 54 (24.5%), fat malabsorption in 41 (18.6%), protein malabsorption in 27 (12.3%), and chronic intestinal infection in 26 (11.8%). Gender distribution did not differ significantly across etiologies (p = 0.412). Age showed a significant association with Giardiasis as it was predominated in children aged 2–5 years (58.3%), while carbohydrate (68.5%), and protein malabsorption (66.7%) were more frequent in those aged >5–10 years (p=0.041). Residence was significantly related to etiology as Giardiasis (65.3%) and chronic intestinal infection (69.2%) were more common in rural areas, whereas carbohydrate (63.0%) and fat malabsorption (56.1%) occurred more often in urban children (p=0.021). Parental education showed significance (p=0.029) as infective causes predominated in children of parents with no or primary education, while carbohydrate malabsorption was frequent in those with higher education (50.0%). Hemoglobin levels varied significantly as Giardiasis and chronic infection had lower median hemoglobin values (9.6 [8.9–10.3] and 9.9 [9.0–10.7] g/dL) compared with higher levels in carbohydrate, fat, and protein malabsorption (10.4, 10.3, and 10.5 g/dL, respectively), indicating greater anemia in infective etiologies (p=0.004). Table-II is showing details about the association of etiology of non-celiac malabsorption with respect to demographic and clinical characteristics.

TABLE-II

Association of etiology of non-celiac malabsorption with respect to demographic and clinical characteristics (N=220)

Characteristics	Giardiasis (n=72)	Carbohydrate Malabsorption (n=54)	Fat Malabsorption (n=41)	Protein Malabsorption (n=27)	Chronic Infection (n=26)	P-Value	
Gender	Male	43 (59.7%)	32 (59.3%)	22 (53.7%)	15 (55.6%)	12 (46.2%)	0.412
	Female	29 (40.3%)	22 (40.7%)	19 (46.3%)	12 (44.4%)	14 (53.8%)	
Age group (years)	2 to 5	42 (58.3%)	17 (31.5%)	20 (48.8%)	9 (33.3%)	6 (23.1%)	0.041
	>5 to 10	30 (41.7%)	37 (68.5%)	21 (51.2%)	18 (66.7%)	20 (76.9%)	
Residence	Rural	47 (65.3%)	20 (37.0%)	18 (43.9%)	13 (48.1%)	18 (69.2%)	0.021
	Urban	25 (34.7%)	34 (63.0%)	23 (56.1%)	14 (51.9%)	8 (30.8%)	
Parental education	No formal education	26 (36.1%)	8 (14.8%)	9 (22.0%)	5 (18.5%)	9 (34.6%)	0.029
	Primary	26 (36.1%)	19 (35.2%)	19 (46.3%)	10 (37.0%)	10 (38.5%)	
	Secondary or above	20 (27.8%)	27 (50.0%)	13 (31.7%)	12 (44.5%)	7 (26.9%)	
Hemoglobin in g/dl (median IQR)	9.6 (8.9-10.3)	10.4 (9.7-11.2)	10.3 (9.4-11.0)	10.5 (9.6-11.5)	9.9 (9.0-10.7)	0.004	

TABLE-III

Association of clinical manifestations with respect to etiology of non-celiac malabsorption (N=220)

Clinical Manifestations	Giardiasis (n=72)	Carbohydrate Malabsorption (n=54)	Fat Malabsorption (n=41)	Protein Malabsorption (n=27)	Chronic Infection (n=26)	P-Value
Chronic diarrhea	69 (95.8%)	45 (83.3%)	34 (82.9%)	21 (77.8%)	25 (96.2%)	0.032
Weight loss / failure to thrive	58 (80.6%)	38 (70.4%)	32 (78.0%)	19 (70.4%)	20 (76.9%)	0.241
Abdominal distension	39 (54.2%)	31 (57.4%)	27 (65.9%)	16 (59.3%)	16 (61.5%)	0.326
Steatorrhea	31 (43.1%)	21 (38.9%)	36 (87.8%)	12 (44.4%)	7 (26.9%)	<0.001
Abdominal pain / cramps	31 (43.1%)	24 (44.4%)	20 (48.8%)	16 (59.3%)	14 (53.8%)	0.284
Fatigue / pallor	33 (45.8%)	12 (22.2%)	17 (41.5%)	6 (22.2%)	11 (42.3%)	0.018
Vomiting	13 (18.1%)	9 (16.7%)	7 (17.1%)	5 (18.5%)	8 (30.8%)	0.712

Chronic diarrhea had the highest frequency in Giardiasis (95.8%) and chronic intestinal infection (96.2%), showing a significant association with etiology ($p=0.032$). Steatorrhea showed a strong association with fat malabsorption, present in 36 of 41 (87.8%) children compared with lower frequencies in other etiologies ($p<0.001$). Fatigue or pallor was significantly associated with infective etiologies, occurring in 33 of 72 (45.8%) with Giardiasis and 11 of 26 (42.3%) with chronic infection ($p = 0.018$). Details about the association of clinical manifestations with respect to etiology of non-celiac malabsorption.

