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RELATIONSHIP OF TEMPERATURE, HUMIDITY AND LIGHTING WITH FLY DENSITY IN PANCUR BATU MARKET, PANCUR BATU DISTRICT, DELI SERDANG REGENCY

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Abstract

Flies are one of the mechanical vectors of disease commonly found in market environments. Environmental factors such as temperature, humidity, and lighting are suspected to influence the density of flies. This study aims to determine the relationship between temperature, humidity, and lighting with fly density at Pancur Batu Market, Pancur Batu District, This study involved a sample of 85 stalls selected through purposive sampling from five types of vendor areas (chicken, fish, meat, vegetables, and fruit). Fly density was measured using Pagoda fly paper traps, while temperature, humidity, and lighting were measured using a thermohygrometer and a luxmeter. Data analysis was conducted using the chi-square test in SPSS software, The results showed that most locations 69 stalls (81.2%) had high fly density. Temperature did not meet the standard at 73 stalls (85.9%), humidity met the standard at 31 stalls (36.5%), and lighting met the standard at 61 stalls (71.8%). Only humidity was significantly associated with fly density ($p = 0.012$), whereas temperature ($p = 0.848$) and lighting ($p = 1.000$) showed no significant relationship with fly density at Pancur Batu Market. Humidity is the most influential environmental factor affecting fly density at Pancur Batu Market. Therefore, managing humidity and improving market cleanliness should be prioritized to reduce the fly population and the risk of disease transmission.

Keywords: Flies, Temperature, Humidity, Lighting, Market, Vector Density

Introduction

Flies are a group of insects that spread diseases mechanically from sufferers to others through contaminated materials (food, drinks, and water) disease-causing organisms stick to their legs and body parts. These diseases include digestive tract infections, dysentery, diarrhea, typhoid, cholera and worm infections. In addition to being a mechanical factor, the presence of flies in an area can be an indicator that the area is not clean. (Rahayu et al., 2019)

Based on previous WHO analysis in all sectors shows that mortality (death), number of sick people (incidence) and pandemic effects are known in areas related to environmental degradation or hygiene and sanitation, such as waste capacity, flies and mosquitoes or other animals, or unfavorable or inadequate water vector capacity and poor socio-economic water.

According to News (WHO, 2020), vector-borne bacteria account for approximately 17% of all infectious bacteria and can cause approximately 70,000 deaths each year. Flies are one of the vectors of foodborne diseases such as gastroenteritis, diarrhea, typhus, dysentery and some groups that can cause myiasis. (Nanda et al., 2024)

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Minister of Health Regulation No. 7 of 2019 concerning Environmental Health stipulates that the density of flies in public facilities such as markets should not exceed 2 per trap per day. The Indonesian Ministry of Health explains that: "Places that flies like are wet places, organic objects, feces, wet garbage, animal waste, rotten plants, cumulative accumulation of dirt (in animal cages) are very good breeding grounds for flies". In general, breeding places for flies are dirty and wet places. (Nendisca Ritje, 2022).

The health status of a population is largely determined by the condition of a place where many people are active every day at the same time, public places can also be the main route of disease transmission. One of the public places around the community is the market. The market is a place where people are active every day, to carry out middle to lower buying and selling transactions (Ministry of Health of the Republic of Indonesia).

Data from the Deli Serdang Health Service (2023) shows that Pancur Batu Market in Pancur Batu District has an average fly density of 4–6 per trap, with the highest point reaching 7 in the fish and meat sales area. This shows a large gap between national standards and real conditions in the field.

The density and distribution of flies are greatly influenced by environmental factors that support the vector's breeding process, such as temperature, air humidity, and lighting intensity. There is a reciprocal relationship between temperature and humidity, where high environmental temperatures tend to be accompanied by low humidity, and vice versa. The interaction between these two factors directly affects the activity of flies as disease vectors. Flies tend to achieve optimal physiological conditions at high temperatures with low humidity, which are ideal conditions for their survival and reproduction. In addition, flies have a preference for light, but tend to avoid direct exposure to sunlight, so they are more often found in shaded areas or areas protected from direct sunlight.

