Allergologia et immunopathologia
Sociedad Española de Inmunología Clínica, Alergología y Asma Pediátrica
www.all-imm.com

ORIGINAL ARTICLE

OPEN ACCESS

Complementary feeding routines and parental allergy follow-up behavior in early childhood

Özge Kangallı Boyacıoğlu[a]*, Özge Atay[b], Serdar Al[b], Gizem Atakul[c], Nevin Uzuner[b], Özkan Karaman[b], Suna Asilsoy[b]

[a]*Bakircay University, Çiğli Training and Research Hospital, Pediatric Allergy and Immunology Clinic, Çiğli, İzmir*
[b]*Dokuz Eylül University Pediatric Allergy and Immunology Clinic, Balçova / İzmir*
[c]*Eskisehir City Hospital Pediatric Allergy and Immunology Clinic, Odunpazarı/Eskişehir*

Received 17 January 2026; Accepted 21 May 2026
Available online 1 September 2026

KEYWORDS
Complementary feeding;
Allergy-related healthcare-seeking behavior;
Food allergen introduction;
Infant feeding practices;
Food allergy;
Socioeconomic factors

Abstract
Background: Early complementary feeding practices and timely allergen introduction are important components of current infant feeding recommendations. However, evidence remains limited regarding how complementary feeding routines and socioeconomic factors influence parental allergy-related healthcare-seeking behavior during early childhood.
Objective: To examine the association between complementary feeding routines, early allergen introduction, socioeconomic characteristics, and parental allergy-related healthcare-seeking behavior in young children.
Methods: In this cross-sectional study, parents of young children completed a structured questionnaire assessing complementary feeding routines, the timing and type of allergen introduction, allergy-related symptoms, and socioeconomic characteristics. All data were based on parental self-report and were not independently verified through clinical assessment or medical records. The primary outcome, *allergy-related healthcare-seeking behavior*, was operationally defined as any parent-reported healthcare contact, including at least one visit to a pediatrician or pediatric allergy clinic, due to suspected allergy-related symptoms or parental concern. Multivariable logistic regression analysis was performed to identify factors associated with allergy-related healthcare-seeking behavior.
Results: Early introduction of specific allergens, particularly egg white, was significantly associated with increased parental allergy-related healthcare-seeking behavior. The presence of allergy-related symptoms was also a strong determinant of healthcare utilization. In addition, socioeconomic factors, including household income and parental employment status, were associated with differences in healthcare-seeking patterns, likely reflecting variation in access to healthcare services and health awareness. The multivariable model demonstrated moderate sensitivity, indicating that while key factors associated with allergy-related healthcare-seeking behavior were identified, some cases could not be fully captured.

***Corresponding author**: Özge Kangallı Boyacıoğlu, Bakircay University, Çiğli Training and Research Hospital, Pediatric Allergy and Immunology Clinic, Çiğli, İzmir. *Email address*: ozgekangalli@gmail.com

https://doi.org/10.15586/aei.v54i5.1712
Copyright: Boyacıoğlu K, et al.
License: This open access article is licensed under Creative Commons Attribution 4.0 International (CC BY 4.0). http://creativecommons.org/

Conclusion: Complementary feeding practices, early introduction of allergenic foods, and socioeconomic factors were associated with parental allergy-related healthcare-seeking behavior in early childhood. These findings highlight the need for targeted parental education, optimization of infant feeding recommendations with consideration of allergy risk, and improved clinical guidance for families reporting allergy-related symptoms. Prospective studies are warranted to confirm these associations and to support the development of effective preventive strategies.
© 2026 Codon Publications. Published by Codon Publications.

Introduction

Nutrition during pregnancy, infancy, and early childhood is a critical determinant of growth and development in childhood, and optimal nutrition plays a key role in promoting lifelong health and the prevention of disease. Complementary feeding is defined as the process in which foods and beverages other than breast milk or infant formula are gradually introduced during infancy, beginning alongside milk feeding and typically continuing until around 24 months of age. The complementary feeding period represents a sensitive developmental window during which infants are particularly vulnerable to both nutrient deficiencies and excesses. This stage is characterized by substantial changes in dietary patterns; increased exposure to novel foods, flavors, and feeding experiences; and a phase of rapid growth and developmental progression.[1]

The timing and diversity of complementary feeding have gained increasing attention in relation to both the development and monitoring of food allergies in children. In particular, early introduction of allergenic foods such as egg white and cow's milk has been shown to either increase or reduce allergy risk depending on factors including family history and timing of exposure. However, the influence of these feeding practices on parental health-seeking behavior when food allergy is suspected remains relatively underexplored. Understanding the relationship between dietary intake during infancy and toddlerhood and the development of atopic diseases is of considerable importance from a public health perspective.

