THE RELATIONSHIP BETWEEN SANITARY HYGIENE AND PHYSICAL ENVIRONMENTAL CONDITIONS WITH COCKROACH DENSITY IN THE CANTEEN OF SRIWIJAYA UNIVERSITY INDRALAYA CAMPUS IN 2024

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Abstract

The canteen is one of the strategic places in the spread of diseases carried by vectors and disease-carrying animals such as cockroaches. The spread of disease in the canteen is also influenced by environmental sanitation hygiene. A dirty and humid environment is a good breeding ground for cockroaches. The government has established a policy to reduce the vector population to minimize the risk of impact due to the disease it causes. Research to determine the relationship between sanitary hygiene and physical environmental conditions with cockroach density in the canteen of Sriwijaya University Indralaya campus was conducted. The study was an observational analytic study using a cross sectional study design. A total of 50 canteens on campus were used as samples and were total sampling. Data on sanitary hygiene standards were collected from observational sheets and measurements of physical environmental conditions were made using a hygro thermometer, while cockroach density was measured based on the sticky trap method. Data were analyzed univariately and bivariately using the Chi-Square test. The results showed that of the 50 canteens sampled, 6 canteens were classified as canteens with sanitary hygiene that did not meet the Permenkes requirements. This is indicated by the high cockroach density with a p-value of 0.000 <0.05. This means that sanitary hygiene significantly affects cockroach density. It was concluded that the most cockroaches were found in canteens with poor lighting conditions, low room temperature, and high room humidity. Sequential p-values of 0.000; 0.002; 0.002 for the 3 observed variables indicate a poor environment affects cockroach breeding, while a p-value <0.05 is interpreted as a significant relationship between physical environmental conditions and cockroach density.

Keywords: Cross-Sectional Study, Cockroach Density, Canteen, Hygiene Sanitation, Physical Environmental Conditions,

Introduction

Based on World Health Organization (WHO) data in 2019, 45% of the global population or 3.4 billion people in 2017 used protected sanitation and only 40 countries out of 152 countries are on track to achieve sanitation for all by 2030[1]. Sanitation efforts are included in the SDGs (Sustainable Development Goals) 2030 agenda with adequate sanitation targets, one of which is improving sanitation facilities such as providing hand washing facilities with soap in running water and reducing the proportion of indiscriminate liquid waste disposal[2]. Sanitation plays an important role in the process of preventing disease risk. The existence of sanitation acts as a bridge for humans to escape the risk of disease due to poor environmental sanitation. Sanitation is a disease prevention effort that focuses on environmental health efforts such as providing clean water for hand washing, providing trash cans, providing disposal sites and so on[3].

According to the World Health Organization (WHO) in 2022, the impact of having poor sanitation is associated with fecal-transmitted diseases such as cholera, diarrhea, dysentery, typhoid, helminthiasis, and polio[4]. The spread of disease risk can be through direct or indirect spread. The

medium for spreading the risk of sanitation-induced diseases can be through air, water, contaminated food and drink, and an unhealthy environment[5]. In Indonesia, the incidence of diseases caused by poor sanitation is still a concern. Based on data from the South Sumatra Provincial Health Office 2019-2023, there are still high cases of infectious and non-communicable diseases due to low access to sanitation (80.3%) and clean water (62.38%)[6]. In Ogan Ilir District in 2017, there were 16,098 people suffering from diarrhea as a result of poor sanitation[7].

In the spread of impacts caused by poor sanitation, there are various types of vectors and disease-carrying animals that become intermediaries in carrying and transmitting diseases to humans, one of which is cockroaches. Cockroaches are a type of vector whose presence can cause damage. The damage caused by cockroaches is still relatively minimal, but the presence of cockroaches in a place indicates that the sanitation in that place is not good and needs attention so that further action is needed to reduce cockroach density. Explained in the Regulation of the Minister of Health of the Republic of Indonesia Number 50 of 2017 concerning Environmental Health Quality Standards and Health Requirements for Vectors and Disease Carrying Animals and Their Control explains that control of all activities or actions aimed at reducing the vector population as low as possible so that its presence is no longer at risk for transmission of vector-borne diseases in an area or avoiding public contact with vectors so that transmission of vector-borne diseases can be prevented[8].

