INTERNATIONAL JOURNAL OF MEDICAL SCIENCE AND DENTAL HEALTH
(ISSN: 2454-4191)
www.ijmsdh.org (2026)

Received: 10 July 2026
Revised: 26 July 2026
Accepted: 18 Aug 2026
Published: 13 Sep 2026

Volume 12 Issue 09, 2026
Page No - 22-26
DOI - 10.55640/ijmsdh-12-09-03

Article Citation: Bayjanova Gulnoza Jumanazar qizi, Tulyaganova Muslima Xabibulla qizi, & Akramova Khursandoy Abdumalikovna. (2026). Immune Status and Metabolic Disorders of The Intestine in Functional Bowel Disorders Against the Background of Anemia in Young Children. International Journal of Medical Science and Dental Health, 12(09), 22-26. https://doi.org/10.55640/ijmsdh-12-09-03

Immune Status and Metabolic Disorders of The Intestine in Functional Bowel Disorders Against the Background of Anemia in Young Children

Bayjanova Gulnoza Jumanazar qizi

Assistant, Urgench State Medical Institute, Uzbekistan

Tulyaganova Muslima Xabibulla qizi

Researcher at the Tashkent state Medical University, Uzbekistan

Akramova Khursandoy Abdumalikovna

d.m.s., docent, Tashkent State Medical University, Uzbekistan

Abstract

In recent years, increasing attention has been focused on the association between functional gastrointestinal disorders and anemia in infants and young children. Timely identification and management of these conditions, especially when occurring in conjunction with anemia, are crucial for preserving health and improving the quality of life in children. Functional bowel disorders in young children are frequently associated with systemic conditions such as anemia, which can further exacerbate intestinal disturbances.

The primary aim of this study is to determine the diagnostic significance of short-chain fatty acids and secretory immunoglobulin A (serving as the primary immune barrier of the intestinal mucosa and reflecting the functional integrity of the local immune system) in evaluating functional bowel disorders in young children against a background of anemia. Despite the high prevalence of functional bowel disorders, changes in mucosal immunity under the combined impact of anemia and dysbiosis remain insufficiently studied.

Keywords: Secretory immunoglobulin A, short-chain fatty acids, anemia, immunity, microbiota.

Introduction

Secretory immunoglobulin A in feces is considered an important marker of local inflammatory processes, dysbiosis, and impaired intestinal wall permeability. It also serves as an indicator of the functional state of the intestine in children, reflecting local immune response activity and the state of the microbiota. The level of secretory immunoglobulin A in feces depends on the child's age and health status. In the feces of newborns, secretory immunoglobulin A is usually undetectable, but its amount begins to rise after the first feeding and reaches its peak during the first 3 months of life. As age increases, the level of secretory immunoglobulin A in feces gradually decreases, but remains higher than in adults until the age of 5. The analysis of secretory immunoglobulin A levels in feces in young children with functional intestinal disorders and anemia revealed a number of regular patterns.

One of the main indicators of the state of intestinal microbiocenosis is the spectrum of short-chain fatty acids, which are produced as a result of the fermentation of dietary fibers by large intestine bacteria. Short-chain fatty acids perform a number of metabolic functions, such as serving as the primary energy source for colonocytes (butyrate), regulating the barrier function of the intestinal mucosa, participating in the synthesis and regulation of gastrointestinal hormones, modulating immune responses and inflammatory processes, and influencing carbohydrate and lipid metabolism in the child's body. Quantitative and qualitative changes in short-chain fatty acids are viewed as an important marker of dysbiotic processes, as well as a reflection of the functional state of the intestine.

In children with functional intestinal disorders, disruptions in the profile of these acids may be associated with microbiota imbalance, insufficient dietary fiber intake, alterations in intestinal motility, and concomitant metabolic disorders, including anemia and vitamin deficiency states. Short-chain fatty acids account for up to 95% of all organic acids in the intestinal contents and consist of three main components: acetate (C2), propionate (C3), and butyrate (C4). Under normal conditions, their mutual ratio is approximately 60:20:20. Studying the concentration of short-chain fatty acids in the feces of children under examination with varying degrees of anemia showed that their total amount changes significantly. Just as in the unclassified type of functional bowel disorder (K59.9), significant shifts in the metabolic activity of the intestinal microbiota are also observed in functional diarrhea (K59.1) and functional constipation (K59.0).

The Aim of the research. To evaluate the state of intestinal microbiocenosis and local immunity based on indicators of short-chain fatty acids and secretory immunoglobulin A in children with functional intestinal disorders against the background of anemia.

Methods

A prospective study was conducted at the clinic of Urgench state medical institute, Khorezm region, Republic of Uzbekistan, involving 144 children aged 1–3 years diagnosed with various forms of functional bowel disorders (ICD-10 codes K59.0, K59.1, and K59.9). The study involved measuring secretory immunoglobulin A levels in stool using ELISA. The functional state of the intestine was assessed by quantifying fecal short-chain fatty acids concentrations—specifically acetate, propionate, and butyrate—using high-precision Gas Chromatography-Mass Spectrometry (GC-MS).

