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Original Article

The risk factors for food allergy in infants with atopic dermatitis

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ABSTRACT

Background. There is a lack of information about which risk factors accompany food allergy (FA) in infants with atopic dermatitis (AD). We hypothesized that we would be able to predict FA through risk factors in infants with AD.

Methods. This prospective descriptive cross-sectional study was performed with infants aged 1-12 months with newly diagnosed AD. The SCORing Atopic Dermatitis (SCORAD) and Eczema Area and Severity Index (EASI), Infants' Dermatitis Quality Of Life (IDQOL), and Family Dermatological Life Quality (FDLQ) index scores were calculated at first admission. We developed a new tool, Sites of Eczema (SoE), to score sites of eczema on the body.

Results. A total of 279 infants with AD were included. FA was found in 166 (59.5%) infants with AD, of whom 112 had single and 54 had multiple FAs. The SCORAD index, EASI scores, IDQOL1, IDQOL2, and FDQL, and SoE scores were higher in the subgroup with FA compared to that without FA ($p<0.001$). In the multivariate regression model, eosinophil count (odds ratio [OR]=1.00, 95% confidence interval: [CI, 1.00-1.00]; p=0.008), serum total IgE level (OR=1.02, 95% CI: [1.00-1.03]; p=0.002), pruritus score (OR=0.87, 95% CI: [0.77-0.97]; p=0.019), SCORAD index (OR=1.04, 95% CI: [1.01-1.08]; p=0.008), FDQL index (OR=1.09, 95% CI: [1.01-1.18]; p=0.014), and SoE score (OR=1.48, 95% CI: [1.00-2.19]; p=0.046) were identified as the highest risk factors for FA in infants with AD.

Conclusions. Serum total IgE levels, eosinophil counts and ratio, SCORAD index and EASI scores, IDQOL and FDLQ index, pruritus and sleep disturbance scores, and SoE scores were identified as risk factors for FA in infants with AD in this study. The SoE score is an important risk factor for FA in infants with AD. We recommend that the risk factors for FA in patients with AD guide the management of these patients.

Key words: children, Eczema Area and Severity Index (EASI), Family Dermatological Life of Quality (FDLQ), Infants' Dermatitis Quality Of Life (IDQOL), SCORing Atopic Dermatitis (SCORAD), Sites of Eczema (SoE), total serum IgE.

Atopic dermatitis (AD) is the most common heterogeneous inflammatory skin disease, causing morbidity and a health burden in childhood. The prevalence of AD has increased in recent years up to an incidence of 15 to 20% among children. In addition to epidermal barrier dysfunction and immune dysregulation, other factors such as food allergy (FA) may also play a role in the etiopathogenesis of AD. FAs are seen more frequently in children with AD, as well as also being a factor that intensifies the severity and frequency of exacerbations of AD.[1-3]

AD management includes avoidance of individual trigger factors including food, using a moisturizer, and a step-up and step-down approach aimed at reducing inflammation according to the severity of the disease. The prevalence of FAs in patients with AD varies according to age and severity of AD. The

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prevalence of FAs is higher in infants with severe AD. FAs have been reported in 15% of children with mild-to-moderate AD. It has been reported that FA has been associated with children with moderate-severe and persistent AD in more than 50% of cases. Younger groups with AD are at a higher risk of FA.[4-6]

It is important to determine the diagnosis of FA, one of the obvious triggers for skin lesions and symptoms related to AD. Prompt and correct diagnosis of FA and food elimination will result in improvements in skin lesions, reduced drug use, and faster recovery times. It is not always easy to identify which infants have FA. AD and FA are often co-expressed, and the clinical manifestations of the two may overlap. The identification of possible factors that predict FA in infants with AD would be a useful guide in its management. There is also a lack of information in the literature about which risk factors accompany FA in infants with AD. In this study, we hypothesized that we would be able to predict FA through risk factors such as clinical findings, basic laboratory studies, and quality of life indices of infants with AD.

Material and Methods

Study design and population

This observational, descriptive, cross-sectional study was performed prospectively between January 2021 and February 2022. Parents of infants who presented to the Pediatric Allergy and Immunology Clinic as outpatients and who were newly diagnosed with AD were invited to participate in the study. We included the parents of infants aged 1-12 months who were selected to participate in this study based on the Hanifin-Rajka criteria.[7,8] Demographic features, skin prick test, serum total immunoglobulin (Ig)-E, specific IgE (SpIgE), and eosinophil count of patients were recorded.