Physical environmental conditions include lighting, temperature, and humidity. Disease-carrying vectors and animals such as cockroaches certainly favor places with poor lighting that tends to be dark, room temperatures that are not hot, and high room humidity[9]. Physical conditions that are favorable for cockroach growth can trigger a high cockroach density index. Physical environmental conditions certainly have different results in each place. This can be influenced by the location of the building/room, the number of holes and position of air ducts, and the presence of water in the room[10].

The canteen is one of the places that plays an important role in the campus environment and is a gathering point for humans to fulfill a quarter of their daily food needs. As one of the facilities provided by the campus, the canteen should meet the requirements to be declared feasible and healthy. A healthy canteen is a canteen that prioritizes nutritional fulfillment according to health standards in its facilities and infrastructure and management. As for some healthy canteen criteria according to BPOM (Food and Drug Supervisory Agency), among others; maintain the cleanliness of the canteen, provide safe and clean food or drinks, do not sell hard, burnt, strikingly colored food, sell packaged food products with clear food labels, and have hand washing facilities[11]. It should be noted that food safety requirements are one of the priorities. If food is not safe for consumption, the nutritional content and high quality are no longer valuable. Contamination of food can occur from various physical, chemical and biological sources which can then be influenced by factors such as temperature and poor sanitary hygiene practices, for example, during the process of storing food ingredients, washing ingredients, food processing, food packaging, to the process of serving food[12].

As a public place that provides food and drinks to students, the physical condition of the canteen environment must be in good condition and the canteen is required to implement proper hygiene and sanitation in accordance with the Hygiene Sanitation Guidelines for Snack Food Centers / Canteens of the Ministry of Health of the Republic of Indonesia in 2021[13]. Campus canteens have a risk of vector growth, which can be a trigger factor for the transmission of vector-borne diseases. Therefore, an assessment is needed so that vector control efforts can be carried out quickly and appropriately. Based on observations made during the initial survey to the canteens at Sriwijaya University Indralaya, several criteria of sanitary hygiene were found that did not meet the requirements including the condition of equipment storage, the condition of sanitation facilities, kitchen space, and supported by the discovery of signs of cockroach life seen from the presence of cockroach eggs (ootecha). This study was conducted to determine the relationship between sanitary

hygiene and physical environmental conditions with cockroach density in the canteen of Sriwijaya University Indralaya campus in 2024.

Methods

The research method used is a quantitative method with the type of observational analytic research using a cross sectional study design and Chi-Square bivariate analysis to determine the relationship between sanitary hygiene and the physical condition of the canteen environment with cockroach density. The population in this study were all canteens on the Sriwijaya University campus, which were 50 canteen outlets. Sampling in this study used the total sampling method, which made the entire population as a research sample.

Assessment of canteen sanitation using observational sheets from the environmental health instrument (IKL) PERMENKES RI No. 14 of 2021 with the results of the assessment meeting the requirements if the total score of the assessment results is ≥80%. The assessment includes areas of canteen outlets such as food processing/kitchen, use and storage of eating and cooking utensils, food handlers and the completeness of sanitation in it. One (1) sticky trap was set at each canteen outlet in the kitchen area for 1x24 hours. Cockroach traps were used to see the density of cockroaches at each canteen outlet with a low index calculation < 2 per plate and high ≥ 2 per plate. Measurements related to the physical conditions of the canteen environment, including lighting, temperature and humidity, were taken in the morning. Measurements of room lighting were carried out visually and measurements of room temperature and humidity were carried out using a hygro thermometer. This research was conducted in March 2024.

Result

1. Overview of Sanitation Hygiene in the Canteen of Sriwijaya University Indralaya Campus in 2024.

The following is a description of the results of the frequency distribution of canteen sanitation hygiene that meets the requirements and does not meet the requirements.

Table 1 Frequency Distribution of Canteen Sanitary Hygiene

No.	Canteen Sanitation Hygiene	f	%
1.	Qualified Sanitation Hygiene (≥80%)	44	88,0%
2.	Not Eligible Sanitary Hygiene (<80%)	6	12,0%
	Total	50	100,0%

Source: Primary Data March 2024

Table 1 shows that there are 44 canteens in the category of qualified sanitary hygiene (≥80%), and 6 canteens in the category of unqualified sanitary hygiene (<80%).