Design and Setting of the Study

This study was designed as a cross-sectional (descriptive) survey conducted at the Department of Pediatrics, Division of Pediatric Allergy and Immunology, Dokuz Eylül University. The primary aim of the study was to evaluate parental feeding practices during the transition to complementary feeding, sources of nutritional information, and feeding behaviors related to allergy concerns. For the purposes of this study, *allergy follow-up behavior* was operationally defined as any parent-reported healthcare engagement related to suspected allergic symptoms or concerns, including at least one visit to a pediatric allergy outpatient clinic or pediatric healthcare provider for allergy-related evaluation. This variable did not necessarily indicate regular longitudinal follow-up or physician-confirmed allergic disease. All questionnaire responses were based on parental self-report. Reported symptoms, feeding practices, and allergy-related healthcare visits were not independently clinically verified and were not systematically confirmed through medical records.

Ethical approval for the study was obtained from the Dokuz Eylül University Ethics Committee (Decision No: 6395-GOA).

Study Population

Voluntary mothers of children aged 0–24 months who presented to the outpatient clinic were included in the study. Eligibility required that mothers possess sufficient cognitive ability to respond to the questionnaire and to accurately report their child's feeding history. Exclusion criteria comprised preterm birth (<37 weeks of gestation), infants with congenital metabolic or chronic conditions, those requiring special dietary regimens, and participants who provided incomplete responses to the questionnaire. Data were collected using the "Complementary Feeding Routine Questionnaire," which was specifically developed by the researchers for the purposes of this study.

Questionnaire on Complementary Feeding Practices

The questionnaire consisted of a total of 27 items and included multiple-choice and closed-ended questions. It comprised several thematic domains covering sociodemographic characteristics, infant feeding practices, timing of specific food introductions, food elimination behaviors, and sources of nutritional information. Sociodemographic data included maternal age, educational level, occupation, family structure, number of household members and children, and household income level. Infant feeding history addressed feeding practices during the first 6 months of life, timing of breastfeeding cessation, age at introduction of complementary foods, initial foods introduced, adherence to the 3-day rule, and any problems observed following complementary feeding. The questionnaire also assessed the timing of first exposure to specific foods, including dairy products, egg yolk and egg white, nuts, fish, wheat, and soy. In addition, information regarding foods eliminated after complementary feeding and foods avoided before 1 year of age due to parental concerns was collected. Finally, sources of information regarding complementary feeding, family history of allergic diseases, and maternal dietary intake and vitamin use during pregnancy were evaluated.

Data Collection Process

The questionnaires were administered to mothers attending the pediatric outpatient clinic through face-to-face interviews. Participants were informed about the purpose and content of the study, and the questionnaire was completed after obtaining written informed consent. Each participant completed the questionnaire within an average duration of 10–15 minutes.

Statistical analysis

The primary objective of the study was to identify factors associated with the likelihood of engaging in allergy-related follow-up. Given the binary nature of the dependent variable, a logistic regression (logit) model was employed. Logistic regression estimates the probability of the occurrence of a specific outcome—here, the performance of allergy follow-up based on a linear combination of multiple explanatory variables.

All statistical analyses were performed using the Stata statistical software. The logistic regression model was estimated using the logit command, and odds ratio (OR) transformations were applied to enhance the interpretability of the regression coefficients. Overall model validity was assessed using the likelihood-ratio (LR) test, while model explanatory power was evaluated using pseudo R^2 (McFadden's R^2). Model performance and classification accuracy were further examined through receiver operating characteristic (ROC) curve analysis, the area under the curve (AUC), overall classification accuracy, sensitivity and specificity, as well as positive and negative predictive values. A default probability threshold of 0.5 was applied for classification; however, to achieve higher sensitivity, additional reclassification analyses were conducted using alternative cutoff values, such as 0.3. The results demonstrated that the model was statistically significant and exhibited satisfactory predictive performance with practical applicability.

Results

A total of 179 children were included in the study, of whom 77 were female and 102 were male. Adherence to the three-day rule was reported by 74.3% of parents. Decisions regarding the initiation of complementary feeding were influenced by family advice in 8.9% of cases, social media in 12.8%, and parents' own knowledge in 16.8%. In contrast, 86% of infants initiated complementary feeding based on a physician's recommendation. A family history of allergic diseases was present in 43% of the participants (Table 1).

Table 1 Baseline characteristics of the study population.

Variable	Category	n (%)
Total participants		179
Sex	Female	77 (43.0)
	Male	102 (57.0)
Family history of allergic disease	Present	77 (43.0)
	Absent	102 (57.0)
Adherence to 3-day rule	Yes	133 (74.3)
	No/not reported	46 (25.7)
Complementary feeding initiated based on physician recommendation	Yes	154 (86.0)
	No	25 (14.0)
Source influencing feeding decision*	Physician recommendation	154 (86.0)
	Family advice	16 (8.9)
	Social media	23 (12.8)
	Parent's own knowledge	30 (16.8)

Overall model fit

A logistic regression (logit) model was applied to identify factors associated with the likelihood of attending an allergy outpatient clinic. The overall model fit was statistically significant (LR $x^2(9) = 47.59$, $p < 0.001$), indicating that the independent variables included in the model jointly explained allergy clinic attendance in a meaningful way. The log-likelihood value of the full model was −99.469, representing an improvement of 23.8 units compared with the null model containing only the intercept (−123.265). This improvement demonstrates that the inclusion of the explanatory variables significantly enhanced the model's ability to predict the outcome.