Marlinae et al.'s (2019) research revealed that high humidity and low lighting in traditional markets, especially in areas selling animal products, greatly support the process of fly breeding. Uneven lighting can also create dark areas that are ideal places for flies to perch and lay eggs.

Maksuk et al. (2025) stated that relative humidity above 60% and temperature around 30°C significantly accelerate the growth of fly population. Their study conducted in Palembang market showed that areas with poor ventilation and piles of organic waste had much higher fly density compared to areas with good humidity management.

In addition, according to Sari et al. (2024), lighting also affects fly behavior. Although flies are positively phototactic—that is, attracted to light—they still avoid intense exposure such as direct sunlight. The semi-closed market environment with soft artificial lighting actually prolongs the daily activity of flies. Therefore, understanding the interaction between temperature, humidity, and lighting is important in designing a comprehensive fly population control strategy.

Research by Inna et al. (2023) proves that light plays a significant role directly in the high density of flies in the market, while temperature has a biological influence that supports the development of flies, although it is not statistically significant in this study. The interaction of these two factors creates an environment that is very favorable for flies to thrive, especially in market areas with low sanitation.

Based on an initial survey at Pancur Batu Market, Pancur Batu District, flies were found in certain places such as places selling meat, fish, chicken, vegetables, and fruit, indicating the presence of flies perching. (Inna Reni et al., 2023).

Researchers took samples of 85 points, consisting of 15 Chicken stalls, 14 Fruit stalls, 19 Meat stalls, 16 Fish stalls, and 21 Vegetable stalls. The results of the study showed that most stalls in Pancur Batu Market had a high fly density, which was 81.2%. The distribution of flies was most commonly found in vegetable stalls, meat stalls, and fish stalls, which are generally places with high organic material residues.

Based on the distribution of sales locations, vegetable stalls are the locations with the highest frequency and also have a high fly density, this is due to the large amount of organic waste such as

vegetable and fruit waste, where vegetables and fruits contribute greatly to the increase in the fly population, especially if waste management is not carried out routinely and hygienically, Therefore, researchers want to see further the density of flies in the market such as temperature, humidity, and lighting.

Method

This research was conducted at Pancur Batu Market, Medan Tuntungan District. Data collection was conducted in May. The population in this study were all locations in Pancur Batu Market, totaling 568 sales outlets. Meanwhile, the sample in this study was part of the location points totaling 85 samples, namely 15 Chicken stalls, 14 Fruit stalls, 19 Meat stalls, 16 Fish stalls, and 21 Vegetable stalls. The researcher used a purposive sampling technique by selecting sales outlets whose traders were present, willing and allowed their business locations to be observed for research. To measure fly density using Pagoda fly glue and to measure temperature, humidity and lighting using Thermohygrometer and luxmeter. All measurements were taken during the day.

The data obtained were processed using a computer and SPSS by calculating the frequency distribution and average value. Data processing and analysis using the SPSS application with the chi-square test.

Results

This study was conducted at 85 locations in Pancur Batu Market representing five types of sales outlets, namely chicken, meat, fish, vegetable, and fruit stalls. Data collection was carried out through direct observation and measurement of three main environmental variables, namely temperature, humidity, and lighting. In addition, fly density calculations were also carried out using Pagoda fly glue traps to determine the level of fly infestation at each location. This approach aims to identify the relationship between market environmental conditions and high fly vector populations. To describe the results of the study more systematically and measurably, the following are several tables showing the distribution of sales outlets, fly density levels, temperature, humidity, and lighting measurement results, and the relationship between each environmental variable and fly density based on the chi-square test.

Table 1. Frequency Distribution of Sales Places

Sales Places	Frequency	%
Chicken Stall	15	17,6
Fruit Stall	14	16,5
Meet Stall	19	22,4
Fish Stall	16	18,8
Vegetable Stall	21	24,7
Total	**85**	**100**

Table 1 shows that based on the frequency of sales locations, the largest number of samples were found in vegetable sales locations with 21 kiosks (24.7%), while the fewest were found in fruit sales locations with 14 kiosks (16.5%).

