

# Characteristic and clinical relevance of atopic dermatitis patients with positive skin prick test to house dust mites: An Indonesian retrospective study

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## Abstract

**Objective** The objective of this study was to evaluate the characteristics and clinical relevance of HDM sensitization among AD patients in Surabaya, Indonesia.

**Methods** This study examined 50 AD patients who had had skin prick tests (SPT) for food (chicken, shrimp, and cow's milk) and inhalant (HDM) allergens at the Dermatology and Venereology Outpatient Clinic of Dr. Soetomo General Academic Hospital in Surabaya, Indonesia through 2016-2020. Subjects with positive and negative SPT findings for HDM were separated into 2 groups.

**Results** Subjects were dominated by female (74%) and 72% of the patients had positive HDM SPT result. The data of atopic history (including allergic rhinitis and AD), precipitating factor (including food and HDM allergy), positive result to shrimp and cow's milk SPT, chronically relapsing dermatitis, immediate skin test reactivity, and raised serum IgE, were significantly different between groups of AD patients with positive and negative HDM SPT. There was no statistically significant difference between the groups in terms of AD signs and symptoms. The clinical relevance of the HDM allergy history based on anamnesis and the HDM SPT findings was 60.0%.

**Conclusion** Atopic dermatitis due to HDM is prevalent in Surabaya. There were various characteristics linked to AD patients who had a positive HDM SPT. Clinical relevance revealed that allergen recognition remains challenging.

## Key words

Atopic dermatitis; Aeroallergen; Human and disease; House dust mites; Skin prick test.

## Introduction

Atopic dermatitis (AD) is a multifactorial, chronic, relapsing, inflammatory skin disease that commonly has onset within the first 2 years of life.<sup>1,2</sup> It affects about 20% of children and 2-8% of adults. This disease is often linked to

other IgE-associated allergies, such as food allergy, asthma, rhinitis, and conjunctivitis.<sup>3</sup> Atopic dermatitis is usually defined by intense pruritus and eczematous lesions that vary in location depending on age. Eczemas are most common on the extensor sides of joints, face, and body in infants and toddlers. Meanwhile, it

is more common on the flexor sides of the joint, neck, and around the eyes in older children, teenagers, and adults. Additionally, lesion can be present only in hand and foot. Pruritic nodules on the extensor sides might also occur in older teenagers and adults.<sup>4</sup>

Epidermal dysfunction and altered innate or adaptive immunological responses to allergens, irritants, microorganisms, and stress are two main pathways that cause AD. Food (such as shrimp, chicken, and cow's milk) and inhalant (such as dust mites, animal danders, and pollens) allergen have been known as a precipitating factor that exacerbates AD in most patients.<sup>2</sup> House dust mite (HDM) is the most prevalent aeroallergen in Asia, with the highest rates sensitization in Singapore (up to more than 90%).<sup>5</sup> Studies in Indonesia also revealed that HDM had been the most frequently occurring allergen among AD patients in Surabaya, Indonesia (63.3%) and Palembang, Indonesia (64.3%).<sup>6,7</sup> It could live in bedding, mattresses, pillows, and stuffed animals. High humidity was a significant factor in supporting dust mite proliferation. *Dermatophagoides pteronyssinus* (*Der-p*), *Dermatophagoides farina* (*Der-f*), and *Blomia tropicalis* (BT) are the most common HDM species. Atopic Asians were predominantly sensitized to *Dermatophagoides* species.<sup>5,8</sup> Meanwhile, a study in Indonesia found that *Tyrophagus putrescentiae* was the most common source of HDM sensitization in AD patients according to IgE test results.<sup>9</sup> Indonesia as part of Asia has relatively high humidity that supports dust mites' existence as

triggering factor of AD. The objective of this study was to evaluate the characteristics and clinical relevance of HDM sensitization among AD patients.

## Methods

This retrospective study evaluated the medical records of patients from Allergy and Immunology Division of Dermatology and Venereology Outpatient Clinic at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, between January 2016 and December 2020. The information gathered includes identity, history taking, physical examination, diagnosis, and skin prick test results. Inclusion criteria for this study were patients who had diagnosis or history of AD and skin prick tests (SPTs) that were performed with allergens of HDM, shrimp, chicken, and cow's milk. Exclusion criteria were medical records with incomplete variable data. The SPT results of HDM were used to divide the subjects into 2 groups. The first group consisted of subjects with a positive SPT of HDM, while the second group consisted of subjects with a negative SPT of HDM. The test was performed on the volar side of the forearm. Between allergens in the testing area, the distance was set to a minimum of 3 cms. After dripping the allergen extracts, the patient's skin was pricked by microlancettes. Results were observed after 15-20 minutes by dermatovenereologist. It is considered as positive if the induration's diameter is more than 3 mm. The ethical clearance has been obtained from the Ethical Committee of Dr. Soetomo General Academic Hospital Surabaya, Indonesia (No. 0618/LOE/301.4.2/IX/2021).