Model fit measures

Model fit indices indicated a moderate to good level of model adequacy. The pseudo R^2 measures supported acceptable explanatory power for a logistic regression model, with a McFadden R^2 of 0.193 and an adjusted McFadden R^2 of 0.112. The McKelvey–Zavoina R^2 was 0.468, suggesting that approximately 47% of the variance in the latent outcome variable was explained by the model. Additional goodness-of-fit measures, including the Cox–Snell R^2 (0.233), Nagelkerke R^2 (0.312), and Efron R^2 (0.241), further indicated a moderate overall model fit. Tjur's coefficient of discrimination (D = 0.239) demonstrated that the average difference in predicted probabilities between individuals who did and did not engage in allergy follow-up was 23.9%, reflecting a reasonable discriminatory capacity of the model. The overall classification accuracy was 70.9%, while the class-imbalance-adjusted accuracy was 35.8%. Information criteria values were relatively low (AIC = 218.94; BIC = 250.81), providing additional support for the adequacy of the model.

Model performance indicators

According to the classification table, the overall accuracy of the model was 65.36%. Of the 81 individuals who actually engaged in allergy follow-up, 39 were correctly identified, corresponding to a sensitivity of 48.15%. Among the 98

individuals who did not attend the allergy outpatient clinic, 78 were correctly classified, yielding a specificity of 79.59%. The positive predictive value was 66.1%, while the negative predictive value was 65.0%. The false-positive and false-negative rates were 20.4% and 51.9%, respectively. These findings indicate that the model performed better in correctly classifying individuals who did not seek allergy follow-up, whereas its ability to predict those who did was moderate.

Model performance analysis

The predictive performance of the model was evaluated using the ROC curve (Figure 1). The AUC was calculated as 0.7435, indicating that the model was able to discriminate between individuals who did and did not engage in allergy follow-up with approximately 74% accuracy. According to the classification proposed by Hosmer and Lemeshow, an AUC value between 0.7 and 0.8 reflects an acceptable level of discriminative ability, supporting the adequacy of the model's predictive performance.

Inspection of the ROC curve showed a rapid increase in sensitivity in regions of low specificity (1 − specificity < 0.25), whereas specificity was largely preserved at higher threshold values. This pattern suggests that the model more accurately classifies individuals who did not engage in allergy follow-up, while assigning lower predicted probabilities to a subset of those who did. The ROC curve consistently remaining above the diagonal reference line (y = x) further confirms that the model demonstrates meaningful discriminative ability beyond random classification.

These findings support that the variables included in the model—particularly household income level, timing of complementary feeding initiation, and a history of vomiting and eczema—made statistically significant contributions to predicting allergy follow-up behavior. According to the ROC analysis, selecting a probability threshold of 0.5 provided an optimal balance between sensitivity (48.1%) and specificity (79.6%). Nevertheless, the relatively limited sensitivity indicates that a subset of individuals who engaged in allergy follow-up may not have been adequately predicted by the model. This limitation suggests that the predictive performance could potentially be improved by incorporating psychosocial factors, such as parental anxiety, health literacy, and social support, as well as environmental factors, including allergen exposure and seasonal influences.

Factors associated with allergy-related healthcare-seeking behavior: marginal effects analysis

Marginal effects (dy/dx) were calculated to assess the impact of independent variables on the probability of engaging in allergy-related healthcare-seeking behavior. Being a homemaker was associated with a 13.5% lower probability of healthcare-seeking behavior compared with being employed, an effect that was negative and statistically significant at the 5% level (p = 0.046). Individuals with a household income above the minimum wage exhibited a 19.8% higher likelihood of seeking allergy-related

