American Journal of Medicine and Medical Sciences 2026, 16(1): 150-152
DOI: 10.5923/j.ajmms.20261601.33

Immunological Alterations in Children with Small Intestinal Diseases in the Aral Sea Region: A Pilot Study from Uzbekistan

Nargiza Abdurazzakovna Amanova, Nigora Rustamovna Aliyeva

Department of Hospital Pediatrics, Folk Medicine, Tashkent State Medical University, Uzbekistan

Abstract **Background:** Children living in the Aral Sea region are exposed to chronic environmental stressors that may contribute to gastrointestinal and immune disorders. Small intestinal diseases such as malabsorption syndromes, celiac disease, and chronic enteropathies remain understudied in this population [4]. **Objective:** To evaluate immunological profiles in children with small intestinal diseases residing in the Aral Sea region of Uzbekistan. **Methods:** We conducted a cross-sectional study involving 185 children aged 3–16 years. The main group consisted of 125 children with clinically confirmed small intestinal diseases; The comparison group (n=60) consisted of patients with diseases of the small intestine living in Tashkent; 40 healthy children from the same region served as controls. Clinical examination, complete blood count, biochemistry, and immunological assays were performed. Serum immunoglobulins (IgA, IgE) and cytokines (IL-1β, IL-4) were measured using ELISA. Statistical analysis included Mann–Whitney U test, Student's t-test, and Spearman correlation. **Results:** Children with intestinal disorders demonstrated significant immunological alterations: decreased IgA while IgE was elevated ($p<0.05$). Pro-inflammatory cytokines IL-4 and IL-1β were elevated. The severity of immune disturbances correlated with clinical disease severity ($r=0.62$; $p<0.01$). **Conclusion:** Children with small intestinal diseases in the Aral Sea region exhibit marked immune dysregulation. These findings highlight the need for early immunological monitoring and targeted therapeutic strategies.

Keywords Children, Small intestine, Immunity, Enteropathy, Aral Sea region, Uzbekistan

1. Introduction

The Aral Sea ecological crisis has created one of the most environmentally affected regions worldwide. Chronic exposure to pollutants, malnutrition, and infectious agents has been linked to rising gastrointestinal morbidity among children [2,3]. However, the immunological mechanisms underlying small intestinal diseases in this population remain poorly understood. This study aims to fill this gap by evaluating immune alterations in children with enteropathies in the Aral Sea region. The problems of small intestine diseases in children living in ecologically unfavorable areas, such as the Aral Sea region, are becoming particularly relevant. These regions are characterized by a high level of anthropogenic stress, which affects the health of the younger generation, including the indicators of immune status. The study of the immunological status of children with pathologies of the small intestine in these conditions makes it possible to identify characteristic changes in the body's immune responses and assess their severity [1,5].

Received: Sep. 23, 2025; Accepted: Oct. 28, 2025; Published: Jan. 20, 2026
Published online at http://journal.sapub.org/ajmms

2. Materials and Methods

Study design and participants: A cross-sectional study was carried out in 2023–2024 in Aral Sea region, Uzbekistan. Main group: 125 children aged 3–16 years with clinically and laboratory confirmed small intestinal diseases (allergic enterocolitis, celiac disease, chronic enteropathies). The comparison group (n=60) consisted of patients with diseases of the small intestine living in Tashkent. Control group: 25 age- and sex-matched healthy children.

Immunological assays: ELISA: IgA, IgE; cytokines (IL-1β, IL-4).

Statistics: Analysis was performed with SPSS 25.0. Differences between groups were assessed using t-test or Mann–Whitney U test. Correlations were evaluated with Spearman's rank test. Significance was set at $p<0.05$.

3. Results

Based on the objectives of this study, we conducted a comparative analysis of immunological parameters in children with small intestine diseases living in the Aral Sea region, the results of which are shown in the table 1.

