

# Profile of SCORAD, TEWL, and Skin pH values in mild-moderate adult atopic dermatitis patients in Surabaya

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## Abstract

**Background** Atopic dermatitis (AD) is a chronic inflammatory skin disease with skin barrier dysfunction, often persisting into adulthood and impairing quality of life. One of the main pathophysiological characteristics of AD is skin barrier dysfunction, commonly indicated by increased transepidermal water loss (TEWL) and altered skin pH. The SCORAD (Scoring Atopic Dermatitis) index is commonly used to assess disease severity.

**Objective** This study aims to describe the profile of SCORAD, TEWL, and skin pH in adult patients with mild to moderate AD at Dr. Soetomo General Academic Hospital, Surabaya.

**Methods** A descriptive cross-sectional study was conducted from January to October 2022. A total of 32 adult patients aged 18-64 years with clinically diagnosed mild to moderate AD were recruited using consecutive sampling. SCORAD assessments were conducted alongside TEWL and skin pH measurements using Tewameter MPA5 and pH meter devices, respectively. Statistical analysis was performed to evaluate the association of SCORAD, TEWL, and pH values with age and gender.

**Results** The mean age of participants was 37.9±11.8 years, with a balanced sex distribution. Mean SCORAD was 22.2±6.1, TEWL was 20.8±10.2 g/m<sup>2</sup>/h, and skin pH was 5.3±0.5. Most patients (90.6%) had mild AD. No statistically significant correlations were found between age or gender and any of the three measured variables.

**Conclusion** SCORAD, TEWL, and skin pH profiles in adults with mild to moderate AD showed no significant association with age or gender, indicating the heterogeneity of the condition across demographic factors.

**Keywords** Atopic dermatitis; Human and disease; SCORAD; TEWL; Skin pH.

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## Introduction

Atopic dermatitis (AD) is an inflammatory skin condition that generally starts in childhood. The disease's signature symptom is itching, which can be

relentless in severe cases and cause sleep disturbances and irritated, infected skin. Atopic patients have reduced quality of life. In more than 10% of cases, atopic dermatitis can last throughout adolescence or adulthood.<sup>1</sup> The prevalence of AD varies across South-East Asia, ranging from 1.1% of 13-14-year-olds in Indonesia to 17.9% of 12-year-olds in Singapore. Initial presentation of Asian AD patients often manifest as mild to moderate disease. In a study of 80 North Indian children (aged 3 months to 12 years) revealed that 41.2% and 55.5%

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of the children had mild or moderate symptoms, respectively.<sup>2</sup> The most prevalent personal-history among atopic disease was AD, which affected 31 patients (68.89%). Food allergies affected 25 patients (55.56%), while rhinitis allergic patients affected 23 patients (51.11%). Atopic illness was seen in the families of 24 patients (53.33%) in total. Eleven patients (24.44%) had a family history of food allergies, while nine patients (20%) had a history of rhinitis allergies.<sup>3</sup> A retrospective study for the 2013-2015 period was conducted in the Allergy Immunology Division, Department of Dermatology and Venereology, Dr. Soetomo General Hospital. During this time, 7.3% of Immunology Allergy Division patients were diagnosed with atopic dermatitis, with 33.3% of patients belonging to the age group of 15-24 years old.<sup>4</sup> A more recent retrospective study conducted at the aforementioned hospital revealed that there were a total of 243 newly diagnosed adult patients with atopic dermatitis during a period of five years, specifically from 2016 to 2020. Among these patients, the age group of 20-34 years constituted the biggest proportion, with a total of 137 individuals, accounting for 56.4% of the overall patient population.<sup>5</sup>

The condition is typically classified as severe AD if it persists throughout adolescence or adulthood. In addition to the distress caused by the dermatitis itself, such patients frequently experience serious problems with aesthetics and social adaptability. Edema, xerosis, excoriations, erythema, oozing, erosions, crusting, and lichenification are some of the signs of AD. However, they might vary from person to person.<sup>6</sup> Based on the evidence of validity and strong intra- and inter-rater reliability, the Scoring Atopic Dermatitis (SCORAD) was recommended as an outcome evaluation for the symptoms of AD.<sup>7</sup>

One fundamental pathophysiological characteristic underlying AD is barrier disruption. Higher transepidermal water loss (TEWL), which may make it easier for allergens to penetrate the skin and cause inflammation and disease worsening, is also linked

to a disturbance of the skin barrier. In AD skin, high TEWL and inadequate hydration are frequently seen, and both conditions are frequently linked to an elevated skin pH.<sup>8</sup> In Surabaya, Indonesia, there are limited studies that comprehensively describe the profile of SCORAD, transepidermal water loss (TEWL), and skin pH values in patients with atopic dermatitis, particularly in those with mild-to-moderate disease severity. The data remain sparse for adult patients in East Java, and few studies integrate these objective barrier parameters with clinical scoring like SCORAD in mild-moderate cases. Therefore, we intend to describe the profile of SCORAD, TEWL, and skin pH values in Mild-Moderate Atopic Dermatitis Patients at Dr. Soetomo General Academic Hospital, Surabaya to fill the gap.

