CORRELATION BETWEEN HOUSE DUST MITE DENSITY WITH HEALTHY HOUSE CRITERIA AND ASTHMA STATUS IN PEDIATRIC PATIENTS : STUDY AMONG ASTHMA PEDIATRIC PATIENT IN SEMARANG

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ABSTRACT
Background: Asthma is a chronic respiratory disease most often found in children and has the highest prevalence in developing countries. House dust mites are the second most common trigger of asthma whose habitat is influenced by the criteria for a healthy. **Objective:** Understanding the correlation between sleep density and asthma status in pediatric patients and criteria for a healthy house. **Methods:** This study was an analytical observational method with a cross sectional study design that took place from June to October 2020. It involved 25 respondents of children with asthma patients aged 3-11 years. Dust samples were collected in the bedroom of the respondent diagnosed with bronchial asthma. The identification processed using the floating method at the Parasitology Laboratory, Faculty of Medicine, Diponegoro University, Semarang Indonesia. Respondent data were analyzed using statistical software programs. Non-parametric test with lambda correlation test. **Results:** The mean of house dust mite's density in the respondent's house was 3.68 ± 2.32. House dust mite's density was associated with the criteria for a healthy house ($p < 0.05$), but house dust mite density was not related to the asthma status of pediatric patients ($p > 0.05$). **Conclusion:** There is no correlation between pediatric asthma status and house dust mite density.
Keywords: House dust mites; pediatric asthma; asthma status; healthy house.

INTRODUCTION

Asthma is a chronic respiratory disease with clinical manifestations in the form of coughing, wheezing, shortness of breath, recurring or chronic, reversible, tends to worsen at night or early morning and is most commonly found in children[2,6]. There are at least more than 800,000 children aged 5-14 years with asthma in 100 countries and has a high prevalence in developing countries with lower middle income[2]. Based on the frequency of symptoms, asthma is divided into intermittent asthma and mild, moderate and severe persistent asthma.

Until now, the etiology of asthma is still being debated, but in general the occurrence of asthma is influenced by two factors, namely genetic factors and environmental factors. The second biggest trigger of asthma is house dust mites. This is in line with the report of the Allergy-Immunology sub-section of the Pediatric Department at Cipto Mangunkusumo Hospital Jakarta which shows that 45% of children with asthma Aeroallergen triggers are sensitive on the house dust mite[2,8] through skin pinch test.

There are three species of house dust mite which are the main sources of allergens, namely *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, and *Glycyphagus destructor*. In general, house dust mite is round or oval which is divided into four parts, consisting of the mouth and surrounding areas (gnatosoma), the leg pairs I and II (propodosoma), the third and fourth leg pairs (metapodosoma), and the posterior area (opiostoma). Nymphs and adults from house dust mite have four pairs of legs, namely two pairs of front legs and two pairs of hind legs, while the larvae have three pairs of legs and do not have genitals[10,11].

House dust mite stool is the main allergen, although the mite body itself, even the dead house dust mite are also potential allergens. This is because the antigen in dust mites that can trigger the main allergy lies in the house dust mite digestive tract. Patients with allergies to house dust mite have specific antibodies against allergens group I (der p1) and group II (der p II). Therefore, more than 95% of house dust mite allergens came from faecal particles containing strong allergens from group I (der p 1) and group II (der p II).

Shobrina Insan Sakina Armunanto, Dian Puspita Dewi,
Dodik Pramono, Moh. Syarofil Anam

These allergens can stimulate the sensitization phase of bronchial asthma with the proliferation of T-Helper 2 (Th2) resulting in the activation of Immunoglobulin E (IgE) which will increase the permeability of the bronchial epithelium and cause the allergens to be captured by dendritic cells in the subendothelial tissue thereby increasing the occurrence of inflammation and edema which can cause asthma[18,19].

House dust mite is found in dust because dust contains a lot of dead skin flakes or scales, especially on the bed. The bed is the main habitat for house dust mite because on the bed there are a lot of squama which is food for house dust mite, the length of time using the mattress determines the level of house dust mite allergens because the longer it is used, the more feces will enter between the bed fibers, supported by increased humidity due to evaporation of sweat on the bed.[14]

According to the habitat, the role of the criteria for a healthy house is very important for the growth and development of house dust mite, where one of the criteria for a healthy house according to the 1999 Minister of Health Decree is the absence of dust, the total dust is not more than $150\mu g/m^3$, and the house is not made of materials that can grow. and the development of pathogenic microorganisms[15].