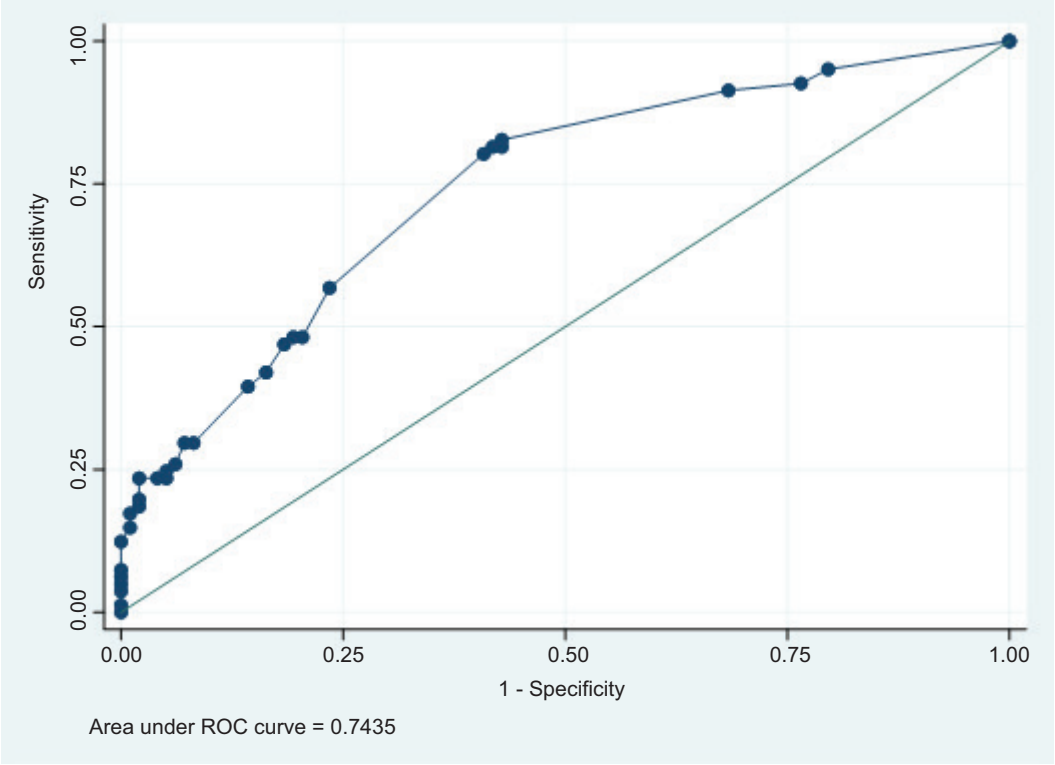


Figure 1 Predictive performance model evaluation using the receiver operating characteristic (ROC) curve.

Table 2 Factors associated with allergy-related healthcare-seeking behavior: logistic regression analysis.

Variable	Direction of Association	p-value
Household income > minimum wage	Higher likelihood	+0.011
Vomiting after complementary feeding	Higher likelihood	0.018
Rash/eczema	Higher likelihood	0.026
Egg white introduced before 6 months	Higher likelihood	0.038
Homemaker status	Lower likelihood	0.046
Complementary feeding at 4–6 months	Higher likelihood	0.004

healthcare (p = 0.011), suggesting that socioeconomic factors may influence healthcare utilization patterns.

Initiation of complementary feeding between 4 and 6 months of age was associated with a 23.3% increase in the probability of healthcare-seeking behavior (p = 0.004). The presence of vomiting symptoms was linked to a 40.1% higher probability of healthcare-seeking behavior (p = 0.018), indicating that symptom perception may act as a key driver of medical consultation.

Early introduction of egg white before 6 months of age was also associated with an increased likelihood of healthcare-seeking behavior, with a marginal effect of 28.4% (p = 0.038). Similarly, individuals who had never been introduced to egg white demonstrated a 30.5% higher probability of healthcare-seeking behavior; however, this association reached statistical significance only at the 10% level (p ≈ 0.06). Finally, the presence of rash or eczema was associated with a 22.4% increase in the probability of healthcare-seeking behavior (p = 0.026).

Overall, these findings suggest that both symptom-related factors and socioeconomic characteristics are associated with parental healthcare-seeking behavior rather than directly indicating underlying allergic disease.

Clinical and Behavioral Interpretation

According to the model results, the main factors associated with an increased probability of engaging in allergy-related healthcare-seeking behavior included higher household income, initiation of complementary feeding between 4 and 6 months of age, the presence of symptoms such as vomiting and rash/eczema, and early introduction of egg white. In contrast, being a homemaker was associated with a lower likelihood of healthcare-seeking behavior.

Overall, the model demonstrates a meaningful association between socioeconomic characteristics, infant feeding practices, and parental healthcare-seeking behavior. These findings should be interpreted in the context of healthcare utilization patterns rather than as indicators of underlying allergic disease.

In this study, sociodemographic and feeding-related factors associated with allergy-related healthcare-seeking behavior were evaluated using a logistic regression (logit) model. The dependent variable represented parent-reported healthcare contact for allergy-related concerns (1 = yes, 0 = no). The model was statistically significant overall, and the included variables jointly contributed to explaining variation in healthcare-seeking behavior (Model χ^2 test, p <0.001).

Effects of Sociodemographic Variables

For the occupation variable, the regression coefficient was −0.669 with a p-value of approximately 0.056, indicating that being a homemaker was associated with a lower likelihood of engaging in allergy-related healthcare-seeking behavior compared with being employed. The negative coefficient suggests a reduction in the log-odds of healthcare-seeking behavior among homemakers. Although the direction of the effect was consistent, its statistical significance was borderline, reaching the 10% significance level.