This study used descriptive statistics (mean, median, minimum, maximum, and percentage) to describe the variables. Pearson's Chi-square test or Fisher's exact test was used to compare the qualitative data between subjects with HDM

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SPT positive and negative results. Kolmogorov Smirnov was used to check the data normality followed by Mann-Whitney U test to compare quantitative continuous variable data such as age. A P-value of 0.05 or less was regarded as statistically significant. The statistical information was analyzed using SPSS ver. 25.0.

**Results**

There were 50 subjects included in this study, of which 37 (74.0%) were female and 13 (26.0%) were male. As many as 36 subjects (72%) were assigned to group 1, and the remaining 14 (28%) were assigned to group 2. The mean age was 28.8±10.9 years, and the age range of the subjects was 11 to 67 years, with median age 25.5 years. The majority of subjects developed AD during adult (40.0%). There was no significant difference in gender, age, and the

onset of disease between these two groups. A total of 84.0% of subjects had personal/family atopic history, predominance by AD (74.0%), followed by allergic rhinitis (30.0%) and asthma (10.0%). There was a significant difference in personal/ family atopic history (p=0.000), AD history (p=0.029), and allergic rhinitis history (p=0.004) between group 1 and group 2. Seventy-two percent of the subjects were aware of the factors that cause exacerbation of AD. The most common precipitating factor was food (44.0%), followed by HDM (40.0%). These three variables gave a significant difference between the two groups of subjects (p=0.042, p=0.045, p=0.021). According to these findings, 19 out of 22 subjects who claimed to have food allergies also had positive HDM SPT (86.3%). The characteristics of the subjects is presented in **Table 1**.

**Table 1** Subjects’ characteristic.

Characteristic	Frequency (n = 50)	Patients with AD (%)*		p-value
		HDM SPT (+) (n = 36)	HDM SPT (-) (n = 14)	
Age, years	Mean ± SD	28.8 (10.9)	28.06 (9.9)	0.380 <sup>b</sup>
	Median (range)	25.5(11-67)	24.5 (16-67)	
Gender	Male	13 (26.0)	11 (30.6)	0.303 <sup>a</sup>
	Female	37 (74.0)	25 (69.4)	
Age of onset	Infantile (< 2 yrs)	8 (16.0)	7 (19.4)	0.717 <sup>a</sup>
	Childhood (2-12 yrs)	12 (24.0)	9 (25.0)	
	Adolescents (13-18 yrs)	8 (16.0)	6 (16.7)	
	Adult (19-60 yrs)	20 (40.0)	13 (36.1)	
	Elderly (> 60 yrs)	2 (4.0)	1 (2.8)	
Atopic History (Personal / Family)**		42 (84.0)	35 (97.2)	<b>0.000</b> <sup>a</sup>
	Asthma	5 (10.0)	5 (13.9)	0.304 <sup>a</sup>
	Allergic rhinitis	15 (30.0)	15 (41.7)	<b>0.004</b> <sup>a</sup>
	Atopic dermatitis	37 (74.0)	30 (83.3)	<b>0.029</b> <sup>a</sup>
Precipitating Factor**		36 (72.0)	29 (80.6)	<b>0.042</b> <sup>a</sup>
	Food	22 (44.0)	19 (52.8)	<b>0.045</b> <sup>a</sup>
	HDM	20 (40.0)	18 (50.0)	<b>0.021</b> <sup>a</sup>
	Psychological stress	1 (2.0)	0	0.280 <sup>a</sup>
	Drug	1 (2.0)	1 (2.8)	1.000 <sup>a</sup>
	Insect bite	1 (2.0)	0	0.280 <sup>a</sup>
	Season	5 (10.0)	2 (5.6)	0.126 <sup>a</sup>
	Viral / bacterial infections	0	0	-
	Contact	0	0	-
	Pollen	2 (4.0)	1 (2.8)	0.486 <sup>a</sup>

\*The percentage represents the proportion of the n value in each column.