2. Overview of the Physical Environmental Conditions at the Canteen Campus of Sriwijaya University Indralaya in 2024.

The following is a description of the results of the frequency distribution of the physical conditions of the canteen environment which includes lighting, temperature, and humidity.

Table 2.1 Frequency Distribution of Canteen Room Lighting Condition

No.	Lighting	f	%
1.	Simply	46	92,0%
2.	Less	4	8,0%
	Total	50	100,0%

Source: Primary Data March 2024

Table 2.1 shows that 46 canteens have fairly bright room lighting conditions and 4 canteens with poor room lighting conditions.

Table 2.2 Frequency Distribution of Canteen Room Temperature Condition

No.	Temperature	f	%
1.	Low (25°C - 30°C)	15	30,0%
2.	High (>30°C)	35	70,0%
	Total	50	100,0%

Source: Primary Data March 2024

Table 2.2 shows canteens with room conditions that have low temperatures (25°C - 30°C) as many as 15 canteens and canteens with room conditions that have high temperatures (>30°C) as many as 35 canteens.

Table 2.3 Frequency Distribution of Canteen Room Humidity Condition

No.	Humidity	f	%
1.	Low (<80%)	35	70,0%
2.	High (80% - 90%)	15	30,0%
	Total	50	100,0%

Source: Primary Data March 2024

Table 2.3 shows that there are 35 canteens with rooms that have low humidity levels (<80%) and 15 canteens with rooms that have high humidity levels (80% - 90%).

3. An Overview of the Cockroach Density Index in the Canteen of Sriwijaya University Indralaya Campus in 2024.

The following is a description of the frequency distribution of cockroach density in canteens with low or high density index results.

Table 3 Frequency Distribution of Cockroach Density Index in the Canteen

No.	Cockroach Density Index	f	%
1.	Low (<2)	44	88,0%
2.	High (≥2)	6	12,0%
	Total	50	100,0%

Source: Primary Data March 2024

Table 3 shows that there are 44 canteens with a low cockroach density index (<2) and 6 canteens that have a high cockroach density index (≥2).

4. Bivariate Analysis Results

The following are the results of bivariate analysis between hygiene and sanitation and physical environmental conditions with cockroach density in the canteen using the Chi-Square test.

Table 4.1 Results of Bivariate Analysis Between Sanitation Hygiene and Cockroach Density in the Canteen of Sriwijaya University Indralaya Campus in 2024

Canteen Sanitation Hygiene	Cockroach Density		Total	p-value
	Low (<2)	High (≥2)		
Qualified Sanitation Hygiene (≥80%)	43 (97,7%)	1 (2,3%)	44 (100%)	
Not Eligible Sanitary Hygiene (<80%)	1 (16,7%)	5 (83,3%)	6 (100%)	0,000
Total	44 (88,0%)	6 (12,0%)	50 (100%)	

Source: Primary Data March 2024

Table 4.1 shows that of the 44 canteens (100%) that meet the requirements of sanitary hygiene (≥80%), there are 43 canteens (97.7%) with a low cockroach density category (<2) and as many as 1 canteen (2.3%) with a high cockroach density category (≥2). While from as many as 6 canteens (100%) that do not meet the requirements of sanitary hygiene (<80%), there are as many as 1 canteen (16.7%) with a low cockroach density category (<2) and as many as 5 canteens (83.3%) with a high cockroach density category (≥2). The results of the Chi-Square test obtained a p-value = 0.000 with a confidence level of 95% ($\alpha = 0.05$). Because the p value (0.000) < α (0.05), Ho is rejected and Ha is accepted, which means that there is a relationship between sanitary hygiene and cockroach density in the canteen of Sriwijaya University Indralaya campus in 2024.