Based on the results of the 2018 Indonesia Health Research analysis of Asthma triggers, five main factors were found, one of which was the sensitization of house dust mites starting at the age of nine months. There are many studies regarding the correlation between house dust mite and asthma, but only a few have studied the density of house dust mite with pediatric asthma patients. Therefore, researchers are interested in discussing the correlation between house dust mite density and the incidence of bronchial asthma in children.

METHOD

An analytic observational study method using cross-sectional study design took place from June to October 2020. This study involved 25 respondents. Respondents are asthmatic children aged 3 to 11 years who diagnosed by the doctor using criteria from Indonesia Pediatric Asthma National Guideline 2015 and met the inclusion criteria by approved the consent form as a sign that they were willing to become respondents and willing to lend their house to collect dust samples in the child's bedroom. There

are a confounding variable, namely the score of the criteria for a healthy house based on the observation sheet issued by the Ministry of Health, it has three aspects for healthy house assessment, which are; house component, sanitation facilities and occupant behavior. Healthy house categories are divided into two as if healthy and unhealthy house based on scoring from questionnaires and interviews, if the score > 1068 was categorized as healthy house. Dust sampling was collected in the respondent's bedroom, namely children who had been diagnosed with bronchial asthma. The identification processed using the floating method and microscopic examination. Thus calculation of dust mites density per gram conducted with the following formula :

$$House\ Dust\ Mite\ (HDT)\ density = \frac{dust\ mass\ (g)}{0,1} \times amount\ of\ HDT\ in\ 0,1g\ of\ dust$$

House dust mites density then determined into three categories as low (1-3), moderate (4-6), and high (>6) for each 0.1 gram. The identification processed was done at the Parasitology Laboratory, Faculty of Medicine, Diponegoro University, Semarang Indonesia. Data from respondents were analyzed using a software program. Non-parametric test with lambda correlation test.

Ethical Approval

All research procedures received ethical clearance from the Health Research Ethics Commission of the Faculty of Medicine, UNDIP Semarang before conducting the research. The Ethical Clearance number is 68/EC/KEPK/FK-UNDIP/VI/2020.

RESULTS

Respondents in this study were children aged 3- 11 years who had been diagnosed with asthma by a doctor based on PNAA criteria. The respondent's identity, address and asthma history were taken from medical records. The researcher went to the respondent's house and collected the dust sampling, especially in the children's room, followed by observations of healthy house which were assessed by questionnaires and interviews. Research respondents have characteristics in accordance with frequency (table 1)

Shobrina Insan Sakina Armunanto, Dian Puspita Dewi,
Dodik Pramono, Moh. Syarofil Anam

Table 1 Characteristics of respondents (n = 25)

Variabel	F	%	Mean ± SD	Median (min-max)
Age			6,08 ±2,16	
Gender				
Male	11	44,0		
Famale	14	56,0		
Asthma status				
Persisten	6	24,0		
Intermitten	19	76,0		
House score			1136,7 ± 62,1	1136 (1042-1267)
Healthy	19	76,0		
Unhealthy	6	24,0		
House dust mite's density			3,68 ±2,32	3 (0 – 10)
Low	8	32,0		
Moderate	8	32,0		
High	9	36,0		

The results of this study show that a healthy house is associated with house dust mite density (p<0.05). This is in line with study conducted by Subahar et al, in 2019 regarding the Effect of Temperature and Humidity on the Existence of house dust mite. The temperature and humidity of a room affect the habitat and development of house dust mite. During its life, House dust mite's does not drink water but takes water from the air, so that the humid air is very helpful in the development of life for HOSP[13]. Temperature is an influence because house dust mite requires an optimal air temperature of 25 - 35°C for its development[13], this is in line with this study because Semarang has an average temperature of 27.5°C and an average air humidity of 75% which is the optimal temperature & humidity for house dust mite [34]. So that a humid room with little sunlight and dust becomes a good habitat for the growth and development of house dust mite [13,10]

The data of this study showed a correlation between the density of house dust mite and the category of the house (p> 0.05). It can be seen that there is a trend of decreasing of house dust mite's density in houses with a healthy category, while those with an unhealthy category have an increasing trend (table 2).

