

# Clinical Relevance of House Dust Mites as Causative Factor of Atopic Dermatitis in Surabaya-Indonesia

Sylvia Anggraeni<sup>1,3</sup>, Bella Ayu Paramitha<sup>2</sup>, Wisnu Triadi Nugroho<sup>3</sup>, Menul Ayu Umborowati<sup>3</sup>, Damayanti<sup>3</sup>, Anang Endaryanto<sup>4</sup>, Cita Rosita Sigit Prakoeswa<sup>3,\*</sup>

<sup>1</sup>Doctoral Program of Medical Science, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

<sup>2</sup>Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

<sup>3</sup>Department of Dermatology and Venereology, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

<sup>4</sup>Department of Pediatric, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

\*Corresponding author. Email: cita-rosita@fk.unair.ac.id

## ABSTRACT

Atopic dermatitis (AD) is chronic inflammation of skin manifested as recurrent itchy redness patches. Avoiding precipitating factors is significant key of successful treatment, but not always possible. House dust mites (HDM) are the most common but not easily proven as aeroallergen. Skin prick test (SPT) is an effective diagnostic modality in recognizing type 1 hypersensitivity reaction. Positive result on SPT should be confirmed by clinical relevance to find the true causative factor. The aim of the study was to analyze the clinical relevance of HDM as AD causative factor in Surabaya, Indonesia. This is a descriptive observational study. Sixty samples were taken from SPT medical records in Allergy-Immunology Division outpatient care at Dr. Soetomo General Academic Hospital period of 2017 - 2019. All samples that qualify inclusion criteria were included. Data were compiled in data sheet, categorized as nominal, and presented as clinical relevance. This study reported that AD is more common in 21-30 years old (70%), Javanese (93.33%), female (78.33%). Most of them had history of itchy redness patches (83.33%), dry skin (55%), self and family history of atopic disease (93.33%; 53.33%). History of suspected HDM allergen was 50%, positive SPT results were 68.33%. Clinical relevance had shown that in 37 patients (61.67%), 17 out of 23 (73.92%) patients did not suspect HDM as allergen but has positive SPT results. It may conclude that HDM should be considered as hidden potent causative factor of AD in Surabaya, Indonesia.

**Keywords:** atopic dermatitis, house dust mites, skin prick test, tropical disease.

## INTRODUCTION

Atopic dermatitis (AD) is a chronic inflammation of skin manifested as recurrent itchy redness patches. The rash turns into excoriations and lichenification. Atopic dermatitis relates to other atopic diseases such as allergic rhinitis and asthma, also food allergy [1,2].

Atopic Dermatitis is one of the most common skin diseases in children and adults, with a prevalence rate of 1-20% worldwide [3]. The prevalence of AD is varied in each country, Barbarot *et al* [4] found that the prevalence of adults AD ranges from 2.5% in Canada, 2.1% in Japan, 4.9% in the US, and 4.4% in the EU. In developed countries the prevalence rate was around 1-3% in adults and 10-20% in children, however the prevalence rate of AD has escalate in the last 30 years and this situation needs serious attention

because its strong possibility to decrease patients' quality of life [5].

Atopic dermatitis is related to sensitization process of Immunoglobulin E (IgE) to aeroallergens and foods. House dust mites (HDM) are the most common aeroallergens, but it's hard (not easily) to prove [6,7]. Avoiding precipitating factors is significant key of successful treatment, but not always possible. Skin prick test (SPT) is proposed as an effective diagnostic tool in recognizing type 1 hypersensitivity reactions. SPT helps confirm a suspected diagnosis of type I hypersensitivity and may provide evidence for sensitization. It is inexpensive, minimally invasive, and the results are quickly available [6,8]. Positive results of SPT should be confirmed with the clinical relevance to find the true causative factor. The aim of the study is to analyze the clinical relevance of HDM as AD causative factor in Surabaya, Indonesia.

