ALLERGIES DURING PREGNANCY: RISKS, MANAGEMENT, AND PREVENTION

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DOI: https://doi.org/10.71419/mtggrc.2025.29

ABSTRACT

Pregnancy introduces a complex interplay of physiological and immunological adaptations that significantly influence the course of allergic diseases. This review article synthesizes current understanding of allergies during gestation, focusing on its prevalence, the unique risks posed to both mother and fetus, and evidence-based strategies for diagnosis, management, and prevention. The maternal immune system undergoes a crucial shift towards a Th2-dominant state, essential for fetal tolerance but potentially exacerbating allergic manifestations. Hormonal fluctuations further modulate immune responses, contributing to variable disease courses. Uncontrolled allergic conditions, particularly asthma, are associated with substantial maternal complications such as preeclampsia and increased rates of cesarean delivery, and adverse fetal outcomes including hypoxia, preterm birth, and low birth weight. Diagnosis in pregnancy prioritizes fetal safety, favoring in vitro methods over skin or provocation tests. Management emphasizes a multidisciplinary approach, combining non-pharmacological interventions with carefully selected pharmacotherapies, where the risks of uncontrolled disease generally outweigh those of appropriate medication.

Keywords: pregnancy; asthma; allergic rhinitis; food allergy; atopic dermatitis; maternal-fetal health; immunological changes; fetal immune programming; anaphylaxis

Introduction

Allergies represent a significant global health concern, with a rising prevalence affecting over a billion individuals worldwide, particularly young adults. Sensitization rates to common environmental allergens among schoolchildren are approaching 40-50% globally. In the United States, allergic rhinitis impacts between 10% and 30% of the population, food allergies affect 5-8%, and eczema is reported in approximately 10.8% of children.[1,2,3]

The physiological and immunological changes inherent to pregnancy introduce a unique dynamic for individuals with pre-existing allergies, and can even lead to new-onset symptoms. The trajectory of allergic conditions during pregnancy is highly variable;[4] approximately one-

third of pregnant individuals experience a worsening of their allergy symptoms, another third find their symptoms remain unchanged, and the remaining third report an improvement. Food allergies are notably common in pregnant women, affecting approximately 20% of pregnant women. Asthma, complicating 3-8.4% of pregnancies, stands as one of the most prevalent chronic medical conditions during gestation. Similarly, allergic rhinitis impacts a substantial proportion of pregnant individuals, with reported incidences around 25% in some studies and a prevalence ranging from 18-30% for all types of rhinitis during pregnancy. Atopic dermatitis is recognized as the most common dermatosis observed during pregnancy.[5,6,7,8]

Effective management of allergic conditions during pregnancy is paramount for ensuring the well-being of both the pregnant individual and the developing fetus. Uncontrolled allergic diseases, particularly asthma, pose significant risks, including decreased oxygen supply to the fetus, impaired fetal growth, preterm birth, low birth weight, preeclampsia, and increased rates of cesarean delivery.[9] A critical principle guiding clinical practice is that the potential risks associated with uncontrolled allergic disease generally outweigh the risks posed by appropriate pharmacological interventions. This underscores the necessity for continuous and nuanced management to achieve optimal maternal health and mitigate adverse perinatal outcomes.[10,11]

Pregnancy necessitates profound adaptations within the maternal immune system. These adaptations are crucial for protecting the pregnant individual and the developing fetus from pathogens while simultaneously maintaining immunological tolerance towards the semi-allogeneic fetus. This intricate balance involves a significant shift in the immune system's phenotype, notably towards a T helper 2 (Th2)-dominant response, which, while vital for fetal tolerance, can also contribute to the exacerbation of allergic reactions. Furthermore, the dramatic fluctuations in pregnancy hormones, particularly estrogen and progesterone, exert a profound influence on immune cell function and can directly modulate the manifestation of allergic diseases. Understanding these physiological and immunological shifts is fundamental to comprehending the unique challenges and considerations in managing allergies during pregnancy.[12,13,14,15]

