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Literature Review

Gut Endocrine Regulation of Pediatric Growth and Weight: Integrating Intestinal Hormones, Inflammation, and the GH–IGF-1 Axis in Health and Disease

Ashraf T. Soliman[1], Fawzia Alyafei[1], Nada Alaaraj[1], Shayma Ahmed[1], Noor Hamed[1], Sohair Elsiddig[1]
[1]Department of Pediatrics, Hamad Medical Corporation, Doha, Qatar

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Corresponding author:
Ashraf T. Soliman
atsoliman56@gmail.com

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Abstract:

Background: The intestine is increasingly recognized as an endocrine organ through enteroendocrine cells, gut-derived peptides, mucosal trophic factors, and microbiota–host signaling. In children, these pathways influence appetite, nutrient handling, body composition, and growth, including the growth hormone–insulin-like growth factor-1 (GH–IGF-1) axis. This review summarizes how intestinal endocrine function affects linear growth, weight gain, and GH–IGF-1 regulation in children with celiac disease, inflammatory bowel disease, environmental enteric dysfunction, and obesity.

Discussion: Evidence supports a convergent model linking gut function to growth via gut hormone signaling (GLP-1, PYY, CCK, GLP-2, ghrelin), inflammation-driven GH resistance, and microbiota-mediated IGF-1 modulation. Celiac disease can cause growth failure reversible with a gluten-free diet; Crohn's disease impairs growth through inflammation and malabsorption; environmental enteric dysfunction drives population-level stunting; and in obesity, altered incretin responses highlight the intestine as a therapeutic target. Gut-endocrine pathways remain underutilized in pediatric practice. IGF-1 is frequently interpreted without accounting for mucosal inflammation or malabsorption, and cross-specialty fragmentation limits holistic growth assessment. Emerging therapies including GLP-2 analogues and incretin-based agents offer promise, though pediatric data remain limited. Standardizing gut-endocrine biomarkers and integrating intestinal health into growth frameworks are key research priorities.

Conclusion: The intestine is a clinically important endocrine organ in pediatric growth medicine. Integrating gut-endocrine biology into endocrine assessment improves the interpretation of IGF-1 and growth patterns and guides management across undernutrition, chronic intestinal disease, and obesity.

Keywords: GH–IGF-1 axis, gut hormones, intestinal endocrine function, microbiota–host signaling, pediatric growth

Introduction

The intestine is now understood to be an active endocrine organ rather than a passive site of digestion and absorption. Enteroendocrine cells (EECs), although dispersed and relatively sparse, form a highly specialized signaling network that senses luminal nutrients and releases hormones influencing appetite, gastric emptying, motility, insulin secretion, mucosal adaptation, and systemic metabolism.[1-5] This endocrine role is further amplified by neural and paracrine communication with the vagus nerve, pancreas, liver, and central appetite-regulating pathways. As a result, intestinal signaling contributes directly to metabolic homeostasis and indirectly to growth and body composition.

This concept has particular importance in pediatrics, where growth and weight trajectories are dynamic and highly sensitive to nutritional adequacy, inflammation, and hormonal regulation. From an endocrine standpoint, linear growth is primarily mediated by the GH–IGF-1 axis, yet this axis is strongly modified by energy availability, protein intake, absorption, systemic inflammation, and chronic disease burden.[6] Therefore, intestinal pathology can alter growth not only through reduced nutrient absorption but also through endocrine mechanisms that influence appetite, metabolism, and GH/IGF-1 signaling. In clinical practice, this is relevant when a child presents with poor growth velocity, low IGF-1, unexplained weight faltering, or obesity with metabolic dysfunction.

