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# Severity of disease and the quality of life indexes in infants with atopic dermatitis

**Seda Şirin Köse[a]*, Zülfikar Akelma[a,b], Serap Özmen[a,c]**

[a]*Pediatric Allergy and Immunology Clinic, Dr. Sami Ulus Maternity and Children Training and Research Hospital, Ankara, Turkey*
[b]*Department of Pediatric Allergy and Immunology, Ankara Yıldırım Beyazıt University, Ankara, Turkey*
[c]*Department of Pediatric Allergy and Immunology, Health Science University, Ankara, Turkey*

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**KEYWORDS**
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**Abstract**
*Background*: Atopic dermatitis (AD) is a chronic, relapsing, inflammatory skin disease. In this study, the relationship between the severity of AD and the quality of life (QoL) of patients and their families were evaluated; also, the factors that predict the severity of AD and the QoL index were determined.
*Methods*: Infants with AD were enrolled in the study. Pruritus, sleep disturbance, and dermatitis severity scores were obtained. The QoL of infants was assessed using the Infants' Dermatitis Quality of Life Index (IDQOL), while the Family Dermatology Life Quality Index (FDLQI) was used to assess the impact of disease on the QoL of parents.
*Results*: 122 patients diagnosed with AD were enrolled in the study. The correlation analysis of score showed a positive correlation between IDQOL and FDLQI ($r = 0.444$, $p < 0.0001$). Positive correlations between the pruritus, sleep disturbance, Severity Scoring of Atopic Dermatitis (SCORAD), Eczema Area and Severity Index (EASI), and dermatitis severity scores and the QoL indexes were found. While pruritus, sleep disturbance scores, and EASI were the most significant parameters for predicting a severe SCORAD score, IDOQL, FDLQI, and SCORAD were the most significant parameters for predicting severe EASI. In the analysis of QoL indexes, sleep disturbance and FDLQI were the most significant parameters for predicting severe IDQOL index, while IDQOL was the most significant parameter for predicting severe FDLQI scores.
*Conclusions*: AD has a negative effect on the QoL of infants and their parents. Pruritus and sleep disturbance should be evaluated during clinical practice due to their strong relationship with disease severity and QoL index.


***Corresponding author**: Seda Sirin Kose. Department of Pediatric Allergy and Immunology, Dr. Sami Ulus Maternity and Children Training and Research Hospital, 06060 Ankara, Turkey. *Email address*: sedasirin85@yahoo.com

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## Introduction

Atopic dermatitis (AD) is a chronic, relapsing, inflammatory skin disease. It is the most common chronic dermatitis in children. The disease onset occurs in the first year of life in 60% of the cases.[1]

While Hanifin and Rajka criteria are the gold standard for diagnosis of AD, various scoring systems such as Severity Scoring of Atopic Dermatitis (SCORAD) and Eczema Area and Severity Index (EASI) are also used to determine the severity of AD.[2-5]

As expected in all chronic diseases, AD has a significant impact not only on the quality of life (QoL) of patients but also on the QoL of their caregivers.[6-8] Recently, different indexes are used to determine patients' own perception of illness and its effects on day-to-day life.[9] The Dermatology Life Quality Index, the Children's Dermatology Life Quality Index, and the Infants Dermatitis Quality of Life Index (IDQOL) are the most common indexes used depending on the age of the patients.[6,10,11] To determine the impact of dermatological diseases on the QoL of caregivers, the Family Dermatology Life Quality Index (FDLQI) has been used in previous studies.[6,10-12] Although it is well-known that there is a significant correlation between the severity of AD and the QoL, data on predicting the severity of disease and QoL index are limited.

In this study, we aimed to evaluate the relationship between the severity of AD and QoL of patients and their families and determine the factors that predict the severity of AD and QoL index.

## Methods

The study was conducted at the Department of Pediatric Allergy and Immunology, Dr. Sami Ulus Maternity and Children Training and Research Hospital, between March 2021 and June 2021. Infants diagnosed with AD were enrolled in the study. Patients older than 1 year of age with a systemic disease and mild SCORAD index (<25) were excluded. The questionnaires were completed by the parents. Parents who were unable to understand the questions were excluded.

