Section: Paediatrics

Original Research Article

ANTHROPOMETRIC PROFILE OF CHILDREN WITH INFLAMMATORY BOWEL DISEASE

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Received *: 13/07/2025*
Received in revised form *: 25/08/2025*
Accepted *: 16/09/2025*

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DOI: 10.70034/ijmedph.2025.4.21

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (4); 108-112

ABSTRACT

Background: Inflammatory bowel disease (IBD) in children often leads to significant growth failure due to chronic inflammation, malnutrition, and treatment-related factors. Growth impairment is particularly concerning in Crohn's disease (CD), but can also be seen in ulcerative colitis (UC). **Objective:** To assess the impact of IBD on growth parameters in children and adolescents and determine associations with disease severity and clinical profile.

Materials and Methods: This descriptive observational study was conducted at a tertiary care centre. Children aged 1 month to 18 years with confirmed IBD were enrolled. Clinical, epidemiological, and anthropometric details were collected. Growth parameters were measured using WHO/IAP charts. Disease activity indices, laboratory parameters, and treatment details were recorded. Associations between growth impairment and clinical features were analysed.

Results: Among 42 children with IBD, 88.1% had CD and 11.9% had UC. Growth impairment was significant: 35.7% of children had both stunting and low BMI (<3rd centile). Only 9.5% had normal height, and 14.3% adequate BMI. Loose stools were correlated significantly with stunting (p=0.04) and low BMI (p=0.007). Early-onset and very-early-onset IBD had a higher prevalence of growth failure compared to adolescents. Nearly all patients had anaemia (100%) and weight loss (97.6%). Biologics (mostly infliximab) were used in 52% of CD patients, especially those with severe disease and marked growth failure.

Conclusion: Growth impairment is common in paediatric IBD in India, particularly in CD and in those with early disease onset. Frequent diarrhoea and severe disease activity were significantly associated with growth failure. Early recognition and aggressive management, including using biologicals when indicated, are essential to improve growth outcomes.

Keywords: Paediatric IBD, Crohn's disease, ulcerative colitis, growth failure, Anthropometry.

INTRODUCTION

In recent decades, the Indian subcontinent has witnessed a notable rise in the incidence and prevalence of inflammatory bowel disease (IBD), particularly among children and adolescents.[1] Given this increasing early onset, IBD has emerged as a significant contributor to pediatric gastrointestinal pathology, prompting critical questions regarding the role of early-life factors in its pathogenesis.[2] This demographic shift presents a substantial burden to healthcare systems, not only due to the long-term economic costs of managing childhood-onset IBD but also because of the unique developmental challenges it poses.

While pediatric IBD shares common gastrointestinal symptoms with adult-onset disease—such as diarrhoea, weight loss, and abdominal pain [3] the chronic inflammatory state in young patients raises particular concerns. Growth impairment is a critical extraintestinal manifestation, especially in Crohn's disease, driven by a complex interplay of

undernutrition, systemic inflammation, and the side effects of corticosteroid therapy. [4,5] Despite these known risks, a comprehensive characterisation of the growth profiles of pediatric IBD patients within the Indian context remains a significant gap in the literature. The specific environmental, dietary, and genetic factors in this region may influence disease manifestation and, consequently, impact growth trajectories that are still unknown.

The fundamental diagnostic approach—including assessing inflammatory markers, albumin, stool analysis, and faecal calprotectin—is consistent across pediatric and adult populations. However, the presentation and management of IBD in children involve a unique set of developmental, psychosocial, and physiological considerations.[6] These include the potential for disease-induced delays in linear growth and pubertal maturation, variations in pharmacokinetics necessitating specific drug-dosing strategies, and patients' evolving social and intellectual needs as they transition through childhood and adolescence. Effective management of pediatric IBD thus requires a comprehensive, multidisciplinary approach. Gastroenterologists must meticulously craft a treatment regimen integrating pharmacologic therapies, nutritional support, psychological care, and timely surgical intervention.[7] The primary objectives of such a regimen are to achieve and sustain disease remission, mitigate both disease- and drug-related adverse effects, and, crucially, optimise the patient's growth and developmental trajectory.

The primary objective of this study was to address this knowledge gap by meticulously characterising the growth profiles of a cohort of pediatric IBD patients and investigating their associations with key disease characteristics. By doing so, we aim to provide a data-driven basis for emphasising the critical need for early and proactive nutritional and therapeutic interventions. The findings from this research are intended to inform the development of more effective, region-specific clinical management strategies, ultimately optimising the long-term growth and developmental outcomes for this vulnerable patient population.

