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Research paper

The Comparison of Models for Reducing Inhalant Allergen Level in House Dust of Urban and Rural Residents

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Abstract

This current study aimed at: (1) describing the model for reducing inhalant allergen in house dust of urban and rural residents; (2) analyzing the different techniques of reducing inhalant allergen level in house dust of urban and rural residents.
This study was employing descriptive comparative design. The objects of this study were models for reducing inhalant allergen level in house dust based on environment management in urban and rural residences. The stage was initiated by modifying conceptual models of urban and rural residences developed in the two previous studies by Rofieq (2015) and Rofieq (2014). Those modified models were expected to be operational models to be implemented by urban and rural residents. The next stage was comparing both operational models analytically. The results concluded that: there was a difference between the model of reducing inhalant allergen in house dust of urban and rural residents. The urban model was composed by multidimensional correlations of seven variables in residential areas, namely: education-economy, the ability to manage the house dust, house facilities, physical environment of houses, the characteristics of residents, chemical environment of house dust, and dust biotic. The rural model was composed of five variables, namely: the ability to manage the house dust, house facilities, the characteristics of residents, chemical environment of house dust, and dust biotic. Based on those two models, it was found that the technique of reducing inhalant allergen in house dust of urban residents was more complex than that of rural residents.

Keywords: *allergen, house dust, urban, rural*

1. Introduction

House dust contains various biotic and abiotic materials that contribute to the level of dust inhalant allergen. Based on the previous studies, Rofieq (2014) concluded that

all dust samples taken from urban and rural residences contained inhalant allergen. In the urban residences, the level of which was found to be the highest in Sawojajar District accounted for 1.02 mg/gram; while the lowest level was found in Sukun District accounted for 0.66 mg/gram. In the rural residences, the highest and the lowest level of inhalant allergen was shown in Pagelaran, respectively 0.46 mg/gram and 0.21 mg/gram. Urban residences showed higher average of inhalant allergen level contained in house dust than that of rural residences. When a person's breathing and inhalation inhalant allergens that cause disease Allergic Rhinitis Rofieq (2000), (Kuriawati, 2005), Lockey and Ledford (2008).

In addition, Rofieq (2014) concluded that there was a predictive correlation between the content of fungi microbe, Salmonella, Shigella, and E.coliand the level of inhalant allergen in house dust of urban and rural residents. However, there was still different correlational pattern between urban and rural residences. This is in line with Soeryani (2008) asserting that environment management depends on how humans conduct some efforts to upgrade their quality of living. The results of Rofieq's study (2010) revealed that there were differences of microbiological indicator variations, both in terms of types and number of microbes per weight of house dust. The results indicated that there was different interaction pattern between urban and rural residences (Rofieq, 2014). Accordingly, it is predicted that there are still a lot more differentiating factors not yet revealed in his study.

Investigating the differentiating factors, it offers interesting insight on the correlation between biotic-abiotic environment factors and the ways to manage house dust in urban and rural residences. In the previous studies, Rofieq (2014) and Rofieq (2015) have developed models for reducing the level of inhalant allergen based on environment characteristics in urban and rural residences. However, those two models have not been compared descriptively and holistically and analyzed in terms of the correlations among the variables of residences' characteristics in urban and rural areas. It has not been investigated the differences among a number of main variables in internal environment of residences that play significant roles in determining the level of inhalant allergen in house dust.

Referring to the above background, this current study aimed at: (1) describing the model for reducing inhalant allergen in house dust of urban and rural residents; (2) analyzing the different techniques of reducing inhalant allergen level in house dust of urban and rural residents.

2. Materials and Methods

This study was conducted by employing descriptive comparative method. The descriptive method was to explain the models of reducing the inhalant allergen level in the house dust of urban and rural residents. The comparative method was employed to compare the models for urban and rural residences, developed in the previous studies.

The investigated objects were the models for reducing the level of inhalant allergen in house dust of urban and rural residents. In addition, the correlation among variables of urban and rural residences'environment in each model was taken as the object of this study to determine the interpretation of the correlation and life styles of urban and rural residents in the context of managing inhalant allergen in house dust.

