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The Connection Between Dust Mite Number And Abiotic Factors In Boarding House Dust

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Abstract: Dust mites are insects that have a wide range and can cause a variety of allergy illnesses. The existence of mites in an environment can be affected by abiotic factors that espouse the growth of the mites. This research aims to analyze the connection between dust mite number and abiotic factors of boarding house dust. This research was descriptive. The research was conducted in Dau District, Malang Regency, using an analysis unit of student boarding houses and their residents (students) from 2018/2019 to 2019/2020. The research population consisted of student boarding houses that had been recognized as having disruptions due to exposure to house dust. The UMM Biology Laboratory was used to obtain research data. Inferential statistical tests with SPSS 21 software were employed as part of the analysis technique. The results of this research indicate that room temperature, humidity, light intensity, wind speed, dry matter, ash content, protein content, crude fat, and crude fiber are abiotic factors that influence the *TDR* (House Dust Mites) population in boarding houses. Humidity is one of the abiotic factors that influence the existence of TDR among all the abiotic factors that influence the existence of TDR. The findings of this research can be utilized as a source of information for the general public, particularly students, to always pay attention to the cleanliness of their surroundings so that it does not become a medium for developing TDR and reducing the TDR population.

Keywords: Allergic; Cleanliness; House Dust Mites; TDR

Introduction

A healthy home is an absolute necessity for human survival (Deni et al., 2022). The house problem has been regulated in the Law (UU) concerning housing and settlements number: 4/1992 chapter III article 5 paragraph 1 that contains "*Every citizen has the right to occupy and/or enjoy and/or own a decent house in a healthy, safe, harmonious and orderly environment*". A healthy house is not just functional as a place to live but must provide a sense of security and comfort to its residents (Kuswara et al., 2022). Healthy physical, chemical, and biological conditions in the house and its surroundings allow people to achieve optimal wellness (Lubis et al., 2022).

A *Room in private homes* or boarding houses is a residence in the form of a boarding room with a very limited number of rooms, facilities, and equipment (Ermadani, 2015). The concept of a healthy, living residence is not always used in the construction of boarding houses. Nevertheless, various factors must be considered to establish a healthy household, including (1) good air circulation, (2) good lighting, (3) sufficient clean water, (4) wastewater disposal is properly regulated so as not to cause pollution, (5) parts of the room such as floors and walls are not damp and are not polluted by odors, seepage of dirty water or dirty air (Rofieq, 2018).

Inhalant allergy levels correspond with house dust levels (Rofieq, 2014). It is in line with Tham et al. (2016) who assert that *TDR* is an aeroallergen that is generally discovered in Asia region, with the highest sensitization rate in Singapore at more than 90%. The results of a study in Indonesia indicate that *TDR* is the most

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common allergen among patients in Surabaya, Indonesia (63.3%) and Palembang, Indonesia (64.3%) (Anggraeni, Rosita, et al., 2023). Survey results of Pratama et al. (2023) in Skin and Venereology Diseases Polyclinic, General Academic Hospital, Dr. Soetomo Surabaya between 2017 and 2019 is the cause of the most allergens due to *TDR*.

TDR are mites that spread very widely and can trigger various allergic diseases (Gustina & Anni, 2021; Sánchez-Borges et al., 2017). As a result, it is nearly impossible to remove. TDR will create excrement produced by the digestive system of mites containing inhalant allergens every day. Mite droppings can contaminate household dust, resulting in an allergic reaction (Miller, 2019). The use of carpets and curtains can improve the *TDR* population (Tjandra et al., 2013). Anggraeni, Rosita, et al. (2023) claim that the *TDR* can live in beds, mattresses, pillows, and stuffed animals. The more dust accumulates in a room, the more likely mites will dwell and grow, causing allergens in the air (Bora'a et al., 2023). Inhalant allergens are a form of glucose-protein that activates an immune response, resulting in an allergic reaction. (Grosse-Kathoefer et al., 2023). Allergens cause respiratory disorders, psoriasis, and dermatitis caused by *Sarcoptes* and *Demodex* mites (Akpan et al., 2023). Because of the large prevalence and variety of diseases that can be caused by insects in the *TDR* group, it is critical to implement preventative actions or initiatives to promote public health.

