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The humanistic burden of atopic dermatitis in Greece: a cross-sectional study

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Ethics approval and consent to participate: the protocol of the study was approved by the management board of "EPIDERMIA" and the study was conducted in accordance with the Helsinki Declaration. All participants were informed *a priori* about the purposes of the study, and they were asked to provide their consensus for study participation.

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Abstract

The purpose of this study was to evaluate the quality of life (QoL) and psychosocial burden in adult Greek patients with atopic dermatitis (AD) using validated tools and to investigate factors that influence AD's humanistic burden.

This observational, cross-sectional study was conducted in Greece (January-September 2023) with 150 adult members of the patient association "EPIDERMIA", all diagnosed with AD. Data was collected *via* a structured questionnaire, including socio-demographic details, clinical history, AD severity (using the Patient-Oriented Eczema Measure [POEM]), QoL, sleep disorders, and psychological health.

Based on POEM scores, 11% of participants had clear/almost clear skin, 27% had mild eczema, 51% had moderate eczema, and 12% had severe/very severe eczema. AD had a moderate or very/extremely large impact on QoL for 29% and 42% of participants, respectively. Insomnia affected 55%, while 31% had mild anxiety, 23% had moderate/severe anxiety, 10% had moderate depression, and 8% had moderately severe/severe depression. AD severity was associated with reduced QoL and higher rates of insomnia, anxiety, and depression.

Our study highlights significant associations between AD severity, QoL, and psychosocial factors, emphasizing the need for comprehensive management strategies.

Introduction

Atopic dermatitis (AD) is a chronic inflammatory skin condition characterized by flares and remissions. Symptoms of AD include inflammation, itching, rashes, scaling, dryness, and increased susceptibility to infection.[1] AD is associated with both epidermal barrier defects and immunological dysregulation, while recent evidence suggests that it is a systemic disorder.[2] Genetic variations and mutations affecting the epidermal barrier are central aspects of the emergence of AD.[1,2]

AD is the most common non-fatal skin disorder, affecting an estimated 230 million people worldwide. Moreover, it can occur at any age, and its prevalence ranges from 2% to 30% of the general population.[1,3] Approximately half of the patients suffering from AD experience a moderate to severe form of the disease.[1] The prevalence differs by gender and age, being lower in men than in women and decreasing with advanced age.[3] Only one study has examined the prevalence of AD among Greek adults over a 12-month period. This study reports that prevalence ranges from 1.7% to 6.4%, depending on the definition of AD used.[4]

AD is a global health problem with significant adverse effects on various areas of life.[1,5] The humanistic burden of AD has been studied in both pediatric and adult populations, highlighting its

impact on patients, their families, and caregivers.[1,6-8] Additionally, patients with atopic dermatitis (AD) often experience intense itching and skin pain, leading to sleep disturbances and difficulties in daily functioning. These issues significantly affect their quality of life (QoL), with the impact being particularly severe for those with more advanced stages of the disease.[5,9-12] AD patients also face stigma and psychological difficulties in their everyday lives.[1]

To the best of our knowledge, published data regarding the humanistic burden of AD in the adult population in Greece are limited. To be more specific, such data have been retrieved from a recently published nationwide survey targeting individuals who self-reported as AD patients through telephone interviews, collecting comprehensive information about the humanistic burden associated with the condition.[7] However, disease burden seems to be one of the commonly used decision-making criteria from various stakeholders across the healthcare system, such as clinicians, patients, policymakers, funders, program managers, regulators, and scientific communities. For example, disease burden is involved in health technology assessments, development of guideline recommendations, health insurance coverage decisions, selection of essential medicines and diagnostics, *etc.*[13] Given the developing treatment landscape, it is expected that country data regarding AD burden will be extremely significant in supporting healthcare policy decision makers. Hence, the objective of this study was to estimate the QoL and psychosocial burden in adult Greek patients with AD through validated assessment tools as well as to explore parameters that may influence AD humanistic burden.

Materials and Methods

Study design and participants

A non-interventional cross-sectional observational study was conducted in Greece from January 2023 through September 2023. All adult members of the Panhellenic Society of Patients with Psoriasis and Psoriatic Arthritis “EPIDERMIA”, diagnosed with AD, regardless of current treatment regimen and disease severity, were eligible to participate as long as they were capable of understanding and signing the consent form. They were invited through an email sent by the management board of the association. They were informed about the scope of the study and that data collection would be anonymous and confidential. Moreover, they were informed that their participation in this study was voluntary, and they had the right to withdraw their consent at any time. The protocol of the study was approved by the management board of “EPIDERMIA” and the study was conducted in accordance with the Helsinki Declaration.

Data collection

A structured questionnaire, developed as a Google Form, was used for data collection. To assess the face validity of the questionnaire, a pilot study was initially conducted with 10-20 patients. A questionnaire was distributed *via* email to 170 eligible participants; two emails were undeliverable (N=168), and 150 individuals responded, yielding a response rate of 89.28%. This questionnaire consisted of two sections. The first section focused on patients' socio-demographic characteristics and clinical history, while the second section focused on data regarding the patients' QoL and psychosocial burdens.

Specifically, socio-economic characteristics included age, gender, self-reported weight and height, marital and occupational status, smoking habits, and occupations related to AD.

Moreover, participants were asked to provide data regarding their medical history, such as the age of AD diagnosis and comorbidities.

Disease severity was assessed using the self-reported, repeatable Patient-Oriented Eczema Measure (POEM) assessment tool.[14] POEM scores range from 0 to 28 and are categorized into five levels of atopic eczema severity as follows: 0-2 (mild/almost nonexistent); 3-7 (mild); 8-16 (moderate); 17-24 (severe); and 25-28 (very severe).