Table 2. Fly Density

Fly Density	Frequency	%
Low 0-5 flies	16	18,8
High 6-20 flies	69	81,2
Total	**85**	**100**

Table 2 shows that most of the sales places in the Pancur Batu market, Pancur Batu sub-district, there are 69 stalls (81.2%) with high fly density, where the stalls that attract flies to land are: chicken stalls (11), fruit stalls (11), meat stalls (16), fish stalls (13) and vegetable stalls (18). While the other 16 stalls (81.2%) show a low fly category. This shows that there needs to be fly vector control in places that allow flies to breed.

Table 3. Frequency Distribution of Temperature, Humidity and Lighting Measurement Results at Pancur Batu Market, Pancur Batu District

Variable	N	%
Temperature		
Qualified	12	14.41
Not Qualified	73	85.9
Humidity		
Qualified	31	36.5
Not Qualified	54	63.5
Lighting		
Qualified	61	71.8
Not Qualified	24	28.2
Total	**85**	**100**

Table 3 above shows that most of the sales places in the environmental temperature measurement do not meet the standards, which is 73 stalls (85.9%). The results of humidity measurements at the sales places mostly meet the standards, which is 31 stalls (36.5%) and the results of lighting measurements at the sales places mostly meet the standards, which is 61 stalls (71.8%).

Table 4. Relationship of Variables Using the *Chi-Squared Test*

Variable	Fly Density						*p-value*
	Low		High		Total		
Temperature	N	%	N	%	N	%	
Qualified	3	25.0	9	75.0	12	100	0.848
Not qualified	13	17.8	60	82.2	73	100	
Humidity							
Qualified	1	3.2	30	96.8	31	100	0.012
Not qualified	15	27.8	39	72.2	54	100	
Light							
Qualified	11	18.0	50	82.0	61	100	1.000
Not qualified	5	20.8	19	79.2	24	100	
Total	85	100	85	100	85	100	

Table 4 shows that most of the sales places, at temperatures that meet standards and do not meet standards, there are 12 stalls that meet temperature requirements and 73 stalls that do not meet temperature requirements with p-value = 0.848 meaning, there is no significant relationship between environmental temperature and fly density. In humidity measurements, there are 31 stalls that meet humidity requirements and 54 stalls that do not meet humidity requirements with p-value = 0.012 which means there is a significant relationship between humidity and fly density and lighting measurements there are 61 stalls that meet lighting requirements and 24 stalls do not meet lighting requirements with p-value = 1,000 which means there is no significant relationship between lighting and fly density in the Pancur Batu market, Pancur Batu sub-district.

3.1 Table

Tables are written in Times New Roman, font 9, 1 space between tables and paragraphs 1 space. The table consists of a number, table title, table contents, and information below the table (if additional information is needed). There is no space between the information below and the table.

The contents of the table are placed in the middle of a full page (not in two columns) if two columns do not fit on a page

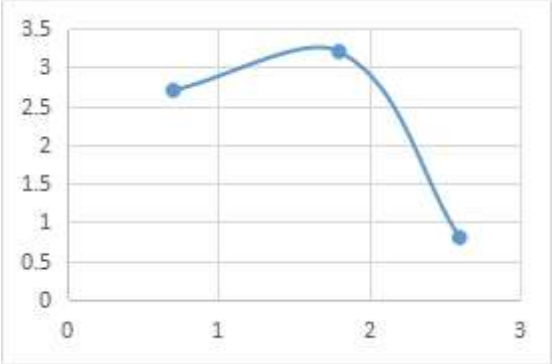
Example table:

Table 1 Frequency Distribution Based on Age of UIKA FIKes Female Students in 2019

Variabel	Mean	Median	Minimal - Maksimal
Umur	20	20	17 – 23

3.2 Graphics/Images

Graphics/images are placed in the middle of a full page (not in two columns) if there are not enough pages in two columns. The graphic title located below consists of the graphic/image number and bold. Times New Roman type, font 10, 1 space. Between tables and paragraphs 1.15 spaces.