The SCORing Atopic Dermatitis (SCORAD) index and Eczema Area and Severity Index (EASI) were calculated by the same physician (S.Ş.K.) at the first admission of the patients. In addition, Infants' Dermatitis Quality Of Life (IDQOL) and Family Dermatological Life of Quality (FDLQ) questionnaires were administered to the parents of the infants. Infants aged over 12 months, those diagnosed as having dermatosis, and infants with comorbidities such as primary immune deficiency were excluded. Infants whose parents were unable to understand the questions were also excluded.

The study was approved by the Ethics Committee of Dr. Sami Ulus Maternity and Children Training and Research Hospital (approval number: E-21/09-207).

Written informed consent was obtained from the parents for enrollment in the study.

Clinical scores

The clinical severity of eczema in infants with AD was evaluated using the SCORAD index and EASI.[9] The body surface area affected was calculated using the rule of nine for this index. SCORAD evaluates (1) the extent of the lesions, (2) the severity of the lesions with six clinical signs (erythema, edema/papulation, oozing/crust, excoriation, lichenification, xerosis), and (3) subjective items (including pruritus and sleep loss) using a visual analog scale (VAS). SCORAD has three sections - extent of illness, severity, and subjective symptoms, with a maximum possible score of 103. The severity of illness can be classified as mild (below 25 points), moderate (25-50 points), and severe (over 50 points) based on the SCORAD index.[10]

EASI is a tool used in the evaluation of four separate body regions (head/neck, trunk, upper and lower extremities) affected by erythema, induration/papulation/edema, excoriation, and lichenification. Each finding is scored between 0 and 3 according to the severity. The maximum possible EASI score is 72.[11]

The IDQOL questionnaire was administered to the parents. This contains 10 questions concerning symptoms and difficulties with mood, sleep (two questions), play, family activities, mealtimes, treatments, dressing, and

bathing. The maximum score for each question is 3, making a maximum possible score of 30. The higher the score, the greater the negative impact on the infant's quality of life. This questionnaire was identified as IDQOL1. There is an additional question that is scored separately, asking for the parents' own assessment of current dermatitis severity, giving a choice of four grades from none to extremely severe (0-4). These answers were identified as IDQOL2. This questionnaire has been validated in Turkish and is available on the official website of the university that conducted the questionnaire (www.cardiff.ac.uk).

The FDQL is used in the evaluation of the quality of life of parents of children affected by dermatologic diseases. The FDQL consists of 10 questions, each being scored between 0 and 3 depending on the severity (0 points none, 1 mild, 2 moderate, 3 severe). The maximum possible score is 30.[12] The Turkish language version of the FDLQ has been shown to exhibit high reliability and validity.[13]

The parents were asked to use a VAS to determine pruritus (range: 0-10) and sleep disturbance (range: 0-10).

Based on the eczema site, a simple new scoring was developed by modifying the EASI index for this study. The Sites of Eczema (SoE) system is a tool used in the evaluation each of four separate body regions (head/neck, trunk, upper and lower extremities). Each region was scored 1 point in the presence of eczema (Fig. 1).

Allergic assessment

The diagnosis of food allergy in AD is currently based on clinical history, skin prick tests (SPTs), or blood test screening, followed by an elimination diet and/or standardized oral food challenge (OFC). The presence of FA was confirmed in every child with a definite history of anaphylaxis and/or OFC.[14,15] Serum total IgE, food-specific IgE levels (Siemens Immulite 2000 CLIA-I, Germany), and eosinophil levels on peripheral smears (Beckman Coulter, Fullerton, CA, USA) were studied from blood samples.