QoL was assessed using the Dermatological Life Quality Index (DLQI), which is a certified translated version of the questionnaire available in Greek.[15] The DLQI assesses the impact of dermatological conditions on symptoms and emotions, daily activities, leisure time, work and school, personal relationships, and the effects of treatment. The scores range from 0 to 30 and are categorized as follows: 0-1 (no effect in QoL); 2-5 (small effect); 6-10 (moderate effect); 11-20 (very large effect); and ≥21 (extremely large effect).

Sleep difficulty was assessed using the Greek version of the Athens Insomnia Scale (AIS), with scores ranging from 0 to 24, with a higher score indicating greater insomnia symptom severity.[16,17] A score ≥6, a widely accepted cutoff score, was used to identify participants with insomnia.

Depression was measured using the Greek-validated translation of the Patient Health Questionnaire (PHQ).[18,19] Its score ranges from 0 to 27, with higher scores indicating a need for clinical evaluation. The values 0-4, 5-9, 10-14, 15-19, and 20-27 indicate none or minimal, mild, moderate, moderately severe, and severe depression, respectively.

Anxiety was assessed through the Greek-validated translation of the Generalized Anxiety Disorder (GAD) scale, ranging from 0 to 21.[18-20] The values of 0-4, 5-9, 10-14 and 15-21 indicate minimal, mild, moderate, and severe anxiety, respectively.

Statistical analysis

To detect a small to medium effect size of 0.31 with a statistical power of 0.95, a sample size of 144 participants is required. This calculation is based on a Wilcoxon signed-rank test, assuming a normal distribution and a significance level of 0.05. The effect size of 0.31 was estimated based on data from the literature, using the DLQI score with a mean of 9 (standard deviation [SD]=6.5) from previous studies and an expected mean of 11 (SD=6.5) for the current study.[21,22] Normally distributed continuous variables were summarized with the mean and SD, while skewed variables were summarized using the median and 1st-3rd quartiles (Q1-Q3). Categorical variables were presented with absolute (n) and relative (%) frequencies. The association between two categorical variables was assessed with Fisher's exact test, while the association between continuous variables and AD severity groups was assessed through one-way analysis of variance (ANOVA) and Kruskal-Wallis's test for normally distributed and skewed continuous variables, respectively. Appropriate univariate and multiple generalized linear models (GLM) were applied to determine factors that might be independently associated with QoL and psychosocial burden. Baseline demographic, lifestyle, anthropometric, and clinical characteristics of patients were used as potential independent factors. In the case of QoL, sleep, anxiety and depression, logistic regression models were fitted with a binary categorization of the dependent variables as follows: DLQI score [0: DLQI score<11; 1: DLQI score≥11], AIS-8 score [0: AIS-8 score<6; 1: AIS-8 score≥6], GAD-7 score [0: GAD-7 score<5; 1: GAD-7 score≥5], and PHQ-9 score [0: PHQ-9 score<5; 1: PHQ-9 score≥5], respectively. All tests were 2-sided, and the significance level was set at 5% for all analyses. This was a complete case analysis, as the proportion of missing data was low. The data management, cleaning, and analysis were performed using STATA software (version 17.0, 2017, STATA Corp).

Results

Participants baseline characteristics

The mean age (SD) of participants was 37.6 (12.7) years, with 44.7% being males. According to body mass index (BMI), no participants were classified as underweight, 41% were overweight, and 12% obese.

Regarding occupational status, most participants (77%) did not work in dermatitis-related occupations. Among those who worked in dermatitis-related occupations, most were laboratory or technical workers (21%). The 47% of participants were current smokers (Table 1).

The median (Q1-Q3) age of study participants at diagnosis of AD was 10 (2-20) years. In total, 58% of the participants reported at least one comorbidity. The most common comorbidities were asthma (29%), rhinitis (28%), and food allergies (25%). Just over half of the sample (51%) had a family history of AD, rhinitis, or asthma. The median (Q1-Q3) POEM score was 9 (6-13) points. Overall, 51% had moderate eczema, and 12% had severe to very severe eczema (Table 2).

Impact of AD on QoL, sleep difficulties, and mental health

The median (Q1-Q3) DLQI score was 9 (4-15). Overall, 29% and 42% of the participants had a moderate and a very large/extremely large effect on their QoL due to AD, respectively.

The impact of AD on QoL increased with the severity of the condition. Among individuals with clear or almost clear/mild eczema, 11% reported that AD had a very large or extremely large effect on their QoL. This percentage rose significantly to 54% among those with moderate eczema and further increased to 89% for individuals with severe or very severe eczema ($p<0.001$).

Moreover, 55% of the study participants experienced insomnia. The proportion of subjects with insomnia increased concomitantly with AD severity, recording rates of 16%, 75%, and 94%, respectively, for participants with clear or almost clear/mild, moderate, and severe/very severe eczema.

The median GAD-7 score (Q1-Q3) was 5.0 (3.0-9.0). Regarding the impact of AD on anxiety, 31% had mild anxiety, 23% had moderate/severe anxiety. Anxiety severity increased with AD severity. Specifically, the proportion with moderate/severe anxiety increased from 13% in those with clear or almost clear/mild eczema to 56% in those with severe/very severe eczema.

Finally, the mean (Q1-Q3) PHQ-9 score was 4.0 (2.0-8.0). Overall, 28% of participants had mild depression, and 18% had moderate to severe depression. Moreover, 54%, 12%, and 1% of the participants found it somewhat, very, and extremely difficult, respectively, to perform their tasks and manage their home or social relationships. The proportion of patients with mild to moderate depression increased from 20% in those with clear or almost clear/mild eczema to 78% in those with severe/very severe eczema (Table 3).