To avoid exposure to *TDR*, one potential health measure is to provide education through a variety of health promotions. College students are one of the components of society and future agents that should maintain their physical health. Maintaining the cleanliness of your living environment (boarding house) is one of the preventive actions that students may take to avoid the risks of illnesses, including allergy diseases like allergic rhinitis. Contracting allergic rhinitis can limit student productivity in a variety of ways, including absenteeism, loss of active study time, lower immunity, lack of concentration, lack of passion, and so on. Departing from the above explanation, this research aims to analyze the connection between the number of mites and abiotic factors of boarding house dust.

Method

This research was descriptive. This research was carried out in Dau District, Malang Regency using an analysis unit of students' boarding houses and its residents (college students). This research ran for one academic year, from even 2018/2019 to odd 2019/2020. To test seven independent variable indicators characteristic of house dust abiotic factors, the study population was student boarding houses that were identified by anamnesis as having problems with exposure to house dust, such as allergic rhinitis and respiratory allergies caused by exposure to house dust. Seven indicators are used as independent variables for the characteristics of dust abiotic factors: dust weight, moisture content, dust pH, organic matter content, inorganic matter content, sugar content, and fiber content. The number of *TDR* was the dependent variable.

The research procedures embraced: 1) collecting home dust at student boarding houses with a vacuum cleaner, 2) weighing and analyzing house dust in a laboratory on seven independent research variable indicators, namely dust weight, water content, dust pH, organic matter content, and matter content, organic content, inorganic content, sugar content, and fiber content are all factors to consider. Following the collection of data, its characteristics are described. The UMM Biology laboratory was used to obtain research data. The following statistical methods were employed in the analysis: (1) descriptive statistics, such as percentages, central tendency values, bar charts, and standard deviation; (2) inferential statistics, such as multiple regression analysis and factor analysis using SPSS software version 21.

Results and Discussion

According to the findings of the SPSS version 21 analysis, all assumption tests strongly support proceeding to the linear regression test (Table 1). The analysis can be continued with the linear regression test of all types of assumption tests that are feasible to continue with the linear regression test because all distributions of the X factor data fulfill the five assumption requirements with the TDR data (factor Y), except the moisture content factor (X5). Perform a linear regression test with predictors of all environmental and abiotic factor data (excluding X5) and the number of TDR factors criteria. Table 1 represents the summary results of calculations performed with SPSS (See table 2, 3, and 4 too).

Table 1. Results of the Assumption Test of all X Factors with Total *TDR*

Assumption Test of All X to Y	SPSS Results
Linearity Test	p < 0,05
Heteroscedasticity Test	p > 0,05
Normality test	p > 0,05
Multicollinearity Test	VIF < 10
Autocorrelation Test	d=2,93 – 3.04 (Except X5 = 2,15)

Table 2. Summary of Linear Regression Analysis Results.

Model	R	R Square	Adjustted R Square	Std Error of the Estimate
1	.928[a]	.861	.747	30.48194

a. Predictors: (Constant), crude fiber, humidity, dry matter, temperature, proteins, ash, wind speed, crude fat, and light intensity

Table 3. Summary of Linear Regression Analysis Results (ANOVA)

Model	Sum of Square	df	Mean Square	F	Sig
1. Regression	63366031	9	7040670	7.578	001[a]
Residual	10220636	11	929.149		
Total	73586667	20			

a. Predictors: (Constant), crude fiber, humidity, dry matter, temperature, proteins, ash, wind speed, crude fat, and light intensity

b. Dependent Variable: number of *TDR*

Table 4. Summary of Linear Regression Analysis Results

Model	Unstand coefficiesnts		Standard coefficiesnts	t	Sig
	B	Std. error	Beta		
(Constant)	-20190	130356		-1.549	.150
Temperature	2.457	7.235	.067	340	.741
Humidity	21,408	6.462	1.156	3.313	.007
Light Intensity	1,086	1.861	171	584	.571
Wind Speed	13048	24.346	113	536	.603
Dry Matter	2180	12.872	023	169	.889
Ash	-1700	1.288	-241	-1.320	214
Proteins	-2819	3.389	-173	-832	423
Crude Fat	21809	20.269	274	1.076	305
Crude Fiber	24809	3.066	162	805	438

