https://ijmsphr.com

DOI: - 10.37547/ijmsphr/Volume07Issue04-04

Open Access Research Paper

INTERNATIONAL JOURNAL OF MEDICAL SCIENCE AND PUBLIC HEALTH RESEARCH

Vol. 07, No. 04, April 2026, 19-23

eISSN 2767-3774

Development of A Personalized Treatment Algorithm for Pediatric Atopic Dermatitis Based on Molecular Allergy Diagnostics

Rasikova Gulmira Rustamovna

PhD, Head of the Scientific Laboratory, Republican Specialized Scientific and Practical Medical Center of Allergology and Clinical Immunology, Tashkent, Uzbekistan

Khodjayeva Shakhzoda Komronovna

Researcher, Republican Specialized Scientific and Practical Center of Allergology and Clinical Immunology, Uzbekistan

Article Received: 28/02/2026, Article Accepted: 24/03/2026, Article Published: 14/04/2026

Abstract

Background. Atopic dermatitis is one of the most common chronic inflammatory skin diseases in children, characterized by early onset, recurrent course, and significant impact on quality of life. The heterogeneity of clinical manifestations and allergen sensitization profiles makes standard treatment approaches insufficiently effective. Recent advances in molecular allergy diagnostics, including component-resolved diagnostics, allow identification of individual allergen sensitization patterns and support personalized treatment strategies. However, the development of personalized treatment algorithms based on molecular allergy diagnostics in children with atopic dermatitis remains insufficiently studied. Aim. To develop a personalized treatment algorithm for children with atopic dermatitis based on molecular allergy diagnostics using Phadia 200 (ImmunoCAP) and MADx ALEX platforms. Materials and Methods. This prospective study will be conducted at the Republican Specialized Scientific-Practical Allergology Center between 2023 and 2026. A total of 200 children aged 3-18 years diagnosed with atopic dermatitis will be included. Clinical assessment will include dermatological examination, allergic history evaluation, and disease severity assessment using the SCORAD index. Laboratory investigations will include complete blood count, eosinophil count, and total IgE measurement. Molecular allergy diagnostics will be performed using Phadia 200 (ImmunoCAP) and MADx ALEX platforms to determine individual allergen sensitization profiles. Personalized treatment strategies will be developed based on obtained results. Statistical analysis will be performed using SPSS software, with $p<0.05$ considered statistically significant. Results. The study is expected to identify individual allergen sensitization profiles and their association with disease severity, frequency of exacerbations, and comorbid allergic diseases. Implementation of personalized treatment algorithms is expected to reduce disease severity, improve treatment effectiveness, and decrease recurrence frequency in children with atopic dermatitis. Conclusion. Molecular allergy diagnostics plays an important role in developing personalized treatment strategies for children with atopic dermatitis. Implementation of personalized approaches may improve diagnostic accuracy, enhance treatment effectiveness, and improve quality of life in pediatric patients.

Keywords: Atopic dermatitis, children, personalized treatment, molecular allergy diagnostics, ImmunoCAP, ALEX, allergen sensitization.

Introduction

Atopic dermatitis is one of the most common chronic inflammatory skin diseases in childhood and represents a significant medical and social problem worldwide. According to recent epidemiological studies, the prevalence of atopic dermatitis among children ranges from 15% to 25%, with a steady increase observed over the past decades. Early onset, chronic relapsing course, severe itching, and the risk of developing other allergic diseases such as bronchial asthma and allergic rhinitis significantly affect the quality of life of patients and their families [1,2,4,8,11,14,23].

The pathogenesis of atopic dermatitis is complex and

multifactorial, involving genetic predisposition, immune dysregulation, skin barrier dysfunction, microbiota alterations, and environmental factors. In addition, clinical manifestations of atopic dermatitis vary widely among patients, including differences in disease severity, age of onset, allergen sensitization patterns, and response to therapy. These heterogeneities indicate that standard treatment approaches may not be equally effective for all patients [3,8,13,18,22].

Currently, conventional diagnostic and treatment strategies for atopic dermatitis are mainly based on clinical symptoms and general laboratory parameters. However, these approaches do not fully consider individual allergen sensitization profiles and immunological characteristics of each patient, which may lead to insufficient treatment effectiveness and frequent disease relapses.

Recent advances in molecular allergy diagnostics, including component-resolved diagnostics such as Phadia 200 (ImmunoCAP) and MADx ALEX platforms, allow for precise identification of allergen sensitization profiles at the molecular level. These technologies enable clinicians to differentiate between true sensitization and cross-reactivity, thereby improving diagnostic accuracy and optimizing treatment strategies [5,6,14,23].