Factors associated with QoL, sleep disorders, anxiety and depression

Univariate logistic regression models revealed that an earlier age at AD diagnosis is associated with better QoL outcomes. In contrast, the presence of comorbidities, family history of AD, food allergies, GI problems, asthma, rhinitis, and AD severity is linked to a diminished QoL. The multivariate analysis further confirmed the association of QoL with the presence of GI problems, rhinitis, and AD severity.

Regarding sleep disorders, obese participants showed higher odds of experiencing insomnia compared to those with a healthy weight at the univariate level. Additionally, an earlier age of AD diagnosis, comorbidities, especially food allergies and rhinitis, and AD severity were associated with increased odds of suffering from insomnia. The multivariate analysis further confirmed the association of insomnia with food allergies and with AD severity (Table 4).

In terms of anxiety, several factors were associated with its severity at the univariate level. Female gender, diagnosis at an earlier age, family history of AD, presence of food allergies, GI problems, asthma, or rhinitis, and AD severity were significantly associated with a higher probability of suffering from mild to severe anxiety. Multivariate analysis confirmed the association of anxiety with AD severity, with a family history of AD, and the presence of GI problems, rhinitis, or asthma.

Considering depression, at the univariate level, factors including gender, working in dermatitis-related occupations, an earlier diagnosis of AD, food allergies, GI problems, rhinitis, and AD severity were significant predictors of increased odds of experiencing mild to severe depression. However, only AD severity was confirmed in a multivariate analysis (Table 5).

Discussion

The lives of people with AD are significantly impacted in health, QoL, psychological well-being, and social interactions. To date, only one cross-sectional study has evaluated the burden of moderate to severe AD in Greece.[7] Therefore, our study aims to contribute to existing knowledge by investigating the effects of AD on QoL, sleep patterns, and psychological problems. Also, we assessed how disease severity and other factors might affect these domains, providing evidence to inform healthcare decisions and optimize patient care strategies.

In our study, according to the POEM score, 11% of the participants had clear or almost clear skin, 27% had mild eczema, and 62% had moderate to very severe eczema. These findings were partially comparable to those reported in the previously conducted Greek study by Gregoriou *et al.,* in which 53.0% of the AD population as defined by the United Kingdom Working Party (UKWP) criteria and 25.8% of the AD population as defined by patient-reported AD diagnosis from a physician (Expert Diagnosis cohort) were classified as suffering from moderate to very severe eczema, respectively.[7]

In the cross-sectional study conducted by Fuxench *et al.* in 2019 in the USA, 60.1% of participants were classified as having mild, 28.9% moderate, and 11% severe disease, based on the POEM score.[23] Therefore, the severity of eczema, as assessed by the POEM score, varies among different populations. This might be attributed to the fact that the study used different inclusion criteria, including stricter

diagnostic criteria and limiting the participation to the ages of 18-65 years old.[23] However, it is evident that a considerable proportion of participants experience moderate to severe eczema.

Our results revealed significant impacts of AD on participants' QoL, sleep quality, and mental health. Specifically, 89.5% of participants with moderate eczema reported a moderate to extremely large effect on their QoL, while 100% of participants with severe/very severe eczema experienced a similar impact. Consequently, in our study, 91.4% of participants with moderate to very severe eczema reported a moderate to extremely large effect on their QoL. This is higher than the findings of the previously conducted study, which reported that 84.3% (UKWP criteria cohort) and 72.2% (Expert Diagnosis cohort) of participants with moderate/very severe eczema experienced a moderate to extremely large effect on their QoL.

In our study, the mean (SD) DLQI score for overall participants was 9.9 (6.8), resembling the UKWP criteria cohort in the prior Greek study (mean DLQI score: 10.92, 95% CI: 9.24, 12.59). However, our mean DLQI score was notably higher than the Expert Diagnosis cohort in the same study (mean DLQI score: 5.29, 95% CI: 4.66, 5.93). This difference may be due to the different definitions of AD population in these studies. The similarity in DLQI scores between our study and the UKWP cohort in the previous Greek, may be attributed to the stricter definition of AD patients used. In our study, participants were members of a patient association and, therefore, had AD diagnosis by a physician, whereas the UKWP cohort used the self-diagnosed assessment tool with one-year recall. On the other hand, the Expert Diagnosis cohort included participants who had been diagnosed with AD by a doctor at least once in their lifetime, which might explain the notably lower DLQI score observed in that group due to the wider recall period. More related results in the DLQI scores were presented in a study conducted in the USA.[23] Moreover, another US study involving 186 individuals showed a mean (SD) DLQI score of 9.9 (7.4), aligning closely with our study's score; these scores increased as disease severity worsened.[24] In addition, the findings of systematic review and meta-analysis confirm the substantial impact of worsening disease on QoL.[5]

In our multivariate analysis, we discovered that beyond the disease severity affecting QoL, rhinitis and GI issues also significantly impacted QoL, consistent with the previous study by Gregoriou *et al.* This underscores the necessity of providing dermatological treatment and integrating QoL screening tools in dermatology. Nonetheless, AD's complexity suggests that QoL cannot solely be explained by disease severity, as our study reports correlations between other variables.

Our findings aligned with existing literature, revealing a robust connection between the severity of AD and symptoms of insomnia, alongside allergic comorbidities.[1,8-10,21,25,26] While variations exist among

the validated assessment tools for insomnia and sleep disorders across studies, most agree on the correlation between the severity and frequency of AD symptoms and sleep disturbances.[8-10,21,25,26] Studies have noted nocturnal escalation in itching behavior, suggesting the circadian rhythm's role in modulating symptom severity.[27] Consequently, individuals affected by AD experience disrupted sleep characterized by increased restlessness due to associated itchiness, frequent awakenings, reduced sleep duration, and daytime fatigue, thereby elucidating these associations.