## MATERIALS AND METHOD

This is a descriptive observational study. Sixty samples were taken from SPT medical records in Allergy-Immunology Division outpatient care at Dr Soetomo General Academic Hospital Surabaya, Indonesia period of 2017 - 2019. All samples that qualify inclusion criteria are included. Data were compiled in data sheet, and presented in percent, categorized in nominal, and presented as clinical relevances.

## RESULT

Characteristics of patients in this study shown in Table 1. Subject of this study were 60 patients, with 78.33% of them were female. Most patients were of 21-30 years old (42 patients; 70%), followed by group of 31-40 years old (7 patients; 11.67%). This study showed that 56 of patients (93.33%) were Javanese.

**Table 1.** Subject Characteristics

| Characteristics | Total | Percentage |
|-----------------|-------|------------|
| <b>Gender</b>   |       |            |
| Female          | 47    | 78.33%     |
| Male            | 13    | 21.67%     |
| <b>Age</b>      |       |            |
| <10             | 2     | 3.33%      |
| 11-20           | 5     | 8.33%      |
| 21-30           | 42    | 70%        |
| 31-40           | 7     | 11.67%     |
| 41-50           | 1     | 1.67%      |
| 51-60           | 2     | 3.33%      |
| >60             | 1     | 1.67%      |
| <b>Race</b>     |       |            |
| Balinese        | 1     | 1.67%      |
| Batak           | 1     | 1.67%      |
| Chinese         | 2     | 3.33%      |
| Javanese        | 56    | 93.33%     |

The most common clinical symptom was itchy redness patches that complained by 50 patients (83.33%). A total of 33 patients (55%) complained of dry skin. One patient could have more than one symptoms as presented in Table 2. Table 3 shows atopic history in the patients and their family. A total of 56 patients (93.33%) had self-history of atopic disease and a total of 32 patients (53.33%) had atopic disease family history. Food allergy and rhinitis allergic were the most common self-history of atopic disease in 27 patients (48.21%). A total of 15 patients (26.78%) had a self-history of conjunctivitis allergy. This study found that 28 patients (46.67%) had no history of atopic disease in their family. A total of 14 patients (43.75%) had food allergy history and 11 patients (34.37%) had rhinitis allergy history in their family. One patient could have more than one history of self/family atopic diseases.

**Table 2.** Clinical Symptoms

| Clinical Symptoms | Total | Percentage |
|-------------------|-------|------------|
|-------------------|-------|------------|

|                       |    |        |
|-----------------------|----|--------|
| Itchy redness patches |    |        |
| Yes                   | 50 | 83.33% |
| No                    | 10 | 16.67% |
| Dry skin              |    |        |
| Yes                   | 33 | 55%    |
| No                    | 27 | 45%    |

**Table 3.** History of atopic disease

| History of atopic disease               | Total | Percentage |
|-----------------------------------------|-------|------------|
| <b>Self-history of atopic disease</b>   |       |            |
| Yes                                     | 56    | 93.33%     |
| Atopic dermatitis                       | 8     | 14.28%     |
| Asthma allergica                        | 7     | 12.50%     |
| Conjunctivitis allergica                | 15    | 26.78%     |
| Food Allergy                            | 27    | 48.21%     |
| Rhinitis allergica                      | 27    | 48.21%     |
| No history                              | 4     | 6.67%      |
| <b>Family history of atopic disease</b> |       |            |
| Yes                                     | 32    | 53.33%     |
| Atopic dermatitis                       | 4     | 12.50%     |
| Asthma allergica                        | 10    | 31.25%     |
| Conjunctivitis allergica                | 3     | 9.37%      |
| Food Allergy                            | 14    | 43.75%     |
| Rhinitis allergica                      | 11    | 34.37%     |
| No history                              | 28    | 46.67%     |

Table 4 shows the results of house dust mites skin prick test. This study found that 50% of patients had history of suspected HDM allergy. A total of 41 patients (68.33%) had positive result of HDM SPT. Table 5 showed the clinical relevance of HDM SPT. Clinical relevance had shown in 37 patients (61.67%). This study found that 17 from 23 patients (73.92%) did not suspect HDM as allergen but has positive SPT results.