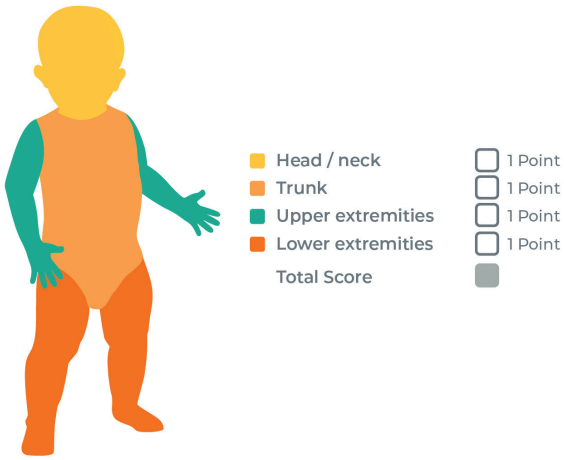

Fig. 1. Sites of eczema scores.

Sites of eczema (SoE) is a tool used in the evaluation of four separate body regions (head/neck, trunk, upper and lower extremities). Each region was scored 1 point in presence of eczema; the maximum score is 4.

SPTs were conducted with a panel including cow's milk, hen's egg, tree nuts, wheat, and soy (ALK-Abello, Madrid, Spain). Therewith, SPT was expanded individually to include each food suspected of allergy. Histamine (10 mg/mL) and saline were used as positive and negative controls, respectively. A positive SPT test was defined as a wheal with a mean diameter of at least 3 mm greater than that of the saline control.

Statistical analysis

Statistical analysis was performed using the SPSS version 26 software package. Categorical variables are shown as frequency and percentage values. The Kolmogorov–Smirnov test was used to determine whether the data conformed to normal distribution. Non-normally distributed numerical variables are presented as median and interquartile range. The chi-square and Fisher's exact tests were used to assess the differences between the frequency values. p values <0.05 were considered significant.

The sensitivity and specificity rates of the cut-off values of FA predictive factors in infants with AD were investigated using receiver operating characteristic (ROC) curve analysis. Youden's index was calculated to identify optimal cut-off points.

Factors emerging as statistically significant in the univariate binary logistic regression model were then evaluated in a multivariate binary logistic regression model. No clinically significant variable with a p-value between 0.25 and 0.05 for potential risk factors was found after univariate binary logistic regression. Due to the large number of variables, statistically non-significant (p>0.05) factors were excluded using the backward elimination method.

Results

A total of 279 infants with AD were included in this prospective, descriptive cross-sectional study (median age: 5 months, female/male ratio: 111/168). The median age of the infants was 5 months. One hundred seventy-nine (63.1%) of the infants were born via cesarean section delivery. Forty-eight percent of the infants had an allergic family history (mostly AD, followed by allergic rhinitis, asthma, urticaria, and drug allergy).

FAs were identified in 166 (59.5%) infants with AD, 112 of whom had single FAs and 54 had multiple FAs. The most common FAs were hen's egg, cow's milk, hazelnut, wheat, sesame, peanut, and walnut, respectively. The median eosinophil count was 450 count/mm^3, the percentage of eosinophils was 4.6%, and the median serum total IgE was 16.0 kU/L.

AD severity scores were measured. The median scores for pruritus and sleep disturbance were 7 and 4, respectively. The median SCORAD and EASI scores were 46 and 8, respectively. The median IDQOL1 and FDLQ scores were 10 and 12, respectively. The most frequent locations of eczema in infants with AD were the head/neck, trunk, the upper and lower extremities, in descending order.

The enrolled 279 infants with AD were further divided into two subgroups according to the presence of FA, 116 with FA and 113 without FA. Sex, age, delivery history, allergic family history, and type were compared, and the results were statistically similar between the subgroups (p>0.05).

When these two groups were further compared, eosinophil count and ratio, and serum total IgE levels were significantly higher in the subgroup with FA (p<0.001). Pruritus and sleep disturbance scores were also higher in the subgroup with FA (p<0.001 and p=0.023, respectively). The SCORAD index was higher in the subgroup with FA (median index 48 and 38, respectively; p<0.001). EASI scores were also higher in the subgroup with FA (median index 10 and 5, respectively; p<0.001). The quality of life of parents of children affected by AD was also evaluated according to the presence or absence of FA. IDQOL1 (median 11 and 8), IDQOL2 (median 3 and 2), and FDQL (median 14 and 9) scores in these FA subgroups were also measured, respectively (p<0.001).