Furthermore, our study reaffirmed the positive correlation between the severity of AD and symptoms of anxiety and depression. Despite variations in the assessment tools utilized across studies, a consistent trend emerged.[5,8,12,21,22,26,28] Anxiety levels were further influenced by the presence of GI comorbidities and a family history of AD, rhinitis, or asthma among patients. One plausible explanation for the correlation between AD and psychological comorbidities is the social stigma attached to visible skin lesions. This stigma can significantly impact individuals with AD, leading to increased rates of depression and anxiety.

This study has several limitations that should be taken into account. First, the sample size was relatively small. Additionally, the exlusion of any tools for diagnosing AD, even self-reported ones, due to the nature of web-based surveys, may have restricted the range of outcomes evaluated. Furthermore, participants' responses may have been affected by recall bias or reporting bias, leading them to respond based on perceived expectations rather than true experiences. Lastly, because the study employed a cross-sectional design, we can only hypothesize about the direction of effects, which limits our ability to draw definitive conclusions. These limitations must be taken into account when interpreting the study results and designing future research in this field.

Conclusions

These findings underscore the complex impact of AD, emphasizing the necessity for comprehensive management approaches. The study reveals a significant burden on AD patients in Greece, who experience impairments in QoL, sleep, and social activities. Recognizing this burden is crucial for guiding healthcare decisions to benefit AD patients and alleviate societal burdens. The results suggest that prioritizing the management of patients' psychosocial well-being can benefit both healthcare systems and society.

References

1. Torres T, Ferreira EO, Gonçalo M, et al. Update on atopic dermatitis. Acta Med Port 2019;32:606-13.
2. Cabanillas B, Brehler AC, Novak N. Atopic dermatitis phenotypes and the need for personalized medicine. Curr Opin Allergy Clin Immunol 2017;17:309-15.
3. Barbarot S, Auziere S, Gadkari A, et al. Epidemiology of atopic dermatitis in adults: Results from an international survey. Allergy 2018;73:1284-93.
4. Stefanou G, Gregoriou S, Kontodimas S, et al. Prevalence of adult self-reported atopic dermatitis in greece: Results from a nationwide survey. Eur J Dermatol 2022;32:597-606.
5. Birdi G, Cooke R, Knibb RC. Impact of atopic dermatitis on quality of life in adults: A systematic review and meta-analysis. Int J Dermatol 2020;59:e75-e91.
6. Achten R, Van der Rijst L, Piena M, et al. Economic and humanistic burden in paediatric patients with atopic dermatitis. Acta Derm Venereol 2023;103:adv00881.
7. Gregoriou S, Stefanou G, Kontodimas S, et al. Burden of atopic dermatitis in adults in greece: Results from a nationwide survey. J Clin Med 2022;11.
8. Girolomoni G, Luger T, Nosbaum A, et al. The economic and psychosocial comorbidity burden among adults with moderate-to-severe atopic dermatitis in europe: Analysis of a cross-sectional survey. Dermatol Ther 2021;11:117-30.
9. Jeon C, Yan D, Nakamura M, et al. Frequency and management of sleep disturbance in adults with atopic dermatitis: A systematic review. Dermatol Ther 2017;7:349-64.
10. Kelsay K. Management of sleep disturbance associated with atopic dermatitis. J Allergy Clin Immunol 2006;118:198-201.
11. Sibbald C, Drucker AM. Patient burden of atopic dermatitis. Dermatol Clin 2017;35:303-16.
12. Brunner PM, Silverberg JI, Guttman-Yassky E, et al. Increasing comorbidities suggest that atopic dermatitis is a systemic disorder. J Invest Dermatol 2017;137:18-25.
13. Schünemann HJ, Reinap M, Piggott T, et al. The ecosystem of health decision making: From fragmentation to synergy. Lancet Public Health 2022;7:e378-e90.
14. Charman CR, Venn AJ, Ravenscroft JC, et al. Translating patient-oriented eczema measure (poem) scores into clinical practice by suggesting severity strata derived using anchor-based methods. Br J Dermatol 2013;169:1326-32.

15. Finlay AY, Khan GK. Dermatology life quality index (dlqi)--a simple practical measure for routine clinical use. Clin Exp Dermatol 1994;19:210-6.
16. Soldatos CR, Dikeos DG, Paparrigopoulos TJ. The diagnostic validity of the athens insomnia scale. J Psychosom Res 2003;55:263-7.
17. Soldatos CR, Dikeos DG, Paparrigopoulos TJ. Athens insomnia scale: Validation of an instrument based on icd-10 criteria. J Psychosom Res 2000;48:555-60.
18. Eleftheriou A, Rokou A, Arvaniti A, et al. Sleep quality and mental health of medical students in greece during the covid-19 pandemic. Front Public Health 2021;9:775374.
19. Kroenke K, Spitzer RL, Williams JB. The phq-9: Validity of a brief depression severity measure. J Gen Intern Med 2001;16:606-13.
20. Kroenke K, Spitzer RL, Williams JB, et al. Anxiety disorders in primary care: Prevalence, impairment, comorbidity, and detection. Ann Intern Med 2007;146:317-25.
21. Silverberg JI, Gelfand JM, Margolis DJ, et al. Patient burden and quality of life in atopic dermatitis in us adults: A population-based cross-sectional study. Ann Allergy Asthma Immunol 2018;121:340-7.
22. Lugovic-Mihic L, Mestrovic-Stefekov J, Fercek I, et al. Atopic dermatitis severity, patient perception of the disease, and personality characteristics: How are they related to quality of life? Life (Basel) 2021;11.
23. Chiesa Fuxench ZC, Block JK, Boguniewicz M, et al. Atopic dermatitis in america study: A cross-sectional study examining the prevalence and disease burden of atopic dermatitis in the us adult population. J Invest Dermatol 2019;139:583-90.
24. Bacci ED, Correll JR, Pierce EJ, et al. Burden of adult atopic dermatitis and unmet needs with existing therapies. J Dermatolog Treat 2023;34:2202288.
25. Alomayri W, Alanazi N, Faraj F. Correlation between atopic dermatitis and sleep quality among adults in saudi arabia. Cureus 2020;12:e12051.
26. Salfi F, Amicucci G, Ferrara M, et al. The role of insomnia in the vulnerability to depressive and anxiety symptoms in atopic dermatitis adult patients. Arch Dermatol Res 2023;315:1577-82.
27. Ratley G, Zeldin J, Chaudhary PP, et al. The circadian metabolome of atopic dermatitis. The J Allergy Clin Immunol 2024.
28. Silverberg JI, Gelfand JM, Margolis DJ, et al. Measurement properties of the hospital anxiety and depression scale used in atopic dermatitis in adults. J Invest Dermatol 2019;139:1388-91.