**Table 4.** HDM-SPT

| HDM-SPT                                 | Total | Percentage |
|-----------------------------------------|-------|------------|
| <b>History of suspected HDM allergy</b> |       |            |
| Yes                                     | 30    | 50%        |
| No                                      | 30    | 50%        |
| <b>Result of HDM-SPT</b>                |       |            |
| Positive                                | 41    | 68.33%     |
| Negative                                | 19    | 31.67%     |

**Table 5.** Clinical relevance of HDM-SPT

| Clinical Relevance of HDM SPT | History of suspected HDM allergy | Result of HDM SPT | Total | Percentage |
|-------------------------------|----------------------------------|-------------------|-------|------------|
| Yes (61.67%)                  | Yes                              | Positive          | 24    | 64.86%     |
|                               | No                               | Negative          | 13    | 35.14%     |
| No (38.33%)                   | Yes                              | Negative          | 6     | 26.08%     |
|                               | No                               | Positive          | 17    | 73.92%     |

## DISCUSSION

Atopic dermatitis (AD) is chronic inflammatory skin disease with intense pruritus as chief complain, triggered by many factors such as allergens, infections, climate changes, and psychological stress [9,10]. The diagnosis of AD is based on atopic diseases on self/ family, and clinical manifestations. The most frequently used diagnostic criteria is the Hanifin Rajka criteria. Hanifin Rajka's criteria consist of 4 major criteria and 23 minor criteria, while the diagnosis of AD can be established if it has at least 3 major criteria and 3 minor criteria [11,12].

This study reported that AD is more common in female (78.33%) rather in male patients. A study in Iran showed that 60% patients who had atopic dermatitis were female [13]. The AD prevalence of AD is slightly higher in female than in male with female: male ratio was 1.3 : 1 [1,14]. The presence of female hormones, progesterone and estrogen will stimulate increased activities of Th2 cell regulator, however it will suppressed the activities of Th1 and Th17. Excessive Th2 expression is one of the pathogenesis of atopic dermatitis. The disruption of skin barrier occurs in menstrual luteal phase when both progesterone and estrogen are secreted simultaneously. Estradiol has a paradoxical effect in exacerbating progesterone-induced skin barrier disruption [15,16].

Atopic dermatitis affects 1-3% adults and 15-20% children [17]. Pedersen *et al* [18] showed that AD prevalence in children <1 year is 9.3%, 18.8% in 2 years old children, 3.8% in 6-9 years old children, 6.4% in the 15-19 years old group, and 2.8% in the >40 years old group. Patients in this study were in the 21-30 years old group (70%), as presented in the Table 1. This study was conducted in an adult allergy clinic, pediatric patients, and AD were examined separately in a pediatric dermatology clinic. Most patients in this study were Javanese (93.33%), this may because of this study was conducted in Surabaya, where most of the population are Javanese. We have not found any research on racial tendencies in Indonesia related to atopic dermatitis.

Refer to the Table 2, most of patients had history of itchy redness patches (83.33%) and dry skin (55%). A study conducted in Surabaya found that 71.1% complained of itching, 26.1% complained of itching accompanied by red patches, and 2.8% complained of itching with dry skin [19]. A literature stated that the typical complaint in AD is itching (pruritus) that can occur throughout the day. Itching in AD is a manifestation of skin hyperreactivity due to the exposure of allergens, changes in humidity, and excessive sweating. In addition to itching, other clinical features that can appear are erythema, dry skin, papules, vesicles, crusts, lichenification, excoriations, and secondary infection [1,14]. Dry skin is common clinical finding of AD. Dry skin is caused by decreased levels of natural moisturizing factor (NMF) due to

filaggrin gene mutations. Decreased in water content and lipid levels in the stratum corneum can worsen the condition. Skin barrier disruption, resulting in dry skin, increase the allergen penetration into the skin and finally causing allergic sensitization [20,21].