Physiological and Immunological Adaptations in Pregnancy and Allergic Responses

The physiological and immunological landscape of pregnancy is meticulously orchestrated to support fetal development while safeguarding maternal health. These adaptations, however, can profoundly influence the manifestation and severity of allergic diseases.[13]

Maternal Immune System Shift (Th1/Th2 Balance, Treg cells)

Normal pregnancy is characterized by a dynamic shift in the maternal immune system. Initially, a transient pro-inflammatory T helper 1 (Th1)-dominant state is observed during the peri-implantation period, which is beneficial for trophoblast invasion. However, this quickly transitions to a predominant T helper 2 (Th2)-dominant anti-inflammatory immune response following placental implantation. This Th2 dominance is crucial for maintaining tolerance towards the semi-allogeneic fetus, preventing its immunological rejection by the maternal immune system. Key cytokines such as interleukin (IL)-4, IL-10, and IL-13 mediate this shift, actively promoting maternal-fetal tolerance and repressing the potentially detrimental Th1 and Th17 immunities. Concurrently, regulatory T cells (Tregs) undergo significant expansion,

particularly at the feto-maternal interface, playing a major role in inducing and maintaining this state of tolerance.[14,15,16,17,18]

Hormonal Influences (Estrogen, Progesterone) on Immune Cells, IgE Production, and Mast Cell Activity

Pregnancy hormones, most notably estrogen and progesterone, exert a profound and multi-faceted influence on the maternal immune system and the course of allergic diseases.

Estrogen, for instance, enhances allergic sensitization. It promotes the differentiation of T helper cells towards a Th2 phenotype, increases the production of immunoglobulin E (IgE), and induces the degranulation of mast cells and basophils, which are key effector cells in immediate hypersensitivity reactions. Estrogen can also augment the function of antigen-presenting cells, further directing the immune response towards a Th2-dominant profile.[17,18]

Progesterone plays a critical role in maintaining pregnancy by facilitating endometrial changes necessary for implantation and by modulating maternal immune responses to prevent fetal rejection. It possesses anti-inflammatory properties and can regulate T-lymphocyte-mediated immune responses, promoting a Th2-type immunity and suppressing the production of pro-inflammatory Th1 and Th17 cytokines. Progesterone can also inhibit the maturation and T cell-activating capacity of dendritic cells, thereby fostering a state of immune tolerance.[19,20]

However, the role of progesterone in allergic responses is complex and, at times, appears contradictory. While some studies suggest progesterone inhibits mast cell secretion, others have noted its potential to stimulate IgE-mast cell degranulation. This highlights that progesterone's influence is not uniformly suppressive but rather highly nuanced, likely depending on specific cellular contexts, concentrations, and interactions with other factors. This complexity is further underscored by conditions like Progestogen Hypersensitivity (PH), also known as Autoimmune Progesterone Dermatitis (APD). This rare condition, characterized by symptoms such as dermatitis, urticaria, asthma, and even anaphylaxis, can be triggered by endogenous progesterone or exogenous progestins. It is hypothesized that in susceptible individuals, IgE antibodies may form against progestins, leading to allergic reactions. The occurrence of such hypersensitivity reactions, despite progesterone's overall immune-tolerant role, demonstrates the intricate and sometimes unpredictable nature of hormonal immunomodulation during pregnancy. This makes predicting an individual's allergic response during pregnancy challenging.[18,20,21]

Other Physiological Changes Impacting Allergic Manifestations

Beyond direct immune cell modulation, other systemic physiological changes during pregnancy can significantly influence the presentation and severity of allergic symptoms.