Table 4.2 Results of Bivariate Analysis Between Physical Environmental Conditions and Cockroach Density in the Canteen of Sriwijaya University Indralaya Campus in 2024

Conditions Physical Environment	Cockroach Density		Total	p-value
	Low (<2)	High (≥2)		
Lighting Simply	43 (93,5%)	3 (6,5%)	46 (100%)	0,000
Less	1 (25,0%)	3 (75,0%)	4 (100%)	
Temperature Low	10 (66,7%)	5 (33,3%)	15 (100%)	0,002

High	34 (97,1%)	1 (2,9%)	35 (100%)	
Humidity				
Low	34 (97,1%)	1 (2,9%)	35 (100%)	0.002
High	10 (66,7%)	5 (33,3%)	15 (100%)	

Source: Primary Data March 2024

Table 4.2 shows that there were 43 canteens (93.5%) with low cockroach density (<2) and 3 canteens (6.5%) with high cockroach density (≥2) out of 46 canteens (100%). Whereas from 4 canteens (100%) with poor room lighting conditions, there were 1 canteen (25%) with low cockroach density (<2) and 3 canteens (75%) with high cockroach density (≥2). The Chi-Square test results obtained a p-value = 0.000 with a confidence level of 95% (α = 0.05). Because the p-value (0.000) < α (0.05), Ho is rejected and Ha is accepted, which means that there is a relationship between room lighting and cockroach density in the canteen of Sriwijaya University Indralaya campus in 2024.

Furthermore, from 15 canteens (100%) with low room temperature conditions (25°C - 30°C), there were 10 canteens (66.7%) with low cockroach density (<2) and 5 canteens (33.3) with high cockroach density (≥2). Whereas from 35 canteens (100%) with high room temperature conditions (>30°C), there were 34 canteens (97.1%) with low cockroach density (<2) and as many as 1 canteen (2.9%) with high cockroach density (≥2). The Chi-Square test results obtained a p-value = 0.002 with a confidence level of 95% (α = 0.05). Because the p-value (0.002) < α (0.05), Ho is rejected and Ha is accepted, which means that there is a relationship between room temperature and cockroach density in the canteen of Sriwijaya University Indralaya campus in 2024.

Obtained from 35 canteens (100%) with low room humidity conditions (<80%), there were 34 canteens (97.1%) with low cockroach density (<2) and 1 canteen (2.9%) with high cockroach density (≥2). Whereas from 15 canteens (100%) with high room humidity conditions (80% - 90%), there were 10 canteens (66.7%) with low cockroach density (<2) and as many as 5 canteens (33.3%) with high cockroach density (≥2). The Chi-Square test results obtained a p-value = 0.002 with a confidence level of 95% (α = 0.05). Because the p-value (0.002) < α (0.05), Ho is rejected and Ha is accepted, which means that there is a relationship between room humidity and cockroach density in the canteen of Sriwijaya University Indralaya campus in 2024.

Discussion

1. Univariate

Based on the results of data analysis, it shows that most (88%) canteens on the UNSRI campus meet sanitary hygiene health requirements with assessment results ≥80% in 44 canteens and there are 6 canteens (12%) that do not meet health requirements in the low sanitation category with assessment results <80%. Some canteens with categories that do not meet sanitary hygiene requirements can be influenced by several aspects such as sanitation facilities, equipment storage, food storage and cooked food, building conditions, and food handlers. In line with the results of research from Fitri (2021) which states that the sanitary hygiene of food management places (TPM) in the Cirebon Port working area is mostly not good sanitary hygiene (score ≤700) which is influenced by location, building, sanitation facilities, kitchen, dining room, food storage warehouse, cooked food storage and labor or food handlers (63.6%) do not meet the requirements[14].

Based on the results of research on the physical condition of the environment which includes lighting, temperature, and humidity of the room in the UNSRI Indralaya campus canteen, it shows

that most of the canteen room lighting is quite bright. Apart from the measurements taken in the morning so that the lighting obtained comes from direct sunlight, sufficient lighting is also obtained from room lighting in the form of bulb lights available. Based on data analysis, there are 46 canteens (92%) with sufficient room lighting conditions and as many as 4 canteens (8%) with poor room lighting conditions.