This study found that 93.33% of patients had self-history of atopic disease and 53.33% had family history of atopic disease as in the Table 3. Food and rhinitis allergy were the most common patient's history of atopy (48.21%). This study found that 46.67% of patients stated that there is no history of atopic disease in their family. Genetics plays a role in skin barrier function. Many genes are associated with atopic dermatitis, but the filaggrin gene is known to be the strongest genetic risk factor for atopic dermatitis. Mutation of filaggrin gene (FLG) causes functional disturbance in filaggrin protein, causing loss of all by-products including natural moisturizing factor (NMF). The disruption decreases the osmotic draw, creates large water gradient across stratum corneum, then increase cutaneous water loss. These all causes the disruption of skin barrier [20,22].

House dust mites is a potent allergen and one of the most common precipitating factor of allergy in the world. Symptoms of an allergy to HDM can include atopic dermatitis, conjunctivitis, urticaria, asthma, rhinitis, sinusitis, bronchitis, and gastrointestinal disorders. In AD, sensitization to HDM is common. In 95% of patients with AD, IgE reactivity to HDM allergen was found [7,23,24]. There are about 16 genus and 46 species of house dust mites that may produce allergens and the most abundant was the *Pyroglyphidae* family. *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Dermatophagoides microceras*, and *Euroglyphus maynei*, are said to have a close relationship with allergic disease incidence. Another species that is often found is *Blomia tropicalis* from the *Glycyphagidae* family [25]. *Dermatophagoides farinae* and *D. pteronyssinus* were the most common species of HDM in Indonesia. *Dermatophagoides pteronyssinus* can be found everywhere such as sofas, mattresses, and floors, while *D. farinae* is most commonly found on sofas [26,27].

History of suspected HDM allergy was found in 50% of patient. This study reported that 68.33% of patients had positive result of HDM SPT and 31.67% patients showed the negative result as in the Table 4. A study in Surabaya found that house dust mites was the most common allergen detected by SPT (42%) [28]. Skin prick test is still the first-line test for allergic disease mediated by type 1 hypersensitivity and can indicate the presence of allergen-specific IgE antibodies. SPT is a simple, fast, and safe examination. The validity of the SPT results is affected by the quality of the allergen extract. As an alternative diagnostic test, serum IgE can be used especially in patients at high risk of anaphylaxis or patients with persistent skin problems, there was limited areas of their skin can be examined [26,29].

Positive result of SPT should be confirmed by clinical relevance to find the true causative factor. The clinical relevance of this study was determined based on the

suitability between the history of suspected HDM allergy and the results of HDM SPT. The results are declared that there is clinical relevance between the history of suspected HDM allergy and the positive result of HDM-SPT in patients, like wise in patients who are no history of suspected HDM and have negative results of their HDM-SPT. This study found that 61.67% patients had clinical relevance and 38.33% of patients had no clinical relevance, as showed in Table 5. Of all patients with no clinical relevance, 73.92% did not suspect HDM as allergen but has positive SPT results.

## CONCLUSION

It may conclude that HDM should be considered as hidden potent causative factor of AD in Surabaya, Indonesia.

## ACKNOWLEDGEMENTS

We gratefully thank The Ministry of Research and Technology / National Agency for Research and Innovation (Direktorat Riset dan Pengabdian Masyarakat, Deputy Bidang Penguatan Riset dan Pengembangan Kementerian Riset dan Teknologi/ Badan Riset dan Inovasi Nasional) for funding and supporting this research.