Table 1. Socio-economic factors.

Demographics – General profile	**Participants N=150**
Gender, n (%)	
Female	83 (55.3%)
Male	67 (44.7%)
Age, years	
Mean (SD)	37.6 (12.7)
Weight, kg	
Mean (SD)	76.1 (16.4)
Height, m	**N=147**
Mean (SD)	1.7 (0.1)
BMI, n (%)	
Underweight	0 (0.0%)
Normal weight	70 (46.7%)
Overweight	62 (41.3%)
Obese	18 (12.0%)
Marital status, n (%)	
Unmarried	74 (49.3%)
Married / cohabitation	59 (39.3%)
Divorced / separated	14 (9.3%)
Widow/er	3 (2.0%)
Occupational status, n (%)	**N=149**
Freelancer/self-employed	46 (30.9%)
Employee	59 (39.6%)
Unemployed	8 (5.4%)
Retired	7 (4.7%)
Student	25 (16.8%)
Household	4 (2.7%)
Other	0 (0.0%)
Occupation related to AD*, n (%)	**N=34**
Hairdresser/Barber - Beautician	6 (17.6%)
Food industry worker	4 (11.8%)

Healthcare professional - Dentist - Veterinarian	5 (14.7%)
Laboratory worker - Laboratory technician	7 (20.6%)
Farmer- Gardener - Florist	3 (8.8%)
Janitor - Cleaner	5 (14.7%)
Painter - Artist - Decorator	0 (0.0%)
Automotive mechanic	2 (5.9%)
Construction worker	2 (5.9%)
Smoking habits, n (%)	
Smoker	70 (46.7%)
Former smoker	24 (16.0%)
No smoker	56 (37.3%)

*if occupational status was “freelancer/ self-employed” or “employee”.

Table 2. Medical profile and severity of atopic dermatitis.

Medical profile	**N=150**
Age at AD diagnosis, years	**N=149**
Median (Q1-Q3)	10.0 (2.0-20.0)
Comorbidities, n (%)	
None	63 (42.0%)
One	37 (24.7%)
Two	25 (16.7%)
Three or more	25 (16.7%)
Comorbidities, n (%)	**N=150**
Asthma	44 (29.3%)
Chronic obstruction pneumonopathy	0 (0.0%)
Food allergies	38 (25.3%)
Conjunctivitis	22 (14.7%)
Gastrointestinal problems	16 (10.7%)
Rhinitis	42 (28.0%)
Diabetes	6 (4.0%)
Hypertension	7 (4.7%)
Heart failure	0 (0.0%)
Other	0 (0.0%)
Family history of atopic dermatitis, rhinitis, or asthma	**N=149**
Yes	77 (51.7%)
No	72 (48.3%)
AD severity (POEM), n (%)	
Clear or almost clear	16 (10.7%)
Mild eczema	40 (26.7%)
Moderate eczema	76 (50.7%)
Severe eczema	15 (10.0%)
Very severe eczema	3 (2.0%)
POEM score	
Median (Q1 – Q3)	9.0 (6.0 – 13.0)

N, number; SD, standard deviation; Q, quartiles; min, minimum; max, maximum; POEM, Patient Oriented Eczema Measure; AD, atopic dermatitis.

Table 3. QoL, sleep problems, anxiety, and depression in AD patients based on DLQI.