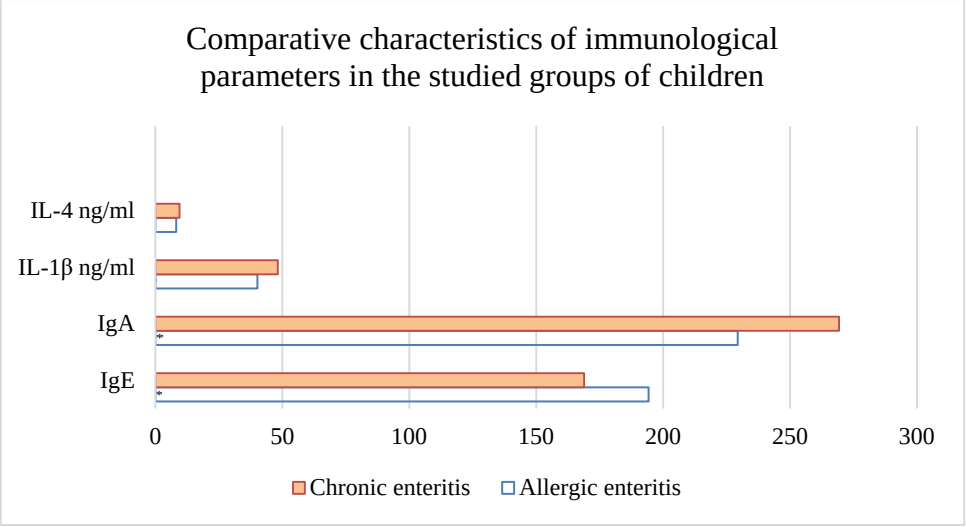

Table 1

According to the results of an immunological study of children with diseases of the small intestine living in the Aral Sea region, significant deviations in the indicators of immune status were revealed. In children of the main group (MG), the IgE level was elevated and amounted to 239.6±5.9 mg%, which was significantly higher than in children of the comparative group (MG) — 162.1±6.8 mg% 1.5 times, and the control group — 35.8±3.1 mg%. This indicator could indicate an increased allergic background in children with intestinal diseases in this area.

The IgA level was also highest in the main group (376.7±8.6 mg%), whereas in the comparative group it was 201.5±7.5 mg%, which was 1.9 times higher in the MG, and in the control group — 131.0±3.7 mg%. These data indicated activation of the humoral link of the immune system in children of the main group.

The concentration of the proinflammatory cytokine IL-1b in children of the main group reached 52.15±3.2 ng/ml, which was higher than in the comparative group (41.1±3.3 ng/ml) and in the control group (17.7±4.5 ng/ml). These indicators probably reflected an increased inflammatory response in patients with intestinal diseases.

The level of anti-inflammatory cytokine IL-4, on the contrary, was lower in the main group (7.85±2.4 ng/ml) compared with the control group (13.7±3.1 ng/ml), which could indicate a violation of the regulation of the immune response in children with chronic intestinal diseases. In the comparative group, the concentration of IL-4 was 9.6±1.9 ng/ml, which was also lower than the control values, but higher than in the main group.

Thus, significant deviations were observed in key indicators of the immune status in children of the main group, which could indicate pronounced violations of immune regulation in pathologies of the small intestine in an ecologically unfavorable environment.

Next, we conducted a comparative analysis of the key components of the immune system among children with acute hypertension living in the Aral Sea region, depending on the nosology of the disease, the results of which are shown in the table 2.

