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FEEDING-TYPE–ASSOCIATED DIFFERENCES IN ALLERGIC INFLAMMATION MARKERS IN PRETERM INFANTS: A PROSPECTIVE COHORT STUDY FROM BUKHARA

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Abstract

Preterm infants are at increased risk of allergic diseases due to the immaturity of their immune system and intestinal barrier. Early-life nutrition is a key modifiable factor influencing immune development and allergic sensitization. This study aimed to evaluate the association between feeding type and allergic inflammation markers, including total immunoglobulin E (IgE) and eosinophil levels, in preterm infants.

A cohort of 90 preterm infants was analyzed, including 30 exclusively breastfed, 30 formula-fed, and 30 mixed-fed infants. A control group of 30 full-term infants was included. Clinical and laboratory data were collected and analyzed using comparative statistical methods.

Formula-fed infants demonstrated significantly higher IgE levels ($p<0.001$) and eosinophil percentages compared to breastfed infants. Mixed-fed infants showed intermediate values. Elevated IgE (≥60 IU/mL) and eosinophilia (≥5%) were more prevalent in the formula-fed group.

These findings highlight the critical role of feeding type in modulating allergic inflammation in preterm infants and support breastfeeding as a primary preventive strategy.

Keywords

preterm infants; allergy; IgE; eosinophils; breastfeeding; formula feeding; immune regulation; cohort study

Introduction

Preterm birth remains a major global health challenge and is associated with increased susceptibility to immune-mediated diseases, including allergic disorders. The immaturity of both innate and adaptive immune responses in preterm infants leads to dysregulation of cytokine production and impaired development of immune tolerance.

The intestinal barrier in preterm infants is underdeveloped, allowing increased permeability to allergens and microbial antigens. This contributes to systemic immune activation and the development of allergic diseases.

Nutrition during early life is one of the most influential environmental factors shaping immune development. Breast milk contains bioactive compounds such as secretory IgA, cytokines, and oligosaccharides that promote immune tolerance and gut microbiota maturation.

In contrast, formula feeding may expose infants to foreign proteins and increase the risk of immune sensitization.

Despite growing evidence, data from Central Asian populations remain limited. This study aims to address this gap by analyzing the relationship between feeding type and allergic inflammation markers in preterm infants in the Bukhara region.

Materials and Methods

Study Design and Population

A prospective cohort study was conducted at the Early Age Department of the Bukhara Regional Children's Multidisciplinary Medical Center.

The study included:

- 90 preterm infants (≤37 weeks gestation)
- 30 full-term infants as a control group

Preterm infants were divided into three groups:

- Breastfeeding (n=30)
- Formula feeding (n=30)
- Mixed feeding (n=30)

Data Collection

Data included:

- gestational age and birth weight
- feeding type
- eosinophil percentage (%)
- total IgE levels (IU/mL)

Laboratory Analysis

IgE levels were measured using immunoassay methods. Eosinophil counts were determined through standard hematological analysis.

Statistical Analysis

Statistical analysis was performed using standard software. Data were expressed as mean ± standard error. Group comparisons were conducted using Student's t-test and ANOVA. A p-value <0.05 was considered statistically significant.

Results

Baseline Characteristics

The distribution of infants by age and sex showed no significant differences between groups, ensuring comparability.

IgE Levels

Formula-fed infants demonstrated significantly higher IgE levels compared to breastfed infants:

- Breastfed: lowest mean IgE
- Mixed-fed: intermediate
- Formula-fed: highest ($p<0.001$)

Eosinophil Levels

Eosinophil percentages followed a similar pattern:

- Breastfed infants: minimal eosinophilia
- Formula-fed infants: significantly elevated values
- Mixed-fed: moderate levels

Prevalence of Elevated Markers

The proportion of infants with:

- IgE ≥60 IU/mL
- Eosinophils ≥5%

was highest in the formula-fed group.

Feeding Type	Mean IgE (IU/mL)	Eosinophils (%)	Clinical Interpretation
Breastfeeding	20–40	1–3	Low allergy risk
Mixed Feeding	50–75	3–5	Moderate risk
Formula Feeding	80–120	5–10	High allergy risk

Discussion

The findings of this study confirm that feeding type significantly influences allergic inflammation in preterm infants.

Breastfeeding provides immunological protection through:

- anti-inflammatory cytokines
- immunoglobulins
- microbiota modulation

These factors promote immune tolerance and reduce allergic sensitization.

Formula feeding, on the other hand, may:

- introduce foreign antigens
- activate Th2 immune responses
- increase IgE production

The observed elevation of IgE and eosinophils supports the hypothesis that artificial feeding is associated with increased allergic risk.

Importantly, mixed feeding demonstrated intermediate effects, suggesting partial protective benefits of breast milk.

These findings are consistent with international studies and reinforce the importance of early nutritional interventions.

Clinical Implications

- Breastfeeding should be prioritized in preterm infants
- High-risk infants require early allergy screening
- Monitoring IgE and eosinophils can aid early diagnosis
- Preventive algorithms should be implemented in neonatal care

Conclusion

Feeding type plays a critical role in the development of allergic inflammation in preterm infants. Breastfeeding is associated with significantly lower IgE and eosinophil levels, while formula feeding increases allergic risk.

Early identification and targeted prevention strategies can reduce long-term allergic morbidity and improve clinical outcomes.

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