\*\*Each person can have >1 variable.

<sup>a</sup>Pearson X<sup>2</sup> test; <sup>b</sup>Mann-Whitney U test.

**Table 2** Clinical relevance of HDM SPT.

Clinical Relevance of HDM SPT		History of suspected HDM allergy		Result of HDM SPT	Total	Percentage
Yes	30 (60.0%)	Yes		Positive	18	60%
		No		Negative	12	40%
No	20 (40.0%)	Yes		Negative	2	10%
		No		Positive	18	90%

**Table 3** SPT results.

Food allergens**	Frequency (%)* (n = 50)	Patients with AD		p-value
		HDM SPT (+) (n = 36)	HDM SPT (-) (n = 14)	
Shrimp SPT	23 (46.0)	20	3	0.030 <sup>a</sup>
Chicken SPT	12 (24.0)	11	1	0.140 <sup>a</sup>
Cow's milk SPT	9 (18.0)	9	0	0.047 <sup>a</sup>

\*The percentage represents the proportion of the n value in each column.

\*\*Each person can have > 1 positive results.

<sup>a</sup>Pearson X<sup>2</sup> test.

The clinical relevance between the history of HDM allergy and the results of the HDM SPT are summarized in **Table 2**. The results indicate 60.0% clinical relevance. Forty percent (20 subjects) of the subjects misrecognized their allergies. As many as 90% of these 20 subjects did not aware that they were allergic to HDM. As previously stated, the SPT results showed that up to 86.3% of subjects who claimed to have a food allergy also had an HDM SPT (+). It was confirmed by the SPT results, which showed that the majority of subjects allergic to shrimp (20 out of 23 (86.9%)), chicken (11 out of 12 (91.6%)), and cow's milk (9 out of 9 (100.0%)) were also allergic to HDM. There was a significant difference between the shrimp SPT (p=0.030) and cow's milk SPT (p=0.047) results between the two groups. **Table 3** shows an overview of the SPT results.

**Table 4** shows history details regarding Hanifin Rajka's criteria, while **Table 5** shows the signs and symptoms of the subjects when they firstly came to the Allergy and Immunology Division of Dermatology and Venereology Outpatient Clinic at Dr. Soetomo Academic General Hospital, Surabaya, Indonesia. The most common complaints still experienced by subjects were pruritus (erythema (28.0%) and xerosis (20.0%). Lesion mainly found at foot

(24%), arm (22%), leg (22%), and hand (22%). However, difference between the groups in terms of AD signs and symptoms was not significant.

From the major criteria, the most common symptom was pruritus (84%). The points that differed significantly between the two groups were chronically-relapsing dermatitis (p=0.016) and personal/family atopic history (p=0.000). On the minor criteria, the points that differed significantly were the results of the SPT (p=0.000), the increase in serum IgE (p=0.018), and food intolerance (p=0.045). From the results of the SPT, 40 subjects (80.0%) had positive SPT results. Of the 40 subjects, 36 subjects had positive SPT results for HDM, and the remaining 4 subjects were negative for HDM. These 4 subjects had positive results for shrimp (3 subjects), and chicken (1 subject).

## Discussion

This study observed AD patients who underwent SPT in Allergy and Immunology Division of Dermatology and Venereology Outpatient Clinic at Dr. Soetomo Academic General Hospital. Between 2016 and 2020, a total of 50 AD patients visited the outpatient clinic and underwent SPT. Seventy-two percent of the