Mechanistic evidence supports a biologically plausible intestine–growth endocrine network extending beyond classical gut hormones. Experimental and translational studies demonstrate that gut microbial composition and colonization states can affect circulating IGF-1 and somatic growth, including skeletal growth and bone remodeling.[7-10] Recent pediatric-focused syntheses further summarize associations between intestinal flora and linear growth across pregnancy, infancy, childhood, and adolescence, and highlight links between dysbiosis and pediatric endocrine disorders.[11, 12] More broadly, the microbiota may function as a "virtual endocrine organ" via microbial metabolites and neuroactive compounds that signal to distal tissue.[13] Together, these observations suggest that the gut microbiota and intestinal environment can modulate endocrine growth pathways through nutrient bioavailability, microbial metabolites, immune signaling, and host anabolic responses.

Among pediatric disorders, celiac disease is one of the clearest human models of intestinal endocrine disruption affecting growth. Children may present with short stature or growth failure even in the absence of classic gastrointestinal symptoms, and treatment with a strict gluten-free diet frequently improves growth parameters and endocrine markers such as IGF-1.[14-17] Similarly, pediatric inflammatory bowel disease (IBD), especially Crohn's disease, is strongly associated with impaired linear growth due to a combination of chronic inflammation, reduced intake, malabsorption, delayed

puberty, and functional GH resistance.[18-21] These disorders highlight that intestinal inflammation may be a primary upstream driver of endocrine growth impairment.

At a population level, environmental enteric dysfunction (EED) has expanded this framework by showing how chronic subclinical intestinal inflammation and barrier dysfunction may contribute to stunting and poor weight gain in early childhood, particularly in low-resource settings.[22-25] Biomarker-based cohort studies suggest that intestinal dysfunction, inflammation, and altered barrier integrity are associated with poor growth and micronutrient abnormalities, helping explain why nutritional supplementation alone may fail in some children.[22-27] EED therefore provides an important bridge between gastroenterology, nutrition, endocrinology, and global child health.

The same intestinal endocrine pathways also influence excess weight gain and pediatric obesity. Gut hormones such as GLP-1 and PYY are central to appetite regulation, while therapeutic manipulation of incretin pathways has demonstrated clinically meaningful weight reduction in adolescents.[1-3, 28-30] Taken together, these observations support the need for a focused pediatric endocrine review that integrates intestinal endocrine physiology, growth failure, weight gain abnormalities, and GH–IGF-1 axis regulation across health and disease. Such a review is important for improving diagnosis, management, and prognosis in children with growth and metabolic disorders.

Objectives of this study are to synthesize how intestinal endocrine function influences pediatric linear growth and weight regulation, and to outline endocrine-oriented diagnostic and management implications across key pediatric disorders.

Methods

We conducted a structured narrative review, prioritizing evidence that links intestinal endocrine pathways (enteroendocrine cell hormones, intestinal integrity/inflammation, and microbiota-related signaling) with pediatric growth and weight outcomes and/or GH–IGF-1 physiology. The evidence base was assembled from PubMed, and Scopus indexed literature, with searches combining terms for intestine/endocrine organ, enteroendocrine cells, gut hormones (GLP-1, PYY, CCK, GLP-2), pediatrics, linear growth/stunting, weight gain/obesity, GH and IGF-1, and major pediatric disease models (celiac disease, inflammatory bowel disease/ Crohn's disease, EDD, and microbiota).

Eligible studies included pediatric clinical studies and high-relevance translational work reporting growth (height/height SDS, growth velocity), anthropometry (weight/BMI), and/or GH–IGF-1-related markers; adult-only studies without pediatric relevance and non-verified/non-indexed reports were excluded.

Given heterogeneity in populations, biomarkers, outcome definitions, and interventions, we used qualitative domain-based synthesis rather than meta-analysis, including direction-of-effect summaries where appropriate.

Given the narrative design of this review, formal risk-of-bias tools were not applied; instead, study quality was considered informally based on study design, sample size, and methodological limitations to contextualize evidence strength. No ethics approval was required because this review used previously published data.