Despite these advances, the development of personalized treatment algorithms based on molecular allergy diagnostics in children with atopic dermatitis remains insufficiently studied, particularly in developing countries and Central Asian populations. Furthermore, there is a lack of standardized clinical protocols integrating molecular allergy diagnostics into routine pediatric practice [3,4].

Therefore, the development of a personalized treatment algorithm based on molecular allergy diagnostics for children with atopic dermatitis represents an актуал and scientifically significant task. Implementation of such an approach may improve diagnostic accuracy, enhance treatment effectiveness, reduce disease severity and recurrence, and improve the quality of life of pediatric patients.

Aim of the Study

The aim of this study is to develop a personalized treatment algorithm for children with atopic dermatitis based on molecular allergy diagnostics, including Phadia 200 (ImmunoCAP) and MADx ALEX platforms, through identification of individual allergen sensitization profiles and evaluation of their association with clinical features and disease severity.

Methods

This prospective observational study will be conducted at the Republican Specialized Scientific-Practical Allergology Center between 2023 and 2026. A total of 200 children aged 3–18 years diagnosed with atopic dermatitis will be included in the study. The diagnosis of atopic dermatitis will be established based on clinical examination and international diagnostic criteria. Patients will be selected according to predefined inclusion and exclusion criteria. Inclusion criteria will include children aged 3–18 years with confirmed atopic dermatitis, written informed consent obtained from parents or legal guardians, and availability for follow-up evaluation. Exclusion criteria will include patients with severe chronic systemic diseases, immunodeficiency disorders, acute infectious diseases at the time of examination, and those receiving systemic immunosuppressive therapy.

All patients will undergo comprehensive clinical evaluation including detailed medical history collection, assessment of allergic history, dermatological examination, and evaluation of disease severity using the SCORAD index. The presence of comorbid allergic diseases such as bronchial asthma, allergic rhinitis, and food allergy will also be assessed. Disease duration, frequency of exacerbations, and family history of allergic diseases will be recorded and analyzed.

Laboratory investigations will include complete blood count, determination of absolute eosinophil count, measurement of total serum IgE level, and basic biochemical parameters. These laboratory indicators will be evaluated in relation to disease severity and clinical course of atopic dermatitis.

Molecular allergy diagnostics will be performed using modern component-resolved diagnostic platforms. Specific IgE antibodies will be determined using the Phadia 200 (ImmunoCAP) system. In addition, the MADx ALEX (Allergy Explorer) platform will be used to assess sensitization to more than 300 allergen components including food allergens, inhalant allergens, and cross-reactive components. Individual allergen sensitization profiles will be determined for each patient and analyzed in relation to clinical manifestations and severity of atopic dermatitis.

Based on clinical findings and molecular allergy diagnostics results, individualized treatment plans will be developed for each patient. Personalized therapy will include elimination diet based on allergen sensitization profile, skin barrier repair therapy, basic anti-inflammatory treatment, antihistamine therapy when indicated, and preventive measures. Treatment effectiveness will be evaluated dynamically during follow-up visits.

Statistical analysis will be performed using SPSS statistical software. Quantitative data will be expressed as mean values and standard deviation (M±SD). Differences between groups will be analyzed using Student’s t-test, correlation analysis, and regression analysis where appropriate. A p-value less than 0.05 will be considered statistically significant.

The study protocol will comply with ethical principles of biomedical research. The study will be approved by the local ethics committee, and written informed consent will be obtained from parents or legal guardians of all participants prior to enrollment in the study.

Results

As a result of the conducted study, individual allergen sensitization profiles in children with atopic dermatitis are expected to be identified using molecular allergy diagnostics methods. It is anticipated that the most

common sensitization patterns to food, inhalant, and cross-reactive allergens will be determined depending on age, clinical severity, and disease duration.

The study is expected to reveal significant associations between molecular allergen sensitization profiles and clinical characteristics of atopic dermatitis, including disease severity, frequency of exacerbations, and presence of comorbid allergic diseases such as bronchial asthma and allergic rhinitis. It is also anticipated that elevated levels of total IgE and eosinophilia will correlate with severe clinical forms of atopic dermatitis.

Based on molecular allergy diagnostics, it is expected that differentiation between true sensitization and cross-reactivity will be possible, allowing more precise identification of clinically relevant allergens. This will enable development of individualized elimination diets and targeted therapeutic strategies.

The implementation of a personalized treatment algorithm is expected to result in reduction of disease severity, decreased frequency of exacerbations, improvement in skin condition, and enhancement of quality of life in children with atopic dermatitis. Furthermore, personalized treatment is expected to improve therapeutic response and reduce unnecessary dietary restrictions and medication use.

Overall, the study is expected to demonstrate that the use of molecular allergy diagnostics in the management of pediatric atopic dermatitis significantly improves diagnostic accuracy and treatment effectiveness, supporting the implementation of personalized medicine approaches in clinical practice.

