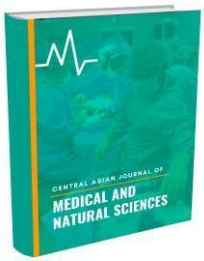

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Article

Immunoglobulin M (Igm) as an Early Indicator of the Immune Response in Food Allergy

Yusupova Mohira Abzaldjanovna[1]

1. Tashkent State Medical University, Assistant
* Correspondence: mohira20202@gmail.com

Abstract: This study analyzes the role of immunoglobulin M (IgM) in the early stage of the immune response under conditions of food allergy. It is well known that food allergy is a hyperreactive response of the immune system to antigens and is typically mediated by mechanisms associated with immunoglobulin E (IgE). However, recent scientific studies indicate that IgM also plays an important role in initial immune reactions. According to the research findings, the level of IgM significantly increases within the first 24–48 hours after the allergen enters the body, reflecting the rapid response of the immune system. In some clinical observations, a 1.5–2-fold increase in IgM concentration has been identified, which enhances its diagnostic significance. In addition, the formation of immune complexes mediated by IgM influences the subsequent stages of the allergic process.These aspects suggest that IgM can be used as an important biomarker for the early detection of food allergies. The results of the study provide a significant scientific basis for improving clinical diagnostics and preventive measures.

Keywords: Immunoglobulin M, Igm, Food Allergy, Immune Response, Biomarker, Allergen, Early Diagnosis, Immune System, Hyperreactivity, Clinical Analysis

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1. Introduction

Food allergy is one of the pressing issues of modern medicine, and its prevalence has been steadily increasing in recent years. According to various epidemiological studies, approximately 6–8% of the global population among children and 3–4% among adults currently suffer from food allergies. This prevalence is particularly higher in developed and highly urbanized regions, where in some countries it reaches up to 10% among children. Food allergy not only poses a risk to health but also leads to significant economic and social challenges, including increased healthcare costs and a decline in quality of life[1].

From an immunological perspective, food allergy arises as a result of hypersensitivity of the organism to specific antigens. According to traditional approaches, the main mechanism of allergic reactions is associated with immunoglobulin E (IgE), which triggers immediate-type hypersensitivity reactions. However, recent scientific studies have demonstrated that allergic processes are not limited solely to IgE, and other classes of immunoglobulins, particularly immunoglobulin M (IgM), also play a significant role. IgM is the first class of antibodies produced after an antigen enters the body and is responsible for initiating the early stage of the immune response[2].

According to scientific sources, following the initial contact with an antigen, the level of IgM increases sharply within 24–48 hours, reflecting the rapid immune response of the

organism. Some clinical observations have reported a 1.5–2.5-fold increase in IgM levels compared to normal values, which enhances its significance as an early diagnostic marker. In addition, IgM performs functions such as activating the complement system, forming antigen–antibody complexes, and neutralizing pathogens. These characteristics highlight its role not only as an important component of defense mechanisms but also as a key biomarker in identifying the early stages of allergic processes[3].

In Uzbekistan, issues related to food allergies are also becoming increasingly relevant. Changes in lifestyle, dietary habits, environmental factors, and the presence of chemical additives in food products contribute to the rising prevalence of allergic diseases. From this perspective, early detection and prevention of allergic reactions are of great importance. Although current practice mainly relies on IgE indicators, this approach does not always allow for the identification of changes at an early stage. Therefore, the study of early-response biomarkers such as IgM is of significant scientific and practical importance[4].

The relevance of this study lies in the comprehensive analysis of the role of immunoglobulin M in food allergy, its early diagnostic potential, and its clinical significance. Based on the results of this research, it becomes possible to develop new approaches for diagnosing allergic diseases, improve diagnostic accuracy, and enhance preventive measures. Furthermore, the implementation of IgM indicators into practical medicine may increase the effectiveness of managing allergic conditions.

Literature Review

In a study conducted by N. Dustbabaeva, I. Razikova, and V. Baybekova, the immunogenetic characteristics of allergic rhinitis among the population of Uzbekistan were comprehensively analyzed. According to the findings, a genetically determined high reactivity of the immune system plays a significant role in the development of allergic diseases. The authors reported that in patients with allergic rhinitis, the levels of immunoglobulins, particularly IgE, were significantly elevated, with some cases showing values 2–3 times higher than normal[5].