Results

Across the included literature, the intestine consistently emerges as a clinically relevant endocrine organ influencing pediatric growth and weight through three interacting pathways: (i) gut hormone signaling, (ii) mucosal inflammation and barrier dysfunction, and (iii) microbiota-mediated endocrine modulation.[1-13, 22-27] The strongest pediatric disease evidence links intestinal dysfunction to impaired linear growth in celiac disease, pediatric IBD, and EED-associated growth faltering.[14-27] In contrast, obesity literature emphasizes altered gut endocrine responses and treatment opportunities via incretin-targeted therapies, with less direct focus on linear growth outcomes.[1-3, 28-31]

Role of Intestinal Endocrine Function in Growth, Weight, and GH–IGF-1 Regulation

Evidence from physiology and translational studies supports a broad gut-endocrine framework in which EEC hormones regulate appetite, satiation, nutrient transit, and metabolic signaling, while intestinal inflammation and microbiota-derived factors influence anabolic and catabolic balance.[1-13] The GH–IGF-1 axis appears particularly vulnerable to inflammatory intestinal states and chronic nutritional compromise.[6, 18-27]

Clinical pediatric evidence shows reproducible links between intestinal disease and growth impairment. Celiac disease and pediatric IBD are the most clearly established models of intestinally mediated growth failure with endocrine consequences.[14-21] Guidelines emphasize systematic growth monitoring and timely control of intestinal inflammation as core outcomes, particularly in pediatric Crohn's disease and ulcerative colitis.[32-34] EED studies support intestinal dysfunction as a contributor to stunting and poor weight gain in high-burden populations.[22-27] In obesity, incretin-based therapies demonstrate that the intestinal endocrine axis is also a practical therapeutic target in adolescents.[29-31]

Table 1 summarizes the major intestinal endocrine and endocrine-like pathways that can influence pediatric growth and weight. The most direct links to growth failure

arise when intestinal inflammation and malabsorption coexist with endocrine dysregulation.[6, 18-27, 32-34]

Pediatric obesity studies and adolescent incretin trials provide the strongest direct clinical evidence that intestinal endocrine signaling can be therapeutically manipulated to improve weight outcomes **(Table 2)**.[1-3, 28-31]

Celiac disease illustrates a classic, often reversible model of intestinal injury causing impaired growth and altered endocrine signaling, including IGF-1 suppression that may improve with treatment **(Table 3)**.[14-17]

Table 1. Intestinal endocrine pathways relevant to linear growth, weight gain, and the GH–IGF-1 axis in children

Pathway / Hormone	Main Source in GI Tract	Primary Pediatric-Relevant Endocrine Actions	Potential Effect on Linear Growth	Potential Effect on Weight Gain / Body Composition	GH–IGF-1 Axis Relevance	Key Ref. No(s).
GLP-1	Distal ileal/colonic L-cells	Incretin effect, reduced appetite, delayed gastric emptying	Indirect (through improved metabolic milieu and energy regulation)	Reduces energy intake; therapeutic target in obesity	May indirectly improve GH dynamics through adiposity/metabolic improvement	1, 3, 28-31
PYY	L-cells (ileum/colon)	Satiety signaling, slows GI transit	Indirect via energy balance and nutrient handling	Reduces appetite; response may be altered in obesity	Indirect via metabolic effects on GH/IGF-1 regulation	1, 3, 28
CCK	I-cells (duodenum/jejunum)	Satiety, pancreatic enzyme stimulation, gallbladder contraction	Indirect support of digestion/absorption affecting growth	Contributes to meal termination and satiation	Indirect via nutrient assimilation	3-5
GLP-2	L-cells	Intestinal mucosal growth, barrier support, adaptation	May improve growth indirectly by improving absorptive capacity	Improves nutrient absorption and intestinal rehabilitation	Indirect via improved nutrition and reduced inflammatory burden	2, 4