Furthermore, regarding the temperature conditions of the canteen room, based on the measurement results, it shows that most canteens have room conditions with high temperatures (>30°C). This could be due to the fact that the measurements were taken in the summer and not in the rainy season. Based on data analysis, it is known that out of a total of 50 canteen samples, there are 15 canteens (30%) that have low room temperatures (25°C - 30°C) and there are 35 canteens (70%) that have high room temperatures (>30°C). Some canteens with low room temperature can be influenced by several factors such as, the presence of shady trees adjacent to the location of the canteen so as to provide a shady and cool effect, the location of the building ventilation which is the pathway for the entry and exit of air from outside to inside and vice versa, to the presence of water that allows for a decrease in room temperature in the canteen, this is in line with the results of research by B. Talarosha (2005) related to the location of the canteen. Talarosha (2005) related to the presence of trees near buildings and the location of roof vents that affect the quality of air exchange in space and the presence of water that reduces the temperature of the surrounding air[10].

Humidity and room temperature are interrelated, if the room temperature is high then the humidity level will decrease, and vice versa. Based on the research conducted, the results show that most of the canteen humidity levels are in low conditions (<80%). Similar to what happened in the results of measuring room temperature, the humidity level of the canteen is also influenced by the location of the canteen, the location of air vents, and the presence of water. Based on the results of data analysis, out of 50 canteen samples, there were 35 canteens (70%) with low humidity status (<80%) and 15 canteens (30%) with high humidity status (80% - 90%).

Based on the results of research on the cockroach density index in the UNSRI Indralaya campus canteen, with a total sample of 50 canteens, most of them have a low cockroach density index. There are at least 44 canteens (88%) with a low category cockroach density index and 6 canteens (12%) others have a high category cockroach density index. Most of the canteens with a low cockroach density index were influenced by the application of qualified sanitary hygiene. In addition, this is supported by the physical conditions of the canteen environment such as adequate lighting, temperature and humidity levels that do not trigger cockroach breeding.

2. Bivariate

Based on the results of research using the Chi-Square test, the authors found results related to the relationship between sanitary hygiene and cockroach density in the UNSRI Indralaya campus canteen gave positive results. From testing the two variables, the p-value = 0.000 <0.05 was obtained, which means Ho is rejected and Ha is accepted. There is a mutually influencing relationship between sanitary hygiene and cockroach density in the canteen. Based on data analysis, it was found that there were at least 6 canteens (12%) out of a total of 50 canteen samples with a high cockroach density index, and 5 of them did not meet the canteen sanitary hygiene requirements (assessment results <80%).

Overall, canteens on the UNSRI Indralaya campus that meet sanitary hygiene requirements tend not to find cockroaches in the traps that have been installed. Meanwhile, in canteens that do not meet sanitary hygiene requirements, cockroaches are found at high densities. The high cockroach density index in canteens that do not meet sanitary hygiene requirements is in accordance with Fitri's research (2021) at TPM in the Cirebon port working area with the results of high cockroach density in TPM that does not meet sanitary hygiene requirements (90.5%) while low cockroach density in TPM

that meets sanitary hygiene requirements (75%)[14]. The results of this study are also in line with the research of Tanjung, D.Y., Agrina (2020) who conducted research on canteens at Dumai Port with the results showing that environmental sanitation with cockroach density in the Dumai Port canteen has a significant relationship with p-value = 0.000, which means that the more health requirements for canteen environmental sanitation, the lower the cockroach density and vice versa[15].

Based on the results of data analysis using the Chi-Square test, the results showed a significant relationship between physical environmental conditions including lighting, temperature, and room humidity with cockroach density. From testing two variables, the p-value of room lighting = 0.000, p value of room temperature = 0.002, and p-value of room humidity = 0.002 with a confidence level of 95%. Based on the p-value <0.05, the Ho hypothesis is rejected and Ha is accepted. The distribution of data results of 50 canteens obtained there are at least 6 canteens (12%) with a high cockroach density index. 3 of them have poor room lighting, 5 of them have low room temperature, and 5 of them have high room humidity levels. Places with poor lighting support the growth of cockroaches supported by the nocturnal nature of cockroaches. Places with low temperatures (25°C - 30°C) and high humidity ≥80% are suitable places for cockroaches to survive and breed, no wonder cockroaches are often found in bathrooms and sewers.