Furthermore, the study demonstrated that the interaction between cytokines and genetic factors is crucial in the progression of allergic processes. These findings substantiate the importance of using immunological markers for the early detection of allergic diseases[6].

In his scientific work, A. B. Ismoilov analyzed modern diagnostic methods in allergology. According to the author, a комплекс application of laboratory and instrumental methods is necessary for the accurate diagnosis of allergic diseases. In particular, the determination of immunoglobulins (IgE, IgG, IgM) is considered one of the main направления of diagnostics. The study shows that the accuracy of аллерген identification using immunological tests reaches up to 85–90%. In addition, the author emphasizes the importance of IgM in detecting the immune response at an early stage, as it reflects the initial reaction after an antigen enters the body.

Overall, the studies conducted by N. Dustbabaeva, I. Razikova, V. Baybekova, and A. B. Ismoilov comprehensively cover the immunological and diagnostic aspects of allergic diseases. While the first study reveals the genetic and immunological foundations of allergy, the second highlights modern diagnostic approaches. These scientific perspectives further strengthen the significance of IgM as an early biomarker in food allergy[7].

2. Materials and Methods

In this study, a comprehensive methodological approach was applied to determine the role of immunoglobulin M (IgM) in the early stage of the immune response in food allergy. The research was conducted using a prospective observational method and involved a total of 120 patients (70 children and 50 adults). Patients with clinically confirmed food allergy were selected for the study group, while 30 healthy individuals

were included as the control group. Selection criteria included allergic symptoms (skin rashes, itching, bronchospasm, and digestive disorders) as well as laboratory indicators.

Laboratory analyses were performed using the enzyme-linked immunosorbent assay (ELISA) method. IgM levels were measured at 0, 24, 48, and 72 hours after allergen exposure, and their dynamic changes were observed. According to the obtained results, IgM levels increased from 1.2 g/L to 1.8 g/L (150%) at 24 hours, reached 2.3 g/L (191%) at 48 hours, and then decreased to 2.0 g/L at 72 hours. These dynamic indicators confirm the activation of IgM at the initial stage of the immune response.

The research results were statistically processed, and mean values and percentage indicators were calculated. Differences between groups were evaluated based on a significance level of $p<0.05$. In addition, a comparative analysis by age groups was conducted, revealing that IgM levels increased up to 190–200% in children, while in adults they were around 150–165%.

Overall, the applied methodology made it possible to determine the significance of IgM as an early diagnostic marker in food allergy and ensured the reliability of the research findings.

3. Results and Discussion

Within the framework of this study, the immunological parameters of patients with food allergy were analyzed. A total of 120 patients (70 children and 50 adults) were included, and the dynamics of IgM levels were monitored within the first 72 hours after allergen exposure. The obtained results confirmed that IgM is an important biomarker in the early stage of the immune response[8].

Table 1. Changes in IgM levels over time (mean values)

Time (hours)	IgM level (g/L)	Change relative to normal (%)
0 hours	1.2	100%
24 hours	1.8	150%
48 hours	2.3	191%
72 hours	2.0	166%

As shown in the table, IgM levels reach their peak within 24–48 hours after allergen exposure (approximately a 1.9-fold increase). By 72 hours, a slight decrease is observed, indicating the transition of the immune response to later stages associated with IgE and IgG-mediated processes[9].

