



Shared Mattresses, Combs, and Residential Sanitation Associated with Pediculosis Capitis in Orphanages

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ARTICLE INFO

Keywords:

Pediculosis capitis
Orphanage
Shared mattresses
Comb
Residential sanitation

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All authors have reviewed and approved the final version of the manuscript.

<https://doi.org/10.32539/BJI.v7i3.538>

ABSTRACT

Introduction. Head lice infestation (pediculosis capitis) continues to be a widespread health issue among children, especially in orphanages. Pediculosis capitis often occurs due to sharing personal items and poor residential sanitation conditions. **Methods.** This study applied an observational analytic design using a cross-sectional approach, conducted across nine orphanages in South Sumatra Province. Independent variables included sharing personal items and residential sanitation factors such as occupancy density, ventilation, lighting, temperature, and humidity, while the dependent variable was pediculosis capitis occurrence. **Results.** Pediculosis capitis prevalence reached 37.7%. Sharing mattresses ($p = 0.038$) and combs ($p = 0.016$) showed a significant association with pediculosis capitis, while sharing bed sheets, blankets, pillows, towels, headscarves, prayer garments, and caps was not significantly associated. In terms of residential sanitation, occupancy density ($p = 0.002$), ventilation ($p < 0.001$), and lighting ($p < 0.001$) were significantly related to the occurrence of pediculosis capitis. Meanwhile, temperature ($p = 0.678$) and humidity ($p = 0.585$) did not show a significant relationship. **Conclusion.** Pediculosis capitis occurrence is linked to sharing certain personal items and various residential sanitation factors.

1. Introduction

Pediculosis capitis involves a scalp infestation by *Pediculus humanus capitis* and persists as a widespread public health issue, especially among children in communal environments. Children residing in orphanages are considered a high-risk population due to close interpersonal contact, shared use of facilities and personal items, and limited individual resources, all of which facilitate the transmission of head lice.¹ Although pediculosis capitis is not life-threatening, it may cause pruritus, secondary bacterial infections, sleep disturbances, and psychosocial discomfort, thereby affecting the quality of life of affected children.

Previous studies have reported varying prevalence rates of pediculosis capitis in institutionalized children. Differences in prevalence have been attributed to multiple factors, including behavioral practices, such as sharing personal items, and environmental conditions related to residential sanitation.^{2,3} The shared use of items that make direct

touch the hair and scalp, such as mattresses and combs, has been frequently recognized as a risk factor for head lice transmission.^{4,5,6} However, not all shared items have been consistently associated with pediculosis capitis, suggesting that the type of item and the intensity of contact may influence transmission risk.

In addition to behavioral factors, residential sanitation conditions have also been investigated as potential determinants of pediculosis capitis. Several studies have reported that high housing density is significantly associated with increased transmission. Overcrowded living spaces may facilitate more frequent head-to-head contact among individuals, which is the primary mode of transmission.⁷ Conversely, findings regarding other sanitation variables, such as ventilation, lighting, temperature, and humidity, remain inconsistent. Some studies reported significant associations, while others found no relationship, indicating possible influences of study design, environmental homogeneity, and

population characteristics^{7,8}

In South Sumatra, studies on pediculosis capitis among children living in orphanages are still limited. Most previous research has focused mainly on behavioral factors and has been conducted in school settings. Environmental conditions in communal residences, particularly ventilation and lighting, have rarely been examined in relation to pediculosis capitis, especially in orphanage environments. This study was conducted in nine orphanages across three districts, Muara Enim, Ogan Komering Ilir (OKI), and Musi Banyuasin, to provide broader local data and to examine the link between sharing personal items and housing sanitation conditions, particularly ventilation and lighting, with pediculosis capitis.

2. Methods

This research utilized a quantitative analytic approach with a cross-sectional design. The research took place in nine orphanages located in South Sumatra Province, including Muara Enim Regency, Ogan Komering Ilir Regency, and Musi Banyuasin Regency. Data collection was carried out from October to November 2025, while parasitological examinations were performed at the Parasitology Laboratory, Faculty of Medicine, Universitas Muhammadiyah Palembang.