	Overall	**Clear or almost clear/mild eczema**	**Moderate eczema**	**Severe/very severe eczema**	**p-value**
	N=150	**N=56**	**N=76**	**N=18**	
Impact of AD in QoL (DLQI), last week					
No effect	14 (9.3%)	13 (23.2%)	1 (1.3%)	0 (0.0%)	
Small effect	29 (19.3%)	22 (39.3%)	7 (9.2%)	0 (0.0%)	
Moderate effect	44 (29.3%)	15 (26.8%)	27 (35.5%)	2 (11.1%)	**<0.001**□□
Very large effect	52 (34.7%)	6 (10.7%)	37 (48.7%)	9 (50.0%)	
Extremely large effect	11 (7.3%)	0 (0.0%)	4 (5.3%)	7 (38.9%)	
DLQI score [range: 0-30], Median (Q1-Q3)	9.0 (4.0-15.0)	4.0 (2.0-7.0)	11.0 (7.0-15.0)	18.5 (15.0-26.0)	**<0.001**◊
DLQI subscales					
Symptoms and feelings [range: 0-6], Median (Q1-Q3)	3.0 (2.0-4.0)	2.0 (1.0-3.0)	4.0 (3.0-4.0)	6.0 (4.0-6.0)	**<0.001**◊
Daily activities [range: 0-6], Median (Q1-Q3)	2.0 (0.0-3.0)	0.0 (0.0-2.0)	2.0 (1.0-3.5)	5.0 (2.0-5.0)	**<0.001**◊
Leisure [range: 0-6], Median (Q1-Q3)	1.0 (0.0-2.0)	0.0 (0.0-1.0)	1.0 (0.0-2.0)	3.5 (1.0-6.0)	**<0.001**◊
Work and school [range: 0-3], Median (Q1-Q3)	1.0 (0.0-3.0)	0.0 (0.0-0.0)	1.0 (0.0-3.0)	3.0 (2.0-3.0)	**<0.001**◊
Personal relationships [range: 0-6], Median (Q1-Q3)	0.0 (0.0-3.0)	0.0 (0.0-0.0)	1.0 (0.0-3.0)	2.5 (1.0-4.0)	**<0.001**◊
Treatment [range: 0-3], Median (Q1-Q3)	0.0 (0.0-1.0)	0.0 (0.0-0.0)	1.0 (0.0-1.0)	2.0 (1.0-2.0)	**<0.001**◊
AIS-8 score [range: 0-24] , Median (Q1-Q3)	6.5 (0.0-10.0)	0.0 (0.0-2.0)	8.0 (5.5-11.5)	10.0 (8.0-14.0)	**<0.001**◊
Suffering with insomnia [AIS-8 score≥6], n (%)					
Yes	83 (55.3%)	9 (16.1%)	57 (75.0%)	17 (94.4%)	**<0.001****
No	67 (44.7%)	47 (83.9%)	19 (25.0%)	1 (5.6%)	
GAD-7 score [range: 0-21], Median (Q1-Q3)	5.0 (3.0-9.0)	3.0 (1.0-5.5)	6.0 (3.5-9.0)	10.0 (6.0-13.0)	**<0.001**◊
Anxiety severity, n (%)					

Minimal anxiety (score: 0-4)	69 (46.0%)	38 (67.9%)	28 (36.8%)	3 (16.7%)	
Mild anxiety (score: 5-9)	47 (31.3%)	11 (19.6%)	31 (40.8%)	5 (27.8%)	**<0.001****
Moderate anxiety (score: 10-14)	18 (12.0%)	5 (8.9%)	6 (7.9%)	7 (38.9%)	
Severe anxiety (score ≥15)	16 (10.7%)	2 (3.6%)	11 (14.5%)	3 (16.7%)	
PHQ-9 score [range: 0-27], Median (Q1-Q3)	4.0 (2.0-8.0)	1.5 (0.0-4.0)	5.5 (3.0-9.0)	8.0 (5.0-11.0)	**<0.001**[◊]
Depression severity, n (%)					
None-minimal (score: 0-4)	81 (54.0%)	45 (80.4%)	32 (42.1%)	4 (22.2%)	**<0.001****
Mild depression (score: 5-9)	42 (28.0%)	8 (14.3%)	26 (34.2%)	8 (44.4%)	
Moderate to severe depression (score: 10-27)	27 (18.0%)	3 (5.4%)	18 (23.7%)	6 (33.3%)	
"How difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?", n (%)	**N=149**	**N=55**			
Not difficult at all	48 (32.2%)	34 (61.8%)	12 (15.8%)	2 (11.1%)	
Somewhat difficult	81 (54.4%)	19 (34.5%)	52 (68.4%)	10 (55.6%)	**<0.001****
Very difficult	18 (12.1%)	2 (3.6%)	11 (14.5%)	5 (27.8%)	
Extremely difficult	2 (1.3%)	0 (0.0%)	1 (1.3%)	1 (5.6%)	

[◊]Kruskal Wallis test except otherwise specified; **Fisher's exact test; n, number; SD, standard deviation; Q, quartiles; PHQ-9, Patient Health Questionnaire; Q, quartiles; QoL, quality of life; DLQI, Dermatology Life Quality Index; AIS, Athens Insomnia Scale; GAD-7, Generalized Anxiety Disorder 7-Item Scale.

Table 4. Factors associated with QoL and insomnia (univariate and multivariate models) (N=150).

	Impact of AD in QoL				**Insomnia**			
	Univariate models[1]		**Multivariate model[2] N=148**		**Univariate models[1]**		**Multivariate model[2] N=148**	
Independent variables	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**
Sex								
Female *vs.* Male	1.78 (0.92, 3.45)	**0.088**	1.05 (0.39, 2.76)	0.942	1.40 (0.73, 2.68)	0.311		
Age, years								
	0.98 (0.95, 1.01)	**0.136**	0.99 (0.95, 1.04)	0.719	1.00 (0.97, 1.03)	0.969		
BMI								
Overweight *vs.* healthy weight	0.69 (0.34, 1.40)	0.280			0.79 (0.40, 1.57)	**0.049**	1.47 (0.52, 4.11)	0.203
Obese *vs.* healthy weight	1.57 (0.55, 4.46)				4.21 (1.12, 15.85)		5.44 (0.84, 35.19)	
Marital status					**N=147**			
Married/cohabitation *vs.* unmarried	0.63 (0.31, 1.26)	0.397			0.75 (0.37, 1.48)	0.664		
Divorced *vs.* unmarried	0.42 (0.12, 1.47)				0.72 (0.23, 2.27)			
Widow/er *vs.* unmarried	0.53 (0.05, 6.08)							
Occupational status	**N=149**				**N=149**			
Employee *vs.* freelancer/self-employed	1.07 (0.49, 2.34)	0.847			0.80 (0.37, 1.73)	0.701		
Unemployed *vs*. freelancer/self-employed	1.56 (0.34, 7.02)				0.77 (0.17, 3.46)			
Retired *vs.* freelancer/self-employed	0.62 (0.11, 3.56)				4.62 (0.51, 41.48)			
Student *vs.* freelancer/self-employed	1.69 (0.63, 4.50)				1.15 (0.43, 3.11)			
Household *vs.* freelancer/self-	1.56 (0.20, 12.05)				0.77 (0.10, 5.94)			

