# PREDICTION OF FOOD SENSITISATION IN CHILDREN WITH ATOPIC DERMATITIS BASED ON DISEASE SEVERITY AND EPIDERMAL LAYER IMPAIRMENT

Nguyen Le Huong Tran[1], Nhung Thi My Ly[1], Hoang Kim Tu Trinh[1], Minh Kieu Le[1], Niem Van Thanh Vo[1], and Duy Le Pham[1]

[1]University of Medicine and Pharmacy Ho Chi Minh City

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**Abstract**

**Background:** Atopic dermatitis (AD) is characterised by epidermal barrier impairment, associated with food allergen (FA) sensitisation and AD severity. However, no clinical guidance has been established for evaluations of food sensitisation (FS) in AD patients. This study investigated how AD severity and epidermal barrier impairment are associated with FS, and factors that can predict FS in children with AD. **Methods:** This cross-sectional study included 100 children (12–60 months) diagnosed with AD. AD severity was determined using the Scoring Atopic Dermatitis (SCORAD) index. FS was evaluated by measuring serum specific IgE antibodies against 31 FAs using an immunoblotting method. Epidermal barrier impairment was assessed by measuring transepidermal water loss (TEWL) and stratum corneum hydration (SCH) levels. **Results:** 90% of participants were sensitised to at least one tested FA, with cow's milk, egg white, beef, almond, egg yolk, and peanut being the most common. Children with moderate-severe AD had lower SCH levels than those with mild AD. Children with AD who were sensitised to $>$ 10 FAs had significantly higher TEWL and lower SCH levels, compared with those sensitised to 1–4 FAs and 5–10 FAs. The SCORAD score and SCH level in lesional skin provided moderately predictive value for sensitisation to FAs in children with AD. **Conclusion:** FS is common in children with AD and closely associate with AD severity as well as epidermal barrier impairment. Evaluations of FS should be considered for children with moderate to severe AD and/or low SCH levels.

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**Nguyen Le Huong Tran[1,3]*, Nhung Thi My Ly[1*], Tu Hoang Kim Trinh[2], Minh Kieu Le[2], Niem Van Thanh Vo[2], Duy Le Pham[1]**

[1]Faculty of Medicine, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam

[2]Center for Molecular Biomedicine, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam

[3]The University of Da Nang - School of Medicine and Pharmacy, Da Nang City, Vietnam

* The authors should be considered joint first authors

**Running title:** Food sensitization in children with AD

**Corresponding author:**

**Duy Le Pham** , MD, PhD

Faculty of Medicine, University of Medicine and Pharmacy at Ho Chi Minh City

Address: 217 Hong Bang street, Ward 11, District 5, Ho Chi Minh City, Viet Nam

Tell: +84-969-965-278

Email: drduypham@ump.edu.vn

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## ABSTRACT

**Background:** Atopic dermatitis (AD) is characterised by epidermal barrier impairment, associated with food allergen (FA) sensitisation and AD severity. However, no clinical guidance has been established for evaluations of food sensitisation (FS) in AD patients. This study investigated how AD severity and epidermal barrier impairment are associated with FS, and factors that can predict FS in children with AD.

**Methods:** This cross-sectional study included 100 children (12–60 months) diagnosed with AD. AD severity was determined using the Scoring Atopic Dermatitis (SCORAD) index. FS was evaluated by measuring serum specific IgE antibodies against 31 FAs using an immunoblotting method. Epidermal barrier impairment was assessed by measuring transepidermal water loss (TEWL) and stratum corneum hydration (SCH) levels.

**Results:** 90% of participants were sensitised to at least one tested FA, with cow's milk, egg white, beef, almond, egg yolk, and peanut being the most common. Children with moderate-severe AD had lower SCH levels than those with mild AD. Children with AD who were sensitised to $>$ 10 FAs had significantly higher TEWL and lower SCH levels, compared with those sensitised to 1–4 FAs and 5–10 FAs. The SCORAD score and SCH level in lesional skin provided moderately predictive value for sensitisation to FAs in children with AD.

**Conclusion:** FS is common in children with AD and closely associate with AD severity as well as epidermal barrier impairment. Evaluations of FS should be considered for children with moderate to severe AD and/or low SCH levels.