MATERIALS AND METHODS

Study Design: This was a prospective, observational, and descriptive study.

Study Setting: The study was conducted over 18 months at two clinical sites: the Pediatric Gastroenterology Clinic of the Institute of Maternal and Child Health and the Department of Gastroenterology, Government Medical College, Kozhikode, Kerala, India.

Inclusion Criteria: Patients aged 1 month to 18 years with a confirmed diagnosis of inflammatory bowel disease (IBD) were eligible for inclusion. The diagnosis was established based on clinical presentation, gastrointestinal endoscopy, and histopathological confirmation of biopsy specimens.

Sample Size Calculation: The minimum required sample size was calculated using the following formula for estimating a population proportion:

$N= Z^2 1-\alpha P(1-p)/d^2= 44$

Where:

- N = sample size
- $Z1-\alpha/2$ = Z-score corresponding to the desired confidence level (1.96 for a 95% confidence level)
- P = expected proportion of the population with a specific characteristic
- d = absolute precision (margin of error)

Based on a previous study conducted in Madurai, South India (1), which reported a 42.9% prevalence of weight loss among IBD patients, we used P=0.429. Assuming a desired precision (d) of 15% (0.15) and a 95% confidence level (Z=1.96), the calculated minimum sample size was determined to be 44. All eligible patients presenting during the study period were enrolled.

Methods: Before patient recruitment, the Institutional Research Committee and the Institutional Ethics Committee obtained ethical approval for the study protocol. Written informed consent was secured from all participating subjects' legal guardians or surrogates. Assent was also obtained from subjects who were deemed capable of providing it.

Patients and their parents were interviewed to collect comprehensive clinical and historical data. This included:

- **Demographics:** Age of onset of symptoms.
- **Clinical Symptoms:** Detailed history of abdominal pain, fever, altered bowel habits, stool frequency, haematochezia, and weight loss.
- **Extraintestinal Manifestations (EIMs):** Arthralgia, dermatological findings, aphthous ulcers, and ocular symptoms consistent with iritis or uveitis.
- **Past Medical History:** History of coexisting conditions such as tuberculosis and prior anti-tuberculosis therapy (ATT).
- **Family History:** History of IBD or similar chronic gastrointestinal conditions in first-degree relatives.

A thorough physical examination was conducted on each patient, including:

- **General Assessment:** Systematic head-to-toe examination.
- **Anthropometric Measurements:** Height, weight, body mass index (BMI), head circumference (for children up to 5 years), and mid-upper-arm circumference (MUAC, for children up to 5 years). All growth parameters were plotted and analysed using standard Indian Academy of Paediatrics (IAP) and World Health Organisation (WHO) growth charts. [8,9]

- **Specific Clinical Signs:** Examine the abdomen for any palpable masses and perform a perianal examination for fissures or fistulas.

Routine diagnostic work-up included a review of laboratory findings (e.g., inflammatory markers, albumin), stool analysis, imaging studies, and histopathological reports of biopsy specimens. Furthermore, information on previous and current medical and surgical treatments was collected and documented. For patients with active disease, disease activity was quantified using the Crohn's Disease Activity Index (CDAI) for Crohn's disease and the Ulcerative Colitis Activity Index (UCAI) for ulcerative colitis. Suspected cases were followed up throughout the study to confirm the diagnosis and disease course.

Data Management and Statistical Analysis

All data collected was meticulously entered into a Microsoft Excel spreadsheet for organisation and initial review. Subsequently, statistical analysis was performed using SPSS software (Version 25.0, IBM Corp., Armonk, NY, USA). Results are presented as the mean ± standard deviation (SD) for quantitative variables. Qualitative data were analysed using the Chi-square test to determine associations between variables and are expressed as percentages (%). A p-value of less than 0.05 was considered to be statistically significant. The findings are systematically presented in tables and figures and discussed in the context of the current scientific literature to highlight their clinical relevance and implications.

RESULTS

A total of 42 pediatric patients with a confirmed diagnosis of IBD were included in the study. The cohort was predominantly composed of patients with Crohn's disease (CD) (n=37, 88.1%), with ulcerative colitis (UC) accounting for the remaining cases (n=5, 11.9%). The majority of the study population were adolescents (64.3%), and the gender distribution was relatively balanced, with 23 females (54.8%) and 19 males (45.2%).