## **Methods**

A total of 32 adult mild-moderate AD patients who met the Hanifin-Rajka criteria for diagnosis of AD at the Dermatology and Venereology Outpatient Clinic in the Dr. Soetomo General Academic Hospital, Surabaya, were recruited in this descriptive study during January-October 2022. Consecutive sampling method was used to select participants for this study and to minimize selection bias. The sample size was determined using unpaired numerical comparative formula. The inclusion criteria were patients aged 18-64 years, who met the diagnostic criteria of mild to moderate atopic dermatitis according to the Hanifin-Rajka scoring, in a state of generally good health, willing to participate in the study and provide informed consent. Pregnant and breastfeeding women were excluded from participation. Interviews and assessments were carried out to determine SCORAD, TEWL and skin pH values. The SCORAD index, created in 1993, is a validated tool for assessing AD severity.<sup>9,16</sup> It includes area (20%), intensity (60%), and subjective symptoms (20%) like pruritus and sleep loss. The score is calculated using  $A/5 + 7B/2 + C$ , with a maximum of 103. AD is categorized as mild ( $\leq 25$ ), moderate (26-50), and severe ( $>50$ ).<sup>18</sup> To minimize the potential bias such as ultraviolet exposure we used the volar side of the left forearm, a 5x4 cm measurement area to take

TEWL measurements with the tewameter MPA5 and pH measurements of the skin with the pHmeter from Courage-Khazaka. The data was then recorded and mean values determined (**Figure 1**). The data were gathered and analyzed with Microsoft Excel (Microsoft Corp., USA) and IBM SPSS Statistics for Windows Ver. 26.0 (IBM Corp., USA). The Kolmogorov-Smirnov test was employed to ascertain the normality of data distribution. An analysis was conducted using either Pearson's correlation coefficient or Spearman correlation to investigate the relationship between age and SCORAD, TEWL, and pH. Fisher exact test was utilized for analyzing categorical data. The Dr. Soetomo General Academic Hospital's ethical committee in Surabaya, Indonesia gave its approval to this study (No. 0356/KEPK/I/2022 dated 18.01.2022).

### Result

The study participants were adults with atopic dermatitis, ranged in age from 18 to 64 years with a mean age of 37.9±11.8 years. The sex ratio is nearly equal for men and women, at 53.1% and 46.9%, respectively. Office workers made up 46.8% of the subjects' occupations, followed by the students (40.6%), housewives (6.2%), and retired individuals (6.2%).

**Table 1** shows the mean value of SCORAD is 22.2±6.1. The lowest value of SCORAD was 15.2 and the highest one was 45. The highest SCORAD values were exhibited by a subject with moderate AD, whereas the lowest values were exhibited by a mild AD subject. The TEWL assessment was performed on all participants. The mean values were 20.8±10.2 g/m<sup>2</sup>/h with lowest level 11.06 g/m<sup>2</sup>/h and the highest level was 48.3 g/m<sup>2</sup>/h. The lowest and highest TEWL values both were found on mild AD subjects. For the pH levels the mean values was 5.3±0.5, with the lowest value of 4.5 and the highest one

**Table 1** Results of SCORAD, TEWL, skin pH

Variable	Mean±SD	Range
SCORAD	22.2±6.1	15.2-45
TEWL (g/m <sup>2</sup> /h)	20.8±10.2	11.06-48.3
Skin pH	5.3±0.5	4.5-6.9

**Table 2** Correlation statistical analyses.

Variable	Age ( r )	Age p-value	Sex p-value
SCORAD	-0.053	0.773	0.229
TEWL	0.032	0.861	1.000
Skin pH	0.010	0.958	0.106

6.9. The lowest skin pH was found on a subject with moderate AD and the highest skin pH was found on a subject with mild AD.

The results of statistical analyses in **Table 2** show that there is no significant correlation or associations between age and gender with SCORAD, TEWL, or skin pH.