Key words: atopic dermatitis, food sensitisation, transepidermal water loss, stratum corneum hydration, paediatrics.

**Key Message**

The study has revealed notable associations between food sensitisations and the disease severity as well as epidermal barrier impairment in children with atopic dermatitis (AD). Specifically, the findings indicate that children with AD who were sensitised to higher numbers of food allergens had higher SCORAD scores and greater epidermal barrier impairment. In addition, SCORAD score and SCH levels at lesional skin could be predictive factors for food sensitisation in children with AD. The findings of this study suggest that clinicians should consider screening for food sensitization in children with moderate-severe AD and/or low SCH levels at lesional skins.

## INTRODUCTION

Atopic dermatitis (AD), characterised by itchy eczema skin lesions, is one of the most common allergic diseases in children with the aged less than 5 years.[1] T helper 2 (Th2) response is an important pathological mechanism of AD, which leads to sensitisation to FAs and aeroallergens.[2,3] Previous studies from Europe and America showed that 91% of children with AD were sensitised to at least one FA.[4] Nevertheless, the profile of sensitised FAs among children with AD in Europe and America could differ from the profile among children in Southeast Asia.

Stratum corneum hydration (SCH) and transepidermal water loss (TEWL) are two important measures of the epidermal integrity.[5]Decreased SCH and increased TEWL indicate an impaired epidermal barrier, which facilitates the penetration of FAs into the skin, where they are captured and presented by antigen-presenting cells, leading to food sensitisation (FS).[3,5,6] The Scoring Atopic Dermatitis (SCORAD) score is a useful tool for assessment of AD severity; SCORAD results are positively associated with allergen sensitisation.[7] In this study, we hypothesised that sensitisation to FAs was associated with AD severity and epidermal layer impairment in children with AD. Accordingly, we evaluated the associations of FS with TEWL, SCH, and SCORAD scores. We then explored factors that could predict FS in children with AD.

## MATERIALS AND METHODS

### Patients

In this cross-sectional study, we recruited 100 children (age 12-60 months) diagnosed with AD at the Allergy and Clinical Immunology Unit of the University Medical Center at Ho Chi Minh City, Vietnam. We excluded patients with the following comorbidities: itchy vulgaris, scabies, seborrheic dermatitis, contact dermatitis, T-cell lymphoma, psoriasis, photosensitive dermatitis, and erythroderma. Study subjects were asked to stop using moisturizers at least 3 hrs prior to enrolment.

The guardians of all study participants provided written informed consent for enrolment. This study was approved by the Institutional Review Board Ethics Committee of the University of Medicine and Pharmacy at Ho Chi Minh City (IRB No: 633/ĐHYD-HĐĐĐ).

### Measurement of TEWL and SCH levels

We measured TEWL and SCH using the GPSkin Barrier Pro® device (Gpower Inc., South Korea), in accordance with the manufacturer's instructions. TEWL and SCH levels were measured in triplicate at the volar forearm area; mean levels were used for statistical analysis. The lesional skin regions selected for measurement of TEWL and SCH were prioritised in the following order: forearms, arms, legs, and thighs.

### Measurement of serum IgE antibodies to FAs

Serum IgE antibodies against 31 FAs were measured by immunoblotting using the EUROLINE Atopy "Venezuela" kit (EUROIMMUN, Lubeck, Germany, kit ID lot A220722AM) in accordance with the manufacturer's instructions. A participant was assumed to have a FS if they had a positive serum IgE antibody result ($>$ 0.35 IU/mL) to at least one tested FA.

### Statistical analysis

Independent samples $t$ -tests were used to compare mean levels among study groups. Receiver operating characteristic (ROC) curves were established to determine cut-off points for TEWL level, SCH level, and SCORAD score in terms of predicting FS. Stata 14.0 (StataCorp) was used for statistical analysis. $p < 0.05$ was considered statistically significant.

## RESULTS

### 3.1. Patients's clinical characteristics

There were 54 male (54%) and 46 female (46%) patients (mean age, 25.9 $\pm$ 13.1 months). The age of AD onset ranged from 1 month to 48 months (median: 3; interquartile range: 2–11.5 months). The mean SCORAD

score was 31.1 ± 16.9. Most participants (60%) had moderate-severe AD, with a SCORAD score > 25. Thirty-three participants (33%) with AD had a family history of atopic dermatitis (Table 1).