Growth Parameters

Growth impairment was highly prevalent across the cohort. Severe undernutrition, defined as weight below the 3rd centile, was observed in 15 patients (35.7%). Similarly, severe stunting (height <3rd centile) affected 15 patients (35.7%). An additional nine patients (21.4%) had a height between the 3rd and 10th centile, and another 9 (21.4%) were between the 10th and 25th centile. Only a small fraction of the cohort, four patients (9.5%), had a height above the 50th centile.

Body Mass Index (BMI) distribution further underscored the nutritional deficits. Fifteen children (35.7%) had a BMI below the 3rd centile, and eight others (19.0%) were between the 3rd and 10th centile, indicating substantial chronic malnutrition. Notably, over one-third of the patients demonstrated a severe growth deficit, presenting with both stunting and a low BMI (<3rd centile).

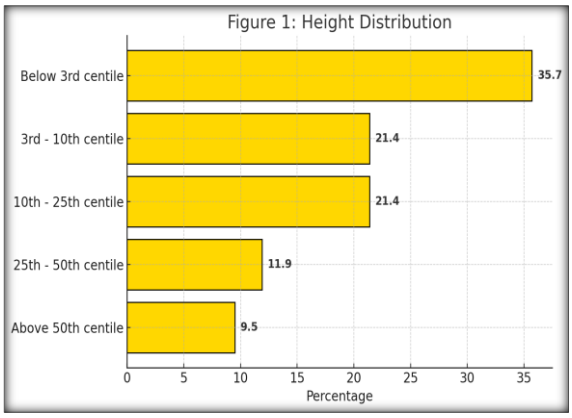


Table 1: Height Distribution

BMI Centile Category	Frequency (n)	Percentage (%)
Above 50th centile	4	9.5
25th – 50th centile	5	11.9
10th – 25th centile	9	21.4
3rd – 10th centile	9	21.4
Below 3rd centile	15	35.7
Total	**42**	**100.0**

Table 2: Body mass index

BMI Centile Category	Frequency (n)	Percentage (%)
Above 50th centile	6	14.3
25th – 50th centile	8	19.0
10th – 25th centile	5	11.9
3rd – 10th centile	8	19.0
Below 3rd centile	15	35.7
Total	**42**	**100.0**

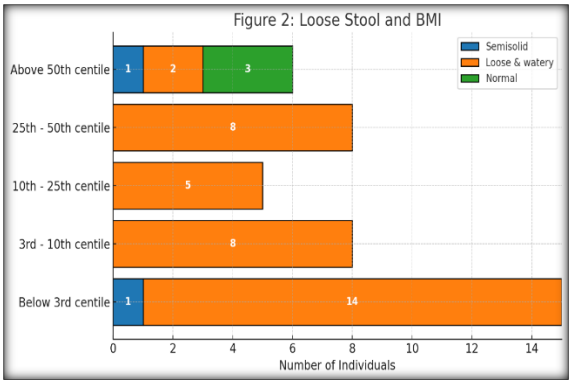
Clinical Correlates of Growth Impairment

Stool Pattern: Most children (88.1%) presented with loose and watery stools. This symptom was significantly associated with low BMI (p=0.007). Specifically, 14 of the 15 patients with BMI below the 3rd centile reported having watery stools. A similar trend was observed for height, with a near-significant association between loose stools and stunting (p=0.04).

Table 3: Loose stool and BMI

Loose Stool and BMI	Normal (n)	Loose and Watery (n)	Semisolid (n)	Total (n)
BMI				
Above 50th centile	3	2	1	6
B/w 25th and 50th centile	0	8	0	8
B/w 10th and 25th centile	0	5	0	5
B/w 3rd and 10th centile	0	8	0	8
Below 3rd centile	**1**	**14**	**0**	**15**
Total	**4**	**37**	**1**	**42**

Pearson Chi-Square Value = 20.877, df = 8, $p=0.007



Disease Behaviour and Severity: The stricturing phenotype of IBD was observed in 19% of the children, and while this subgroup exhibited a higher prevalence of low BMI, the association was not statistically significant. Similarly, perianal disease, present in 50% of patients, showed no significant correlation with growth metrics. As measured by activity indices, disease severity was high, with 78.6% of patients classified as having severe disease. Although severe disease activity was associated with greater growth impairment, this relationship did not reach statistical significance.