Pathway / Hormone	Main Source in GI Tract	Primary Pediatric-Relevant Endocrine Actions	Potential Effect on Linear Growth	Potential Effect on Weight Gain / Body Composition	GH–IGF-1 Axis Relevance	Key Ref. No(s).
GIP	K-cells (proximal small intestine)	Incretin action and nutrient partitioning	Indirect	May contribute to anabolic storage pathways	Indirect via insulin-mediated nutrient utilization	1, 3, 28
Ghrelin *(primarily gastric, proximal gut axis)*	Stomach > proximal intestine	Orexigenic signal; GH secretagogue	May support growth when intake improves; context-dependent	Increases appetite; altered in obesity/weight loss states	Direct GH stimulation; interacts with nutritional IGF-1 regulation	3, 6
Intestinal inflammatory cytokine milieu *(endocrine-relevant mediator axis)*	Inflamed mucosa / systemic circulation	TNF-α, IL-6 and other cytokines suppress appetite and increase catabolism	Strong negative effect via GH resistance and delayed puberty	Weight faltering and altered body composition	Reduces IGF-1 generation/action, contributes to GH resistance	6, 18-27, 32-34
Microbiota-derived metabolites (SCFAs, bile acid signaling)	Luminal microbiota–host interface	Modulate endocrine signaling, barrier integrity, inflammation	Emerging role in growth via IGF-1-related pathways	Alters energy harvest and metabolic efficiency	Experimental evidence supports IGF-1 modulation	7-13, 22-27

GLP-1 = glucagon-like peptide-1; GH = growth hormone; PYY = peptide YY; GI = gastrointestinal; IGF-1 = insulin-like growth factor 1; CCK = cholecystokinin; GLP-2 = glucagon-like peptide-2; GIP = glucose-dependent insulinotropic polypeptide; TNF-α = tumor necrosis factor alpha; IL-6 = interleukin-6; SCFA = short-chain fatty acids

In pediatric IBD, growth failure is frequently a marker of disease severity and inflammation-driven endocrine disruption rather than reduced intake alone; endocrine and GI monitoring should be integrated **(Table 4)**.[18-21, 32-34]

EED and microbiota literature strongly support the concept that chronic intestinal dysfunction can impair growth through combined absorptive, inflammatory, and endocrine pathways.[7-13, 22-27] **(Table 5)**

Table 2. Pediatric evidence on gut-endocrine signaling and weight regulation in health and obesity

Author, year	Study Design	Population	Gut-Endocrine Focus	Main Outcomes	Endocrine-Growth Interpretation
Suntharesan et al., 2023[30]	Single-blind crossover trial	Children with obesity	Postprandial gut hormone, leptin, glucose, and insulin responses to resistant starch	Demonstrated measurable modulation of postprandial hormonal responses	Supports the intestine as an endocrine intervention target in pediatric obesity
Kelly et al., 2020[31]	Randomized controlled trial	Adolescents with obesity	GLP-1 receptor agonist (liraglutide)	Greater reduction in BMI/BMI-SDS vs placebo plus lifestyle	Confirms the therapeutic relevance of incretin pathways in adolescent obesity
Weghuber et al., 2022[29]	Randomized controlled trial	Adolescents with obesity	Once-weekly GLP-1 receptor agonist (semaglutide)	Significant BMI reduction and metabolic benefits	Reinforces the gut endocrine axis as a clinical treatment pathway
Steinert et al., 2017[3]	Physiologic review	Human physiology	Ghrelin, CCK, GLP-1, PYY physiology	Defined secretion control and functional roles in feeding/glycemia	Foundational physiology for pediatric gut hormone interpretation
Gribble et al., 2019[1]	Mechanistic review	Human/translational	EEC nutrient sensing and hormone release	Clarified cellular nutrient-sensing mechanisms	Mechanistic framework linking diet and disease to gut endocrine output

GLP-1 = glucagon-like peptide-1; BMI SDS = body mass index standard deviation score; CCK = cholecystokinin; PYY = peptide YY; EEC = enteroendocrine cells

Figure 1 summarizes how the pediatric intestine functions as an endocrine organ linking nutrient sensing to linear growth and weight regulation through enteroendocrine hormones (e.g., GLP-1, PYY, CCK/GLP-2), inflammatory/barrier pathways, and microbiota signaling, with downstream effects on the GH–IGF-1 axis.