## REFERENCES

- [1] M.R. Ardern-Jones, C. Flohr, N.J. Reynolds, C.A. Holden, Atopic Eczema (atopic dermatitis), in: C.E.M. Griffiths, J. Barker, T. Bleiker, R. Chalmers, D. Creamer (Eds.), *Rook's Textbook of Dermatology*, 9th ed, John Wiley & Sons, West Sussex, 2016: pp. 41.1-41.43.
- [2] A. Wollenberg, K. Feichtner, Atopic dermatitis and skin allergies – update and outlook, *Allergy*. 68 (2013) 1509–1519. DOI: <https://doi.org/10.1111/all.12324>.
- [3] S.P. DaVeiga, Epidemiology of Atopic Dermatitis: a review, *Allergy and Asthma Proceedings*. 33 (2012) 227–234.
- [4] S. Barbarot, S. Auziere, A. Gadkari, G. Girolomoni, L. Puig, E.L. Simpson, D.J. Margolis, M. de Bruin-Weller, L. Eckert, Epidemiology of atopic dermatitis in adults: Results from an international survey, *Allergy*. 73 (2018) 1284–1293. DOI: <https://doi.org/10.1111/all.13401>.
- [5] S. Kapur, W. Watson, S. Carr, Atopic dermatitis, *Allergy, Asthma Clin. Immunol.* 14 (2018) 43–52. DOI: <https://doi.org/10.1186/s13223-018-0281-6>.
- [6] N. Peters, A.T. Peters, Atopic dermatitis, *Allergy Asthma Proc.* 40 (2019) 433–436. DOI: <https://doi.org/10.2500/aap.2019.40.4265>.
- [7] J.D. Miller, The Role of Dust Mites in Allergy, *Clin. Rev. Allergy Immunol.* 57 (2019) 312–329. DOI: <https://doi.org/10.1007/s12016-018-8693-0>.
- [8] L. Heinzerling, A. Mari, K. Bergmann, M. Bresciani, G. Burbach, U. Darsow, S. Durham, W. Fokkens, M. Gjomarkaj, T. Haahtela, A.T. Bom, S. Wöhr, H. Maibach, R. Lockey, The skin prick test – European standards, *Clin. Transl. Allergy*. 3 (2013) 1–10.
- [9] R. Tamagawa-Mineoka, N. Katoh, Atopic Dermatitis: Identification and Management of Complicating Factors, *Int. J. Mol. Sci.* 21 (2020) 2671.
- [10] I. Solomon, M.A. Ilie, C. Draghici, V.M. Voiculescu, C. Căruntu, D. Boda, S. Zurac, The impact of lifestyle factors on evolution of atopic dermatitis: An alternative approach (Review), *Exp. Ther. Med.* 17 (2019) 1078–1084. DOI: <https://doi.org/10.3892/etm.2018.6980>.
- [11] K. Sihaloho, D.M. Indramaya, Penelitian Retrospektif: Dermatitis Atopik pada Anak (Retrospective Study: Atopic Dermatitis in Childhood), *Berkala Ilmu Kesehatan Kulit Dan Kelamin (Periodical Dermatology Venereology* 27 (2015) 176–182.
- [12] B. Evina, Clinical Manifestations and Diagnosis Criteria of Atopic Dermatitis, *J Majority* 4 (2015) 23–30.
- [13] T. Ziyaei, F. Berenji, F. Jabbari-azad, A. Fata, L. Jarahi, M. Fereidouni, House Dust Mite Prevalence in the House of Patients with Atopic Dermatitis in Mashhad, Iran, *J Arthropod-Borne Dis.* 11 (2017) 309–314.
- [14] E.L. Simpson, D.Y.M. Leung, L.F. Eichenfield, M. Boguniewicz, Atopic Dermatitis, in: S. Kang, M. Amagai, A.L. Bruckner, A.H. Enk, D.J. Margolis, A.J. McMichael, J.S. Orringer (Eds.), *Fitzpatrick's Dermatology*, 9th ed., McGraw-Hill Education, New York, 2019: pp. 363–384.
- [15] N. Kanda, T. Hoashi, H. Saeki, The Roles of Sex Hormones in the Course of Atopic Dermatitis, *Int. J. Mol. Sci.* 20 (2019) 4660.
- [16] M.I.A. Munthaha, R.I. Widayati, L. Afriliana, A. Candra, Characteristics of Atopic Dermatitis in Puskesmas (Public Health Center) Masaran 1 Sragen City, *Diponegoro Med. J.* 10 (2021) 27–34.
- [17] S. Nutton, Atopic Dermatitis: Global Epidemiology and Risk Factors, *Ann Nutr Metab.* 66 (2015) 8–16. DOI: <https://doi.org/10.1159/000370220>.
- [18] C.J. Pedersen, M.J. Uddin, S.K. Saha, G.L. Darmstadt, Prevalence of atopic dermatitis, asthma and rhinitis from infancy through adulthood in rural Bangladesh: a population-based, cross-sectional survey, *BMJ Open*. 10 (2020) 1–8. DOI: <https://doi.org/10.1136/bmjopen-2020-042380>.
- [19] N. Herwanto, M. Hutomo, Studi Retrospektif: Penatalaksanaan Dermatitis Atopik (Retrospective Study: Management of Atopic Dermatitis), *Berkala Ilmu Kesehatan Kulit Dan Kelamin*. 28 (2016) 45–54.