DISCUSSION

The present study identified Giardiasis as the leading cause of non-celiac malabsorption in children, accounting for 72 cases (32.7%), followed by carbohydrate malabsorption in 54 (24.5%), fat malabsorption in 41 (18.6%), protein malabsorption in 27 (12.3%), and chronic intestinal infections in 26 (11.8%). Yacha et al.¹¹, reported parasitic infestations as a significant cause of malabsorption in 15% children, particularly among those above 2 years of age. On the other hand, Baciú et al.⁹, demonstrated celiac disease (51%) and cystic fibrosis (32%) as the predominant etiologies.

The disparity reflects the influence of regional, environmental, and socioeconomic factors, where poor sanitation, unsafe drinking water, and inadequate hygiene practices favor infectious etiologies in low- and middle-income countries.¹²

In this study, the predominance of Giardiasis in children aged 2–5 years (58.3%) aligns with the typical epidemiological pattern of *Giardia lamblia* infection in early childhood. Young children are thought to have relatively higher exposure risks due to poor hand hygiene and contaminated water source.¹³ Yacha et al.¹¹, found parasitic infections predominantly affecting younger cohorts which seems similar to the present findings. In contrast, Nidhya et al., reported structural or autoimmune causes such as celiac disease and tropical sprue, exhibiting that infectious etiologies are less common where sanitation and early screening are well established.^{14,15}

The research showed a significant association between residential background and malabsorption etiology ($p=0.021$) as Giardiasis and chronic intestinal infections were more frequent among rural children, whereas carbohydrate and fat malabsorption were more common among urban residents. Pucinischi et al.¹⁶, highlighted that malabsorption etiologies vary according to socio-economic settings. Rural populations often have environmental risk factors related to reduced access to clean water and healthcare, while among urban children, non-infective causes of malabsorption related to dietary habits are more common. The present data highlight the fact that geographic variations play a crucial role in determining the pattern of etiology for pediatric malabsorption.¹⁷ Education of parents formed the other important determinant of etiology ($p=0.029$). Baciu et al.⁹, suggested a strong association between low parental literacy and late diagnosis of treatable malabsorptive diseases. Low educational status may predispose to late utilization of health services, poor dietary hygiene, and ignorance about certain preventive measures.¹⁸ The data suggest that parental awareness and education are important modifiable variables in minimizing preventable infectious causes of pediatric malabsorption.¹⁹

The median hemoglobin concentration was lower

in infective etiologies: Giardiasis, 9.6 g/dL (IQR 8.9–10.3), and chronic intestinal infection, 9.9 g/dL (IQR 9.0–10.7), compared with non-infective causes, $p=0.004$. Our findings are supported by Baciu et al.⁹, who reported anemia in 45% of cases of pediatric malabsorption. Similarly, Yacha et al.¹¹, observed anemia and growth failure as the major presenting complications associated with infective diarrhea of protracted duration among children. These facts underscore the need for a routine anemia screening and nutritional rehabilitation in children with infective malabsorption.²⁰ In this study, chronic diarrhea was significantly associated with Giardiasis and chronic intestinal infection ($p=0.032$). Similarly, Miller et al.²¹, demonstrated the presence of chronic diarrhea and carbohydrate malabsorption in enteric infections among HIV-infected children. The pathophysiology is similar to both conditions consisting of villous atrophy and inflammation of the mucosa, leading to secondary malabsorptive states.²² Our data confirm that chronic diarrhea should raise suspicion for an infectious and non-celiac etiology for malabsorption.²³

There was a specific association of steatorrhea with fat malabsorption, identified in 87.8% of children with this etiology ($p<0.001$). This direct association confirms the diagnostic value of stool fat estimation in distinguishing lipid absorption defects from other forms of malabsorption. Pucinischi et al.¹⁶, similarly reported fat malabsorption as a key symptom of pancreatic or mucosal disease. Tests like Sudan III staining for stool remain simple, inexpensive methods available in developing countries for early detection of fat malabsorption.²⁴ The repeated finding of infection, anemia, and malnutrition clearly indicates the insidious effect of chronic gastrointestinal infections on growth and development in childhood. Testing for micronutrient deficiency and anemia should, therefore, be included in the workup of all children presenting with chronic symptoms of malabsorption.²⁵

This study had several limitations: it was cross-sectional in nature and thus could not establish causality between putative risk factors and malabsorption etiologies; the diagnostics in this study were stool-based, and although sensitive for screening purposes, they may miss more subtle

mucosal abnormalities or enzyme deficiencies detectable through endoscopy or molecular techniques. The single-center design limits the generalizability of findings; multicentric studies across diverse geographical and socioeconomic backgrounds would enhance external validity.

CONCLUSION

Infectious causes, particularly Giardiasis, remain the leading etiology of non-celiac malabsorption among children in low-resource settings. This study underscores the significant influence of age, residence, and parental education on disease pattern and severity. Infective etiologies were associated with anemia, chronic diarrhea, and nutritional compromise, whereas non-infective causes were linked with specific nutrient malabsorption profiles.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

1	Sahar Sharif: Data collection, drafting.
2	Arit Parkash: Study concept, proof reading.
3	Wajid Hussain: Methodology.
4	Shawal Sajid: Literature review.