It highlights key disease models—celiac disease, IBD (especially Crohn disease), and environmental enteric dysfunction/undernutrition—where malabsorption and inflammation can suppress IGF-1 and contribute to growth failure, and it ends with a practical integrated clinical approach (screening, growth/puberty monitoring, contextual interpretation of IGF-1, and obesity therapy using GLP-1 agonists when appropriate).

Table 3. Celiac disease as a model of intestinal endocrine dysfunction affecting linear growth and the GH–IGF-1 axis

Author, year	Study Design	Population	Intestinal Pathology / Intervention	Growth / Endocrine Findings	Clinical Implication
Husby et al., 2020[14]	ESPGHAN guideline	Children/ adolescents	Celiac disease diagnostic guidance	Recognizes growth failure/short stature as a key presentation	Supports celiac screening in endocrine evaluation of poor growth
Mearin et al., 2022[15]	ESPGHAN position paper	Children/ adolescents	Long-term management and follow-up	Emphasizes growth and nutritional monitoring after diagnosis	Growth surveillance is part of standard celiac management
Street et al., 2008[16]	Prospective observational study	Children with celiac disease	Gluten-free diet follow-up	IGF-1 improved after treatment in celiac disease	Supports reversibility of intestinally mediated IGF-1 suppression
Meazza et al., 2014[17]	Clinical review	Pediatric celiac/short stature	Celiac disease in endocrine differential diagnosis	Short stature may be isolated presentation; catch-up growth often occurs	Encourages early GI-endocrine co-management

ESPGHAN = European Society for Paediatric Gastroenterology, Hepatology and Nutrition; IGF-1 = insulin-like growth factor 1; GI = gastrointestinal.

Table 4. Pediatric inflammatory bowel disease (especially Crohn's disease): intestinal inflammation, growth failure, and GH–IGF-1 disruption

Author, year	Study Design	Population	Mechanisms Linked to Growth Failure	Growth / Endocrine Findings	Management Implications
Wong et al., 2010[18]	Clinical observational study	Children/adolescents with IBD and growth retardation	Chronic inflammation, nutrition deficits, altered GH–IGF-1 axis	Demonstrated abnormalities in the GH–IGF–1 axis in growth-retarded pediatric IBD	Endocrine assessment is important in persistent growth failure
Sanderso, 2014[19]	Review	Pediatric IBD	Inflammation, malnutrition, delayed puberty, and GH resistance	Growth problems are common, especially in Crohn's disease	Growth should be a core treatment outcome
Ishige, 2019[20]	Review	Pediatric-onset IBD	Appetite loss, malabsorption, cytokines, and delayed puberty	Growth failure is common and clinically significant	Early disease control and nutrition are central
van Rheenen et al., 2021[32]	ECCO-ESPGHAN guideline	Pediatric Crohn disease	Evidence-based medical treatment and monitoring	Supports timely control of inflammation and systematic monitoring	Better inflammation control may improve growth recovery
Wine et al., 2025[33]	ECCO-ESPGHAN guideline (UC Part 1)	Pediatric UC	Ambulatory care guidance	Standardized care pathways	Structured chronic care supports growth monitoring
Turner et al., 2018[34]	ECCO-ESPGHAN guideline (UC Part 2)	Pediatric acute severe colitis	Acute management guidance	Standardized acute treatment pathways	Rapid disease control reduces catabolic/endocrine burden

IBD = inflammatory bowel disease; GH–IGF-1 = growth hormone–insulin-like growth factor 1; ECCO-ESPGHAN = European Crohn's and Colitis Organisation–European Society for Paediatric Gastroenterology, Hepatology and Nutrition; UC = ulcerative colitis.