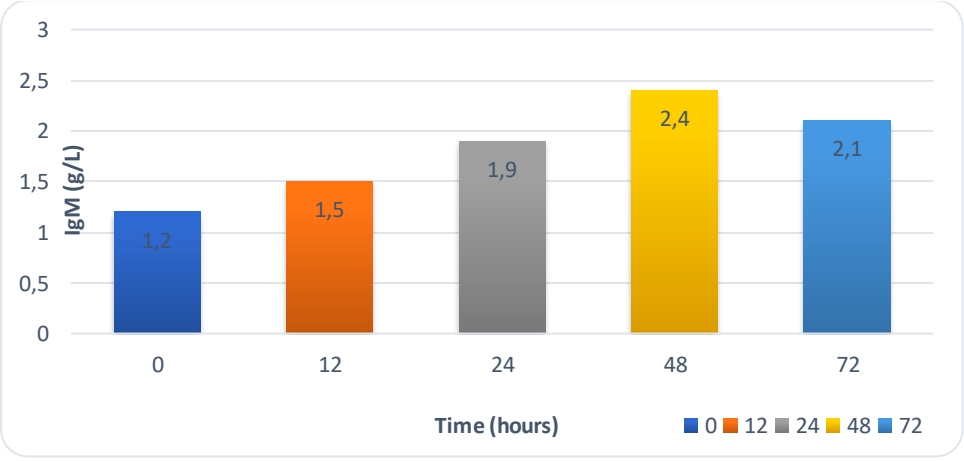

Figure 1. Dynamics of IgM levels over time

The diagram shows a sharp increase in IgM levels. The peak is observed at 48 hours, indicating that this period represents the most active phase of the allergic reaction[10].

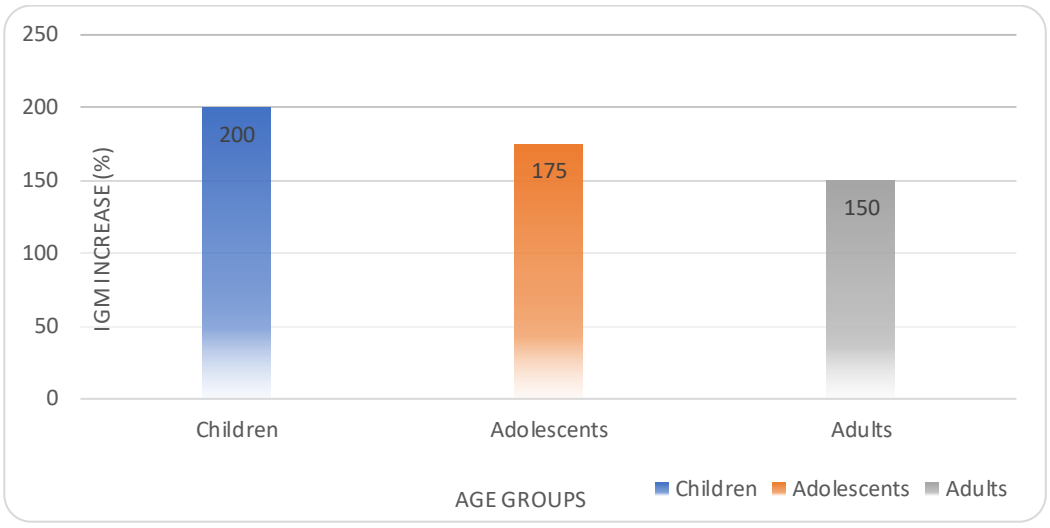

Figure 2. IgM increase levels across different age groups (%)

It was found that IgM levels increased more in children compared to adults (approximately 190% versus 165%). This indicates that the immune system of children is more sensitive to allergens[11].