Household income demonstrated a statistically significant and positive association with the probability of healthcare-seeking behavior (β = +0.982, p = 0.016). Individuals with an income above the minimum wage had a significantly higher likelihood of seeking allergy-related healthcare compared with those earning the minimum wage or less. This finding may reflect differences in access to healthcare services, healthcare utilization patterns, and resource availability rather than differences in underlying disease occurrence.

Timing of Complementary Feeding Initiation

Initiation of complementary feeding between 4 and 6 months of age was associated with a 0.708-unit increase in the log-odds of engaging in allergy-related healthcare-seeking behavior (p = 0.053). The positive coefficient indicates that parents who introduced complementary foods during this period were more likely to seek allergy-related healthcare. Although the statistical significance of this association was borderline at the 10% level, this finding may reflect differences in healthcare-seeking patterns and adherence to general feeding recommendations rather than a direct causal relationship.

Symptoms Following Complementary Feeding

Among individuals reporting vomiting after complementary feeding, the log-odds of engaging in allergy-related healthcare-seeking behavior increased by 1.995 units (p = 0.025), indicating a significantly higher likelihood of healthcare

utilization among families of infants experiencing vomiting. Similarly, the presence of rash or a history of eczema was associated with a significant increase in the log-odds of healthcare-seeking behavior (β = +1.111, p = 0.033). These findings suggest that the presence of symptoms perceived as potentially allergy-related may act as an important driver of parental healthcare-seeking behavior, rather than directly reflecting confirmed allergic disease.

Timing of Specific Food Introduction

Early introduction of egg white before 6 months of age was associated with a 1.63-unit increase in the log-odds of engaging in allergy-related healthcare-seeking behavior (p = 0.002), indicating a statistically significant association. This finding suggests that early exposure to egg white may be associated with increased parental healthcare-seeking behavior, potentially reflecting symptom perception or parental concern rather than a direct effect on underlying allergic disease.

In individuals who had never been introduced to egg white, the log-odds of healthcare-seeking behavior increased by 1.52 units (p ≈ 0.07), reaching statistical significance at the 10% level. This pattern may reflect cautious feeding practices, perceived risk of allergy, or prior experiences influencing parental decisions to seek medical evaluation.

Overall Assessment

The variables identified as significant in the model were associated with allergy-related healthcare-seeking behavior through both socioeconomic characteristics and infant feeding practices. In particular, higher household income, early introduction of egg white, and the presence of symptoms such as vomiting and rash were associated with an increased likelihood of healthcare-seeking behavior. In contrast, being a homemaker was associated with a reduced probability of engaging in allergy-related healthcare-seeking behavior (Table 2).

These findings suggest that both symptom perception and socioeconomic context may influence parental healthcare utilization patterns rather than directly reflecting underlying allergic disease.

Discussion

In this study, factors associated with parents' likelihood of engaging in allergy-related healthcare-seeking behavior for their children were examined using a logistic regression model. The findings suggest that both socioeconomic characteristics and early feeding practices are associated with variation in parental healthcare-seeking behavior.

The overall statistical significance of the model (LR χ^2 (9) = 47.591; p <0.001), together with its moderate explanatory capacity (e.g., McKelvey–Zavoina R^2 ≈ 0.468), indicates that the included variables contribute meaningfully to explaining patterns of healthcare utilization within the study population. These findings should be interpreted in the context of healthcare-seeking behavior rather than as indicators of underlying allergic disease.

These findings indicate that both socioeconomic and clinical factors are associated with parental allergy-related healthcare-seeking behavior. The negative association observed for occupation may reflect differences in time availability, access to healthcare services, or other structural factors influencing healthcare utilization.

Comparisons with randomized controlled trials such as LEAP and EAT should be interpreted cautiously, given the fundamental methodological differences. While these trials evaluated the preventive effects of structured early allergen introduction under controlled conditions, the present study reflects real-world parental behaviors and healthcare-seeking behavior patterns in an outpatient setting. Therefore, these studies are referenced as contextual background rather than as direct comparators.

At present, the findings of this study do not support causal inferences or specific recommendations regarding the timing of complementary feeding or the introduction of individual solid foods for the prevention of food allergy.

However, several studies have suggested that delaying the introduction of solid foods until after 4 months of age may confer potential advantages. Previous research has also reported that symptoms such as vomiting and eczema are associated with increased frequency of medical evaluation. In addition, other factors—including an infant's developmental readiness, parental perspectives and needs, nutritional requirements, and the risk of developing highly selective eating behaviors—should be taken into consideration. Therefore, irrespective of atopic heredity, the introduction of complementary foods between 4 and 6 months of age is recommended in accordance with standard local practices and the individual needs of the infant.[2]

Evidence regarding maternal diet and prenatal supplementation in the prevention of food allergy remains inconsistent. While some randomized controlled trials have suggested potential effects of interventions such as fish oil or probiotic supplementation, the overall evidence does not support clear preventive benefits for food allergy development.[3-9]

In the present study, maternal diet and prenatal supplementation were collected descriptively and were not included as primary explanatory variables in the regression model. Therefore, these factors should be interpreted as contextual information rather than determinants of allergy-related healthcare-seeking behavior.