The diagnosis of AD was established according to Hanifin and Rajka criteria.[2] The diagnosis of food allergy was assessed by medical history, physical examination, and oral food challenge test or laboratory findings with a positive skin-prick test. Demographic characteristics and familial history of allergy were recorded.

The visual analogue scale was used to determine pruritus (range: 0–10) and sleep disturbance (range: 0–10). Dermatitis severity scores (range: 0–4), SCORAD (range: 0–103), and EASI (range: 0–72) were performed to determine severity symptoms of AD by the same pediatric allergist. Dermatitis severity score above 3, SCORAD score above 50 points, and EASI score above 21 were considered severe.[3,5,13]

The QoL of infants with AD were assessed using IDQOL (range: 0–30), which was designed to be completed by parents. FDLQI (range: 0–30) was used to assess the impact of the AD of infants on the QoL of their parents. IDQOL and FDLQI scores above 20 points were considered severe.[12,13]

### *Ethics approval*

The study protocol was designed in compliance with the Declaration of Helsinki, 1964. The study was approved by the Ethics Committee of Dr. Sami Ulus Maternity and Children Training and Research Hospital (approval number: E-21/02-098). Written informed consent was obtained from the parents upon enrollment in the study.

### *Statistical analysis*

Categorical data were expressed as number and percentage (%), while quantitative variables were expressed as mean ± standard deviation, minimum and maximum values, and median. The normality of continuous variables was determined using the Shapiro–Wilk test. Spearman correlation analysis was used to evaluate the relationship between two numerical values. A correlation coefficient (r) smaller than 0.3 indicates a weak correlation, values between 0.3 and 0.7 indicate a moderate correlation, and a value larger than 0.7 suggests a strong correlation. The association between scores was analyzed by using univariate and multivariate logistic regression. All statistical tests were performed using the IBM SPSS Statistics (Version 22 Armonk, NY: IBM Corp.) software package and MedCalc v12.5 software. A two-tailed p-value of <0.05 was considered significant.

## Results

A total of 122 patients diagnosed with AD were enrolled in the study. Of these, 56 (45.9%) were female and 66 (54.1%) were male. The mean age of the study group participants was 5.4 ± 2.3 (2–11) months. Fifty-six (45.9%) patients had familial history of allergy (Table 1).

Seventy-eight patients (63.9%) had food allergy, with 54 (44.3%) and 24 (19.7%) having single food allergy and multiple food allergy, respectively. The most common food allergy was to hen's egg (Table 1).

Pruritus, sleep disturbance and dermatitis severity scores, SCORAD and EASI scores were calculated for all patients. The means of these scores are presented in Table 1. Eighty-eight (72.1%) patients had severe SCORAD score while severe EASI score was found in 20 (16.4%) patients.

The QoL index in infants was evaluated using the IDQOL index, while FDLQI was administered to determine the QoL of their parents. Severe IDOQL and severe FDLQI were found in 14 (11.5%) and 12 (9.8%) infants, respectively (Table 1).

The correlation analysis of score showed a positive correlation between IDQOL and FDLQI ($r = 0.444$, $p < 0.0001$) (data not shown). There were positive correlations between the pruritus, sleep disturbance, SCORAD, EASI, and dermatitis severity scores and the QoL indexes (IDQOL and FDLQI). In all correlation analyses, a moderate association was found except for those between EASI, sleep disturbance scores, and IDQOL (Table 2).

In logistic regression analysis of scores, a positive association was seen between pruritus, sleep disturbance, dermatitis severity scores, EASI, IDQOL, FDLQI, and severe SCORAD scores. Pruritus, sleep disturbance scores, and EASI