- [20] S.F. Thomsen, Atopic Dermatitis: Natural History, Diagnosis, and Treatment, *ISRN Allergy*. 2014 (2014) 1–7.
- [21] Y. Irawan, R. Rihatmadja, L. Legiawati, S.N. Yusharyahya, S.A. Sularsito, Atopic dermatitis in the elderly, *J Gen Pro DVI*. 1 (2016) 54–61.
- [22] W.D. Boothe, J.A. Tarbox, M.B. Tarbox, Atopic Dermatitis: Pathophysiology, *Adv Exp Med Biol*. (2017) 21–37. <https://doi.org/10.1007/978-3-319-64804-0>.
- [23] H. Emran, C.S.E. Chieng, S. Taib, A.C. Cunningham, House dust mite sensitisation and association with atopic dermatitis in Brunei Allergen sensitization and allergic disease in Brunei, *Clin. Transl. Allergy*. 9 (2019) 1–4. DOI: <https://doi.org/10.1186/s13601-019-0304-5>.
- [24] A. Endaryanto, Pengaruh Dermatitis Atopik, Urtikaria dan Gangguan Saluran Cerna sebagai Komorbiditas dalam Perbaikan Klinis dan Kepuasan Orang Tua Pasien pada Anak Alergi dengan Gejala Saluran Nafas Tingkat Moderate- Persistent yang Mendapatkan Imunoterapi Alergen Debu, *Berkala Ilmu Kesehatan Kulit Dan Kelamin (Periodical Dermatology Venereology* 31 (2019) 111–122.
- [25] W.F. Ponggalungu, V.D. Pijoh, G.J.P. Wahongan, Jenis dan Kepadatan Tungau Debu Rumah pada Beberapa Habitat di Rumah Penderita Penyakit Alergi, *J. e-Biomedik*. 3 (2015) 254–260.
- [26] S. Anggraeni, M.A. Umborowati, Damayanti, A. Endaryanto, C.R.S. Prakoeswa, The Accuracy of Indonesian New Local Skin Prick Test (SPT) Allergen Extracts as Diagnostic Tool of IgE-mediated Atopic Dermatitis, *Indian J. Forensic Med. Toxicology*. 15 (2021) 4278–4285. DOI: <https://doi.org/10.37506/ijfmt.v15i3.15965>.
- [27] A.M. Putera, Z. Hikmah, A. Endaryanto, I. Irwanto, M.M. Maramis, The role of house dust mite immunotherapy in Indonesian children with chronic rhinosinusitis allergy: A randomized control trial, *Heliyon*. 7 (2021) e06510.
- [28] F.R. Natallya, J. Barakbah, Penelitian Retrospektif Uji Tusuk Kulit pada Pasien Dermatitis Atopik di Unit Rawat Jalan Kesehatan Kulit dan Kelamin RSUD Dr. Soetomo Surabaya Periode 2007-2012, *Berkala Ilmu Kesehatan Kulit Dan Kelamin (Periodical Dermatology Venereology* 27 (2015) 9–16.
- [29] I.J. Ansotegui, G. Melioli, G.W. Canonica, L. Caraballo, E. Villa, M. Ebisawa, G. Passalacqua, E. Savi, D. Ebo, IgE allergy diagnostics and other relevant tests in allergy, a World Allergy Organization position paper, *World Allergy Organization Journal* 13 (2020) 1–50.