### 3.2 Serum IgE to FAs in children with AD

90/100 study subjects (90%) were sensitised to at least one tested FA. The most prevalent sensitised food was cow's milk protein: any cow's milk proteins (60%), including β-lactoglobulin (44%), α-lactalbumin (37%), and casein (15%); followed by egg white (49%), beef (31%), almond (27%), egg yolk (26%), peanut (26%), goat's milk (24%), and rice (19%) (Figure 1).

### 3.3. FA co-sensitisation in children with AD

The prevalences of co-sensitisation to tested FAs among children with AD are shown in Table 2. The most prevalent co-sensitisation profile in the study population involved cow's milk and egg white (35% of patients). This finding was present in 71.4% of children who were sensitised to egg white and 58.3% of children who were sensitised to cow's milk.

The prevalence of co-sensitisation to cow's milk and beef was 28%; this finding was present in 90.3% of children sensitised to beef and 46.7% of children sensitised to cow's milk. The prevalence of co-sensitisation to egg white and egg yolk was 24%; this finding was present in 92.3% of children sensitised to egg yolk and 49% of children sensitised to egg white. The prevalence of co-sensitisation to cow's milk and goat's milk was 22%; this finding was present in 91.7% of children sensitised to goat's milk and 36.7% of children sensitised to cow's milk.

### 3.4. SCH and TEWL levels

In lesional skins, TEWL levels (20.7 ± 8.6 g/m$^2$/hr) were significantly higher and SCH levels (25.7 ± 18.2 a.u.) were significantly lower than those in non-lesional skins (13.3 ± 8.7 g/m$^2$/hr and 41.9 ± 15.1 a.u, respectively, $p< 0.001$ for both) (Figure S1).

In lesional or non-lesional skin, SCH levels were significantly lower in children with moderate-severe AD (38.0 ± 16.1 and 19.8 ± 15.6, respectively) than in children with mild AD (47.7 ± 11.3 and 34.4 ± 18.5, respectively; $p < 0.001$ for both) (Table 3). Although TEWL levels in children with moderate-severe AD tended to be higher than those in children with mild AD, the differences were not statistically significant.

### 3.5. Associations between FS and TEWL/SCH levels

We compared the levels of TEWL and SCH among 4 study groups: children with AD and no food sensitisation ("non-sensitisers"), children sensitised to 1–4 FAs, 5–10 FAs, and > 10 FAs. Children with AD who were sensitised to more FAs had higher TEWL and lower SCH levels, compared with those sensitised to fewer FAs or non-sensitisers, regardless of non-lesional/lesional skin areas ($p < 0.05$) (Figure 2).

### 3.6. Associations between FS and AD severity

The number of sensitised FAs was positively associated with the SCORAD score in this study. Specifically, children with AD and sensitisation to more FAs had higher SCORAD scores. The highest mean SCORAD score (51.4 ± 18.8) was observed in children sensitised to >10 FAs, whereas the lowest mean SCORAD score (22.9 ± 9.7) was observed in non-sensitised children with AD (Figure S2). Additionally, compared with non-sensitised children, children with AD who were sensitised to egg, casein, goat's milk, beef, pork, chicken, rye flour, rice, soybean, corn, peanut, almond, apple, or strawberry had significantly higher SCORAD scores (Table S1).

### 3.7. Prediction of FS according to SCORAD scores, TEWL levels, and SCH levels

We used ROC curves to determine the area under the curve (AUC), sensitivity, and specificity of cut-off points for SCORAD score, TEWL, and SCH level in predicting sensitisation to the following common allergens: cow's milk, egg, almond, peanut, and goat's milk (Table 4, Figure S3, S4, S5).