The nasal mucosa, for instance, undergoes notable changes. Pregnant individuals are frequently prone to nasal blockage, irritating nasal symptoms, and increased nasal discharge, a condition often referred to as "pregnancy rhinitis". Hormonal fluctuations primarily trigger this non-allergic congestion and can mimic the symptoms of a common cold or allergic rhinitis. Typically, pregnancy rhinitis commences in the second trimester and resolves spontaneously within two weeks postpartum. This physiological phenomenon means that nasal symptoms experienced during pregnancy are not always indicative of an allergic exacerbation. Distinguishing between true allergic rhinitis and pregnancy rhinitis is crucial for appropriate diagnosis and management, as treatment approaches may differ.[21,22]

Changes in the respiratory system, such as an increased tidal volume and altered drug metab-

olism due to increased blood volume, can further complicate the management of conditions like asthma. The vascular system also undergoes significant adaptations; pregnancy is a hypercoagulable state, increasing the risk for deep vein thrombosis. Interactions between acute-phase proteins, the coagulation cascade, and the complement system can influence broader inflammatory responses. Furthermore, there is a gradual and marked increase in neutrophil count from the first trimester onwards, with an elevated basal oxidative burst and increased Neutrophil Extracellular Trap (NET) formation.[23] However, the function of these neutrophils may be decreased after activation, presenting a complex picture of innate immune activity. These systemic changes are not merely incidental; they actively modify how allergic symptoms manifest and are managed. This underscores the need for careful clinical assessment that extends beyond simple allergy testing to distinguish true allergic exacerbations from physiological changes of pregnancy, as treatment strategies may differ.[21]

Risks and Maternal-Fetal Outcomes of Allergies During Pregnancy

Allergic conditions during pregnancy carry distinct risks that can impact both the pregnant individual and the developing fetus. The severity and nature of these risks vary depending on the specific allergic disease and its level of control.

General Allergic Reactions (Anaphylaxis)

Anaphylaxis, a severe, potentially life-threatening systemic allergic reaction, is rare during pregnancy, with an estimated frequency between 1.5 to 3.8 per 100,000 pregnancies. Despite its rarity, it poses significant risks to both the pregnant individual and the fetus. Anaphylaxis-related maternal mortality is estimated at 0.05 per 100,000 live births. The primary triggers identified in pregnant individuals include beta-lactam antibiotics (58% of cases), latex (25%), and anesthetic agents (17%), with a notable proportion (49-74%) of cases occurring during cesarean sections. Management of anaphylaxis in pregnancy generally mirrors that in non-pregnant patients, with epinephrine being the recommended first-line treatment due to its critical role in reversing severe symptoms and its established safety profile in this context. Risk factors for anaphylaxis during pregnancy include a history of multiple cesarean sections or other procedures, a personal history of anaphylaxis, or previous allergic reactions to medication without a proper allergy work-up.[24,25,26]

Asthma

Asthma is one of the most common medical concerns complicating pregnancy, affecting 4-8% of gestations. The course of asthma during pregnancy is highly variable; approximately one-third of individuals experience a worsening of symptoms, often in the late second and early third trimesters, while another third see improvement, and the remaining third report no change. Severe asthma is more prone to exacerbation during pregnancy.[27]

Maternal Risks: Poorly controlled asthma in pregnancy is associated with several adverse maternal outcomes. There is an increased risk of preeclampsia, with some studies reporting up to a 54% increased risk. Other complications include a 34% increased odds of hemorrhage during pregnancy and a 52% increased odds of premature contractions. The rate of cesarean delivery is also significantly increased in individuals with asthma (odds ratio 1.32). Severe and inadequately managed asthma can further lead to increased maternal morbidity and, in rare cases, mortality. [27, 28]

Fetal Risks: The impact of uncontrolled maternal asthma on fetal health is substantial. Asthma exacerbations can lead to decreased oxygen levels in the mother's blood, which directly reduces the oxygen supply to the fetus, thereby impairing healthy fetal growth and development. This physiological consequence is a primary driver of adverse fetal outcomes, including a 41% higher risk of preterm birth, a 46% increased risk of low birth weight, and a 22% increased risk of infants being small for gestational age. Infants born to mothers with uncontrolled asthma also face increased perinatal morbidity, including a higher incidence of respiratory distress syndrome (RDS) and an elevated need for neonatal intensive care unit (NICU) admission. Furthermore, there is a small but statistically significant increased risk of overall congenital malformations (relative risk 1.11), with a specific heightened risk of cleft lip with or without cleft palate (relative risk 1.30). An increased risk of perinatal mortality (relative risk 1.25) has also been reported in infants of asthmatic mothers.[29, 30]