**Table 4** Hanifin Rajka Criteria.

Criteria	Frequency (n = 50)	Patients with AD (%)*		p-value
		HDM SPT (+) (n = 36)	HDM SPT (-) (n = 14)	
<b>Major**</b>				
Pruritus	42 (84.0)	30 (83.3)	12 (85.7)	1.000 <sup>a</sup>
Flexural lichenification	8 (16.0)	6 (16.7)	2 (14.3)	1.000 <sup>a</sup>
Chronically – relapsing dermatitis	15 (30.0)	7 (19.4)	8 (57.1)	<b>0.016</b> <sup>a</sup>
Personal/family atopic history	42 (84.0)	35 (97.2)	7 (50.0)	<b>0.000</b> <sup>a</sup>
<b>Minor**</b>				
Xerosis	10 (20.0)	5 (13.9)	5 (35.7)	0.118 <sup>a</sup>
Ichthyosis, palmar hyperlinearity, or keratosis pilaris	0	0	0	-
Immediate skin test reactivity	40 (80.0)	36 (100.0)	4 (28.6)	<b>0.000</b> <sup>a</sup>
Raised serum IgE	17 (34.0)	16 (44.4)	1 (7.1)	<b>0.018</b> <sup>a</sup>
Early age of onset (< 2 years?)	8 (16.0)	7 (19.4)	1 (7.1)	0.414 <sup>a</sup>
Nipple eczema	0	0	0	-
Non-specific hand or foot dermatitis	8 (16.0)	5 (13.9)	3 (21.4)	0.670 <sup>a</sup>
Cheilitis	1 (2.0)	1 (2.8)	0	1.000 <sup>a</sup>
<i>S. Aureus</i> infection	1 (2.0)	0	1 (7.1)	0.280 <sup>a</sup>
Perifollicular accentuation	0	0	0	-
Pityriasis alba	2 (4.0)	1 (2.8)	1 (7.1)	0.486 <sup>a</sup>
White demographism	0	0	0	-
Anterior subcapsular cataracts	0	0	0	-
Recurrent conjunctivitis	0	0	0	-
Orbital darkening	4 (8.0)	3 (8.3)	1 (7.1)	1.000 <sup>a</sup>
Dennie-Morgan infraorbital fold	4 (8.0)	4 (11.1)	0	0.566 <sup>a</sup>
Facial pallor or facial erythema	1 (2.0)	1 (2.8)	0	1.000 <sup>a</sup>
Food intolerance	22 (44.0)	19 (52.8)	3 (21.4)	<b>0.045</b> <sup>a</sup>
Intolerance to wool and lipid solvents	3 (6.0)	2 (5.6)	1 (7.1)	1.000 <sup>a</sup>
Course influenced by environmental or emotional factors	1 (2.0)	1 (2.8)	0	1.000 <sup>a</sup>

\*The percentage represents the proportion of the n value in each column.

\*\*Each person can have > 1 variable.

<sup>a</sup>Pearson X<sup>2</sup> test.

patients (36 out of 50) had positive HDM SPT results. The mean age of the 50 subjects was 28.8±10.9 years, and the ages varied from 11-67 years, with a median of 25.5 years old. This is not in accordance with the general theory which states that the prevalence of AD is higher in children (20%) than in adults (2-8%).<sup>3</sup> This happens because the study was conducted in an adult allergy and immunology outpatient clinic. However, 3 subjects in this study were children because the SPT examination was centered on the adult allergy and immunology outpatient clinic.

This study showed a predominance of females (74%) in individuals with AD history. This is

consistent with prior research indicating that females experienced AD at a higher rate than males, with a female to male ratio of 2:1.<sup>10</sup> In childhood, males have a slightly higher prevalence of AD than females, but following puberty, females have a larger prevalence. After puberty, sex hormones have a profound effect on immunological systems. Estrogen and progesterone stimulate Th2/regulatory T cell (Treg) activity but suppress Th1/Th17 activity. Androgens inhibit Th1/Th2/Th17 and stimulate Treg activity. Estrogen strengthens the skin permeability barrier, whereas progesterone and androgens weaken it. Dehydroepiandrosterone (DHEA) inhibits Th2 but stimulates Th1 activity.