**Table 1** Demographic characteristics and clinical scores of all subjects.

| Parameters | All patients (N = 122) |
|---|---|
| Gender (F/M), n (%) | 56 (45.9)/66 (54.1) |
| Age (month), mean ± SD (min-max) median | 5.4 ± 2.3 (2-11) 5.0 |
| Type of delivery (Vaginal/C/S), n (%) | 78 (63.9)/44 (36.1) |
| Familial history of allergy, n (%) | 56 (45.9) |
| Atopic dermatitis | 26 (21.3) |
| Allergic rhinitis | 15 (12.3) |
| Asthma | 9 (7.4) |
| Urticaria | 4 (3.3) |
| Drug allergy | 2 (1.6) |
| Food allergy, n (%) | 78 (63.9) |
| Single food allergy | 54 (44.3) |
| Multiple food allergy | 24 (19.7) |
| Type of allergy, n (%) | |
| Hen's egg allergy | 74 (60.7) |
| Cow's milk allergy | 20 (16.4) |
| Wheat allergy | 6 (4.9) |
| Peanut allergy | 4 (3.3) |
| Walnut allergy | 3 (2.5) |
| Hazelnut allergy | 2 (1.6) |
| Sesame allergy | 1 (0.8) |
| Seborrheic dermatitis | 62 (50.8) |
| Scores | |
| Pruritus, mean ± SD (min-max) median | 7.1 ± 2.3 (0-10) 8.0 |
| Sleep disturbance, mean ± SD (min-max) median | 5.7 ± 3.2 (0-10) 6.0 |
| Dermatitis severity score, mean ± SD (min-max) median | 3.2 ± 0.8 (1-4) 3.0 |
| Severe dermatitis severity score (>3), n (%) | 58 (47.5) |
| SCORAD, mean ± SD (min-max) median | 57.6 ± 11.1 (38-84) 55.5 |
| Severe SCORAD (>50), n (%) | 88 (72.1) |
| EASI, mean ± SD (min-max) median | 14.2 ± 8.5 (4-47) 12.5 |
| Severe EASI (>21), n (%) | 20 (16.4) |
| IDQOL, mean ± SD (min-max) median | 14.1 ± 4.6 (6-26) 14.0 |
| Severe IDQOL (>20), n (%) | 14 (11.5) |
| FDLQI, mean ± SD (min-max) median | 14.8 ± 4.7 (2-27) 15.0 |
| Severe FDLQI (>20), n (%) | 12 (9.8) |

F: female, M: male, SD: standard deviation, min: minimum, max: maximum, C/S: cesarean section, SCORAD: severity scoring of atopic dermatitis, EASI: eczema area and severity index, IDQOL: infants' dermatitis quality of life index, FDLQI: family dermatology life quality index.

**Table 2** Correlation analysis of scores.

| Parameters | Pruritus | Sleep disturbance | SCORAD | EASI | Dermatitis severity score |
|---|---|---|---|---|---|
| IDQOL | r = 0.455 | r = 0.617 | r = 0.483 | r = 0.190 | r = 0.220 |
| | p < 0.0001 | p < 0.0001 | p < 0.0001 | p = 0.036 | p = 0.015 |
| FDLQI | r = 0.352 | r = 0.395 | r = 0.392 | r = 0.412 | r = 0.417 |
| | p < 0.0001 | p < 0.0001 | p < 0.0001 | p < 0.0001 | p < 0.0001 |

SCORAD: severity scoring of atopic dermatitis, EASI: eczema area and severity index, IDQOL: infants' dermatitis quality of life index, FDLQI: family dermatology life quality index.

were the most significant parameters for predicting severe SCORAD score with multivariate regression model (Table 3).

Logistic regression analysis of scores for the prediction of severe EASI (>21) showed a positive relationship with dermatitis severity score, SCORAD score, and IDOQL and FDLQI scores, and SCORAD was the most significant parameter for predicting severe EASI (OR:1.143 (1.080-1.210), p<0.0001) (Table 4).