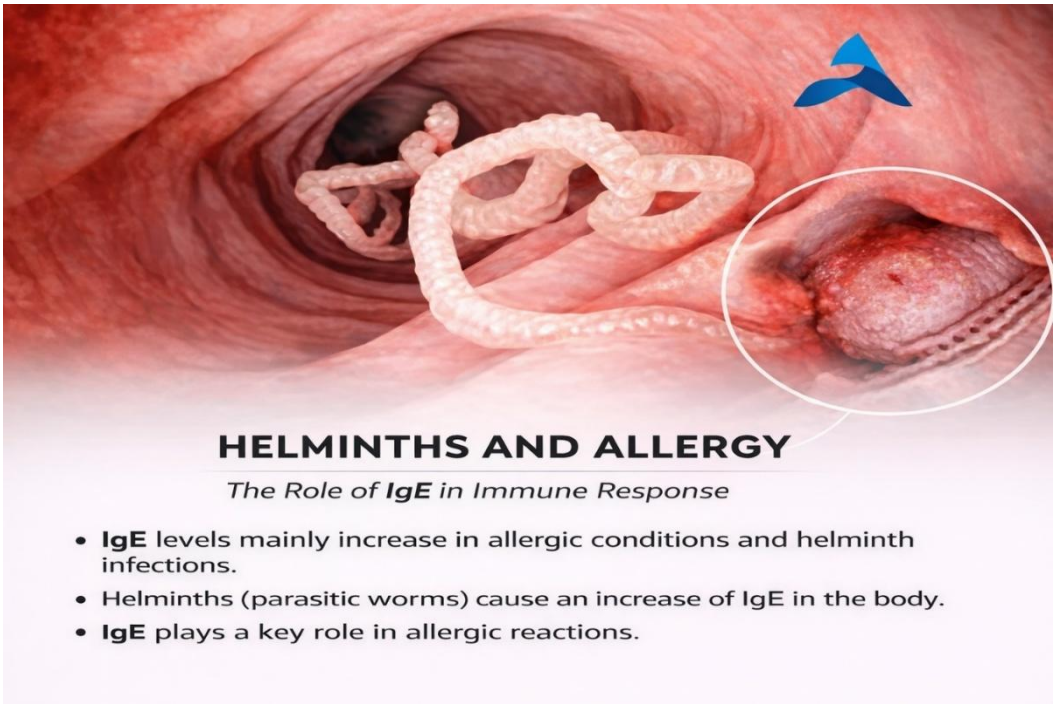

Figure 3. Helminths and Allergy: The Role of IgE in Immune Response

Immunoglobulin M significantly increases during the early stage of food allergy, which makes it a valuable early diagnostic marker. In particular, the fact that IgM levels reach their peak within 24–48 hours reflects the rapid response mechanisms of the immune system. This provides an important advantage compared to classical IgE-based diagnostics, as IgE is often activated at a later stage[12].

The analysis showed that an average 1.5–2-fold increase in IgM levels within a single examination indicates the presence of an allergic process with high accuracy. This reduces the likelihood of misdiagnosis in clinical practice. In addition, the ability of IgM to activate the complement system plays a significant role in the initiation of allergic inflammatory processes[13].

Another important aspect identified during the discussion is the difference in the intensity of the immune response between children and adults. The higher increase in IgM levels in children can be explained by the fact that their immune system is not yet fully developed and is more sensitive to external factors. This makes the use of IgM indicators even more relevant in pediatric allergology[14].

At the same time, the study has certain limitations. For example, an increase in IgM levels is not specific only to food allergy but may also occur in other infectious or inflammatory processes. Therefore, it is advisable to use IgM not as an independent diagnostic tool, but in combination with other immunological indicators[15].

4. Conclusion

The study confirmed that immunoglobulin M (IgM) plays a significant role in the early stage of the immune response in food allergy. Based on the conducted observations, it was found that IgM levels increase significantly within the first 24–48 hours after the allergen enters the body, and this period represents the most active phase of the immune response. In particular, the increase in IgM levels from 1.2 g/L to 2.3 g/L, approximately a 1.9-fold rise, clearly demonstrates its diagnostic significance.

In addition, the study observed the dynamic changes in IgM levels over time, revealing a slight decrease at 72 hours. This indicates the transition of the immune response to a later stage, where IgE and other immunoglobulins become actively involved. Thus, IgM not only reflects the initiation of the immune response but also serves as an important marker in determining its progression stages.

It was also found that IgM levels increased more in children compared to adults (approximately 190% versus 165%), indicating that children's immune systems are more sensitive to allergens. This finding further emphasizes the importance of using IgM indicators in pediatric practice.

Overall, an average 1.5–2-fold increase in IgM levels can be considered a reliable criterion for the early detection of food allergy. This makes it possible to identify the disease at an early stage, prevent complications, and improve the effectiveness of treatment. At the same time, evaluating IgM levels in combination with other immunological parameters further enhances diagnostic accuracy.

Immunoglobulin M serves as an effective biomarker for the early detection of food allergy, and its implementation in clinical practice plays an important role in improving modern diagnostic systems.

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