The research location in Malang East Java, Indonesia.

The stage of this study was initiated by modifying the developed models in the previous studies (Rofieq, 2014 and Rofieq, 2015). The former models were mathematic models. Therefore, the models required further deductive description by investigating various relevant references so as to meet the scientific standards.

3. Discussion and Conclusion

Based on pragmatic stages, the mathematic models of reducing allergen level were altered into operational models. The modified results are shown in Fig.1 and Fig.2. Generally, there were differences between the model for urban and rural residences. The model for urban residences were composed of seven variables; while the model for rural residences were composed of five variables.

The differences implied the interaction complexity level of living components in the urban residences compared to rural residences. Mukono (2000) asserts that interaction complexity and inter-dependency of environment components describe the activity variations of living things or populations in their environment. Therefore, it can be inferred that urban residents showed more complexity than those of rural residents.

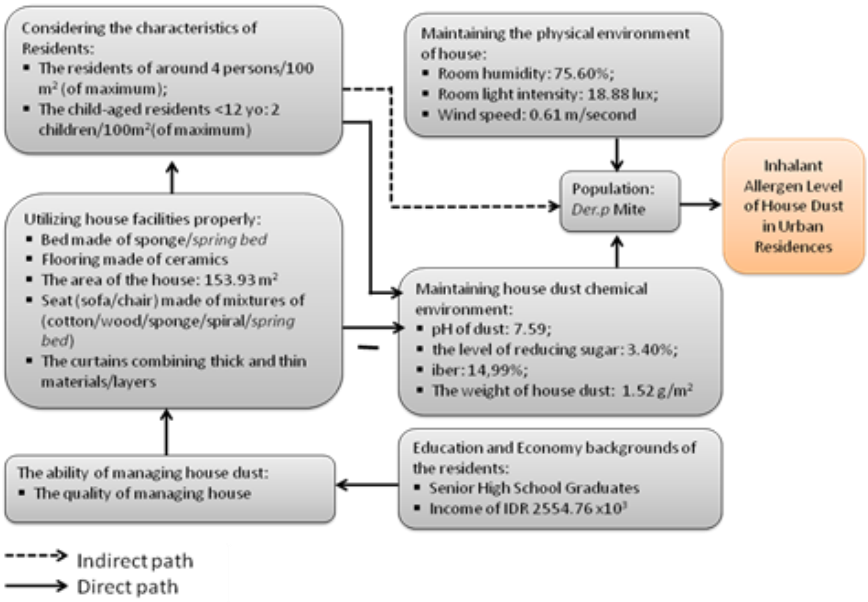

Fig.1: Operational model of reducing house dust in urban residences

Practically, the model for urban residences (Fig.1) is elaborated as follows. The urban residents, especially those sensitive of inhalant allergen in house dust, could do early prevention from atopy respiratory disease. The efforts comprise the manipulation and management of environment components so as to reduce inhalant allergen in house dust to the lowest. The low content of inhalant allergen in house dust could inspire the other environment components to get rid of inhalant allergen. The main concern is suppressing the number or population of Der-p mites not to exceed 176.16 mite/g of dust for urban residences and 71.57 mite/g for rural residences, this view is the consistent with the findings of Mahdi (1995), Rofieq (2014), and Rofieq (2016).

The techniques for reducing inhalant allergen in house dust of urban residents could be conducted by considering the characteristics of the residents. There are two indicators: the number of residents (4 persons/100 m2) and the number of child-aged residents ≤ 12 years old (2 children/100 m2). The more residents staying in a house, the higher the allergen level would be. Some contributing factors are: the daily activities of the residents: scratching, eating and drinking while playing with the children, cloth fiber falling from the clothes, and many others. Scratching causes the skin squama to peel and fall to the floor, bed, and other locations before mixing with house dust (Matthew, 2009) and (Rofieq, 2015). According to Matthew (2009), skin squama contains protein and fat that are the foods for mites to grow in the house dust. Food residue falling to the floor or other locations in the house also contribute to the growth of mites.