When the FA subgroups were compared, even though the numbers of infants with eczema on the head/neck were the same, the numbers of lesions located on the trunk, and upper and lower extremities were higher in the FA-positive subgroup (p=0.016, p=0.001, and p=0.001, respectively). When the number of patients scoring 1 to 4 points on the SoE in the subgroups was compared, the number of patients scoring 2, 3, and 4 was higher in the FA-positive subgroup (p<0.001). The median SoE scores were higher in the subgroup with FA compared with the FA-negative subgroup (2 and 1, respectively; p<0.001). The demographic data and clinical features of the study groups and subgroup comparisons are shown in Table I.

Factors that predicted FA in infants with AD in the univariate regression model are shown in Table II: Serum total IgE, eosinophil count, eosinophil ratio, pruritus scores, sleep disturbance scores, SCORAD index, EASI scores, IDQOL1 index, IDQOL2 index, FDLQ index, and SoE scores, were identified as risk factors for FA in infants with AD. Age, sex, type of delivery, and familial history of allergy were not identified as risk factors for FA (p>0.05).

Factors that predicted FA in infants with AD in the multivariate regression model are shown

Table I. Demographic, laboratory findings, and clinical scores of all infants with AD and subgroups according to FA.

	Atopic dermatitis (overall) (n=279)	Food allergy (n=166)	No food allergy (n=113)	P value
Gender, n (%)				0.991
Female	111 (39.8)	66 (39.8)	45 (39.8)	
Male	168 (60.2)	100 (60.2)	68 (60.2)	
Age, months, median (IQR)	5 (3)	5 (2)	5 (3)	0.663**
Delivery, n (%)				0.348*
Caesarean	176 (63.1)	101 (60.8)	75 (66.4)	
Vaginal	103 (36.9)			
Allergic disease history in the family, n (%)	134 (48.0)	89 (53.6)	45 (39.8)	0.024*
Type of allergic disease history in the family (n=134), n (%)				0.394***
Atopic dermatitis	69 (51.5)	46 (51.7)	23 (51.1)	
Allergic rhinitis	35 (26.1)	2 (27.0)	11 (24.4)	
Asthma	15 (11.2)	9 (10.1)	6 (13.3)	
Urticaria	10 (7.5)	5 (5.6)	5 (11.1)	
Drug allergy	5 (3.7)	5 (5.6)	0	
Food allergy, n (%)				
Total of patients	166 (59.5)			
Single food allergy,	112 (40.1)	112 (67.5)		
Multiple food allergy, n (%)	54 (19.4)	54 (32.5)		
Type of food allergy, n (%)				
Hen's egg	151 (54.1)	151 (91.0)		
Cow's milk	45 (16.1)	45 (27.1)		
Hazelnut	12 (4.3)	12 (7.2)		
Wheat	8 (2.9)	8 (4.8)		
Sesame	8 (2.9)	8 (4.8)		
Peanut	7 (2.5)	7 (4.2)		
Walnut	6 (2.2)	6 (3.6)		
Eosinophil count (/mm^3), median (IQR)	450 (420)	555 (500)	390 (225)	<0.0001**
Eosinophil (%), median (IQR)	4.6 (3.5)	5.2 (3.8)	3.9 (2,4)	<0.0001**
Serum total IgE (IU/mL), median (IQR)	16.0 (23.2)	17.1 (32.8)	7.7 (12.8)	<0.0001**
Pruritus scores, median (IQR)	7 (3)	8 (2)	6 (4)	<0.0001**
Sleep disturbance scores, median (IQR)	4 (7)	4 (8)	2 (6)	0.023**
SCORAD scores, median (IQR)	46 (27)	48 (23)	38 (28.5)	<0.0001**
SCORAD index scores, n (%)				
Mild (<25)	35 (12.5)	4 (2.4)	31 (27.4)	
Moderate (25-50)	130 (46.6)	83 (50.0)	47 (41.6)	<0.0001*
Severe (>50)	114 (40.9)	79 (47.6)	35 (31.0)	
EASI scores, median (IQR)	8 (11)	10 (10.5)	5 (10)	<0.0001**
IDQOL1 scores, median (IQR)	10 (8)	11 (7.2)	8 (10.5)	<0.0001**
IDQOL2 scores, median (IQR)	3 (2)	3 (1)	2 (1)	<0.0001**
FDLQ scores, median (IQR)	12 (10)	14 (9)	9 (9)	<0.0001**
Sites of eczema, n (%)				
Head/neck	221 (79.2)	135 (81.3)	86 (76.1)	0.292*
Trunk	128 (45.9)	86 (51.8)	42 (37.2)	0.016*
Upper extremities	111 (39.8)	80 (48.2)	31 (27.4)	0.001*
Lower extremities	115 (41.2)	85 (51.2)	30 (26.5)	0.001*
SoE scores, n (%)				<0.0001*
1 point	98 (35.1)	33 (19.9)	65 (57.5)	
2 point	95 (34.1)	68 (41.0)	27 (23.9)	
3 point	56 (20.1)	42 (25.3)	14 (12.4)	
4 point	30 (10.8)	23 (13.9)	7 (6.2)	
SoE scores, median (IQR)	2 (1-4)	2 (1-4)	1 (1-4)	<0.0001**