In line with the research of Firmansyah, M. (2017) on passenger ships anchored at Semayang Port Balikpapan related to the relationship of temperature, humidity, and lighting to cockroach density with the results obtained that there is a positive relationship between the physical environment which includes temperature, humidity, and lighting with cockroach density on passenger ships with a p-value of 0.004 and a correlation coefficient of 0.529 for temperature variables, a p-value of 0.000 and a correlation coefficient of 0.808 for humidity variables, and a p-value of 0.004 and a correlation coefficient of 0.525 for lighting variables[2].

Conclusion

It was concluded that 88% (44 out of 50 canteens) at Sriwijaya University Indralaya campus had met the requirements of health sanitation hygiene characterized by low cockroach density (97.7%). Canteens at UNSRI Indralaya campus mostly have good room lighting conditions (92%), high temperature (70%), and low humidity (70%). Canteens with low sanitary hygiene have an association with high cockroach density (83.3%) characterized by a p-value of 0.000. In canteens with poor lighting, low temperature, and high humidity showed a significant relationship between physical environmental conditions and high category cockroach density. Characterized by the p-value of lighting, temperature, and room humidity (0.000; 0.002; 0.002).

References
[1] WHO. Water, Sanitation, Hygiene and Health: A Primer for Health Professionals. 2019;1–40.
[2] WHO. State of the World's Sanitation. 2020.
[3] Purbasari H, Sudiadnyana S, Wayan I, Yulianti S, Elly A. Hubungan Tingkat Pengetahuan Higiene Sanitasi Makanan dengan Perilaku Pengelola Kantin Sekolah Dasar di Kecamatan Kuta Selatan, Kabupaten Badung tahun 2020: Poltekkes Kemenkes Denpasar; 2020.
[4] WHO. Sanitation. 2022.
[5] Ikhtiar M. Pengantar Kesehatan Lingkungan: CV. Social Politic Genius (SIGn); 2017.
[6] Dinkes. Data Kasus Penyakit Menular dan Tidak Menular di Provinsi Sumatera Selatan Tahun 2019-2023: Dinas Kesehatan Provinsi Sumatera Selatan; 2023
[7] BPS. Data Penderita Penyakit Diare di Kabupaten Ogan Ilir Tahun 2017. Badan Pusat Statistik 2017.

[8]   Permenkes. Peraturan Menteri Kesehatan Republik Indonesia Nomor: 50 Tahun 2017 tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Vektor dan Binatang Pembawa Penyakit serta Pengendaliannya. Dalam: DPPdP Lingkungan Hidup, editor. Jakarta: Departemen Kesehatan RI; 2017.

[9]   Firmansyah M. Hubungan Suhu, Kelembaban dan Pencahayaan terhadap Kepadatan Kecoa pada Kapal Penumpang di Pelabuhan Semayang Balikpapan Tahun 2017. Universitas Mulawarman. 2017.

[10]   Talarosha B. Menciptakan Kenyamanan Termal dalam Bangunan. Jurnal Sistem Teknik Industri. 2005;6(3):0.

[11]   BPOM. Pedoman Keamanan di Kantin Sekolah. Badan Pengawas Obat dan Makanan. 2012.

[12]   Azad Z, Ahmad, M., & Siddiqui, W. Pembusukan Makanan dan Kontaminasi Makanan. Aspek Kesehatan dan Keselamatan dari Teknologi Pengolahan Makanan. 2019.

[13]   Kemenkes. Pedoman Penyehatan Tempat Pengelolaan Makanan Jajanan/Kantin atau Sejenisnya yang Aman dan Sehat. Jakarta: Kementerian Kesehatan RI RI; 2021.

[14]   Fitri R. Hubungan Tingkat Higiene Sanitasi dengan Kepadatan Kecoa pada Tempat Pengelolaan Makanan (TPM) di Wilayah Kerja Pelabuhan Cirebon Tahun 2021: STIKes Kuningan; 2021.

[15]   Tanjung DY, Agrina A, Putra RM. Analisis Sanitasi Lingkungan dan Perilaku Penjamah Makanan Terhadap Kepadatan Kecoa di Kantin Pelabuhan Dumai. J Ilmu Lingkungan. 2020;14(2):172.