The role of socioeconomic factors was evident in the present study, with higher household income being associated with an approximately 20% increase in the likelihood of engaging in allergy-related healthcare-seeking behavior (19.8%, p = 0.011). This finding may reflect differences in access to healthcare services, healthcare utilization patterns, and resource availability rather than differences in underlying disease occurrence.

In contrast, being a homemaker was associated with an approximately 13.5% reduction in the probability of healthcare-seeking behavior (13.5%, p = 0.046). This association may be related to structural factors such as time constraints, accessibility of healthcare services, or differences in healthcare utilization patterns.

The literature similarly suggests that higher socioeconomic status is associated with increased healthcare utilization and engagement with health services. Several studies have identified socioeconomic status as an important determinant of access to care and participation in pediatric health monitoring programs.[10]

Factors such as access to healthcare services, educational level, and resource availability have been highlighted as key influences on healthcare-seeking behavior and utilization patterns. These considerations support the interpretation that the associations observed in the present study may primarily reflect differences in access and healthcare utilization rather than underlying disease occurrence.

Early Feeding Practices and Allergen Introduction

Another notable finding of the present study was the 23.3% increase in the likelihood of engaging in allergy-related healthcare-seeking behavior among individuals who initiated complementary feeding between 4 and 6 months of age ($p = 0.004$). This observation aligns with current international recommendations, including those from the British Society for Allergy & Clinical Immunology (BSACI), which discourage delaying the introduction of complementary foods beyond approximately 4–6 months of age.[11]

However, given the observational design of the present study, this finding should be interpreted as reflecting differences in parental feeding practices and healthcare-seeking behavior rather than as evidence supporting a causal role in allergy prevention.

Moreover, within the context of early allergen introduction, randomized controlled trials such as LEAP and EAT provide important background evidence regarding the timing of allergen exposure. The LEAP trial demonstrated a reduced risk of peanut allergy with early introduction in high-risk infants, while the EAT study explored the effects of introducing multiple allergenic foods during infancy.[12,13]

However, direct comparisons with the present study are limited due to fundamental methodological differences. While these trials assessed the preventive effects of structured early allergen introduction under controlled conditions, the current study reflects parent-reported feeding practices and healthcare-seeking behavior in a real-world outpatient setting.

In this context, the observed associations in our study—such as increased healthcare-seeking behavior among those with early or delayed egg white introduction—may reflect parental perceptions, concerns, or responses to symptoms rather than causal effects on allergic disease risk.

The presence of symptoms perceived as potentially allergy-related appeared to be an important driver of healthcare-seeking behavior. In children with a history of vomiting, the likelihood of engaging in allergy-related healthcare-seeking behavior increased by 40.1% ($p = 0.018$), while the presence of rash or eczema was associated with a 22.4% increase ($p = 0.026$). These findings suggest that parental perception of symptoms may play a key role in prompting medical consultation.

However, it is important to note that many symptoms observed during infancy, including vomiting, regurgitation, and transient skin rashes, are often nonspecific and may reflect functional or benign conditions rather than true allergic disease. Previous studies have shown that symptom-based assessment tools, such as CoMiSS and IMAP, may overidentify infants as having possible food allergy when used without objective diagnostic confirmation. Therefore, the associations observed in this study may partly reflect parental interpretation of common infant symptoms rather than the presence of confirmed allergy.

Consistent with this, the literature indicates that early-life symptoms—particularly dermatologic and gastrointestinal manifestations—are strong determinants of parental healthcare-seeking behavior and healthcare utilization patterns.[14]

Given the cross-sectional and observational design of the present study, causal inferences cannot be established. Therefore, comparisons with randomized controlled trials such as LEAP and EAT should be interpreted with caution. While these trials evaluated the preventive effects of structured early allergen introduction under controlled conditions, the present study reflects parent-reported feeding practices and allergy-related healthcare-seeking behavior in a real-world outpatient setting. Accordingly, these trials are referenced as contextual evidence rather than direct comparators.

In addition, maternal dietary habits and prenatal supplementation were not primary explanatory variables in the current regression model. As these factors were not directly associated with the main outcome in our dataset, their relevance within the scope of the present study is limited and should be interpreted cautiously.

Clinical and Public Health Implications

The findings of this study have potential implications at both the individual and population levels. In particular, parents with lower socioeconomic status and those who are not formally employed may experience differences in access to healthcare services and patterns of healthcare utilization. These findings highlight the importance of considering structural and socioeconomic factors when evaluating parental healthcare-seeking behavior.

Furthermore, early feeding practices and the presence of symptoms perceived as potentially allergy-related appear to be associated with increased healthcare-seeking behavior. These observations suggest that parental interpretation of symptoms and feeding practices may play a role in healthcare utilization patterns. Accordingly, efforts to support families through clear guidance on infant feeding practices and appropriate use of healthcare services may be beneficial.