The SCORAD score was a good predictor of sensitisation to egg yolk (AUC = 0.75, $p < 0.001$), beef (AUC = 0.71, $p = 0.001$), almond (AUC = 0.82, $p < 0.001$), peanut (AUC = 0.81, $p < 0.001$), and goat's milk (AUC = 0.74, $p< 0.001$) in children with AD. Additionally, the SCORAD score was moderately able to predict sensitisation to cow's milk (AUC = 0.63,$p = 0.02$) and egg white (AUC = 0.68, $p = 0.001$). Generally, the SCH level in children with lesional skin had good predictive value for sensitisation to peanut (AUC = 0.73, $p< 0.05$) and goat's milk (AUC = 0.72, $p < 0.05$), moderately predictive value for sensitisation to cow's milk (AUC = 0.62, $p = 0.03$), egg white (AUC = 0.65, $p = 0.009$), egg yolk (AUC = 0.64, $p = 0.04$), almond (AUC = 0.63, $p = 0.05$), and beef (AUC = 0.66, $p = 0.01$). However, the TEWL level had low predictive value for FS in children with AD.

## DISCUSSION

In the present study, we found that most of children with AD were sensitised to at least 1 food allergens, and those who were sensitised to a greater number of FAs had more severe AD phenotypes and greater epidermal integrity impairment. Moreover, SCORAD score and SCH level could predict FS in children with AD.

Most children with AD (90%) in the present study were sensitised to at least one of the tested FAs; this prevalence was higher than those reported by Moghtaderi et al.[8] (51%) and Yuenyongviwat et al.[9] (60%). However, those studies investigated smaller numbers of FAs (20 and 8 allergens, respectively), compared with our study.[8,9] Additionally, other studies in children aged < 15 years showed that the prevalence of FS ranged from 30% to 40%,[10,11] below the prevalence in our study. This difference may have occurred because FS is more frequent in young children and can be outgrown. In another study, the prevalence of FS in children with AD ranged from 20% to 80%.[12] These findings suggest that FS is more common than previously reported in children with AD, particularly among such children aged < 5 years. Additionally, the number of FAs investigated in each study and the ethnicity of the study population could affect FS prevalence.

We found that cow's milk protein (60%) was the most common sensitised FA, followed by egg white (49%), beef (31%), almond (27%), egg yolk (26%), and peanut (26%). Similar results were reported by Moghtaderi et al.[8]. Another study also showed that egg, cow's milk, and peanut were the most prevalent allergens in children with AD who were sensitised to FA.[13] However, a study in an American population showed that egg and peanut were the most prevalent FAs.[14] Differences in common sensitised FAs among studies could be related to differences in ethnicity, age, local food customs, and dietary habits among study populations. In Vietnam and other Asian countries, cow's milk proteins and egg appear to be the most common FAs in children.

We also examined features of co-sensitisation among the tested FAs and found that egg white and beef had the highest prevalence of co-sensitisation, such that 71.4% of children sensitised to egg white were also sensitised to beef; 58.3% of children sensitised to beef were also sensitised to egg white. This prevalence was higher than that reported previously, which showed that 28.5% of AD children who were sensitised to egg white also exhibited beef sensitisation.[15] The prevalence of co-sensitisation to cow's milk and cow's milk protein ranged from 75% to 91.7% in children with AD who were sensitised to goat's milk. Therefore, in clinical practice, caution should be exercised when introducing cow's milk to AD children who have had allergic reactions to beef and/or goat's milk. Additionally, children with AD who were sensitised to egg yolk demonstrated a high prevalence (92.3%) of sensitisation to egg white; consequently, caution should be exercised when introducing egg white to children with AD who have had allergic reactions to egg yolk.

To our knowledge, this is the first study in Vietnam to evaluate the association between FS and epidermal layer impairment. We found that in children with AD, lesional skin had significantly higher TEWL levels and lower SCH levels compared with non-lesional skin. Additionally, participants with moderate-severe AD had significantly higher TEWL levels and lower SCH levels in lesional skin, compared with participants who had mild AD. These findings were consistent with the results of Montero-Vilchez et al.[16], who showed that impaired skin barrier function in the lesional skin was associated with AD severity.

The damaged epidermal barrier (indicated by increased TEWL levels and decreased SCH levels) in patients with AD could enhance FA penetration and induce FS.[2] In the present study, participants who were sensitised

to more FAs exhibited higher TEWL levels and lower SCH levels, compared with non-sensitisers or children sensitised to fewer FAs. A previous study involving children aged 1–2 years with AD and FS revealed higher TEWL levels than non-sensitisers.[14]Although these findings suggest a clear association between FS and epidermal barrier impairment, the causative relationship between these factors cannot be determined using data from cross-sectional studies.