*Chi-square test, **Mann Whitney U test, *** Fisher's exact test

EASI: eczema area and severity index, FA: food allergy, FDLQ: family dermatology life quality index IDQOL: infants' dermatitis quality of life index, IQR: interquartile range, SCORAD: severity scoring of atopic dermatitis, SoE: sites of eczema

Table II. Univariate regression model: the analysis of risk factors for food allergy in children with atopic dermatitis.

Risk factors	OR (95% CI)	p value
Gender	1.270 (0.771-2.093)	0.348
Age	1.079 (0.920-1.266)	0.348
Type of delivery	0.857 (0.409-1.796)	0.683
Familial history of allergy	1.051 (0.515-2.145)	0.891
Serum total IgE	1.029 (1.014-1.044)	<0.0001
Eosinophil count	1.002 (1.001-1.003)	<0.0001
Eosinophil (%)	1.209 (1.100-1.329)	<0.0001
Pruritus score	1.351 (1.201-1.520)	<0.0001
Sleep disturbance score	1.082 (1.010-1.158)	0.025
SCORAD index	1.044 (1.027-1.062)	<0.0001
EASI score	1.078 (1.040-1.118)	<0.0001
IDQOL1 score	1.101 (1.052-1.153)	<0.0001
IDQOL2 score	2.347 (1.722-3.199)	<0.0001
FDLQ score	1.151 (1.098-1.208)	<0.0001
SoE score	2.153 (1.614-2.872)	<0.0001

Cl: confidence interval, EASI: eczema area and severity index, FDLQ: family dermatology life quality index IDQOL: infants' dermatitis quality of life index, OR: odds ratio, SCORAD: severity scoring of atopic dermatitis, SoE: sites of eczema

Table III. Multivariate regression model: the analysis of risk factors for food allergy in children with atopic dermatitis.

Risk factors	OR (95% CI)	p value
Eosinophil count	1.001 (1.000-1.002)	0.008
Serum total IgE	1.021 (1.008-1.034)	0.002
Pruritus score	0.871 (0.777-0.978)	0.019
SCORAD index	1.049 (1.012-1.086)	0.008
EASI score	0.954 (0.888-1.005)	0.072
FDLQ score	1.098(1.019-1.183)	0.014
SoE score	1.487 (1.007-2.196)	0.046

Cl: confidence interval, EASI: eczema area and severity index, FDLQ: family dermatology life quality index IDQOL: infants' dermatitis quality of life index, OR: odds ratio, SCORAD: severity scoring of atopic dermatitis, SoE: sites of eczema

in Table III: Eosinophil counts, serum total IgE levels, pruritus scores, SCORAD index, FDQL index, and SoE scores were identified as the greatest risk factors for FA in infants with AD.

The ratios of the sensitivity and specificity of the cut-off values of FA predictive factors are shown in Table IV. The largest areas under the ROC curve (AUC) belonged to, in descending order, total IgE levels, FDQL scores, and SoE scores.