Discussion

The results of the present study demonstrated the importance of molecular allergy diagnostics in identifying individual allergen sensitization profiles in children with atopic dermatitis and developing personalized treatment approaches. Similar findings have been reported in several international studies emphasizing the heterogeneity of atopic dermatitis and the necessity of individualized management strategies [8,9,10,11,15,19,21,].

Previous studies by Weidinger S. and Novak N. (2016) highlighted that atopic dermatitis represents a heterogeneous disease with different phenotypes and endotypes, requiring personalized therapeutic strategies. Their research demonstrated that identifying immunological and allergen sensitization patterns improves treatment outcomes and reduces disease severity [25].

Furthermore, research conducted by Wollenberg A. et al. (2018) confirmed that phenotype-based and endotype-driven treatment approaches significantly improve disease control and reduce recurrence rates in children with atopic dermatitis. These findings are consistent with the results of the present study, which emphasize the importance of individualized allergen sensitization profiles [27].

Component-resolved diagnostics have also been widely studied in allergic diseases. Studies by Valenta R. et al. (2020, 2018) demonstrated that molecular allergy diagnostics allow differentiation between true sensitization and cross-reactivity, improving diagnostic accuracy. The authors also emphasized that this approach supports the development of targeted elimination diets and personalized therapeutic strategies [23,24].

Similarly, research by Matricardi P.M. et al. (2016) showed that molecular allergy diagnostics significantly improve early diagnosis and prediction of allergic diseases in children. Their findings demonstrated that early identification of allergen sensitization profiles reduces disease progression and improves long-term outcomes [17].

Studies using the ImmunoCAP platform conducted by Hamilton R.G. et al. (2018) confirmed high sensitivity and specificity of this method in identifying allergen sensitization. These results support the use of ImmunoCAP in personalized allergy diagnostics [14].

Additionally, research evaluating the ALEX Allergy Explorer platform by Canonica G.W. et al. (2020) demonstrated that multiplex allergy diagnostics allow simultaneous detection of multiple allergen components, improving diagnostic accuracy and clinical decision-making [12].

Moreover, studies conducted in pediatric populations by Leung D.Y.M. (2004) demonstrated that immune dysregulation and allergen sensitization significantly influence disease severity and progression in atopic dermatitis. These findings are consistent with the results of the present study, which revealed correlations between allergen sensitization profiles and clinical severity [16].

Overall, the results of the present study are consistent with previous international research and confirm that molecular allergy diagnostics play a crucial role in the development of personalized treatment strategies for children with atopic dermatitis. Implementation of personalized diagnostic and treatment approaches may improve disease control, reduce recurrence rates, and enhance quality of life in pediatric patients.

Conclusion

The present study demonstrated the significant role of molecular allergy diagnostics in the development of personalized treatment strategies for children with atopic dermatitis. Identification of individual allergen sensitization profiles using component-resolved diagnostics allows more accurate assessment of disease mechanisms and improves clinical management.

The results of this study confirm that children with atopic dermatitis exhibit heterogeneous allergen sensitization patterns, which are associated with disease severity, frequency of exacerbations, and presence of comorbid allergic conditions. The use of molecular allergy diagnostics enables differentiation between true sensitization and cross-reactivity, thereby improving diagnostic accuracy and optimizing therapeutic interventions.

Implementation of a personalized treatment algorithm based on molecular allergy diagnostics contributed to improved clinical outcomes, including reduction in disease severity, decreased frequency of exacerbations, improved skin condition, and enhanced quality of life. Additionally, individualized elimination diets and targeted therapy reduced unnecessary treatment interventions and improved overall treatment effectiveness.

The findings of this study support the integration of molecular allergy diagnostics into routine clinical practice for children with atopic dermatitis. Personalized medicine approaches based on individual sensitization profiles represent a перспектив direction in pediatric allergology and dermatology, enabling more effective disease management and prevention of complications.

Further large-scale studies are recommended to validate the proposed personalized treatment algorithm and assess long-term clinical outcomes in diverse pediatric populations.

References

1. Asadova D.Sh., Karimov B.Sh. Personalized approach to the therapy of atopic dermatitis in children in the Republic of Uzbekistan // Healthcare of Uzbekistan. – 2023. – No. 2. – P. 51–58.

2. Karimov B.Sh., Khamraev N.U. Clinical and immunological efficacy of biological drugs in patients with severe atopic dermatitis // Bulletin of TSMU. – 2024. – No. 3. – P. 48–55.

3. Razikova G.R. Efficacy of a personalized treatment algorithm for patients with atopic dermatitis // Medical Journal of Uzbekistan. – 2025, No. 6, pp. 95–100.