However, given the observational nature of the study, these findings should not be interpreted as evidence for causal relationships or as a basis for changes in clinical guidelines.

International guidelines indicate that delaying the introduction of allergenic foods may not provide protection against allergy development and may, in some cases, have unintended consequences. For example, a review recommends introducing allergens such as cooked egg and peanut during the complementary feeding window—approximately

between 4 and 6 months of age (but not before 4 months) and maintaining regular consumption once introduced.[15]

In this context, the findings of the present study suggest that both early allergen exposure (specifically egg white) and the presence of symptoms perceived as potentially allergy-related are associated with parental healthcare-seeking behavior. However, these associations should be interpreted as reflecting behavioral responses and healthcare utilization patterns rather than causal effects on allergy development.

Strengths and Limitations of the Study

This study contributes to the existing literature by modeling the relationship between the timing of complementary feeding initiation, the introduction of specific allergens, and parental allergy-related healthcare-seeking behavior. Nevertheless, several limitations should be acknowledged.

First, due to the cross-sectional (descriptive) design of the study, causal inferences cannot be established. Second, the data were based on self-reported questionnaire responses; therefore, reported symptoms, healthcare-seeking behavior, and allergy-related outcomes were not independently verified through clinical assessment or diagnostic testing.

In addition, the overall sample size and the limited size of certain subgroups may restrict the robustness of the findings. The predictive model demonstrated moderate sensitivity (true positive rate) of approximately 48%, indicating that a proportion of individuals who engaged in healthcare-seeking behavior could not be accurately identified by the model.

Finally, regional differences in allergen exposure—such as the more prominent role of sesame or walnut compared with peanut in the Turkish population—should be considered when comparing these findings with globally reported data, as variations in allergen profiles may influence both feeding practices and healthcare-seeking patterns.[16]

Many symptoms observed during infancy—including regurgitation, crying, altered stool patterns, vomiting, and transient skin rashes—are common and often functional rather than allergic in origin. Previous studies have shown that symptom-based tools such as CoMiSS and IMAP may overidentify infants as having possible cow's milk allergy when used without objective diagnostic confirmation. Therefore, some of the healthcare-seeking behavior observed in this study may reflect parental interpretation of common infant symptoms rather than the presence of confirmed allergic disease.

An additional consideration when interpreting these findings is the role of socioeconomic factors. The observed associations with indicators such as household income are likely to reflect differences in access to healthcare services and patterns of healthcare utilization rather than true differences in allergic disease occurrence. Families with greater resources may be more likely to seek specialist care or medical evaluation when concerns arise. Accordingly, socioeconomic variables in this study should be interpreted as influencing healthcare-seeking behavior rather than as direct markers of disease risk.

In addition, the study population consisted of mothers already attending an outpatient clinical setting, which may have introduced selection bias. Participants presenting to healthcare facilities may differ systematically from the general population in terms of symptom perception, healthcare-seeking tendencies, anxiety levels, and patterns of healthcare utilization. Consequently, the generalizability of the findings to community-based populations may be limited.

Another limitation relates to the data collection methodology. Both exposure variables (feeding practices, symptom history, and socioeconomic characteristics) and the primary outcome were based entirely on parental self-report using a study-specific questionnaire that had not undergone formal external validation. This may increase the risk of recall bias, reporting bias, and misclassification, and may limit reproducibility across different populations. Accordingly, the present findings should be interpreted as exploratory and hypothesis-generating, warranting confirmation in larger prospective studies using validated instruments and clinically verified outcomes.

Conclusion

In conclusion, the model developed in this study identifies associations between early feeding practices, socioeconomic characteristics, and parental allergy-related healthcare-seeking behavior in early childhood. The findings suggest that both symptom perception and socioeconomic context may influence patterns of healthcare utilization.

These results should be interpreted within the limitations of the cross-sectional design and the use of parent-reported data, and should not be considered indicative of causal relationships or underlying allergic disease.

Future research incorporating prospective designs, larger populations, and clinically validated outcomes is warranted to further clarify these associations and to improve understanding of factors influencing healthcare-seeking behavior in early childhood.

Acknowledgements

The authors thank all participating families for their contribution to this study and the clinical staff for their support during data collection.

Ethical Approval

The study was approved by the Dokuz Eylül University Ethics Committee (Decision No: 6395-GOA), and written informed consent was obtained from all participants.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Mandatory Disclosure on Use of Artificial Intelligence

No generative AI tools were used to generate data, perform analysis, or produce scientific content. The authors take full responsibility for the integrity and accuracy of the manuscript.