Results and Discussion

An analysis of fecal secretory immunoglobulin A levels in young children with functional bowel disorders and concomitant anemia revealed several significant patterns. In children with stage I anemia and unspecified functional bowel disorders (ICD-10 codes; K59.9), the concentration of secretory immunoglobulin A was 3.22 ± 0.68 mg/ml. In stage II anemia, secretory immunoglobulin A values significantly decreased to 2.62 ± 0.05, reflecting the exhaustion of the mucosal immune response. In stage III anemia, the secretory immunoglobulin A level remained low (2.88 ± 0.06), confirming a progressive weakening of the local immune defense. A downward trend in secretory immunoglobulin A levels was also observed in patients with functional diarrhea. In stage I anemia, the secretory immunoglobulin A level was 2.29 ± 0.25. In stage II anemia, it was 2.48 ± 0.23, while in stage II anemia, the values remained almost unchanged at 2.49 ± 0.22. In children with functional constipation, secretory immunoglobulin A levels in stages I and II anemia ranged between 2.53 ± 0.31 and 2.32 ± 0.36, respectively. These levels also represent a relative decrease compared to the group with unspecified functional bowel disorders and mild anemia.

Table 1

Secretory immunoglobulin A in young children in the main group, mg/ml

	Unspecified functional bowel disorders (К59.9) n=76			**Functional diarrhea (К59.1) n=41**			**Functional constipation (К59.0) n=27**		
	I n=13	II n=55	III n=8	I n=12	II n=25	III n=4	I n=11	II n=13	III n=3
sIgA <0,9 mg/ml	3,22±0,68	2,62±0,05	2,88±0,06	2,29±0,25	2,48±0,23	2,49±0,22	2,53±0,31	2,32±0,36	2,95±1,15

Severity of anemia correlated with progressive short-chain fatty acids depletion. In unspecified functional bowel disorders, stage III anemia led to a predominant decrease in Acetate (75%) and a 100% deficiency in Propionate and Butyrate. Butyrate deficiency was particularly severe, rising from 83.6% in stage II to 100% in stage III cases. Total isoforms (Σ isoCn) showed a pervasive decline (72.7%–100%) across all anemia stages, reflecting severe microbiota dysfunction.

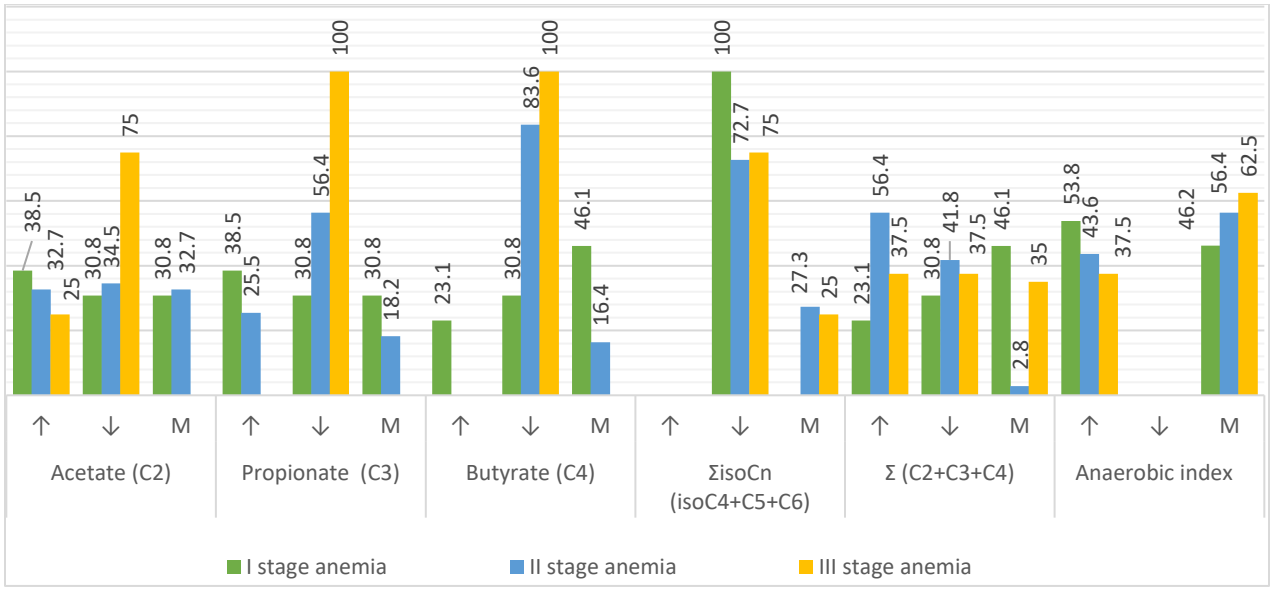

Figure 1. Profile of short-chain fatty acids in children with an unclassified form of functional intestinal disorder (K59.9) against the background of anemia (%)

In cases of functional diarrhea and constipation, stage III anemia consistently resulted in profound Butyrate depletion (100% and 40-60% respectively). "The anaerobic index shifted significantly, particularly in stage I (53.8%) and stage III (60% in patients with constipation), indicating a transition toward proteolytic metabolism. However, a relative increase (2.95 ± 1.15) was observed in stage III anemia.