Treatment Associations:

- Corticosteroid exposure was almost universal (83.3%) but did not significantly affect growth outcomes.
- In contrast, induction therapy with infliximab was strongly associated with severe growth impairment. Of the 14 children who received infliximab, 11 (78.6%) had a BMI below the 3rd centile and 12 (85.7%) had a height below the 3rd centile ($p<0.001$). This strong correlation likely reflects a selection bias, as biologics are typically reserved for the most severely ill patients who have already experienced significant growth failure.

Extraintestinal and Laboratory Features: Extraintestinal manifestations were present in 76.1% of the cohort, with arthritis being the most common (35.7%). All patients were anaemic, with 62% exhibiting moderate-to-severe anaemia. Hypoalbuminemia was documented in 47.6% of patients, and elevated faecal calprotectin (>200 µg/g) was found in 52.4%. While these markers correlated with disease activity, they did not show a direct statistical association with growth parameters.

DISCUSSION

Growth impairment remains a critical extraintestinal manifestation of pediatric IBD, particularly in Crohn's disease.[10] In our study, over one-third of the children presented with both stunting and low BMI (<3rd centile), highlighting the significant burden of malnutrition and growth failure in this population. These findings are consistent with earlier reports from both India and Western cohorts, where growth impairment was found in 25–40% of pediatric IBD patients, with a higher prevalence in CD compared to ulcerative colitis (UC).[11]

The pathogenesis of growth failure in IBD is complex and multifactorial, involving decreased nutritional intake, increased intestinal losses, systemic inflammation with cytokine-driven catabolism, and the iatrogenic effects of corticosteroids.[12] Our observation that stool frequency and watery consistency were significantly associated with stunting and low BMI underscores the contribution of ongoing intestinal inflammation and malabsorption to impaired growth. This aligns with data from European and North American studies, which have also demonstrated a clear correlation between disease activity and growth deficits. [13,14]

Our data revealed a higher prevalence of growth impairment in children with early- and very-early-onset IBD compared to adolescents. This emphasises the particular vulnerability of younger children, as their linear growth and pubertal development are highly susceptible to disruption by chronic inflammation. Prior research has consistently shown that a prepubertal onset of IBD often leads to delayed puberty and a compromised final adult height if disease control is inadequate.[4]

Our laboratory findings of near-universal anaemia and common hypoalbuminemia further reflect the systemic inflammatory state and poor nutritional reserves within our cohort. While these markers indicated overall disease severity, they did not independently predict growth outcomes. This suggests that the continuous inflammatory process, rather than isolated laboratory abnormalities, is the primary driver of growth failure in these patients.

Regarding treatment, corticosteroids were used in nearly all of our patients (83.3%), making it difficult to establish a direct association between steroid exposure and growth outcomes. However, a strong and statistically significant association was observed between the need for infliximab and severe growth

failure. This finding likely reflects a clinical decision-making process where biologics are preferentially used in children with the most refractory and high-burden disease, who have already experienced significant growth compromise. This observation is consistent with international studies demonstrating that the early use of biologics in high-risk children induces remission and improves growth velocity, supporting the need for timely and aggressive escalation of therapy in this subgroup. Our finding that 81.8% of patients received an immunomodulator is also consistent with a prospective multicentre study conducted by Srivastava et al. [15]

In conclusion, our findings underscore the critical importance of routine, systematic anthropometric assessment in pediatric IBD management. The use of standardised WHO/IAP growth charts is crucial for the early detection of deviations in weight and height. This is particularly relevant in the Indian context, where high baseline rates of undernutrition can make it challenging to differentiate IBD-related growth failure from constitutional or pre-existing nutritional short stature.

CONCLUSION

Acknowledgements: The authors sincerely thank the children and their families for participating in this study. We also acknowledge the support of the staff and colleagues from the Department of Paediatrics and the Department of Gastroenterology at Government Medical College, Kozhikode, for their assistance in data collection and patient care.

Funding: This study, which was conducted as part of routine departmental work, did not receive external funding.

Authors' Contributions: All authors contributed to the study's conception and design, data collection, analysis, and interpretation. They also participated in drafting and revising the manuscript, approved the final version, and agreed to be accountable for all aspects of the work.

Conflict of Interest: The authors declare no conflict of interest regarding this publication.

Data Availability: The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

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