We found that the number of sensitised FAs was positively associated with AD severity, as determined by SCORAD scores. Compared with non-sensitisers, children with AD who were sensitised to FAs such as egg, cow's and goat's milk proteins, beef, pork, chicken, rice, and others (Table S1) had more severe AD. This was consistent with the findings of Wolkerstorfer et al.[17]. Additionally, Leung et al.[18] showed that decreased expression of filaggrin and increased TEWL levels in the skin of individuals with AD could facilitate FS into deeper skin layers. Subsequent exposure to FAs via damaged skin could trigger an inflammatory response, leading to enhancement of AD severity.[2] Other studies showed strong associations among FS, food allergies, and the severity and chronicity of AD.[8,18] Consequently, those findings indicate that FS could be associated with epidermal barrier impairment and subsequently AD severity in children.

There is currently no clinical guidance regarding the appropriate time to evaluate FA in patients with AD. The results of previous studies have suggested that FS is associated with severe and persistent AD.[19] In the present study, we analysed the ROC curves of SCORAD scores, as well as the utilities of SCH and TEWL levels, in terms of predicting FS in the study subjects. We found that SCORAD scores and SCH levels in lesional skin had moderate predictive value for sensitisation to cow's milk, egg, almond, beef, peanut, and goat's milk in children with AD. SCORAD scores and SCH levels in lesional skin had the highest predictive value for sensitisation to peanut and the lowest predictive value for sensitisation to cow's milk. However, TEWL levels were not useful for predicting FS in the present study. The SCORAD assessment and the measurements of TEWL and SCH levels are easy, non-invasive procedures that are safe for children. Our findings suggest that clinicians should consider assessing FS in children with moderate-severe AD and/or low SCH levels in lesional skin.

The limitations of the present study include the inability to perform a follow-up assessment because of the cross-sectional design. Furthermore, we did not perform an oral food challenge test to determine food allergies. The age range of our study participants was also limited because we did not include children aged $< 1$ year. Thus, the study results are not representative of children with the highest prevalence of AD (i.e., children aged $< 6$ months).

In conclusion, FS was common in children with AD; it was closely associated with AD severity and epidermal barrier impairment. Evaluations of food sensitisation should be considered for children with moderate-severe AD and/or low SCH levels.

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## AUTHOR CONTRIBUTIONS

**Nguyen Le Huong Tran** : Conceptualization; Methodology; Data Curation; Formal Analysis; Investigation; Writing – Original Draft Preparation; Writing – Review & Editing**. Nhung Thi My Ly** : Conceptualization; Project Administration; Supervision; Writing – Original Draft Preparation; Writing – Review & Editing. **Tu Hoang Kim Trinh** : Project Administration; Writing – Review & Editing.**Minh Kieu Le** : Investigation; Writing – Review & Editing.**Niem Van Thanh Vo:** Investigation; Writing – Review & Editing.**Duy Le Pham:** Conceptualization; Formal Analysis; Investigation; Methodology; Validation; Project Administration; Supervision; Writing – Original Draft Preparation; Writing – Review & Editing and acceptance for submission.

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## TABLES

**TABLE 1. Clinical characteristics of study subjects**

| Clinical characteristics | Total (n=100) |
|---|---|
| Gender (Male) | 54 (54) |
| Age (month) (mean ± SD) | 25.9 ± 13.1 |
| Age of onset (month), median (IQR) Min - Max | 3 (2 – 11.5) 1 – 48 |
| Mean SCORAD score (mean ± SD) | 31.1 ± 16.9 |
| AD Severity | |
| Mild (SCORAD < 25) | 40 (40) |
| Moderate-severe (SCORAD [?] 25) | 60 (60) |
| Family history of AD | 33 (33) |
| Personal history of atopy | |
| Urticaria | 13 (13) |
| Allergic rhinitis | 9 (9) |
| Asthma | 6 (6) |

*Note:* n presented sample size

*Abbreviations:* AD: Atopic Dermatitis; IQR: Interquartile range; SCORAD: Scoring Atopic Dermatitis; SD: Standard deviation

Data were presented as prevalence (%)