Severe dermatitis severity score (>3) had a positive relationship with food allergy, pruritus, SCORAD, EASI,

**Table 3** Logistic regression analysis of parameters for the prediction of severe SCORAD (>50) score.

| Parameters | Univariate regression model | | Multivariate regression model | |
|---|---|---|---|---|
| | OR (95% CI lower-upper) | p-value | OR (95% CI lower-upper) | p-value |
| Gender | 2.063 (0.923-4.613) | 0.078 | | |
| Age | 1.034 (0.865-1.237) | 0.713 | | |
| Type of delivery | 0.955 (0.418-2.182) | 0.912 | | |
| Familial history of allergy | 1.833 (0.809-4.155) | 0.146 | | |
| Food allergy | 1.905 (0.848-4.278) | 0.119 | | |
| Seborrheic dermatitis | 1.232 (0.558-2.722) | 0.606 | | |
| Pruritus | 1.689 (1346-2.117) | **<0.0001** | 1.881 (1.371-2.582) | <0.0001 |
| Sleep disturbance | 1.430 (1.228-1.666) | **<0.0001** | 1.549 (1.252-1.916) | <0.0001 |
| EASI | 1.181 (1.086-1.284) | **<0.0001** | 1.189 (1.060-1.353) | 0.003 |
| Dermatitis severity score | 2.064 (1.261-3.379) | **0.004** | | |
| IDQOL | 1.291 (1.143-1.459) | **<0.0001** | | |
| FDLQI | 1.219 (1.101-1.351) | **<0.0001** | | |

OR: odds ratio, Cl: confidence interval, EASI: eczema area and severity index, IDQOL: infants' dermatitis quality of life index, FDLQI: family dermatology life quality index.
Bold values: statistical significance at the p < 0.05 level.

**Table 4** Logistic regression analysis of parameters for the prediction of severe EASI (>21) score.

| Parameters | Univariate regression model | | Multivariate regression model | |
|---|---|---|---|---|
| | OR (95% CI lower-upper) | p-value | OR (95% CI lower-upper) | p-value |
| Gender | 1.717 (0.633-4.656) | 0.288 | | |
| Age | 1.051 (0.854-1.294) | 0.640 | | |
| Type of delivery | 0.638 (0.242-1.686) | 0.365 | | |
| Familial history of allergy | 1.548 (0.591-4.058) | 0.374 | | |
| Food allergy | 1.385 (0.491-3.909) | 0.538 | | |
| Seborrheic dermatitis | 0.962 (0.369-2.508) | 0.936 | | |
| Pruritus | 1.262 (0.972-1.640) | 0.081 | | |
| Sleep disturbance | 1.083 (0.924-1.270) | 0.324 | | |
| SCORAD | 1.143 (1.080-1.210) | **<0.0001** | 1.143 (1.080-1.210) | <0.0001 |
| Dermatitis severity score | 2.493 (1.157-5.372) | **0.020** | | |
| IDQOL | 1.112 (1.002-1.234) | **0.046** | | |
| FDLQI | 1.176 (1.043-1.326) | **0.008** | | |

OR: odds ratio, Cl: confidence interval, SCORAD: severity scoring of atopic dermatitis, IDQOL: infants' dermatitis quality of life index, FDLQI: family dermatology life quality index.
Bold values: statistical significance at the p < 0.05 level.

IDQOL, and FDLQI. Multivariate regression model showed that the most significant parameters to predict severe dermatitis severity score were food allergy, SCORAD, and FDLQI (Table 5).

Logistic regression analysis of severe IDQOL (>20) index showed a positive relationship with age, pruritus, sleep disturbance, SCORAD, and FDLQI. Sleep disturbance and FDLQI were the most significant parameters to predict severe IDQOL index (Table 6).

A positive relationship was found between sleep disturbance, EASI, IDQOL, and severe FDLQI (>20). IDQOL was the most significant parameter to predict severe FDLQI (OR: 1.191 (0.991-1.126), p = 0.017) (Table 7).

## Discussion

We found that there is a significant relationship between disease severity and QoL index of parents and their infants aged between 0 and 1 year with atopic dermatitis. While IDQOL was the most significant parameter to predict severe FDQOL, FDQOL was almost identical with regard to the best prediction of severe IDQOL. Moreover, we found a positive correlation between different scoring indexes used to determine the severity of atopic dermatitis. The strength of this study is the exclusion of infants with mild SCORAD. We believe that the exclusion of mild AD helped