### Discussion

This study found that the mean age of adult patients with mild-to-moderate atopic dermatitis (AD) was 37.9±11.8 years, with a nearly equal sex distribution (53.1% male and 46.9% female). This finding aligns with the demographic information from research done in Finland, which shows that the age group of 30-39 years accounted for 38.31%, as the largest prevalence of AD in adults, followed by adults between the ages of 50 and 59 years (23.32%).<sup>9</sup> A study conducted at Dr. Soetomo General Academic Hospital Surabaya between 2012 and 2014 also reported findings on the prevalence of adult AD cases among different age groups.<sup>10</sup> A more recent study at the same hospital reported that the age group 20-34 years constituted the highest number of cases (56.4%), followed by 35-49 and 50-64 years, each with 17.7%.<sup>5</sup>

This study revealed a male preponderance of 53.3%. According to most studies, females aged 18-74 years had nearly three times the risk of atopic dermatitis compared to males.<sup>11</sup> However, in clinical populations, older men show higher AD prevalence. Males have a higher childhood AD rate, while females exceed after puberty, possibly due to hormonal influences on the immune system and skin barrier.<sup>12</sup>

Atopic dermatitis is a chronic, itchy, eczematous skin disorder.<sup>13</sup> It results from genetic and

environmental interactions that impair the skin barrier. Reduced filaggrin expression compromises the barrier. The stratum corneum is key to this barrier function. Cytokines like IL-4 and IL-13 play roles in disrupting this barrier in AD.<sup>14,15</sup>

This study's mean SCORAD was 22.2±6.1 (range: 15.2 to 45). Most patients (90.6%) had mild AD. This differs from a 2019 study in Surabaya showing more moderate cases.<sup>18</sup> A 2016 study also found 60% moderate AD.<sup>10</sup> Discrepancies may stem from subjective scoring variability influenced by socio-cultural factors.<sup>19</sup> TEWL and skin pH measure epidermal barrier function.<sup>14</sup> TEWL is derived from humidity gradients on the skin surface and measured in g/m<sup>2</sup>/h. Devices used include condenser, open, or unventilated chambers. Due to variability, multiple readings are averaged.<sup>20</sup>

Previous studies showed higher TEWL in lesional versus non-lesional skin.<sup>21,22</sup> This study found a mean TEWL of 20.8±10.2 g/m<sup>2</sup>/h, with a maximum of 48.3. TEWL elevation indicates a compromised barrier, often linked to filaggrin gene mutations-the strongest known genetic risk for AD.<sup>14,22</sup>

Skin pH in this study ranged from 4.5 to 6.9, with a mean of 5.3±0.5. AD patients typically have elevated skin pH compared to healthy controls.<sup>20</sup> Acidic pH is maintained by various factors; neutralization disrupts lipid processing, leading to barrier breakdown and itch. Studies confirm higher pH in lesional skin.<sup>21,23</sup>

Statistical analysis showed no significant correlation between age, gender, and SCORAD, TEWL, or skin pH. Female patients may experience more distress due to visible lesions and societal expectations.<sup>24</sup> This could influence scoring variation across studies. TEWL is generally negatively correlated with age, though findings vary.<sup>25</sup> TEWL peaks in infancy and declines post-adolescence. Differences in TEWL values across studies may stem from ethnicity and body site measurement. Skin pH also changes with age, influenced by enzymes like NHE1 and SPLA2.

**Limitations** The single center hospital based design limit the statistical generalizability of the findings to the broader Indonesian population. Potential confounding factors such as recent treatment and environmental influences in a tropical climate could not be controlled. These limitations should be considered when reading the results.

## Conclusion

This research paper presents an analysis of SCORAD, TEWL, and skin pH profiles across adult individuals diagnosed with mild to moderate atopic dermatitis. The possibility of other factors influencing the outcomes necessitates further investigation into the associations between the characteristics of adults with mild to moderate atopic dermatitis and assessments of their skin profile.

**Declaration of patient consent** Authors certify that they have obtained all appropriate patient consent.

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**Conflict of interest** No conflict of interest.

## Author's contribution

**SA,D,MAU:** Conceived and designed the study, collected and analyzed data, and drafted the manuscript.

**CRSP:** Supervised the research process, approved the final version.

**MS,MPH:** Contributed to data analysis and revised the manuscript critically for important intellectual content.

Every author has given final approval of the manuscript version to be published and agreed to be accountable for all aspects of the work.

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