Allergic Rhinitis (including Pregnancy Rhinitis)

Allergic rhinitis is common among pregnant individuals, with 10-30% of adults affected globally and 10-30% of women experiencing symptom worsening during pregnancy. Pregnancy rhinitis, a non-allergic nasal congestion, affects 9-39% of pregnant individuals, typically appearing in the second or third trimester and resolving postpartum.[31,32]

Maternal Risks: Severe symptoms of allergic rhinitis can significantly impair maternal eating, sleeping, and emotional well-being. Uncontrolled rhinitis may predispose individuals to sinusitis or worsen co-existing asthma. Persistent nasal obstruction, whether allergic or pregnancy-induced, can lead to reduced sleep quality, snoring, and obstructive sleep apnea (OSA).

Fetal Risks: While direct fetal risks specifically from allergic rhinitis are less definitively established compared to asthma, severe nasal congestion, particularly if leading to chronic maternal hypoxia or fragmented rest, *may* be associated with adverse perinatal outcomes. These include gestational hypertension, intrauterine growth retardation, preeclampsia, and lower Apgar scores in neonates. However, some studies have unexpectedly suggested that allergic rhinitis may offer a protective effect against unfavorable pregnancy outcomes, highlighting the need for further research in this area.[33,34,35]

Food Allergies

Food allergies are more prevalent in pregnant individuals, affecting approximately one in five. These allergies can manifest at any point during pregnancy, with symptoms typically appearing immediately or within a few hours of allergen ingestion. Common food allergens include seafood, milk, eggs, peanuts, tree nuts, wheat, and soy.[36]

Maternal Risks: Food allergies can profoundly impact maternal health, leading to a range of symptoms such as rash, hives, vomiting, stomach cramps, diarrhea, and angioedema. Severe allergic reactions, including anaphylaxis, carry the risk of serious obstetric complications such as miscarriage or premature birth.

Fetal Risks: Maternal allergies during pregnancy are believed to increase the risk of the child developing allergies post-birth. The underlying allergic mechanisms may potentially hinder fetal growth and development or directly affect the developing fetal lungs and bronchi, raising concerns about potential birth defects. However, the precise reasons and evidence for the causes of new-onset food allergies during pregnancy and their direct impact on fetal development require further exploration.[37,38]

Atopic Dermatitis (Eczema)

Atopic dermatitis (AD), or eczema, is the most common dermatosis encountered during pregnancy. Its course is often fluctuating; approximately 25% of pregnant individuals experience an improvement in symptoms, while over 50% report a deterioration, with a slightly higher rate of worsening observed in the second trimester. About 10% of cases may flare in the postpartum period. New onset of AD symptoms during pregnancy is also common, occurring in 60-80% of cases. [39, 40]

Table 1. Summary of Maternal and Fetal Risks Associated with Allergic Conditions in Pregnancy

Allergic Condition	Maternal Risks	Fetal/Offspring Risks	Key Quantitative Data
Anaphylaxis	Rare, but life-threatening; risk to mother and fetus; can cause miscarriage/ premature birth.	Fetal distress, hypoxia, and potential mortality	Frequency: 1.5-3.8 per 100,000 pregnancies; Maternal mortality: 0.05 per 100,000 live births
Asthma	Preeclampsia, hemorrhage, premature contractions, increased C-section rates, maternal morbidity/ mortality	Hypoxia, impaired fetal growth, preterm birth, low birth weight, small for gestational age (SGA), respiratory distress syndrome (RDS), NICU admission, congenital malformations (cleft lip/palate), perinatal mortality	Preeclampsia: up to 54% increased risk; Hemorrhage: 34% increased odds; Preterm contractions: 52% increased odds; C-section: OR 1.32; Preterm birth: 41% higher risk; Low birth weight: 46% increased risk; SGA: 22% increased risk; Congenital malformations: RR 1.11; Cleft lip/palate: RR 1.30; Perinatal mortality: RR 1.25
Allergic Rhinitis (including Pregnancy Rhinitis)	Impaired eating/ sleeping, emotional distress, sinusitis, worsening asthma, obstructive sleep apnea (OSA)	Potential association with gestational hypertension, intrauterine growth retardation, preeclampsia, and lower Apgar scores (due to chronic maternal hypoxia from nasal congestion). Some studies suggest a protective effect against unfavorable pregnancy outcomes.	Prevalence: 18-30% (all rhinitis), 9-39% (pregnancy rhinitis)