Table 2 . Correlation between house dust mite density and house category (n = 25)

House Category	House dust mite's density			P	r
	Low	Moderate	High		
	n	n	n		
Healthy	7	8	4	0,019*	0,166
Unhealthy	1	0	5		

Notes: Data analysis tested using lambda correlation test
*Significance (p<0,05), weakly positive

There were 19 respondents with the Intermittent asthma category from a total of 25 respondents. This shows that in the house of respondents with intermittent asthma the most distribution is at low densities (Table 3). The correlation between pediatric asthma status and house dust mite's density was tested using the lambda correlation test, the results were not significant (p> 0.05), which means that there was no correlation between asthma status and house dust mite's density criteria can reduce the humidity in the room so that it affects the density of the house dust mite.

Table 3. Correlation between asthma status and house dust mite's density (n = 25)

House dust mite's density	Intermitten Asthma				p
	Yes		No		
	n	%	n	%	
Low	8	100	0	0	0,110
Moderate	6	75	2	25	
High	5	55,6	4	44,4	

The dust taken only came from the respondent's bedroom, because the density of house dust mite was mostly found in dust in the bedroom than in other rooms[35]. The high house dust mite density in the bedroom is related to physical and biological factors required for mite growth. The main food for house dust mite is human skin flakes that are found in mattresses because humans can spend an average of 6-8 hours on the bed and every day humans can produce 0.5-1 grams of squama per day which is food for house dust mite [13]. In addition, the mattress is also a place that supports the growth of house dust mite because its surface tends to retain moisture, this is related to the presence of windows and ventilation in the bedroom [35,25].

Shobrina Insan Sakina Armunanto, Dian Puspita Dewi,
Dodik Pramono, Moh. Syarofil Anam

In this study, the results were not significant between house dust mite density and asthma status. This can be due to several things, such as in this study not all respondents had a trigger factor, namely house dust mite, so that if the respondent's asthma status was correlated with the density of house dust mite, it was not related. This is in line with study conducted by Opy Diah Paramita regarding the Relationship of Asthma, Allergic Rhinitis and Atopic Dermatitis with Child-Specific IgE, it was found that from the results of examining child-specific IgE, there were only 14 out of 56 children who had house dust mite-trigger factors[34]. In this study, there are also confounding factors, namely the criteria for a healthy house related to the density of house dust mite. The results of this study are not in line with previous study conducted by Denaneer Rahmadatu in 2019 entitled Relationship of *Dermatophagoides spp.* density, in this study there is a relationship between asthma attacks and house dust mite density where the respondents of the study were adult asthma sufferers who had a frequent asthma attack in the last three months during the study. In this study, the frequency of asthma attacks> 4 times / month was thought to be due to a lack of prevention of asthma attacks, so exposure to asthma triggers, as well as a lack of family support. can be minimized[26].

CONCLUSION

From the study that has been done, it can be concluded that there is a relationship between the healthy house category and the house dust mite density (p <0.05) and there is no relationship between the asthma status in pediatric patients and the house dust mite density (p> 0.05).

REFERENCES

[1] Astuti N, Azam M. Slow Deep Breathing Terhadap Kontrol Asma. Higeia Journal Of Public Health [Internet] 2017;1(1):39.

[2] World Health Organizations. The Global Asthma Report 2018 [Internet]. 2018 [updated 2018 Aug 31; cited 2020 Feb 22]. Available from: http://www.globalasthmanetwork.org/

[3] Serebrisky D, Wiznia A. Pediatric asthma: A global epidemics. Annals of Global Health. [Internet]. 2019; 85(1): 6, 1–6.

[4] Masoli M, Fabian D, Holt S, Beasley R. The Global Burden Of Asthma Executive Summary Of The GINA Dissemination Committee Report. European Journal of Allergy Clinical Immunology [Internet]. 2004 ;59(5):473.

[5] Lougheed MD, Leniere C, Ducharme FM, Licksai C, Sharon DD, Brian HR, et al. Canadian Thoracic Society 2012 guideline Diagnosis and Management of Asthma in Preschoolers, Children and Adults. Journal of the Canadian Thoracic Society [Internet]. 2012 ;19(6):89.