**Table 5.** Sign and Symptom

Characteristic	Frequency (n = 50)	Patients with AD (%)*		p-value
		HDM SPT (+) (n = 36)	HDM SPT(-) (n = 14)	
Chief Complain**	16 (32.0)	9 (25.0)	7 (50.0)	0.105 <sup>a</sup>
Itchy	15 (30.0)	9 (25.0)	6 (42.9)	0.304 <sup>a</sup>
Redness	10 (20.0)	6 (16.7)	4 (28.6)	0.436 <sup>a</sup>
Location of lesion**	16 (32.0)	9 (25.0)	7 (50.0)	0.105 <sup>a</sup>
Face	1 (2.0)	1 (2.8)	0	1.000 <sup>a</sup>
Neck	2 (4.0)	2 (5.6)	0	1.000 <sup>a</sup>
Arm (lengan)	11 (22.0)	6 (16.7)	5 (35.7)	0.252 <sup>a</sup>
Trunk	3 (6.0)	2 (5.6)	1 (7.1)	1.000 <sup>a</sup>
Leg (tungkai)	11 (22.0)	6 (16.7)	5 (35.7)	0.252 <sup>a</sup>
Foot (kaki)	12 (24.0)	7 (19.4)	5 (35.7)	0.278 <sup>a</sup>
Hand (tangan)	11 (22.0)	7 (19.4)	4 (28.6)	0.476 <sup>a</sup>
Skin lesion morphology**	16 (32.0)	9 (25.0)	7 (50.0)	0.105 <sup>a</sup>
Erythema	14 (28.0)	8 (22.2)	6 (42.9)	0.173 <sup>a</sup>
Papule	8 (16.0)	4 (11.1)	4 (28.6)	0.197 <sup>a</sup>
Pustule	0	0	0	-
Vesicle	1 (2.0)	0	1 (7.1)	0.280 <sup>a</sup>
Erosion	2 (4.0)	2 (5.6)	0	1.000 <sup>a</sup>
Excoriation	4 (8.0)	1 (2.8)	3 (21.4)	0.061 <sup>a</sup>
Lichenification	4 (8.0)	3 (8.3)	1 (7.1)	1.000 <sup>a</sup>
Xerosis	10 (20.0)	6 (16.7)	4 (28.6)	0.436 <sup>a</sup>
Ichtyosis	1 (2.0)	1 (2.8)	0	1.000 <sup>a</sup>

\*The percentage represents the proportion of the n value in each column.

\*\*Each person can have > 1 variable.

<sup>a</sup> Pearson X<sup>2</sup> test.

Females have a larger level of steroid sulfatase, which converts DHEA sulfatase (DHEAS) to DHEA, and hence may be more susceptible to DHEA's impact. This causes the prevalence of females with AD to be larger than males.<sup>11</sup>

The data showed 40% of the subjects firstly had AD when they entered adulthood. This is in contrast to the general theory which states that AD generally occurs in children before 2 years.<sup>1</sup> However, recent research in the United States of America (USA) indicated that the prevalence of adult-onset AD approaches 26.1%, especially in more than 16 years old. The risk between male and female is equal.<sup>12</sup> Adult-onset AD's mechanisms are still unknown. Head and neck area is the most common areas that initially affected. Most of adult AD patient has positive contact sensitization to environmental allergen (41%). House dust mite is considered as the most prevalent aeroallergen.<sup>13</sup>

As many as 42 subjects (84.0%) had a personal/family history of atopic diseases, with the most common type is AD (74.0%). This is consistent with a previous study that showed 70% of AD patients had a first-degree relative who had atopy.<sup>10</sup> Genome studies discovered 34 loci that account for less than 20% of the heredity of AD.<sup>14</sup> This study showed an association between AD patients with HDM allergy and personal/family atopic disease history (p=0.000). This is in accordance with research conducted in Thailand in 2008-2010 (p=0.028).<sup>15</sup> This condition indicates the presence of genetic factors. Interleukin (IL)-12B gene polymorphism at +1188 A/C and IL17A gene polymorphism at -197 G/A may contribute to patients' vulnerability to HDM allergy.<sup>16</sup> The history of AD and allergic rhinitis gave significantly different results between the two groups in this study. House dust mites as aeroallergens can enter the body via the

respiratory tract and causing both AD and allergic rhinitis. The exact mechanism between sensitization and atopic disease is still unclear. Sensitization via airway mucosa is still known as the main route, although skin sensitization also has proven.<sup>17</sup>

Identifying precipitating factors had a significant effect on patients with dermatitis who were allergic to HDM ( $p=0.042$ ). Food ( $p=0.045$ ) was a significant precipitating factor. Several foods are known to have cross-reactivity with HDM, the most common is shrimp. A previous study showed that tropomyosin is a common allergen found in all arthropods, including arachnids such as HDM (*Der p 10*), crustaceans such as shrimp, and insects such as cockroaches.<sup>18</sup> This is also supported by the results of the SPT which showed 20 out of 23 subjects (86.9%) that had shrimp allergy also had HDM allergy, and difference between groups was significant ( $p=0.030$ ). Besides shrimp SPT, cow's milk SPT also gave significant results between the two groups. Further research is needed to determine whether or not these two allergens have a cross-reactivity.