employed								
Occupation (dermatitis-related)								
Dermatitis-related jobs *vs*. other jobs	1.30 (0.60, 2.81)	0.497			1.95 (0.87, 4.37)	0.104	1.47 (0.51, 4.28)	0.478
Education								
Bachelor's degree *vs.* primary school/lower secondary education/upper secondary education	0.80 (0.38, 1.66)	0.601			0.72 (0.35, 1.49)	0.206		
Master's/Doctoral degree *vs.* primary school	1.22 (0.50, 2.98)				1.61 (0.64, 4.07)			
Age at AD diagnosis, years	**N=149**				**N=149**			
	0.93 (0.90, 0.97)	**<0.001**	0.96 (0.91, 1.002)	0.062	0.95 (0.93, 0.98)	**0.002**	0.97 (0.93, 1.01)	0.100
Comorbidities[3]								
One *vs.* none	1.19 (0.47, 3.00)	**<0.001**			1.97 (0.86, 4.50)	**<0.001**		
Two *vs.* none	8.23 (2.89, 23.47)				21.43 (4.62, 99.47)			
Three or more *vs.* none	12.80 (4.10, 39.97)				5.90 (2.06, 16.93)			
Comorbidities (each *vs.* no)								
Asthma	1.58 (0.78, 3.22)	0.202			1.24 (0.61, 2.53)	0.551		
Food allergies	6.16 (2.70, 14.06)	**<0.001**	1.94 (0.61, 6.11)	0.260	8.18 (2.98, 22.51)	**<0.001**	3.81 (1.03, 14.13)	**0.045**
GI problems	26.88 (3.44, 209.77)	**0.002**	21.51 (2.39, 193.29)	**0.006**	6.59 (1.44, 30.15)	**0.015**	2.19 (0.34, 14.26)	0.412
Rhinitis	5.68 (2.59, 12.45)	**<0.001**	4.07 (1.39, 11.90)	**0.010**	5.12 (2.17, 12.07)	**<0.001**	2.57 (0.81, 8.10)	0.107
Diabetes	2.88 (0.51, 16.25)	0.230			4.23 (0.48, 37.12)	0.193		
Hypertension	1.04 (0.22, 4.81)	0.962			2.08 (0.39, 11.10)	0.390		

Family history of AD, rhinitis, or asthma	**N=149**				**N=149**			
Yes *vs.* No	2.05 (1.06, 3.98)	**0.034**	2.02 (0.78, 5.22)	0.148	1.26 (0.66, 2.40)	0.487		
AD severity (POEM)[4]								
Moderate eczema *vs.* clear or almost clear/mild eczema	9.76 (3.74, 25.48)	**<0.001**	4.64 (1.54, 14.00)	**<0.001**	15.67 (6.48, 37.85)	**<0.001**	11.10 (4.12, 29.89)	**<0.001**
Severe/very severe eczema *vs.* clear or almost clear/mild eczema	66.67 (12.22, 363.63)		91.14 (12.06, 688.77)		88.78 (10.45, 753.92)		79.47 (7.91, 798.20)	
POEM score								
	1.35 (1.22, 1.50)	**<0.001**			1.45 (1.29, 1.63)	**<0.001**		

Logistic regression with dependent variables:

The impact of AD in QoL last week (based on DLQI score) categorized as: 1=very large/extremely large effect (DLQI score ≥11), 0=no effect/small/moderate (DLQI score <11); insomnia (based on AIS-8 score) categorized as: 1=Yes (AIS-8 score ≥6), 0=No (AIS-8 score < 6).

[1]All variables with $p<0.15$ in the univariate model, were inserted to the multivariate model; [2]all variables with $p<0.05$ in the multivariate model were deemed to have a significant effect; [3]number of comorbidities variable was not inserted in the multivariate model, as it was statistically significantly associated with the variables for food allergies, GI problems and rhinitis; [4]the numeric POEM score was not inserted in the multivariate model, as it was statistically significantly associated with AD severity based on POEM score.

N, number; QoL, quality of life; DLQI, Dermatology Life Quality Index; POEM, Patient-Oriented Eczema Measure; OR, odds ratio; AD, atopic dermatitis; GI, gastrointestinal.

Table 5. Factors associated with anxiety and depression (univariate and multivariate models) (N=150).