[6] Zhang W, Zhang L, Chen X, Ma L, Zhao L, Huang T, et al. Epidemiology of bronchial asthma and asthma control assessment in Henan Province, China. Translational Respiratory Medicine [Internet]. 2014 ;2(1):5. Available from : http://www.transrespmed.com/content/2/ 1/5

[7] Laksana MA, Berawi K. Faktor – Faktor Yang Berpengaruh pada Timbulnya Kejadian Sesak Napas Penderita Asma Bronkial. [Skripsi]. Lampung : Universitas Lampung [Internet]. 2015 ;4(2):3.

[8] Wistiani HN. Hubungan Pajanan Alergen Terhadap Kejadian Alergi pada Anak. Sari Pediatri [Internet]. 2011 ;13(3):185. Available from: https://sari-pediatri/article/view/431

[9] Dharmayanti I, Hapsari D, Azhar K. Asma pada anak Indonesia: Penyebab dan Pencetus. Kesmas : National Public Health Journal [Internet]. 2015 ;9(4):320.

[10] Kartika S, Frahesti N. Tungau Debu Rumah (Dermatophagoides pteronyssinus). Indonesia : Akademi Analisis Kesehatan Borneo Banjarbaru [Internet]. 2015 ;2(1):3

[11] Ponggalunggu B, Pijoh V, Wahongan G. Jenis dan Kepadatan tungau Debu Rumah pada Beberapa Habitat di Rumah Penderita Penyakit Alergi. Jurnal e- Biomedik (eBm) [Internet]. 2015;3(4):60.

[12] Hadi K. Tungau Debu Rumah Dermatophagoides sp. Bogor (Indonesia): Institut Pertanian Bogor [Internet]. 2014 ;6(2):1-4. Available from: http://upikke.staff.ipb.ac.id/files/2014/06/

[13] Ponggalunggu B, Pijoh V, Wahongan G. Jenis dan Kepadatan tungau Debu Rumah pada Beberapa Habitat di Rumah Penderita Penyakit Alergi. Jurnal e- Biomedik (eBm) [Internet]. 2015

Shobrina Insan Sakina Armunanto, Dian Puspita Dewi,
Dodik Pramono, Moh. Syarofil Anam

[14] Hadi K. Tungau Debu Rumah Dermatophagoides sp. Bogor (Indonesia): Institut Pertanian Bogor [Internet]. 2014 ;6(2):1-4. Available from: http://upikke.staff.ipb.ac.id/files/2014/06/

[15] Subahar R, Aulung A, Firmansyah NE, Lubis SN, Wibowo H. Pengaruh Suhu Dan Kelembaban Udara terhadap Keberadaan Tungau Debu Rumah di Pamulang (Tangerang) dan Pasar Rebo (Jakarta). Jurnal Profesi Medika [Internet]. 2019 ;10(1):1-11.

[16] Subahar R, Riady R. Hubungan jumlah anggota keluarga terhadap prevalensi dan intensitas Dermatophagoides Pteronyssinus di Jakarta Timur dan Tangerang Selatan. Indonesia: Universitas Indonesia [Internet]. 2014 ; 4(2):2.

[17] Peta Kesehatan Indonesia Tahun 2019. Kementrian Kesehatan Republik Indonesia [Internet]. 2020 ;53(9):1689- 1699. [cited 2020 Mar 10] Available from : https://pusdatin.kemkes.go.id/

[18] Muir WK. Community House Health. Journal of the America Medical Association [Internet]. 2016 ;1(17):515.

[19] Alimuddin S, Rengganis I. Comparison of Specific Immunoglobulin E with the Skin Prick Test in the Diagnosis of House Dust Mites and Cockroach Sensitization in Patients with Asthma. Acta Medica Indonesiana [Internet]. 2018 ;50(2):125- 131.

[20] Jacquet A. New Insights into the Molecular Basis of the House Dust Mite- Induced Allergic Response. Open Allergy Journal [Internet]. 2009 ;2(1):38-44.

[21] Adam E, Hansen K, Astudillo F, Coulon L, Bex F, Duhant X, et al. The House Dust Mite Allergen Der P 1, Unlike Der P 3, Stimulates Expression of Interleukin-8 in Human Airway Epithelial Cells via a Proteinase-Activated Receptor-2- Independent Mechanism. Journal of Biological Chemistry [Internet]. 2006 : 281(11):6910-6923.