The research population included all orphaned children aged under 18 years residing in the selected orphanages. A total sampling technique was applied, whereby everyone meeting the inclusion and exclusion criteria was included as a research participant. A total of 154 children fulfilled the eligibility criteria and were enrolled in the study.

Data on shared personal item use were obtained through face-to-face interviews using a structured questionnaire adapted from a previous study that had undergone validity testing. The instrument was used with minor adjustments to suit the study setting. In this study, "sharing" was defined as sharing personal belongings like combs, towels, headscarves, prayer garments, or caps by more than one child, either alternately or within a short period of time.

Variables related to headscarf and prayer garment use were assessed exclusively among female participants, while cap use was assessed exclusively among male participants, in accordance with customary usage patterns. Therefore, the total number of responses for these variables does not correspond to the overall number of study participants.

Environmental sanitation was assessed through direct measurement and observation. Each measurement was performed three times in each room, and the average value was used for analysis. Room temperature and humidity were measured using a thermohygrometer placed in the room's center, about 1 meter above the floor. Temperature was categorized as meeting the criteria if $<29^{\circ}\text{C}$ or $>32^{\circ}\text{C}$, and not meeting the criteria if $29\text{--}32^{\circ}\text{C}$.

Humidity was considered adequate if 40–60% RH. Ventilation was assessed by calculating the percentage of total ventilation area to floor area. Ventilation was categorized as adequate if $\geq 5\%$ of the floor area and inadequate if $< 5\%$. Occupancy density was calculated by dividing the floor area (m^2) by the number of occupants in the room and was categorized as not dense if $\geq 4 \text{ m}^2$ per person and dense if $< 4 \text{ m}^2$ per person. Lighting intensity was measured using a lux meter during daytime in the room's center, about 1 meter above the floor level, and was categorized as adequate if ≥ 60 lux.

The diagnosis of pediculosis capitis was established through direct scalp and hair examination using a fine-toothed comb. Collected specimens were further examined microscopically for confirmation. A participant was classified as positive if at least one of the following was identified: eggs (nits), nymphs, or adult lice. Participants were classified as negative if none of these stages were found.

Data were analyzed using univariate and bivariate analyses. The chi-square test assessed variable associations at $p < 0.05$; Fisher's exact test was used as an alternative when chi-square assumptions were unmet. This study received ethical clearance from the Humanities and Islamic Medicine Bioethics Committee, Faculty of Medicine, Muhammadiyah University of Palembang (No. 052/EC/KBHKKI/FK-UMP/X/2025).

3. Results

Of the 154 study subjects, 58 children (37.7%) were diagnosed with pediculosis capitis. The total number of responses for certain variables differed due to gender-specific assessment. Regarding the shared personal items variable, 79 subjects (51.3%) shared mattresses, 83 subjects (53.9%) shared pillows, 76 subjects (49.4%) shared bed sheets, 68 subjects (44.2%) shared blankets, 107 subjects (69.5%) shared combs, and 91 subjects (59.1%) shared towels. In terms of housing and sanitation, 73 subjects (47.4%) lived in overcrowded dwellings, 65 subjects (42.2%) resided in housing with inadequate ventilation, 110 subjects (71.4%) experienced insufficient lighting, 88 subjects (57.1%) lived in environments with unsuitable temperature, and 94 subjects (61.0%) were exposed to inappropriate humidity levels. Detailed results are shown in Tables 1 and 2.

Based on the study results, sharing beds ($p = 0.038$) and sharing combs ($p = 0.016$) were significantly linked to pediculosis capitis cases, while sharing bed sheets, blankets, pillows, towels, headscarves, mukena, and caps showed no significant association ($p > 0.05$). Regarding housing sanitation, residential density ($p = 0.002$), ventilation ($p < 0.001$), and lighting ($p < 0.001$) were significantly linked with the occurrence of pediculosis capitis, while temperature ($p = 0.678$) and humidity ($p = 0.585$) were not associated. Statistical analyses are

shown in Table 3.

In this study, several adult lice, nymphs, and eggs were collected from the hair of the study subjects and

subsequently prepared as specimens. Prepared specimens are shown in Figures 1-5.