	Anxiety				**Depression**			
	Univariate models[1]		**Multivariate model[2] N=148**		**Univariate models[1]**		**Multivariate model[2] N=148**	
Independent variables	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**
Sex								
Female *vs.* male	2.20 (1.14, 4.24)	**0.019**	1.71 (0.77, 3.76)	0.185	2.38 (1.22, 4.62)	**0.011**	2.08 (0.87, 5.00)	0.101
Age, years								
	1.00 (0.97, 1.02)	0.798			1.00 (0.98, 1.03)	0.889		
Age group								
30-39 *vs.* 18-29	1.16 (0.50, 2.67)	0.613			1.32 (0.57, 3.02)	0.228		
40-49 *vs.* 18-29	0.63 (0.25, 1.62)				0.52 (0.19, 1.40)			
50+ *vs.* 18-29	1.08 (0.42, 2.78)				1.38 (0.54, 3.54)			
BMI								
Overweight *vs.* healthy weight	0.55 (0.27, 1.10)	0.192			0.71 (0.35, 1.42)	**0.119**	0.97 (0.36, 2.59)	0.322
Obese *vs.* healthy weight	1.05 (0.36, 3.03)				2.24 (0.76, 6.65)		2.67 (0.68, 10.49)	
Marital status	**N=147**				**N=147**			
Married/cohabitation *vs.* unmarried	0.69 (0.35, 1.37)	0.538			0.71 (0.36, 1.43)	0.400		
Divorced *vs.* unmarried	1.02 (0.32, 3.22)				1.49 (0.47, 4.70)			
Widow/er *vs.* unmarried								
Occupational status	**N=149**				**N=142**			
Employee *vs.* freelancer/self-employed	0.74 (0.34, 1.61)	0.662			0.59 (0.27, 1.30)	0.719		

Unemployed *vs.* freelancer/self-employed	1.28 (0.27, 6.01)				0.60 (0.13, 2.81)			
Retired *vs.* freelancer/self-employed	4.62 (0.51, 41.48)							
Student *vs.* freelancer/self-employed	0.83 (0.31, 2.21)				0.92 (0.35, 2.45)			
Household *vs.* freelancer/self-employed	0.77 (0.10, 5.94)				1.00 (0.13, 7.72)			
Occupation (dermatitis-related)								
Dermatitis-related jobs *vs.* other jobs	1.51 (0.69, 3.29)	0.303			2.29 (1.04, 5.01)	**0.039**	2.20 (0.77, 6.27)	0.139
Education								
Bachelor's degree *vs.* primary school/lower secondary Education/upper secondary education	0.67 (0.32, 1.38)	0.487			0.48 (0.23, 1.00)	**0.050**	0.53 (0.20, 1.44)	0.312
Master's/Doctoral degree *vs.* primary school	0.98 (0.40, 2.41)				1.24 (0.51, 3.02)		1.16 (0.35, 3.91)	
Age at AD diagnosis, years	**N=149**				**N=149**			
	0.96 (0.93, 0.98)	**0.002**	0.97 (0.94, 1.01)	0.125	0.95 (0.92, 0.98)	**0.001**	0.97 (0.94, 1.01)	0.124
Comorbidities[3]								
One *vs.* none	1.16 (0.51, 2.64)	**<0.001**			2.00 (0.84, 4.77)	**<0.001**		
Two *vs.* none	7.98 (2.45, 26.03)				15.42 (4.60, 51.74)			

Three or more *vs.* none	4.81 (1.69, 13.72)				6.24 (2.26, 17.21)			
Comorbidities (each *vs.* no)								
Asthma	1.17 (0.58, 2.38)	0.656			1.85 (0.91, 3.77)	**0.089**	1.42 (0.55, 3.71)	0.468
Food allergies	3.72 (1.61, 8.57)	**0.002**	1.14 (0.40, 3.27)	0.805	5.80 (2.50, 13.46)	**<0.001**	1.97 (0.68, 5.66)	0.210
GI problems	15.45 (1.98, 120.34)	**0.009**	11.04 (1.27, 96.21)	**0.030**	6.04 (1.64, 22.18)	**0.007**	2.92 (0.61, 14.02)	0.180
Rhinitis	3.85 (1.72, 8.61)	**0.001**	2.49 (0.92, 6.76)	0.074	4.42 (2.04, 9.61)	**<0.001**	1.88 (0.67, 5.22)	0.228
Diabetes								
Hypertension	2.20 (0.41, 11.74)	0.354			2.20 (0.41, 11.74)	0.354		
Family history of AD, rhinitis, or asthma	**N=149**				**N=149**			
Yes *vs.* No	2.19 (1.13, 4.22)	**0.020**	2.21 (1.02, 4.76)	**0.043**	1.79 (0.93, 3.43)	0.080	1.77 (0.75, 4.19)	0.195
AD severity (POEM)[4]								
Moderate eczema *vs.* clear or almost clear/mild eczema	3.62 (1.75, 7.50)	**<0.001**	1.98 (0.87, 4.54)	**0.014**	5.62 (2.52, 12.53)	**<0.001**	2.94 (1.15, 7.55)	**0.006**
Severe/very severe eczema *vs.* clear or almost clear/mild eczema	10.56 (2.71, 41.15)		8.28 (1.89, 36.20)		14.32 (3.93, 52.12)		10.01 (2.15, 46.61)	
POEM score								
	1.17 (1.09, 1.26)	**<0.001**			1.23 (1.13, 1.33)	**<0.001**		

Logistic regression with dependent variables:

The anxiety severity (based on GAD-7 score) categorized as: 1=mild/moderate/severe anxiety (GAD-7 score ≥5), 0=minimal anxiety (GAD-7 score <5); The depression severity (based on PHQ-9 score) categorized as: 1=mild/moderate/moderately severe/severe depression (PHQ-9 score ≥5), 0=none/minimal depression (PHQ-9 score <5).

[1]All variables with p<0.15 in the univariate model, were inserted into the multivariate model; [2]all variables with p<0.05 in the multivariate model were deemed to have a significant effect; [3]number of comorbidities variable was not inserted in the multivariate model, as it was statistically significantly associated with the variables for food allergies, GI problems and rhinitis; [4]the numeric POEM score was not inserted in the multivariate model, as it was statistically significantly associated with AD severity based on POEM score.

N, number; QoL, quality of life; DLQI, Dermatology Life Quality Index; POEM, Patient-Oriented Eczema Measure; OR, odds ratio; AD, atopic dermatitis; GI, gastrointestinal.