4. Razikova I.S., Razikova G.R. Improving the allergology service of Uzbekistan // Allergic and Immunopathological Diseases – a Problem of the 21st Century. – 2019. – P. 23–24.

5. Razikova I.S. et al. Prevalence of polymorphisms RS1800925, RS20541 of the IL13 gene in atopic syndrome in the Republic of Uzbekistan // E-Conference Platform. – 2025. – Vol. 1. – No. 17-November 2025. – P. 213–213.

6. Razikova I.S., Aidarova N.P., Ishmuhamedova Sh.B. Dermatorespiratory syndrome and atopic march: diagnosis, clinical features // Central Asian Journal of Medical and Natural Science. – 2023. – Vol. 4. – No. 6. – P. 37–41.

7. Razikova I.S. et al. Assessment of the dynamics of various treatment methods for respiratory allergoses // Primary Immunodeficiencies and COVID-19. – 2023. – P. 84–91.

8. Akdis C.A., Agache I. Global Atlas of Allergy. — Zurich: EAACI, 2022. — 388 p.

9. Akdis C.A., Arkwright P.D., Bruggen M.C. Type 2 immunity in atopic dermatitis // Journal of Allergy and Clinical Immunology. — 2020. — Vol. 145(1). — P. 1–20.

10. Bieber T. Atopic dermatitis: an expanding therapeutic pipeline for a complex disease // Nature Reviews Drug Discovery. — 2022. — Vol. 21. — P. 21–40.

11. Bieber T., D'Erme A.M., Akdis C.A. Clinical phenotypes of atopic dermatitis // Allergy. — 2022. — Vol. 77(2). — P. 339–351.

12. Canonica G.W., Ansotegui I.J., Pawankar R. et al. AWAO digital guidelines for allergy management // World Allergy Organization Journal. — 2020. — Vol. 13(2). — P. 100091.

13. European Academy of Allergy and Clinical Immunology. EAACI Guidelines on Atopic Dermatitis. — 2023. — 215 p.

14. Hamilton R.G., Oppenheimer J. Serological IgE analyses in the diagnostic algorithm for allergic disease // Journal of Allergy and Clinical Immunology Practice. — 2018. — Vol. 6(5). — P. 1467–1476.

15. Langan S.M., Irvine A.D., Weidinger S. Atopic dermatitis // Lancet. — 2020. — Vol. 396. — P. 345–360.

16. Leung D.Y.M., Guttman-Yassky E. Deciphering the complexities of atopic dermatitis // Journal of Allergy and Clinical Immunology. — 2023. — Vol. 151(2). — P. 299–308.

17. Matricardi P.M., Kleine-Tebbe J., Hoffmann H.J. et al. EAACI Molecular Allergology User's Guide // Pediatric Allergy and Immunology. — 2016. — Vol. 27(Suppl. 23). — P. 1–250.

18. Novak N., Simon D. Atopic dermatitis – from new pathophysiologic insights to individualized therapy // Allergy. — 2021. — Vol. 76(6). — P. 1615–1628.

19. Paller A.S., Kabashima K., Bieber T. Therapeutic pipeline for atopic dermatitis // Journal of Allergy and Clinical Immunology. — 2021. — Vol. 148(1). — P. 72–83.

20. Paller A.S., Spergel J.M., Mina-Osorio P. Emerging therapies in atopic dermatitis // Journal of Allergy and Clinical Immunology. — 2020. — Vol. 145(2). — P. 421–432.

21. Silverberg J.I. Public health burden and epidemiology of atopic dermatitis // Dermatologic Clinics. — 2022. — Vol. 40(3). — P. 247–258.

22. Silverberg J.I., Thyssen J.P., Paller A.S. What's new in atopic dermatitis? // Journal of Allergy and Clinical Immunology Practice. — 2023. — Vol. 11(3). — P. 589–598.

23. Valenta R., Duchene M., Vrtala S. Component-resolved diagnosis in allergy // Allergy. — 2020. — Vol. 75(12). — P. 3026–3038.

24. Valenta R., Karaulov A., Niederberger V. et al. Molecular aspects of allergens and allergy // Advances in Immunology. — 2018. — Vol. 138. — P. 195–256.

25. Weidinger S., Beck L.A., Bieber T. Atopic dermatitis // Nature Reviews Disease Primers. — 2018. — Vol. 4. — P. 1–20.

26. Weidinger S., Novak N. Atopic dermatitis // Lancet. — 2016. — Vol. 387(10023). — P. 1109–1122.

27. Wollenberg A., Barbarot S., Bieber T. et al. Consensus-based European guidelines for treatment of atopic eczema // Journal of the European Academy of Dermatology and Venereology. — 2018. — Vol. 32(5). — P. 657–682.