**TABLE 2. Co-sensitisation to food allergens**

| **Food allergens** | **Egg white** | **Cow's milk** | **β-lactoglobulin** | **α-lactalbumin** | **Beef** | **Almond** | **Peanut** | **Egg yolk** | **Goat's milk** |
|---|---|---|---|---|---|---|---|---|---|
| **Egg white** (n = 49) | | 35 (71.4) | 27 (55.1) | 25 (51.0) | 21 (42.9) | 20 (40.8) | 21 (42.9) | 24 (49) | 19 (38.8) |
| **Cow's milk** (n = 60) | 35 (58.3) | | 43 (71.7) | 37 (61.7) | 28 (46.7) | 19 (31.7) | 19 (31.7) | 18 (30) | 22 (36.7) |
| **β-lactoglobulin** (n = 44) | 27 (61.4) | 43 (97.7) | | 26 (59.1) | 22 (50) | 15 (34.1) | 14 (31.8) | 13 (29.5) | 18 (40.9) |
| **α-lactalbumin** (n = 37) | 25 (67.6) | 37 (100) | 26 (70.3) | | 21 (56.8) | 15 (40.5) | 14 (37.8) | 14 (37.8) | 20 (54.1) |

| **Food allergens** | **Egg white** | **Cow's milk** | **β-lactoglobulin** | **α-lactalbumin** | **Beef** | **Almond** | **Peanut** | **Egg yolk** | **Goat's milk** |
|---|---|---|---|---|---|---|---|---|---|
| **Beef** (n = 31) | 21 (67.7) | 28 (90.3) | 22 (71) | 21 (67.7) | | 14 (45.2) | 11 (35.5) | 14 (45.2) | 17 (54.8) |
| **Almond** (n = 27) | 20 (74.1) | 19 (70.4) | 15 (55.6) | 15 (55.6) | 14 (51.9) | | 16 (59.3) | 17 (63) | 15 (55.6) |
| **Peanut** (n = 26) | 21 (80.8) | 19 (73.1) | 14 (53.8) | 14 (53.8) | 11 (42.3) | 16 (61.5) | | 15 (59.7) | 12 (46.1) |
| **Egg yolk** (n = 26) | 24 (92.3) | 18 (69.2) | 13 (50) | 14 (53.8) | 14 (53.9) | 17 (65.4) | 15 (57.7) | | 14 (53.9) |
| **Goat's milk** (n = 24) | 19 (79.2) | 22 (91.7) | 18 (75) | 20 (83.3) | 17 (70.8) | 15 (62.5) | 12 (50) | 14 (58.3) | |
| **Rice** (n = 19) | 15 (78.9) | 12 (63.2) | 11 (57.9) | 10 (52.6) | 10 (52.6) | 13 (68.4) | 9 (47.4) | 11 (57.9) | 9 (47.4) |

*Note:* n is the number of children with atopic dermatitis who were sensitised to each type of food allergen.

Data were presented as frequency and prevalence (%)

**TABLE 3. Comparison of TEWL and SCH levels in children with mild vs. moderate-severe AD**

| | Mild (n=39) | Moderate-severe (n=58) | *p* |
|---|---|---|---|
| TEWL (g/m$^2$/hr) (mean ± SD) | | | |
| Non-lesional skin | 11.9 ± 7.4 | 14.3 ± 9.4 | 0.184 |
| Lesional skin | 18.8 ± 9.0 | 21.9 ± 8.1 | 0.08 |
| SCH (a.u.) (mean ± SD) | | | |
| Non-lesional skin | 47.7 ± 11.3 | 38.0 ± 16.1 | **<0.001** |
| Lesional skin | 34.4 ± 18.5 | 19.8 ± 15.6 | **<0.001** |

*Abbreviations:* hr: hour; SD: Standard deviation.

*p* -values were obtained by using Independent sample t-test.