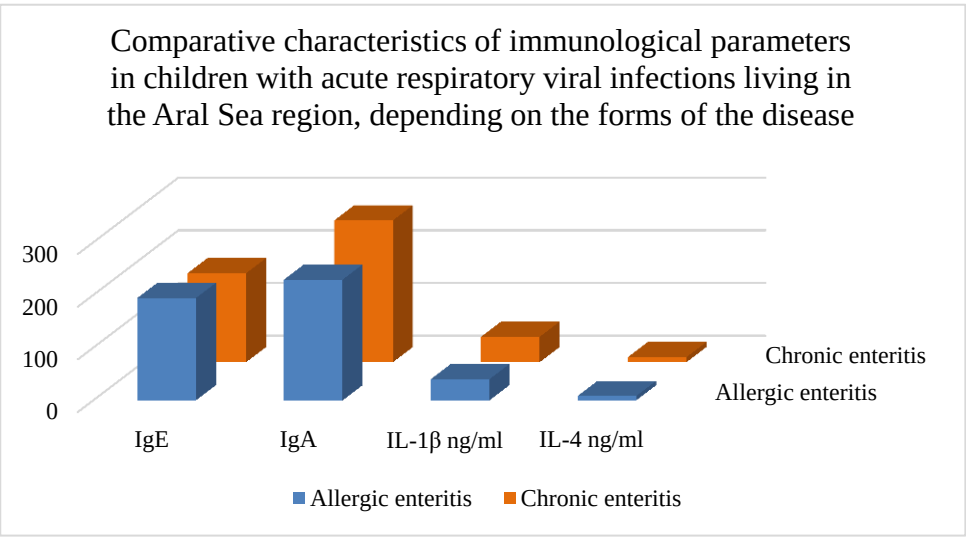

Table 2

According to the results of an immunological study of children with diseases of the small intestine in the Aral Sea region, there are various changes in the indicators of immune status depending on the form of the disease.

In children with celiac disease (C), the IgE level was 293.8±11.3 mg%, which was significantly higher than in comparison with chronic enterocolitis (CE) — 168.9±13.5 mg% and allergic enterocolitis (AE) — 194.3±12.9 mg%. These data may indicate a high level of allergic reaction in the C groups compared to HE and AE. The IgA level also showed differences: in the C group, it was 556.2±15.1 mg%, which significantly exceeded the values of CE (269.3±6.2 mg%) and AE (229.4±9.3 mg%). This indicates a marked activation of the humoral link of the immune system in children with celiac disease.

The concentration of the pro-inflammatory cytokine IL-1b in children with celiac disease was 65.8±4.2 ng/ml, which is significantly higher than in CE (48.2±5.4 ng/ml) and AE (40.2±6.5 ng/ml). These results reflect an increased inflammatory response in children with various intestinal pathologies.

The level of anti-inflammatory cytokine IL-4, on the contrary, was lowest in C (7.8±3.2 ng/ml) compared with CE (9.5±4.1 ng/ml) and AE (8.2±3.1 ng/ml). This may indicate abnormalities in the regulation of the immune response, especially in children with cystic fibrosis.

4. Conclusions

The cytokine status in children of the Aral Sea region with diseases manifested by maldigestion and malabsorption is characterized by an almost 3-fold increase in IL-1 β in relation to children with this pathology living in Tashkent against the background of a significant decrease in IL-4. These indicators reflected an increased inflammatory response in patients with intestinal diseases. A significantly significant increase in IgE and ID in peripheral blood in children of the Aral Sea region indicates an increased allergic background and activation of humoral immunity in children with intestinal diseases in this area in relation to children living in Tashkent. These markers may serve as predictors of disease severity and targets for immunomodulatory interventions.

REFERENCES

[1] Zhang Y., Li H., Wang J. *Immune dysregulation in pediatric enteropathies: a systematic review*. J Pediatr Gastroenterol Nutr. 2021; 72(4): 515–523.

[2] Lee S., Kim H., Park J. Cytokine imbalance in children with chronic intestinal diseases. Front Immunol. 2022; 13: 874123.

[3] World Health Organization. Health and ecological consequences of the Aral Sea crisis. WHO Report, 2020.

[4] Ivanov A., Petrova N., Sokolov V. *Immune status of children in ecologically disadvantaged regions.* Cent Asian J Med Sci. 2019; 5(2): 45–52.

[5] Akhmedov R., Karimova D. Pediatric gastrointestinal disorders in Uzbekistan: current challenges and future perspectives. Uzbek Med J. 2023; 2: 33–40.