Table 2

Profile of short-chain fatty acids in children with functional gastrointestinal disorders associated with anemia, (%)

Indicators	Changes	Functional diarrhea (K59.1) n=41			Functional constipation (K59.0) n=27		
		I n=12	II n=25	III n=4	I n=11	II n=13	III n=3
Acetate (C2) (4.12±0.84 мг/г)	↑	50,0	36,0	–	18,2	36,4	20,0
	↓	25,0	36,0	75,0	54,5	27,3	60,0
	N	25,0	24,0	25,0	36,4	36,4	20,0
Propionate (C3) (0.97±0.19 мг/г)	↑	33,3	36,0	–	27,3	54,5	40,0
	↓	25,0	36,0	75,0	54,5	18,2	20,0
	N	41,7	24,0	25,0	18,2	27,3	40,0
Butyrate (C4) (0.86±0.17 мг/г)	↑	16,7	36,0	–	27,3	27,3	–
	↓	41,7	36,0	100	45,5	36,4	40,0
	N	41,7	24,0	–	27,3	36,4	60,0
Σ изоCn (изоC4+C5+C6) (6.36±1.27 мг/г)	↑	–	–	–	9,1	45,5	20,0
	↓	100	100	100	81,8	27,3	60,0
	N	–	–	–	9,1	27,3	20,0
Σ (C2+C3+C4) (6.36±1.27 мг/г)	↑	50,0	32,0	–	45,5	27,3	40,0
	↓	50,0	48,0	75,0	54,5	72,7	60,0
	N	–	16,0	25,0	–	–	–
Anaerobic index (-0.433±0.03 д.)	↑	41,7	48,0	50,0	45,5	27,3	60,0
	↓	25,0	8,0	50,0	18,2	72,7	40,0
	N	33,3	44,0	–	36,4	–	–

Note: ↑ — increase in the indicator; ↓ — decrease in the indicator; N — indicator within the normal range; n — number of patients in each group; Σ isoCn — index of branched-chain fatty acids; Σ SCFA — sum of short-chain fatty acids.

Conclusions

Children with functional bowel disorders associated with anemia exhibit pronounced changes in their short-chain fatty acids profiles. These alterations include significant deficiencies in propionate and butyrate, a reduction in total isoforms (ΣisoCn), and a distinct shift in the anaerobic index. The sharp decline in essential short-chain fatty acids and the shift in the anaerobic index highlight a critical failure of the intestinal barrier, necessitating the inclusion of metabolic and probiotic correction in standard treatment protocols.

This elevation of secretory immunoglobulin A can be interpreted as a compensatory hyperactivation of the local immune response against the background of pronounced microbiocenosis disturbances and a sharp decline in the anaerobic index. This state confirms the presence of immunological restructuring aimed at compensating for the disturbed microbiocenosis.

References

1. Shi N., Li N., Duan X., Niu H. Interaction between the gut microbiome and mucosal immune system. Military Medical Research. 2017; 4:59. doi: 10.1186/s40779-017-0122-9.
2. Shuiming Xiao, Na Fei, Xiaoyan Pang et al. A gut microbiota-targeted dietary intervention for amelioration of chronic inflammation underlying metabolic syndrome // FEMS Microbiol& Ecol. 2013, 1–11.
3. Steutel N.F., Zeevenhooven J., Scarpato E., Vandenplas Y., Tabbers M.M., Benninga M.A. Prevalence of Functional Gastrointestinal Disorders in European Children and Adolescents // Journal of Pediatrics. - 2020. - Vol. 221. - P. 54–61.

4. Steutel NF, Zeevenhooven J, Scarpato E et al. Prevalence of Functional Gastrointestinal Disorders in European Infants and Toddlers. J. Pediatr. 2020; 221:107–114.

5. Stinson L.F., et al. Establishment of the early-life microbiome: Implications for health and disease // Life. – 2019. – Vol. 9, №1. – P. 25.

6. Tachibana K., Sakurai K., Watanabe M. et al. Associations between changes in the maternal gut microbiome and differentially methylated regions of diabetes-associated genes in fetuses: A pilot study from a birth cohort study. J Diabetes Investig. 2017; 8(4):550-553. D0I:10.1111/jdi.12598.

7. Tang W. H., Kitai T., Hazen S. L. Gut Microbiota in Cardiovascular Health and Disease. Circ Res 2017; 120: 1183-1196. D0I:10.1161/CIRCRESAHA.117.309715.

8. Tilg H., Moschen A.R. Food, immunity, and the microbiome. Gastroenterology. 2015;148(6):1107–1119. doi: 10.1053/j.gastro.2014.12.036.

9. Torano E. G., Garcia M. G., Fernandez-Morera J.L. et al. The Impact of External Factors on the Epigenome: In Utero and over Lifetime. Biomed Res Int 2016: s2568635. D0I:10.1155/2016/2568635.