Another way to reduce the allergen level of house dust in urban residences is by controlling the number of Der-p mites by means of managing physical and chemical environment of house dust. Those two environment components are to collaborate or interact one another so as to suppress the number of mites to the minimum. The first step is managing three physical environment indicators, namely: room humidity, light intensity, and wind speed. Humidity is to be maintained around 75.60%, light intensity of around 18.89 lux, and the wind

intensity into the house of around 0.61 m/second. Simply put, those three components interact one another and the interaction influences the quality of physical environment of houses. To maintain the quality of physical environment, it is crucial to control the population of Der-p mites by controlling the interactions among those three environment components.

In addition, another alternative to reduce allergen level of house dust is by controlling the four chemical environment indicators of house dust in urban residences, namely: dust pH, dust sugar level, fiber, and dust weight. Those four indicators must be managed and their interaction must be maintained in orderto maintain the quality of chemical environment of house dust in hope of suppressing the population of Der-p mites. Below are the requirements of chemical environments of house dust to interact properly: house dust pH of 7.59, reducing sugar level of 3.4%, fiber of 14.99%, and the weight of dust of around 1.52 g/m2.

To maintain the chemical environments of house dust, it is necessary to maintain the quality of house facilities and concern on the characteristics of the residents. Based on the model for urban residences shown in Fig.1, the following characteristics should be met: The residents of around 4 persons/100 m2 (of maximum) and the child-aged residents <12 years old of around 2 children/100m2. The house facilities should consider the choice of materials, namely: materials for bed, for flooring, for seat, and for curtains, as well as the area of the house. According Oribe and Miyazaki (2000), provision of infrastructure can increase the humidity of house dust. The humidity can promote the growth of Der.p mites.

There are some requirements to meet in order to maintain the quality of chemical environments of house dust, namely: bed made of sponge/spring bed, flooring made of ceramics, the area of the house: 153.93 m2, seat (sofa/chair) made of mixtures of (cotton/wood/sponge/spiral/spring bed), and the curtains combining thick and thin materials/layers.

To meet the above requirements for house facilities, the ability of managing house dust properly is of necessity. In urban areas, the ability of managing house dust requires the basic knowledge of managing the dust. The knowledge will be achieved if the residents have proper education and economy background, such as: of minimum senior high school graduates and the monthly income not less than IDR. 2,554,760,-.

The model for rural residences (Fig.2), practically, could be narrated as follows. Rural residents, especially those sensitive of inhalant allergen in house dust, can do independent prevention from atopy respiratory disease. Similar to those in urban areas, the efforts comprise the manipulation and management of environment components so as to reduce inhalant allergen in house dust to the lowest. The differences rely on the types of indicators and the interacting environment components. Similarly, the low content of inhalant allergen in house dust could inspire the other environment components to get rid of inhalant allergen. The main concern is suppressing the number or population of Der-p mites not to exceed 71.57 mite/g of dust and the total pollens not to exceed 186.29 seeds/g.

In effort to reduce the inhalant allergen in house dust of rural residents, concerning the characteristics of the residents is of importance. There are three indicators of the residents' characteristics, namely: the residents of around 7 persons/100 m2, the child-aged residents <12 years old of around 2 children/100m2, and the number of pet is 2 pets/house. In rural areas, there is an additional valid indicator of the characteristics of the residents that is the existence of pets in the house. The pets included in this current study were animals that have hair/feather.

The number of residents and pets (with hair and fur/feather) in the house has triggered the allergen level. Some determining factors include: the daily activities of the residents and pets in the house such as: scratching, food and drink residues, cloth fiber falling from clothes, hair or fur/feather of pets falling into the house dust. Scratching causes skin squama to peel and fall to the floor, bed, and other locations, before finally mixing with the house dust. Skin squama contains protein and fat that are the foods for mites to grow in the house dust. In addition, food residue falling to the floor or other locations in the house also contribute to the growth of mites. Animals' hair and fur/feather falling and mixing with dust particles will become the shelter forthe activities of mites.