a. Dependent Variable: number of *TDR*

The analysis results in Table 2 can be expressed as a linear regression line formulation (all numbers are rounded), namely $Y = 2.4X_1 + 21{,}4X_2 + 1.1X_3 + 2.2X_4 - 1{,}7X_5 + 2.8X_6 + 21.8X_7 + 2.5X_8 - 2019.0$. Based on the linear regression line equation formed by environmental and abiotic factors, the amount of *TDR* is significant. The line equation that is formed has a value of F = 7.578 and Sig.=0.01; thus, the value is $p < 0.05$, means that there is a significance there is a significant regression line equation formed by all environmental factors and abiotic factors on the total *TDR*, except for the moisture content. The regression line equation has an R-value -square = 0.861, means that the regression line equation has an effectiveness of 86.1%. The "coefficients" section of Table 2 displays the significant values (sig) that differ between each environmental and abiotic factor on the amount of TDR. The discrepancy in these figures indicates that the influence of each environmental and abiotic factor on the amount of TDR varies. The most important or most powerful component is room humidity.

Findings from this research indicate that the occurrence of *TDR* in student boarding rooms is connected to abiotic environmental conditions (Table 2). Each abiotic component influences the existence of *TDR* in its unique way. Room temperature, humidity, light intensity, wind speed, dry matter, ash content, protein content, crude fat, and crude fiber are all abiotic variables that influence the occurrence of *TDR*. The findings of urban research reveal that ambient factors such as the use of mattresses, sofas, floors, pets, bed linen, temperature, and humidity have an impact on the existence of *TDR* (Ikbal et al., 2015).

The first abiotic factor that influences the occurrence of *TDR* is humidity. One of the most important factors influencing the occurrence of TDR in boarding rooms is humidity (Table 2). Research findings of (Majawati & Joselyn Kezia, 2019) reveal that humidity influences the growth of *TDR*. According to Subahar & Aulung, (2016), temperature and humidity in in urban areas affect the development of house dust mites. Mites are known as a group of animals that have high tolerance to environmental factors such as temperature and humidity (Madyaningrana & Apra, 2021). This is due to the body structure of dust mites which have heat-resistant skin. Majawati & Joselyn Kezia (2019) postulate that the *TDR* has thin skin that is vulnerable to fluid loss in low humidity, so a home with high humidity is a good setting for *TDR* development. The *TDR* can grow optimally at a relative humidity of 75% and a temperature of 15^{o}C (Ambarwati & Ferial, 2021). As a result, the surroundings, especially rooms, must receive adequate sunlight and be cleaned on a regularly, since sunlight can eliminate the presence of *TDR* (Mumcuoglu & Taylan-Özkan, 2020) and *TDR* also prefers moist to dark environments (Yousif & Al Muhyi, 2019).

High humidity is a significant factor in supporting the breeding of dust mites (Anggraeni, Rosita, et al., 2023). Indonesia is a tropical country with a hot and

humid climate that can be suitable for *TDR* growth (Anggraeni, Triesayuningtyas, et al., 2023; Trasia, 2022), with the most *TDR* is *Dermatophagoides pteronyssinus* (Anggraeni, Triesayuningtyas, et al., 2023). External factors of dust mites as the primary contributors to allergic sensitization caused by house dust mites are air temperature and humidity (Anasis et al., 2021). The intensity of room light about 18.89 lux also effects on activities. *TDR* needs a temperature of 25^{o}C - 30^{o}C and a humidity between 70%- 80% with critical humidity of 60-65 % in order to develop optimally (Lesmana et al., 2018). Based on a study conducted by Ponggalunggu et al. (2015) in Manado City, with temperatures ranging from 29 ^{o}C- 32.6 ^{o}C and humidity 85% shows the dominance of mites found from the Pyroglyphidae family with a total of 157.

Aside from humidity, room temperature influences the occurrence of mites in student boarding rooms. Mites are temperature-sensitive organisms; each mite species has an ideal temperature for survival. Research findings of (Widiastawan et al., 2015) reveal that mites with *Dermatophagoides pteronyssinus* species have optimum life at 25^{o}C, while at above temperature of 35^{o}C, mites' growth slows down (Brożek et al., 2017). Temperature is one of the important factors in influencing the growth of mite population, fecundity, development, and the amount of allergen produced by mites (Vackova et al., 2021). A study conducted by Anasis et al. (2021) report that the main habitat of mites is warm, dark, and humid environments; hence, mites are abundant in the bedroom mattress, living room sofa, bedroom floor, and living room carpet.