Authors' Contributions

Özge Kangallı Boyacıoğlu contributed to the conceptualization and design of the study, data collection, statistical analysis, and manuscript drafting. Özge Atay and Serdar Al contributed to data collection and interpretation of the data. Gizem Atakul participated in data acquisition and revision of the manuscript. Nevin Uzuner, Özkan Karaman and Suna Asilsoy contributed to study supervision, critical revision of the manuscript, and final approval of the version to be published. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that they have no conflict of interest.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. Fewtrell M, Bronsky J, Campoy C, Domellöf M, Embleton N, Fidler Mis N, et al. Complementary feeding. J Pediatr Gastroenterol Nutr. 2017;64(1):119–32. https://doi.org/10.1097/MPG.0000000000001454
2. Muraro A, Halken S, Arshad SH, Beyer K, Dubois AEJ, Du Toit G, et al; EAACI Food Allergy and Anaphylaxis Guidelines Group. EAACI food allergy and anaphylaxis guidelines. Primary prevention of food allergy. Allergy. 2014;69(5):590–601. https://doi.org/10.1111/all.12398
3. Kramer MS, Kakuma R. Maternal dietary antigen avoidance during pregnancy or lactation, or both, for preventing or treating atopic disease in the child. Cochrane Database Syst Rev. 2012;(9):CD000133. https://doi.org/10.1002/14651858.CD000133.pub3
4. Lilja G, Dannaeus A, Foucard T, Graff-Lonnevig V, Johansson SG, Oman H. Effects of maternal diet during late pregnancy and lactation on the development of IgE and egg- and milk-specific IgE and IgG antibodies in infants. Clin Exp Allergy. 1991;21(2):195–202. https://doi.org/10.1111/j.1365-2222.1991.tb00830.x
5. Fälth-Magnusson K, Kjellman N-IM. Allergy prevention by maternal elimination diet during late pregnancy. J Allergy Clin Immunol. 1992;89(3):709–13. https://doi.org/10.1016/0091-6749(92)90378-F
6. Palmer DJ, Sullivan T, Gold MS, Prescott SL, Heddle R, Gibson RA, et al. Effect of n-3 long chain polyunsaturated fatty acid supplementation in pregnancy on infants' allergies in first year of life: randomised controlled trial. BMJ. 2012;344:e184. https://doi.org/10.1136/bmj.e184
7. Denburg JA, Hatfield HM, Cyr MM, Hayes L, Holt PG, Sehmi R, et al. Fish oil supplementation in pregnancy modifies neonatal progenitors at birth in infants at risk of atopy. Pediatr Res. 2005;57(2):276–81. https://doi.org/10.1203/01.pdr.0000148279.72611.1d
8. Dunstan JA, Mori TA, Barden A, Beilin LJ, Taylor AL, Holt PG, et al. Fish oil supplementation in pregnancy modifies neonatal allergen-specific immune responses and clinical outcomes in infants at high risk of atopy: a randomized, controlled trial. J Allergy Clin Immunol. 2003;112(6):1178–84. https://doi.org/10.1016/j.jaci.2003.09.009
9. Huurre A, Laitinen K, Rautava S, Korkeamaki M, Isolauri E. Impact of maternal atopy and probiotic supplementation during pregnancy on infant sensitization: a double-blind placebo-controlled study. Clin Exp Allergy. 2008;38(8):1342–8. https://doi.org/10.1111/j.1365-2222.2008.03008.x
10. Kim J, Kim B, Kim DH, Kim Y, Rajaguru V. Association between socioeconomic status and healthcare utilization for children with allergic diseases: findings from the Korean National Health and Nutrition Examination Survey. Healthcare (Basel). 2023;11(4):492. https://doi.org/10.3390/healthcare11040492
11. British Society for Allergy & Clinical Immunology. Early feeding guidance for the prevention of food allergy in infants. Clin Exp Allergy. 2018;48(12):1508–14. Available at: https://www.bsaci.org/wp-content/uploads/2020/02/pdf_Early-feeding-guidance-for-HCPs-2.pdf
12. Du Toit G, Roberts G, Sayre PH, Bahnson HT, Radulovic S, Santos AF, et al; LEAP Study Team. Randomized trial of peanut consumption in infants at risk for peanut allergy. N Engl J Med. 2015;372(9):803–13. https://doi.org/10.1056/NEJMoa1414850
13. Perkin MR, Logan K, Tseng A, et al. Randomized trial of introduction of allergenic foods in breast-fed infants. N Engl J Med. 2016;374(18):1733–43. https://doi.org/10.1056/NEJMoa1514210
14. Güneş Bayır A, Can B, Ekingen Ş. Food allergy in children. Bezmialem Science. 2021;9(3):373–9. https://doi.org/10.14235/bas.galenos.2020.4097
15. Trogen B, Jacobs S, Nowak-Wegrzyn A. Early introduction of allergenic foods and the prevention of food allergy. Nutrients. 2022;14(13):2565. https://doi.org/10.3390/nu14132565
16. Akarsu A, Ocak M, Köken G, Şahiner ÜM, Soyer Ö, Şekerel BE. IgE mediated food allergy in Turkey: different spectrum, similar outcome. Turk J Pediatr. 2021;63(4):554–63. https://doi.org/10.24953/turkjped.2021.04.002