**Table 5** Logistic regression analysis of parameters for the prediction of severe dermatitis severity score (>3).

| Parameters | Univariate regression model | | Multivariate regression model | |
|---|---|---|---|---|
| | OR (95% CI lower-upper) | p-value | OR (95% CI lower-upper) | p-value |
| Gender | 1.086 (0.532-2.216) | 0.821 | | |
| 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 | | |
| Food allergy | 2.773 (1.276-6.027) | **0.010** | 2.571 (1.048-6.303) | 0.039 |
| Seborrheic dermatitis | 0.824 (0.404-1.678) | 0.593 | | |
| Pruritus | 1.236 (1.038-1.471) | **0.018** | | |
| Sleep disturbance | 1.121 (0.998-1.259) | 0.054 | | |
| SCORAD | 1.088 (1.044-1.133) | **<0.0001** | 1.063 (1.017-1.111) | 0.007 |
| EASI | 1.103 (1.045-1.164) | **<0.0001** | | |
| IDQOL | 1.129 (1.038-1.228) | **0.005** | | |
| FDLQI | 1.210 (1.100-1.331) | **<0.0001** | 1.175 (1.065-1.296) | 0.001 |

OR: odds ratio, Cl: confidence interval, SCORAD: severity scoring of atopic dermatitis, EASI: eczema area and severity index, IDQOL: infants' dermatitis quality of life index, FDLQI: family dermatology life quality index.
Bold values: statistical significance at the $p < 0.05$ level.

**Table 6** Logistic regression analysis of parameters for the prediction of severe IDQOL (>20) index.

| Parameters | Univariate regression model | | Multivariate regression model | |
|---|---|---|---|---|
| | OR (95% CI lower-upper) | p-value | OR (95% CI lower-upper) | p-value |
| Gender | 1.149 (0.374-3.537) | 0.808 | | |
| Age | 1.396 (1.106-1.762) | **0.005** | | |
| Type of delivery | 1.471 (0.433-4.999) | 0.537 | | |
| Familial history of allergy | 1.204 (0.395-3.668) | 0.744 | | |
| Food allergy | 0.375 (0.121-1.163) | 0.089 | | |
| Seborrheic dermatitis | 1.333 (0.433-4.102) | 0.616 | | |
| Pruritus | 1.461 (1.027-2.079) | **0.035** | | |
| Sleep disturbance | 1.684 (1.214-2.316) | **0.002** | 1.488 (1.032-2.144) | **0.033** |
| SCORAD | 1.065 (1.013-1.119) | **0.013** | | |
| EASI | 1.029 (0.969-1.093) | 0.352 | | |
| Dermatitis severity score | 1.932 (0.849-4.395) | 0.116 | | |
| FDLQI | 1.338 (1.129-1.585) | **0.001** | 1.219 (1.018-1.460) | **0.031** |

OR: odds ratio, Cl: confidence interval, SCORAD: severity scoring of atopic dermatitis, EASI: eczema area and severity index, FDLQI: family dermatology life quality index.
Bold values: statistical significance at the $p < 0.05$ level.

us better determine the relationship between disease severity and QoL indexes.

In a study evaluating the QoL and disease severity in patients with atopic dermatitis, a positive correlation was found between the IDQOL and SCORAD scores among 71 patients aged between 0 and 4 years.[14] A recent study reported a higher IDQOL in patients with active AD compared to patients in remission.[15] Similarly, we also found a positive correlation between the SCORAD and IDQOL scores. Previously, QoL in patients and their caregivers was investigated by Siafaka et al.[11] Just as we did, they showed a significant relationship between patients' and their parents' QoL scores. However, we found a higher IDQOL (14.1 ± 4.6) compared to the one by Siafaka et al. (6.67 ± 5.30), which is likely to be related to our inclusion criteria.[11] We excluded patients with mild SCORAD. As expected, the mean SCORAD score was 56.7 ± 11.1 in our study versus 44.05 ± 22.41 in the abovementioned study.