Discussion

This study evaluated the risk factors for FA in infants with AD. In the univariate regression model, serum total IgE levels, eosinophil counts, the eosinophil ratio, pruritus scores, sleep disturbance scores, SCORAD index, EASI scores, IDQOL1 index, IDQOL2 index, FDLQ index, and SoE scores were determined as risk factors in our study group. In the multivariate regression model, eosinophil count, serum total IgE levels, pruritus scores, the SCORAD index, FDQL index, SoE scores were associated with highest risk for FA in infants with AD. We suggest that if there is a presence of risk factors in infants with AD, detailed diagnostic tests should be performed to investigate FA.

AD is the most common heterogeneous inflammatory skin disease, with an incidence of 15 to 20% among children.[3] AD and FA are often co-expressed. FA has been reported in 15% of children with mild-moderate AD. FA has been associated with children with moderate-severe AD in more than 50% of cases. Infants with AD are at a particularly higher risk of FA.[4-6,16] This study represents an important guide for determining patients with FA in AD cases in infancy. AD requires long-term follow-up and care despite skin moisturizing, topical anti-inflammatory treatments, and nevertheless often does not heal completely. Infants with moderate-to-severe AD experience eczema, itching, and psychosocial problems.[17] Timely and accurate diagnosis of FAs is extremely important in these cases in clinical practice. The factors that facilitate the clinical decision of FA in terms of infant AD are presented in the present study.

Table IV. Cut-off values of predictive factors of food allergy and their sensitivity and specificity values in infants with atopic dermatitis.

Risk factors	Sensitivity (%)	Specificity (%)	AUC (95% CI)	p
Eosinophil count (/mm^3) >417	69.9	63.7	0.689 (0.626-0.752)	<0.0001
Serum total IgE (IU/mL) >13.1	71.1	63.7	0.732 (0.673-0.792)	<0.0001
Eosinophil (%) >4.3	66.9	60.2	0.670 (0.606-0.734)	<0.0001
SCORAD index > 44	63.9	58.4	0.680 (0.615-0.745)	<0.0001
IDQOL1 score >9	59.0	61.1	0.668 (0.600-0.736)	<0.0001
IDQOL2 score >2	78.9	53.1	0.686 (0.622-0.750)	<0.0001
FDLQ score>11	65.1	61.1	0.717 (0.654-0.779)	<0.0001
Sleep disturbance score >3	60.2	57.5	0.577 (0.509-0.646)	0.028
Pruritus score >6	64.5	66.4	0.678 (0.612-0.744)	<0.0001
EASI score >7	62.7	59.3	0.690 (0.624-0.756)	<0.0001
SoE score >1	80.1	57.5	0.698 (0.634-0.762)	<0.0001

AUC: area under the receiver operating characteristic (ROC) curve, CI: confidence interval, EASI: eczema area and severity index, FDLQ: family dermatology life quality index, IDQOL: infants' dermatitis quality of life index, OR: odds ratio, SCORAD: severity scoring of atopic dermatitis, SoE: sites of eczema

This study determined the cut-off values of risk factors that predicted FA in infants with AD. The sensitivity and specificity ratios of these factors may be a useful guide in clinical practice. In our study, Serum total IgE levels, FDLQ scores, and SoE scores were determined as the factors with the highest AUC values.

The prevalence of FA in children with AD is markedly higher than in children without eczema. The presence of eczema has been identified as one of the powerful risk factors for FA. In the HealthNuts cohort from Australia, the authors found that by 12 months of age, infants with eczema were 11 times more likely to develop peanut allergy and 5.8 times more likely to develop egg allergy, compared with infants without eczema.[18] We determined at least one FA in 59.5% of infants with AD in our study. The prevalence of FA is especially high in infants with moderate-severe AD. Most of our patients were infants with moderate and severe AD. Hen's egg (54.1%) and cow's milk FAs (16.1%) were the most frequent allergies. Other FAs detected included hazelnut, wheat, sesame, peanut, and walnut. Hen's egg and cow's milk have been observed most frequently in the literature.[18,19] We consider that the lower rate of peanut allergy in the present study than in the previous literature is due to the lower consumption of peanuts in Türkiye.