Another external factor is light intensity. The results of this research indicate that light intensity in an area influences the occurrence of house mites. The light intensity is one of the factors in house mite growth since the house mites like a quite dark places (Anasis et al., 2021). Research findings of a study conducted by Lesmana et al. (2018) claim that the occurrence of house mites is often discovered in a quite dark place rather than a bright place. Insufficient sunlight entering the area leads the room to become wet, allowing mites to survive and grow larger (Majid et al., 2020). Insufficient exposure to sunlight entering the bedroom, along with insufficient ventilation, causes wet conditions in the room, fostering the growth of *TDR* (Kumarayanti et al., 2020).

In addition to the abiotic factors mentioned above, the presence of ash or dust in the home environment, including rooms, cannot be avoided. The findings reveal that the presence of dust or ash has an effect on the occurrence of mites. One of the factors contributing to the high mobility of *TDR* life is someone who rarely cleans the area, making it easier for dust to accumulate and form a living medium for *TDR* (Yolazenia et al., 2019). This is supported by a study of Ponggalunggu et al. (2015) that in Manado, 3.02 grams of ash contain mites of 410 mite/ gram of dust. According to Saputra et al. (2019), one indication of an unclean room is the presence of dust in the room. Consequently, this becomes one of the factors in the high population of *TDR* in the bedrooms since the *TDR* is often found in bedroom dust, specifically on cotton mattress dust (Crowther et al., 2000).

TDR growth is also affected by protein, crude fat, crude fiber, and dry matter levels, according to the findings. *TDR's* primary food sources are human and animal skin fragments, as well as fine food waste bits. *TDR* typically consumes these delicacies on beds, blankets, sofas, and pillows (Anasis et al., 2021; Majawati & Joselyn Kezia, 2019). Research findings of Lesmana et al. (2021) state that the presence of mites on bedroom furniture is closely related to mite food. Bedrooms include mattresses, blankets, and curtains in addition to furniture. Sheets, like other household furniture, have a lot of threads that tangle quickly and gather dust. As a result, mites are most commonly seen in bedrooms. More efforts are needed to keep boarding rooms clean at all times so that they do not become *TDR* habitats (Mumcuoglu & Taylan-Özkan, 2020).

Knowledge and personality, or individual behavior, are two more factors that are contributing to the increase in the number of dust mites. Knowledge is a critical sensory mechanism for the formulation of actions (Kusnadi, 2021), while personality is a way of reacting to existing situations (Rivaie, 2011). Research findings conducted by Rambing et al. (2016) in Paal district, Manado City indicate that 34.86% of respondents' knowledge regarding House Dust Mites is still lacking and 75.96% indicate that the actions of the majority of respondents in preventing and eradicating *TDR* are sufficient. In the research findings of Haslinda & Agustiandi (2021), As many as 54.4% of students are classified as having a negative attitude toward *TDR,* while 44.4% are classified as having a *PHBS* attitude (Clean and Healthy Living Behavior) toward *TDR*. Research findings of Tjandra et al. (2013) discover that residents of boarding houses are sloppy about keeping their rooms clean, which might increase the population of dust mites in boarding rooms.

These research findings can be utilized as information sources and an education effort for students on the danger of *TDR* and its countermeasures. Aside from that, it is believed that it will motivate students to pay greater attention to the hygiene of the boarding home environment in order to achieve optimal health. Aside from the primary goal, especially students, the community is a broader target of this research. Through this research, it is intended that the general population would learn about *TDR*, its potential risks, and how to

deal with it. Thus, it might raise cleanliness awareness in the home environment.

Conclusion

From this research, it can be concluded that there is a correlation between abiotic factors and the *TDR* (House Dust Mites) population in college students' boarding houses. Abiotic factors that affect the *TDR* population are room temperature, humidity, light intensity, wind speed, dry matter, ash content, protein content, crude fat, and crude fiber. Recommendations for future research include identifying types of house dust based on the characteristics or indicators of the internal environment of boarding rooms and conducting development research where the results of research development can be elaborated into promotional media for disease prevention due to exposure to house dust among students and people who own boarding houses.

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Conflicts of Interest
The authors declare that there is no conflict of interest regarding the publication of this paper

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