We found a significant relation between sleep disturbance and SCORAD score. In other words, sleep quality had a negative correlation with the severity of atopic dermatitis. Likewise, a longitudinal cohort study revealed that there was a significant association between AD and sleep quality.[16] These findings suggest that in infants with atopic dermatitis, especially with the severe form, physicians should evaluate sleep disturbance. Another important clinical symptom of AD is pruritus. We also evaluated the relationship between the pruritus score and the QoL indexes. Although there was a positive correlation between pruritus and QoL indexes, pruritus score was not effective in the

**Table 7** Logistic regression analysis of parameters for the prediction of severe FDLQI (>20) score.

| Parameters | Univariate regression model | | Multivariate regression model | |
|---|---|---|---|---|
| | OR (95% CI lower-upper) | p-value | OR (95% CI lower-upper) | p-value |
| Gender | 1.793 (0.510-6.304) | 0.363 | | |
| Age | 1.263 (0.991-1.609) | 0.059 | | |
| Type of delivery | 3.088 (0.645-14.787) | 0.158 | | |
| Familial history of allergy | 1.200 (0.364-3.953) | 0.764 | | |
| Food allergy | 1.143 (0.324-4.035) | 0.836 | | |
| Seborrheic dermatitis | 1.400 (0.419-4.681) | 0.585 | | |
| Pruritus | 1.386 (0.966-1.988) | 0.076 | | |
| Sleep disturbance | 1.351 (1.039-1.755) | **0.025** | | |
| SCORAD | 1.053 (1.000-1.109) | 0.051 | | |
| EASI | 1.079 (1.014-1.147) | **0.016** | | |
| Dermatitis severity score | 1.624 (0.709-3.721) | 0.251 | | |
| IDQOL | 1.222 (1.064-1.405) | **0.005** | 1.191 (0.991-1.126) | **0.017** |

OR: odds ratio, Cl: confidence interval, SCORAD: severity scoring of atopic dermatitis, EASI: eczema area and severity index, IDQOL: infants' dermatitis quality of life index.
Bold values: statistical significance at the $p < 0.05$ level.

prediction of severe IDQOL and FDQOL. These findings suggest that sleep disturbance has a more significant effect on the QoL of patients and their caregivers, compared to pruritus.

Controversial findings have been reported for the factors that have an effect on caregivers' QoL. For instance, a study performed in Greece showed that illness concerns and emotional representations of mothers of children diagnosed with AD were effective on the Dermatitis Family Impact Questionnaire score.[11] On the other hand, Xu et al. reported that there was no significant relationship between sociodemographic factors of parents and children's QoL.[17] However, both studies agreed that disease severity has a major impact on the family's QoL. Another study demonstrates that FDQOL was higher in mothers than in fathers.[6] In our study, we did not evaluate the sociodemographic factors of parents which may influence the QoL. Although most of our caregivers were mothers, we did not evaluate the QoL of patients' mothers and fathers independently.

The impact of concomitant conditions on QoL indexes has also been evaluated. No significant differences were noticed in the QoL of patients with concomitant asthma, allergic rhinitis, or allergic conjunctivitis.[14] However, the effect of seborrheic dermatitis on QoL indexes has not been studied so far. It has been reported that the prevalence of AD in infants with seborrheic dermatitis was significantly higher than in the general population.[18] In our study, half of the patients with AD had seborrheic dermatitis. However, we did not find any significant relationship between the severity of atopic dermatitis, QoL indexes, and seborrheic dermatitis. This is the first study to evaluate the effect of seborrheic dermatitis on the severity of AD and QoL indexes.

There are several limitations to this study. First, this was a survey study and all scores were based on parents' reports as in similar studies. Second, we did not evaluate the sociodemographic factors which might have an effect on the scores and indexes. Third, these findings were obtained from a single center, limiting the generalization of our results.

In conclusion, AD negatively impacts the QoL of infants and their parents. There was a moderate correlation between the severity of AD and QoL indexes. This study also showed that infants' QoL index was important to predict the QoL index of parents. Pruritus and sleep disturbance should be evaluated in clinical practice due to their strong relationship with disease severity and QoL index. In the clinical follow-up of AD, not only clinical scores but also QoL indexes may be useful in monitoring the clinical progress of disease. Multi-center longitudinal studies including sociodemographic factors are required to confirm our findings.

## Conflict of Interest

The authors declare no potential conflicts of interest with respect to research, authorship, and/or publication of this article.

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