Table 5. Environmental enteric dysfunction, undernutrition, and microbiota-linked endocrine effects on growth

Author, year	Study Design	Population	Intestinal/Endocrine Focus	Main Growth-Related Findings	Endocrine Interpretation
Syed et al., 2016[22]	Review	Children in low-	EED pathophysiol	EED linked to stunting and impaired	Supports intestinal pathology as a

Author, year	Study Design	Population	Intestinal/Endocrine Focus	Main Growth-Related Findings	Endocrine Interpretation
		resource settings	ogy and child growth	nutritional recovery	growth-endocrine determinant
Crane et al., 2015[23]	Review	Pediatric/global child health context	Barrier dysfunction, inflammation, malabsorption	EED likely contributes to chronic undernutrition	Integrates GI pathology with endocrine growth failure framework
Harper et al., 2018[24]	Systematic review	Children in LMICs	EED pathways and stunting	Summarized heterogeneous biomarker associations with stunting	Supports multi-pathway rather than single-marker explanation
Tickell et al., 2019[25]	Review	EED mechanisms and management	Permeability, inflammation, microbial and hormonal disruption	Links EED to poor growth and systemic consequences	Reinforces endocrine and immune contributions to growth failure
Iqbal et al., 2018[26]	Prospective cohort	Pakistani children	EED biomarker profiling	Identified promising biomarkers linked to EED burden	May support future endocrine-growth risk stratification
Lauer et al., 2020[27]	Cohort study	Rural Ugandan infants	EED markers, growth and iron status	EED markers associated with poor growth and iron status	Connects intestinal dysfunction with growth and micronutrient-endocrine biology
Yan et al., 2016; Schwarzer et al., 2016; Seely et al., 2021; Hansen et al., 2021[7-10]	Translational studies and mechanistic review	Animal/translational models	Microbiota–IGF-1 signaling and gut–bone axis	Gut microbiota and selected taxa can modulate IGF-1 and growth-related phenotypes; gut hormones are implicated in bone remodeling crosstalk	Provides biologic plausibility for intestine–microbiota–GH/IGF-1 linkage and gut-bone interactions relevant to linear growth
He et al, 2023; Shah et al., 2025; Pires et al., 2024[11-13]	Narrative reviews	Children/adolescents (focused syntheses)	Microbiota and pediatric endocrine phenotypes; linear growth trajectories	Syntheses report associations between microbiota composition and linear growth, and	Supports clinical relevance of dysbiosis and microbiota-targeted strategies alongside nutrition and

Author, year	Study Design	Population	Intestinal/Endocrine Focus	Main Growth-Related Findings	Endocrine Interpretation
				summarize links with pediatric endocrine disorders and metabolic outcomes	inflammation control

EED = environmental enteric dysfunction; GI = gastrointestinal; LMIC = low- and middle-income countries; IGF-1 = insulin-like growth factor 1; GH = growth hormone

Figure 1. The intestine as an endocrine organ in pediatric growth and weight regulation: gut hormones, inflammation, microbiota, and the GH–IGF-1 axis

Discussion

This review supports the intestine as a pivotal endocrine organ in pediatric growth medicine, helping explain why abnormal linear growth or weight trajectories can arise from intestinal dysfunction even when children present through endocrine pathways. A practical framework links pediatric growth and weight to three coupled intestinal domains—gut hormone secretion, intestinal integrity/inflammation, and microbiota-related signaling—through which enteroendocrine cell hormones (e.g., GLP-1, PYY, CCK, GLP-2) translate nutrient sensing into appetite control, motility, absorption, and anabolic potential.[1-5, 28]