**TABLE 4. SCORAD scores, TEWL levels, and SCH levels predicting food sensitisation in children with atopic dermatitis according to sensitised allergens**

| | AUC | Cut-off | Sensitivity | Specificity | *p* |
|---|---|---|---|---|---|
| Cow's milk | | | | | |
| SCORAD | 0.63 | 29.1 | 60.5 | 59.7 | **0.02** |
| SCH non-lesional skin | 0.59 | 49 | 43.6 | 74.3 | 0.13 |

| | AUC | Cut-off | Sensitivity | Specificity | $p$ |
|---|---|---|---|---|---|
| SCH lesional skin | 0.62 | 19 | 69.4 | 42.9 | **0.03** |
| TEWL non-lesional skin | 0.57 | 14.6 | 45.7 | 74.2 | 0.73 |
| TEWL lesional skin | 0.50 | 19 | 57.1 | 46.8 | 0.70 |
| Egg white | | | | | |
| SCORAD | 0.68 | 34.2 | 51.0 | 86.3 | **0.001** |
| SCH non-lesional skin | 0.61 | 38 | 70.0 | 46.8 | **0.04** |
| SCH lesional skin | 0.65 | 22 | 70.0 | 55.3 | **0.009** |
| TEWL non-lesional skin | 0.61 | 12.6 | 55.3 | 68.0 | 0.08 |
| TEWL lesional skin | 0.59 | 18.2 | 68.1 | 52.0 | 0.12 |
| Egg yolk | | | | | |
| SCORAD | 0.75 | 34.3 | 61.5 | 79.7 | **< 0.001** |
| SCH non-lesional skin | 0.60 | 47 | 46.6 | 58.3 | 0.08 |
| SCH lesional skin | 0.64 | 15 | 75.3 | 45.8 | **0.04** |
| TEWL non-lesional skin | 0.60 | 12 | 62.5 | 60.3 | 0.35 |
| TEWL lesional skin | 0.55 | 23 | 45.8 | 65.8 | 0.56 |
| Beef | | | | | |
| SCORAD | 0.71 | 30.3 | 67.7 | 69.6 | **0.001** |
| SCH non-lesional skin | 0.69 | 34 | 78.3 | 50.0 | **0.002** |
| SCH lesional skin | 0.66 | 19 | 72.5 | 53.6 | **0.01** |
| TEWL non-lesional skin | 0.59 | 12 | 60.7 | 60.9 | 0.49 |
| TEWL lesional skin | 0.53 | 22 | 50.0 | 60.9 | 0.47 |
| Almond | | | | | |
| SCORAD | 0.82 | 30.1 | 81.5 | 71.2 | **< 0.001** |
| SCH non-lesional skin | 0.63 | 45 | 55.6 | 64.0 | 0.09 |
| SCH lesional skin | 0.63 | 25 | 56.9 | 56.0 | **0.05** |
| TEWL non-lesional skin | 0.52 | 13 | 56.0 | 63.9 | 0.89 |
| TEWL lesional skin | 0.60 | 25.3 | 48.0 | 75.0 | 0.13 |
| Peanut | | | | | |
| SCORAD | 0.81 | 34.3 | 73.1 | 83.8 | **< 0.001** |
| SCH non-lesional skin | 0.70 | 38 | 68.5 | 58.3 | **0.007** |

| | AUC | Cut-off | Sensitivity | Specificity | $p$ |
|---|---|---|---|---|---|
| SCH lesional skin | 0.73 | 20 | 69.9 | 66.7 | **< 0.001** |
| TEWL non-lesional skin | 0.50 | 10.5 | 52.1 | 54.2 | 0.77 |
| TEWL lesional skin | 0.64 | 26.5 | 45.8 | 80.8 | 0.06 |
| Goat's milk | | | | | |
| SCORAD | 0.74 | 30.1 | 70.8 | 65.8 | **< 0.001** |
| SCH non-lesional skin | 0.67 | 46 | 46.1 | 76.2 | **0.008** |
| SCH lesional skin | 0.72 | 19 | 71.1 | 57.1 | **0.001** |
| TEWL non-lesional skin | 0.53 | 13 | 52.4 | 61.8 | 0.82 |
| TEWL lesional skin | 0.55 | 25.3 | 42.9 | 72.4 | 0.32 |

*Abbreviations:* AUC: area under the curve; SCORAD: Scoring Atopic Dermatitis; SCH: Stratum corneum hydration; TEWL: Transepidermal water loss

**FIGURE LEGENDS**

**FIGURE 1.** Prevalence of sensitization to food allergens in the study subjects.

**FIGURE 2.** Comparison of **(A) transepidermal water loss**(TEWL) and **(B) stratum corneum hydration** (SCH) according to the number of sensitized allergens in non-lesional and lesional skins.$p$ -values were obtained by using Independent sample t-test

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