Several scoring systems have been developed to describe the clinical severity of AD. The SCORAD index is the most widely used and is frequently used in daily practice. The SCORAD index of infants with AD with FA was statistically significantly higher than those without FA in this study. Similarly, the number of infants with moderate-severe AD with FA was statistically significantly higher than those without FA. In a recently published article, the SCORAD index of infants with AD with FA was statistically significantly higher than that of those without FA, consistent with the present study. In addition, the prevalence of FA was higher in infants with moderate-severe AD than in those with mild AD.[17,20] EASI scoring is the second most frequently used system in children and adults, as recommended by Hanifin et al.[11] EASI scores were higher in infants with FAs in the present study.[21] The severity of eczema increases in patients with AD with FAs.

A new scoring system was employed in this study. SoE scores, a system designed for this study, were significantly higher in infants with AD with FA. Although there was no difference

between the subgroups with and without FA in terms of the presence of eczema in the head/neck region, infants with FA had significantly more eczema in the trunk, and upper and lower extremities. We determined that the presence of eczema in the head/neck region alone was not a risk factor for FA. In contrast, the risk of FA increases significantly in case of eczema in at least two regions. In the children with AD, eczema was common in areas that were exposed to the open air, including the cheeks and neck. Factors such as dry skin and irritation of the exposed areas lead to a disposition to eczema. However, in the presence of eczema on the trunk, legs, and arms, which are parts of the body less exposed to trauma, the risk of accompanying FA increases. We believe this will represent a practical clue to FA in infants with AD.[1,3]

The rate of cesarean birth and familial allergic disease history was significantly higher in infants with AD in the present study. Eosinophil counts and serum total IgE levels were significantly higher in the subgroup with FA. The pruritus and sleep loss scores evaluated according to the VAS were also higher in the subgroup with FA.

This study evaluated the IDQOL index, a quality of life score, and FDLQ, a family quality of life score, in infants with AD. Both scores were higher in infants with AD with FA compared with those without FA. The quality of life of the infant and parents was adversely affected in line with the clinical severity of eczema. Although family members of patients with dermatologic diseases experience many physical, social, and mental problems, this secondary effect is often neglected. Care and treatment costs impose extra burdens on family members, and emotional stress and social restriction may cause disruptions in family functioning. Additionally, family members may experience work-life problems due to the care and treatment of the patient. In addition to causing significant financial losses, this situation can lead to the deterioration of family harmony. The secondary effect on the family varies according to the diagnosis, duration, severity of the skin disease, the age of the patient, and especially depending on the relationships between the patients' family members. Healthcare providers should consider the magnitude of this secondary effect when presenting treatment plans and decisions to patients and families or conducting research.[22-24]

There are a number of limitations to this study. First, we observed an association between FA and the site of the eczema lesion in children with AD in clinical practice. We then established the SoE scoring system for the first time, and have provided a simple description of how this was applied in the present paper. We calculated SoE scores for our patients with AD. The data obtained were then presented as a preliminary scoring system. No comparison was performed with other scoring systems, for which reason validation with objective and more numerous data is required. Second, this study reveals that various factors are capable of predicting FA. However, the fact that the OR values of the risk factors identified in this study were statistically significant does not necessarily mean that they are important in clinical practice. However, further studies are now needed in order for these factors to guide the decision-making process in diagnosis and treatment management in children with AD in clinical practice.

In conclusion, FA has a negative effect that impacts the clinical severity and spread of eczema in infants with AD, as well as their quality of life. Early and accurate diagnosis of FA is very important in the follow-up of these patients. Serum total IgE levels, eosinophil counts and ratios, SCORAD index and EASI scores, IDQOL and FDLQ indexes, pruritus, and sleep disturbance scores were identified as risk factors for FA in infants with AD in this study. A new SoE score, a tool scored according to the sites of eczema on the body, was developed. SoE scores were found to constitute an important risk factor for FA in infants with AD. We consider that risk factors for FA in patients with AD will be a useful guide in the management of these patients.

Ethical approval

The study was approved by the Ethics Committee of Dr. Sami Ulus Maternity and Children Training and Research Hospital (approval number: E-21/09-207). Written informed consent was obtained from the parents for enrollment in the study.

Author contribution

The authors confirm contribution to the paper as follows: study conception and design: ZA, SŞK; data collection: ZA, SŞK; analysis and interpretation of results: ZA, SŞK, SÖ; draft manuscript preparation: ZA, SŞK, SÖ. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of interest

The authors declare that there is no conflict of interest.

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