Besides food, HDM itself was also a significant precipitating factor between the two groups ( $p=0.021$ ). Along with the oral route, HDM has been shown to disrupt tight junctions and impair the skin barrier function in AD patients due to their enzymatic activity. This disruption of the skin barrier enables proteins from HDM to infiltrate the epidermis, reach allergen-presenting dendritic cells, stimulate Th2, and so exacerbate the severity of AD.<sup>3</sup> Although the difference in precipitating factor for HDM was statistically significant between the groups in this study, the clinical relevance value was only 60%. There were still 40% (20 subjects) of people who misrecognize their allergies. As many as 90% of these 20 subjects were unaware that they had HDM allergies. This phenomenon

often causes the prevention of AD recurrence through the avoidance of allergens by the patient is inadequate.

From this study, most subjects (84%) have history of pruritus. The Hanifin Rajka's criteria showed 5 criteria that significantly differed between the 2 groups: chronically relapsing dermatitis, personal/family atopic history, food intolerance, raised IgE serum, and immediate skin test reactivity (SPT). This test showed positive results from 40 people (80%). As many as 90% of these 40 people (36 subjects) tested positive for HDM. This high percentage indicates that HDM allergies in Surabaya, Indonesia is quite high. This is consistent with previous research conducted globally in Asia and locally in Bandung, Indonesia which showed 70.59% HDM sensitization.<sup>5,19</sup> Skin prick test is one of several diagnostic tools used to confirm allergen sensitization. This method is considered a valuable diagnostic tool for allergic disease due to its simplicity, safety, accuracy, and economic nature.<sup>20</sup> There were 44% (16 patients) of 36 subjects who tested positive for HDM also got an increase in their serum IgE level. It is already known that higher levels of IgE is associated with more severe AD.<sup>21</sup> However, individuals with normal total serum IgE levels may have a positive SPT, while some AD patients may have low total serum IgE levels.<sup>22</sup> Even if there is a positive link between the two, this underlines the relevance of specific IgE (sIgE) rather than total IgE.<sup>23</sup>

This study showed that there were no significant differences in terms of signs and symptoms between the groups who were allergic to HDM or not. Dr. Soetomo Academic General Hospital is the last referral hospital in East Indonesia, patients commonly came with a diagnosis of AD from the previous hospital. Thus, when the patient came to Dr. Soetomo Academic General Hospital, the signs and symptoms may have

diminished in comparison to the first time they came to the previous hospital. In general, the most common lesions were erythema and xerosis, especially on foot (24%), arm (22%), leg (22%), and hand (22%). Downregulation of keratin, filaggrin, and loricrin, decreased ceramide levels, increased endogenous proteolytic enzyme activity, and increased transepidermal water loss that manifests as xerosis.<sup>2</sup>

## Conclusion

Atopic dermatitis due to HDM is prevalent in Surabaya. There were various characteristics linked to AD patients who had a positive HDM SPT. Clinical relevance revealed that allergen recognition remains challenging.

## References

1. Ardern-Jones MR, Flohr C, Reynolds NJ, Holden CA. Atopic Eczema. In: Griffiths CEM, Barker J, Bleiker T, Chalmers R, Creamer D, editors. *Rook's Textbook of Dermatology*. WILEY Blackwell; 2016. p. 41.1-41.34.
2. Simpson EL, Leung DYM, Eichenfield LF, Boguniewicz M. Atopic Dermatitis. In: Kang S, Amagai M, Bruckner AL, Enk AH, Margolis DJ, McMichael AJ, *et al.*, editors. *Fitzpatrick's Dermatology*. New York: McGraw-Hill Education; 2019. p. 363-84.
3. Bumbacea RS, Corcea SL, Ali S, Dinica LC, Fanfaret IS, Boda D. Mite allergy and atopic dermatitis: Is there a clear link? (Review). *Exp Ther Med*. 2020;3554-60.
4. Wichmann K, Heratizadeh A, Werfel T. In-vitro diagnostic in atopic dermatitis: Options and limitations. *Allergol Select*. 2017;1(2): 150-9.
5. Tham EH, Lee AJ, van Bever H. Aeroallergen sensitization and allergic disease phenotypes in Asia. *Asian Pac J Allergy Immunol*. 2016;34(3):181-9.
6. Nugroho WT, Ervianti E, Zulkarnain I, Nurul Hidayati A, Damayanti, Utomo B, *et al.* Characteristics of Atopic Dermatitis Patients who Underwent Skin Prick Test.