Allergic Condition	Maternal Risks	Fetal/Offspring Risks	Key Quantitative Data
Food Allergies	Rash, hives, vomiting, diarrhea, angioedema, anaphylaxis, miscarriage, premature birth	Increased offspring allergy risk, hindered fetal growth/ development, potential damage to fetal lungs/ bronchi, and potential birth defects.	Affects ~1 in 5 pregnant women
Atopic Dermatitis (Eczema)	Impact on quality of life, bacterial/ herpetic infections, anxiety, mood changes, depression	No direct harm, but increased offspring eczema risk if parental history; altered in utero growth patterns, premature rupture of membranes, staphylococcal neonatal septicemia, link to maternal stress	Most common dermatosis of pregnancy ; >50% experience deterioration

Diagnosis of Allergies in Pregnancy

Accurate diagnosis of allergic conditions during pregnancy is crucial for effective management and to differentiate allergic symptoms from physiological changes unique to gestation.

Preferred Diagnostic Methods (in vitro tests for IgE) and Limitations of Others (skin/provocation tests)

When diagnosing allergies in pregnant individuals, *in vitro* diagnostic methods are generally preferred due to safety considerations associated with direct allergen exposure. Serological tests for allergen-specific IgE, such as Immuno-CAP or RAST or lymphocyte transformation tests for type IV allergy diagnosis, are recommended. These methods allow for the detection of allergen sensitization without exposing the pregnant individual or fetus to the allergen itself.[41, 42, 43] Conversely, skin prick tests and provocation tests are typically deferred until after birth. This cautious approach stems from the small, though finite, risk of inducing a systemic allergic reaction, including anaphylaxis, during these procedures. Any systemic reaction, particularly anaphylaxis, poses a direct risk to the fetus due to potential maternal hypoxia and subsequent reduced oxygen supply to the fetus. Therefore, the preference for *in vitro* tests, which avoid direct allergen exposure to the mother, reflects a fundamental principle in pregnancy care: minimizing any iatrogenic risk to the fetus, even if low, by opting for safer diagnostic alternatives when available. Similarly, patch testing is generally advised against as a general precaution, even though no documented adverse effects exist, because test findings can interfere with the immunological changes induced by pregnancy.[44, 45, 46]

Management of Allergies During Pregnancy

Effective management of allergies during pregnancy is crucial for mitigating risks to both the pregnant individual and the fetus. This requires a balanced approach, prioritizing symptom control while minimizing the potential adverse effects of interventions. [47, 48]

General Principles

Management of allergic conditions in pregnancy necessitates a nuanced, individualized, and often multidisciplinary approach involving collaboration among allergists, obstetricians, and dermatologists. A guiding principle for pharmacological interventions is to use the "lowest effective dose for the shortest duration necessary" to control symptoms. Regular monitoring of clinical symptoms is essential, with monthly evaluations specifically recommended for asthma to track disease course and adjust treatment as needed.[49, 50]

Pharmacological Interventions

Pharmacological interventions are often necessary to achieve adequate symptom control and prevent complications, with careful consideration given to fetal safety.