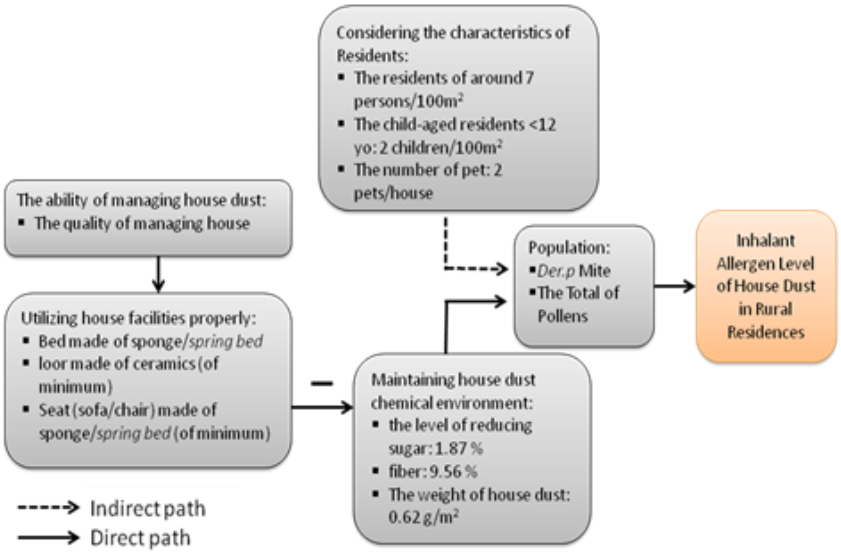

Fig.2: Operational model of reducing house dust in rural residences

To reduce the population of Der-p mites and the total of pollens in house dust of rural residents, it is important to maintain the quality of chemical environment of house dust. Managing the quality of chemical environment of house dust is executed by focusing on three indicators, namely: the level of reducing sugar, the content of fiber in house dust, and the dust weight. Those three indicators are to be maintained and their interactions must be retained in order to maintain the quality of chemical environment of house dust in hope of suppressing the population of Der-p mites. Below are the requirements of chemical environments of house dust to synergize properly: the level of

reducing sugar of around 1.87%, the content of fiber in house dust of around 9.56%, and the dust weight of around 0.62 g/m^2. In other words, to maintain the quality of chemical environments that control the population of Der-p and the pollens in the house dust, it is sufficient to investigate the interaction of the three indicators (the level of reducing sugar, the content of fiber in house dust, and the dust weight).

Maintaining the quality of the chemical environments of house dust in rural residences requires the continuous efforts to maintain the quality of facilities in the house. Based on the findings of the operational model (Fig.2), the key house facilities to maintain related to the chemical environments of house dust are: the materials of bed, flooring, and seat (chair/sofa). There are some requirements to meet regarding the house facilities in effort to maintain the quality of chemical environments of house dust. The requirements cover: bed made of sponge or spiral/*spring bed* (of minimum), flooring made of ceramics (of minimum), and seat (sofa/chair) made of sponge or spiral/*spring bed*.

To meet the above requirements for house facilities, the ability of managing house dust properly is of urgency. In rural areas, the ability of managing house dust requires the basic knowledge of managing the dust. However, the knowledge can be achieved naturally without considering the complex education-economy backgrounds different from that of the urban residents.

Based on the above description and analysis, there was a difference between the models of reducing inhalant allergen in house dust of urban and rural residents. The urban model was composed by multidimensional correlations of seven variables in residential areas, namely: education-economy, the ability to manage the house dust, house facilities, physical environment of houses, the characteristics of residents, chemical environments of house dust, and dust biotic. The rural model was composed of multidimensional correlations involving five variables, namely: the ability to manage the house dust, house facilities, the characteristics of residents, chemical environments of house dust, and dust biotic.

The operational models have been modified to facilitate the knowledge of urban and rural residents to understand and change their environment so as to cope with the problems of house dust. To sum up, the models for reducing allergen level of house dust can be further developed in some community service programs to empower the society, to be specific in the field of maintaining the environment health.

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