Graph.1 Decreased blood sugar after consuming tablets

Discussion

The fly density index is a measure that describes the number of fly populations in a particular location. Measurement of this index is usually done using a pagoda glue tool. Given the importance of fly population control which is closely related to human health, measurements are focused on areas that are directly related to human activities. In this case, measurements will include variables of temperature, air humidity, and lighting intensity, as well as fly density levels in the chicken, meat, fish, vegetable, and fruit sales areas located at Pancur Batu Market.

The results of the analysis showed that air humidity had a significant relationship with fly density ($p = 0.012$). This finding is in line with the results of research by Sari and Nugroho (2020) which stated that relative humidity above 60% can accelerate the life cycle of flies, from the egg phase to adulthood, thereby increasing the overall vector population. Humid air conditions create a microclimate that supports metabolic and reproductive activities of flies, especially during the day when the temperature is stable and the relative humidity is high.

The results showed that humidity was the only environmental factor that had a significant relationship with fly density at Pancur Batu Market ($p=0.012$), while temperature and lighting did not show a significant relationship. This finding confirms that high relative humidity plays an important role in supporting the life cycle of flies, from the egg phase to adulthood. High humidity conditions create an optimal microenvironment for fly metabolism and reproductive activity, so that the fly population can increase significantly (Zhu et al., 2022).

The temperature at Pancur Batu Market in this study did not show a significant relationship with fly density (p = 0.848). However, several other studies, such as by Ramadhani et al. (2019), show that environmental temperature can affect fly behavior and activity, although the effect is more indirect and depends on a certain temperature range. Houseflies, for example, are known to show maximum activity at temperatures of 25–30°C. Therefore, because the temperature at Pancur Batu Market is relatively uniform between stalls and is not extreme, there does not appear to be a significant effect on the temperature.

Although temperature and lighting did not show significant relationships in this study, recent studies still highlight the importance of integrated environmental factor management. Kurniawan et al. (2024) emphasized that good ventilation and effective waste management can simultaneously reduce humidity and fly populations. In addition, WHO (2023) in the Integrated Vector Management (IVM) framework recommends a multifactorial approach, including trader education, improved market design, and regular surveillance, to reduce the risk of vector-borne diseases in public facilities such as markets.

Lighting at Pancur Batu Market in this study, namely the results of the chi-square test, showed no significant relationship with fly density (p = 1,000). Although flies are biologically positively phototactic (attracted to light), artificial light in markets dominated by indoor or semi-closed lighting tends to have an intensity that is not high enough to significantly affect fly movement. Research by Inna et al. (2023) shows that intense natural lighting affects the distribution of flies in open markets, but this effect is not very visible in semi-closed market environments such as Pancur Batu Market.

In general, air humidity is the most dominant factor influencing fly density levels in this study. This finding supports the hypothesis that high humidity conditions create a supportive environment for the physiological and ecological processes of flies to breed. Thus, efforts to control fly populations can be carried out by regulating environmental humidity, for example by increasing air circulation and improving market design. This approach can be an effective strategy, without relying solely on the cleanliness aspect.

These findings reinforce WHO's (2023) recommendation in the Integrated Vector Management (IVM) framework that vector control in public facilities such as markets needs to prioritize the management of environmental factors that have been proven to have an impact, in this case humidity. Improving air circulation and market design that allows humidity to be maintained at optimal levels can be a key strategy to suppress fly populations and reduce the risk of vector-based disease transmission.

Conclusion

The high density of flies in Pancur Batu Market indicates that the market environment is still not clean and supports the development of disease vectors. The vegetable, meat, and fish stalls are the places with the highest number of flies due to the large amount of organic waste that is not managed properly. Of the three environmental factors studied, namely temperature, humidity, and lighting, humidity is the only factor that has been shown to be significantly related to fly density. Humid places accelerate the growth and development of flies, thereby increasing the risk of disease transmission. Meanwhile, temperature and lighting do not show a significant effect in this market condition. To reduce the number of flies, better environmental management is needed, especially in maintaining cleanliness, controlling humidity, and involving traders and market managers in joint prevention efforts

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