Antihistamines: Second-generation non-sedating antihistamines such as loratadine and cetirizine are generally preferred during pregnancy due to their excellent safety records and no significant increase in congenital malformations, even when used in the first trimester. While they can be used throughout pregnancy, it is generally recommended to start them after the first trimester if possible. First-generation antihistamines like chlorpheniramine and diphenhydramine have a long history of use with reassuring animal studies. Still, their sedative properties are a significant drawback, impacting maternal performance and well-being. Chlorpheniramine is often considered the preferred sedating option when needed. Antihistamines with limited human pregnancy data, such as acrivastine and fexofenadine, should be used with caution, with fexofenadine reserved for cases where no other suitable treatment is available.[51,52,53,54]

Corticosteroids:

- **Inhaled Corticosteroids (ICS):** These are the first-line controller therapy for persistent asthma. Budesonide is the preferred ICS during pregnancy due to extensive safety data, but other ICS agents (e.g., fluticasone) can be safely continued if they were effective prior to conception.[54,55]
- **Intranasal Corticosteroids (INCS):** Considered the most effective treatment for allergic rhinitis. Budesonide is the INCS of choice, while fluticasone and mometasone are also considered safe options. Triamcinolone and beclomethasone should be avoided due to potential teratogenic effects or inferiority.[56]
- **Topical Corticosteroids (for Eczema):** Mild to moderate potency topical corticosteroids (e.g., hydrocortisone, triamcinolone, mometasone) are generally safe and preferred, used at the lowest effective dose for the shortest duration necessary to control symptoms.
- **Oral Corticosteroids:** These are not preferred for regular, long-term treatment but can be used for severe asthma attacks or acute eczema flares when the benefits clearly outweigh the risks.[57,58,59]

Immunotherapy (Allergy Shots): If a pregnant individual is already receiving allergen immunotherapy and becomes pregnant, maintenance treatment can generally be continued safely, but the allergen dose should not be increased. However, it is generally not recommended to *initiate* immunotherapy during pregnancy due to the risk of systemic reactions (anaphylaxis) with increasing doses and the delay in achieving effectiveness. In very high-risk situations, such as Hymenoptera (insect venom) hypersensitivity with a history of anaphylaxis, initiation might be considered after careful risk-benefit assessment.[60,61]

Emergency Management

For severe allergic reactions like anaphylaxis, immediate treatment with epinephrine is critical and is considered safe and recommended during pregnancy. Individuals with severe allergies should have a completed Anaphylaxis Action Plan and carry epinephrine auto-injectors at all times for immediate use. [62,63]

Breastfeeding Considerations

Breastfeeding is strongly recommended for its numerous benefits, including enhancing a child's immunity. Medications considered safe for use during pregnancy can generally be continued while nursing, as the amount of medicine transferred to the infant via breast milk is typically less than the exposure *in utero*. For topical eczema treatments, it is advisable to avoid applying medication directly to the nipple area or to clean the area before nursing to minimize infant exposure gently.[64]

Table 2. Recommended Pharmacological Management of Allergic Conditions During Pregnancy

Drug Class	Preferred Agents/ Examples	Safety Profile/ Category	Key Considerations
Antihistamines	Loratadine, Cetirizine (2nd Gen)	Preferred, generally safe; no significant increase in congenital malformations	Non-sedating; generally best taken after 1st trimester if possible
	Chlorpheniramine, Diphenhydramine (1st Gen)	Long history of use, but sedative qualities are a drawback	Sedating: Chlorpheniramine often preferred if sedation is needed
Decongestants	Oral: Pseudoephedrine, Phenylephrine	Generally not recommended; pseudoephedrine linked to a slight increase in abdominal wall defects	Potential for reduced placental blood flow; use in 1st trimester only for severe, unrelieved symptoms
	Nasal Sprays: Oxymetazoline	Appears safest due to minimal systemic absorption	Limit to very intermittent use (≤3 days) to avoid rebound congestion
Corticosteroids	Inhaled (ICS): Budesonide	Preferred ICS; extensive safety data	First-line for persistent asthma; others can be continued if effective
	Intranasal (INCS): Budesonide	INCS of choice; Fluticasone, Mometasone, also safe	Most effective for allergic rhinitis; avoid Triamcinolone, Beclomethasone