[22] Natalia D. Peranan Alergen Tungau Debu Rumah (Der p 1 dan Der p 2) Dalam Reaksi Alergi. CDK Journal [Internet]. 2015 ;42(4):251-255.

[23] Yudopranoto K. Perbandingan populasi tungau debu rumah pada kasur kapuk dan non kapuk di perumahan PJKA Kelurahan Randusari Semarang Selatan Jawa Tengah. Semarang: Universitas Diponegoro, 2006.

[24] Denmark HA, Cromroy HL. House Dust Mites, Dermatophagoides spp. (Arachnida: Acari: Pyroglyphidae). Florida (USA): University of Florida [Internet]. 2014 ;54(314):1-4.

[25] Afkarina F. Hubungan Antara Kepadatan Dermatophagoides sp. Pada Tungau Debu Rumah dengan Skor Rinitis Alergi pada Penduduk Kelurahan Sumbersari [Skripsi]. Jember (Indonesia): Universitas Jember [Internet]. 2019 ;1(8):91.

[26] Colloff MJ. Taxonomy and Identification of Dust Mites. European Journal of Allergy and Clinical Immunology [Internet]. 2015 ;53(14):19

[27] Thomas WR. Geography of House Dust Mite Allergen. Journal of Allergy Immunology [Internet]. 2010 ;28(4):211- 224.

[28] Ikatan Dokter Anak Indonesia. Pedoman Nasional Anak Asma [Internet]. 2016 [updated 2016 January; cited 2020 Mar 21]. Available from: https://www.idai.or.id/pedoman-nasional-asma-anak/.

[29] Global Initiative for Asthma (GINA). Pocket Guide for Asthma Management and prevention 2018 [Internet]. 2018 [updated 2018 May; cited 2020 Mar 21].Available from: https://ginasthma.org/

[30] Canadian Lung Association. Asthma: asthma treatment [Internet]. Ottawa; 2015. Available from: http://www.lung.ca/lung-disease/asthma/treatment

[31] Purnomo, Arwani, Duke HI. Faktor Faktor Risiko Yang Berpengaruh Terhadap Kejadian Asma Bronkial pada Anak (Studi Kasus di RS Kabupaten Kudus). Jurnal Ilmu Keperawatan dan Kebidanan [Internet]. 2012 ;1(7):381-389. Available from: http://eprints.undip.ac.id/18656/1/.pdf

[32] Septianti RR, Rezquita R. Hubungan Riwayat Bayi Berat Lahir Rendah (BBLR) dengan Kejadian Asma Bronkial pada Siswa Sekolah Dasar di Kota Bandung. Bandung (Indonesia) : Universitas Islam Bandung [Internet]. 2015.

[33] Oemiati R, Sihombing M, Qomariah. Faktor-faktor yang berhubungan dengan penyakit

Shobrina Insan Sakina Armunanto, Dian Puspita Dewi,
Dodik Pramono, Moh. Syarofil Anam

asma di Indonesia. Media Litbang. 2010; 20 (1): 41-9.

[34] Kementerian Kesehatan Republik Indonesia. Laporan Hasil Riset Kesehatan Dasar (Riskesdas) Jawa Tengah tahun 2018. Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan [Internet]. 2018. [cited 2020 Mar 23]. Available from:https://www.kemkes.go.id/hasil-riskesdas-2018.pdf.

[35] Kementerian Kesehatan Republik Indonesia. Laporan Hasil Riset Kesehatan Dasar (Riskesdas) Indonesia tahun 2018. Badan Penelitian dan Pengembangan Kesehatan. 2018. Available from : https://kesmas.kemkes.go.id/Hasil- riskesdas-2018.

[36] Paramita OD, Harsoyo N, Setiawan H. Hubungan asma, rinitis alergik, dermatitis atopik dengan IgE spesifik anak usia 6-7 tahun. Sari Pediatri. 2013; 14 (6): 391-7

[37] Oktaviani.J. Hubungan Dermathopagoides Sp., Terhadap Kekerapan Asma Pasien RSUD Jember. Jember (Indonesia): Universitas Jember [Internet]. 2018 ;51(1):51.