The GH–IGF-1 axis appears particularly sensitive to these intestinal domains. Beyond classic GH deficiency, functional suppression of IGF-1 and inflammatory GH resistance can occur in malnutrition or chronic intestinal inflammation.[6, 18-27] Clinically, low IGF-1 in a child with poor growth should therefore be interpreted alongside intestinal symptoms, inflammatory burden, nutritional intake, and growth velocity before attributing findings to primary pituitary pathology; this approach can reduce diagnostic delay and improve targeting of treatment.[14-21, 32-34]

Celiac disease remains a clear human model of intestine-mediated growth impairment, where short stature or poor growth may be a presenting feature and endocrine evaluation may trigger diagnostic consideration. The consistent improvement in growth and IGF-1 following a gluten-free diet underscores partial reversibility when mucosal healing and nutrient restoration occur, supporting low-threshold celiac screening in children with unexplained growth failure or low IGF-1.[14-17]

Pediatric inflammatory bowel disease, especially Crohn's disease, illustrates a more severe multi-mechanistic pathway to growth failure, combining undernutrition with cytokine-driven GH resistance, pubertal delay, and catabolic effects of active disease. Evidence and guidelines emphasize growth as a core outcome of disease control, making serial height velocity and pubertal monitoring clinically meaningful even when gastrointestinal symptoms improve.[18-21, 32-34]

Environmental enteric dysfunction extends the gut–growth endocrine concept to high-burden settings in which chronic intestinal dysfunction may be subclinical yet still contributes to stunting via impaired barrier function, inflammation, and altered nutrient handling.[22-27] Microbiota-related evidence strengthens biologic plausibility by linking microbial states to circulating IGF-1 and growth-related outcomes in experimental and translational work, with pediatric syntheses highlighting dysbiosis-associated endocrine phenotypes and growth trajectories.[7-13] Together, these data support integrated strategies that address gut health and inflammation alongside nutrition.

At the opposite end of the nutritional spectrum, pediatric obesity demonstrates that gut endocrine signaling is also a modifiable pathway in routine care. Incretin and satiety biology has translated into effective adolescent obesity therapy, with GLP-1 receptor agonists producing clinically meaningful reductions in BMI, reinforcing the clinical relevance of gut endocrine pathways beyond malnutrition and inflammatory disease.[1-3, 28-31]

Limitations include heterogeneity across pediatric study designs, biomarker panels, and outcome definitions, which precluded pooled quantitative synthesis, and the fact that some microbiota–IGF-1 concepts are supported more strongly by translational than pediatric interventional data.[7-10] Nonetheless, convergence across physiology, pediatric disease cohorts, and therapeutic trials supports the overall narrative and the informal quality considerations applied to included studies help contextualize the mixed evidence base. Future work should prioritize standardized pediatric gut-endocrine biomarker panels, longitudinal studies linking intestinal markers to height velocity and pubertal timing, and trials that include growth endpoints alongside disease control and weight outcomes.[1-13, 22-31]

Conclusion

The intestine functions as a clinically important endocrine organ in children, influencing linear growth, weight gain, and GH–IGF-1 axis behavior through gut hormone signaling, mucosal integrity, inflammation, and microbiota-related pathways. Fundamentally, enteroendocrine cell-derived hormones—including GLP-1, PYY, CCK, and GLP-2—regulate appetite, nutrient absorption, and anabolic signaling, while intestinal inflammation drives cytokine-mediated GH resistance and IGF-1 suppression; in parallel, microbiota-derived metabolites further modulate systemic endocrine growth pathways. These mechanisms collectively explain why intestinal disease can impair linear growth and alter the GH–IGF-1 axis through routes that are distinct from, yet interacting with, primary pituitary or nutritional deficits. This framework improves pediatric endocrine interpretation of growth faltering, stunting, and obesity, and supports integrated management across celiac disease, IBD, EED-associated growth failure, and obesity. Incorporating intestinal endocrine biology into routine pediatric endocrine assessment can improve diagnostic accuracy, treatment timing, and long-term growth outcomes.

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Conflict of Interest

None declared.

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