Drug Class	Preferred Agents/ Examples	Safety Profile/ Category	Key Considerations
	Topical (for Eczema): Hydrocortisone, Desonide, Triamcinolone, Mometasone	Mild to moderate potency preferred, generally safe	Use the lowest effective dose for the shortest duration; very potent associated with low birth weight
	Oral: Prednisone	Not preferred for regular use; for severe attacks only	Use in short bursts; caution in 3rd trimester; IV during labor if on systemic steroids
Leukotriene Receptor Antagonists (LTRAs)	Montelukast	Generally safe; no major teratogenic risk or association with neuropsychiatric events	Potential slight risk of congenital cardiac abnormalities; benefits often outweigh risks
Immunotherapy	Continuation of pre-existing treatment	Generally safe to continue the maintenance dose	Dose should not be increased; do not initiate during pregnancy (anaphylaxis risk)
Biologics	Asthma: Omalizumab, Mepolizumab, Dupilumab, Tezepelumab	Good efficacy, acceptable safety; international consensus for use	Weigh risks vs. benefits; can be initiated/continued throughout pregnancy and breastfeeding
	Atopic Dermatitis: Dupilumab	Probably safe; no significant increase in miscarriage or congenital malformations	Topical calcineurin inhibitors (TCIs) relatively safe; avoid Methotrexate, Mycophenolate mofetil.

Environmental Modifications

Reducing exposure to indoor allergens (e.g., dust mites, pet dander) and outdoor pollutants (e.g., tobacco smoke, volatile organic compounds from new carpets or renovations) is a crucial preventive measure. Maternal smoking during pregnancy is identified as a potent trigger for the development of allergies and asthma in offspring.

Other Preventive Measures

Pre-conception Counseling: Optimizing maternal health and ensuring reasonable control of pre-existing asthma or allergies before conception is considered an ideal preventive strategy.[65]

Mode of Delivery: Studies have indicated an association between cesarean section, particularly elective cesarean delivery, and a higher risk of allergic rhinitis in offspring. This potential link is hypothesized to be due to altered infant microbial diversity compared to vaginal delivery, which influences immune development.[66,67,68]

Exclusive Breastfeeding: Exclusive breastfeeding for the first 4 to 6 months is recommended, as it can contribute to increasing a child's immunity.[69]

Maternal Psychological Well-being: Maternal stress and depression during pregnancy have been linked to an increased risk of offspring atopic eczema. This suggests that interventions aimed at optimizing maternal mental health and reducing stress could potentially lower the risk of infantile atopic dermatitis. [70,71]

Conclusion

Pregnancy represents a unique physiological and immunological state that profoundly influences the manifestation and management of allergic diseases. The maternal immune system's essential shift towards a Th2-dominant environment, while critical for fetal tolerance, simultaneously creates a milieu that can exacerbate allergic responses. Hormonal fluctuations further modulate these immune dynamics, leading to a variable course of allergic conditions during gestation.

The implications of uncontrolled allergies during pregnancy are significant, posing substantial risks to both the pregnant individual and the developing fetus. Poorly managed conditions, particularly asthma, can lead to severe maternal complications such as preeclampsia and increased rates of cesarean delivery, and adverse fetal outcomes including hypoxia, preterm birth, and impaired growth. The imperative to maintain adequate fetal oxygenation often dictates that the benefits of appropriate pharmacological management outweigh the risks of medication.[72,73]

Current diagnostic approaches prioritize fetal safety, advocating for *in vitro* tests over methods involving direct allergen exposure. Management strategies emphasize a multidisciplinary, individualized approach that integrates non-pharmacological interventions with carefully selected pharmacotherapies.[74,75] A notable evolution in the understanding of offspring allergy prevention has occurred, moving away from the once-common recommendation of maternal dietary allergen avoidance towards encouraging the consumption of common allergens during pregnancy to foster immune tolerance. This shift, alongside the growing evidence for specific nutritional supplements, highlights the dynamic interplay between maternal health and offspring immune development. The concept of fetal immune programming underscores the profound, intergenerational legacy of maternal immune status and environmental exposures on a child's long-term allergy risk.

Acknowledgments

The author(s) do not have any acknowledgments to report for this manuscript.

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