- Berkala Ilmu Kesehatan Kulit dan Kelamin*. 2022;34(1):11-4.
7. Nopriyati N, Antonius CS, Thaha HMA, Diba S, Kurniawati Y, Argentina F. Skin Prick Test Profile: A Retrospective Study. *Berkala Ilmu Kesehatan Kulit dan Kelamin*. 2022;34(3):189-96.
  8. Huang FL, Liao EC, Yu SJ. House dust mite allergy: Its innate immune response and immunotherapy. *Immunobiology*. 2018;223(3):300-2.
  9. Anggraeni S, Umborowati MA, Damayanti, Endaryanto A, Prakoeswa CRS. Correlation between Skin Prick Test and Specific IgE of Local Mites Allergen in Atopic Dermatitis Patients: an Indonesian Study. *Chiang Mai University J Nat Sci*. 2022;21(4):e2022053.
  10. Sendrasoa FA, Ramily SL, Razafimaharo TI, Ranaivo IM, Andrianarison M, Raharolahy O, *et al.* Atopic dermatitis in adults: A cross-sectional study in the department of dermatology, Antananarivo, Madagascar. *JAAD Int*. 2021;4:28-31.
  11. Kanda N, Hoashi T, Saeki H. The roles of sex hormones in the course of atopic dermatitis. *Int J Mol Sci*. 2019;20(19):4660. doi: 10.3390/ijms20194660.
  12. Lee HH, Patel KR, Singam V, Rastogi S, Silverberg JI. A systematic review and meta-analysis of the prevalence and phenotype of adult-onset atopic dermatitis. *J Am Acad Dermatol*. 2019;80(6):1526-32.
  13. Oninla OA, Akinkugbe AO, Otike-Odibi BI, Oripelaye MM, Olanrewaju FO. Atopic Dermatitis in Adults: Epidemiology, Risk Factors, Pathogenesis, Clinical Features, and Management. In: Pereira C, editor. *Atopic Dermatitis-Essential Issues*. London: Intech Open; 2021.
  14. Langan SM, Irvine AD, Weidinger S. Atopic dermatitis. *The Lancet*. 2020; 396(10247):345-60.
  15. Kulthanan K, Chularojanamontri L, Manapajon A, Nuchkull P. Prevalence and clinical characteristics of adult-onset atopic dermatitis with positive skin prick testing to mites. *Asian Pac J Allergy Immunol*. 2011; 29(4):318-26.
  16. Ammar AM, Elham EA, Khayyal AES, Hamdy DM, EL-Gendy A, Elleboudy NAF. Role of interleukins 12B and 17A genetic variation in house dust mites allergy. *Egypt J Med Hum Genet*. 2020;21(60). <https://doi.org/10.1186/s43042-020-00098-w>

17. Sánchez-Borges M, Fernandez-Caldas E, Thomas WR, Chapman MD, Lee BW, Caraballo L, *et al*. International consensus (ICON) on: Clinical consequences of mite hypersensitivity, a global problem. *World Allerg Org J* 2017;**10(1)**:1–26.
18. Emran H, Chieng CSE, Taib S, Cunningham AC. House dust mite sensitisation and association with atopic dermatitis in Brunei. *Clin Transl Allergy*. 2019;**9(1)**:1–4.
19. Garna DR, Lucianus J, Ivone J. Descriptive Study on Skin Prick Test in Allergy Clinic Immanuel Hospital Bandung Indonesia. *J Med Health*. 2017;**1(6)**:558–67.
20. Anggraeni S, Umborowati MA, Damayanti, Endaryanto A, Prakoeswa CRS. The Accuracy of Indonesian New Local Skin Prick Test (SPT) Allergen Extracts as Diagnostic Tool of IgE-mediated Atopic Dermatitis. *Indian J Forensic Med Toxicol* 2021;**15(3)**:4278–85.
21. Holm JG, Agner T, Clausen M-L, Thomsen SF. Determinants of disease severity among patients with atopic dermatitis: association with components of the atopic march. *Arch Dermatol Res*. 2019;**311(3)**:173–82.
22. Kulthanan K, Boochangkool K, Tuchinda P, Chularojanamontri L. Clinical features of the extrinsic and intrinsic types of adult-onset atopic dermatitis. *Asia Pac Allergy*. 2011;**1(2)**:80–6.
23. Ott H, Stanzel S, Ocklenburg C, Merk H, Baron J, Lehmann S. Total Serum IgE as a Parameter to Differentiate Between Intrinsic and Extrinsic Atopic Dermatitis in Children. *Acta Dermato Venereologica*. 2009;**89(3)**: 257–61.