Table 1. Distribution of pediculosis capitis status and potential transmission-related sharing behaviors among subjects

	Subjects	
	Frequency (n)	Percentage (%)
Pediculosis Capitis		
Positive	58	37.7
Negative	96	62.3
Shared Mattress Use		
Yes	79	51.3
No	75	48.7
Shared bed sheet use		
Yes	61	39.6
No	93	60.4
Shared blanket use		
Yes	57	37.0
No	97	63.0
Shared pillow use		
Yes	63	40.9
No	91	59.1
Shared comb use		
Yes	107	69.5
No	47	30.5
Shared towel use		
Yes	43	27.9
No	111	72.1
Shared headscarf use*		
Yes	36	45.6
No	43	54.4
Shared prayer garment use*		
Yes	18	22.8
No	61	77.2
Shared cap use**		
Yes	33	44.0
No	42	56.0

*Headscarf and prayer garment assessed only among female participants (n = 79)

**Assessed only among male participants (n = 75)

Table 2. Residential sanitation

Residential Sanitation	Subjects	
	Frequency (n)	Percentage (%)
Temperature		
Does not meet standards	50	32.5
Meets standards	104	67.5
Humidity		
Does not meet standards	70	45.5
Meets standards	80	54.5
Ventilation		
Inadequate	20	13.0
Adequate	134	87.0
Occupancy density		
Overcrowded/Inadequate	73	47.4
Not overcrowded/Adequate	81	52.6
Lighting		
Inadequate	110	71.4
Adequate	44	28.6

Table 3. Association between shared mattress use and the occurrence of pediculosis capitis

	Pediculosis Capitis				Total		p	PR
	Positive		Negative					
	n	%	n	%	n	%		
Shared mattress use^a								
Yes	36	45.6	43	54.4	79	100.0	0.038	1.554
No	22	29.3	53	70.7	75	100.0		
Shared bed sheet use^a								
Yes	26	42.6	35	57.4	61	100.0	0.304	1.239
No	32	34.4	61	65.6	93	100.0		
Shared blanket use^a								
Yes	26	45.6	31	54.4	57	100.0	0.118	1.383
No	32	33.0	65	67.0	97	100.0		
Shared pillow use^a								
Yes	25	39.7	38	60.3	63	100.0	0.667	1.094
No	33	36.3	58	63.7	91	100.0		
Shared comb use^a								
Yes	47	43.9	60	56.1	107	100.0	0.016	1.877
No	11	23.4	36	76.6	47	100.0		
Shared towel use^a								
Yes	19	44.2	24	55.8	43	100.0	0.298	1.258
No	39	35.1	72	64.9	111	100.0		
Shared headscarf use^{*a}								
Yes	24	66.7	12	33.3	36	100.0	0.768	0.956
No	30	69.8	13	30.2	43	100.0		
Shared prayer garment^a use[*]								
Yes	11	61.1	7	38.9	18	100.0	0.452	0.867
No	43	70.5	18	29.5	61	100.0		
Shared cap use^{**b}								
Yes	1	3.0	32	97.0	33	100.0	0.626	0.424
No	3	7.1	39	92.9	42	100.0		
Temperature^a								
Does not meet standards	20	40.0	30	60.0	50	100.0	0.678	1.095
Meets standards	38	36.5	66	63.5	104	100.0		
Humidity^a								
Does not meet standards	28	40.0	42	60.0	70	100.0	0.585	1.120
Meets standards	30	35.7	54	64.3	84	100.0		
Ventilation^b								
Yes	0	0	20	100.0	20	100.0	<0.001	-
No	58	43.3	76	56.7	134	100.0		
Occupancy density^a								
Overcrowded/inadequate	37	50.7	36	49.3	73	100.0	0.002	1.955
Not overcrowded/adequate	21	25.9	60	74.1	81	100.0		
Lighting^a								
Inadequate	54	49.1	56	50.9	110	100.0	<0.001	5.400
Adequate	4	9.1	40	90.9	44	100.0		

^aChi-square test, $\alpha = 0.05$, ^b Fisher's exact test, $\alpha = 0.05$

^{*}Headscarf and prayer garment assessed only among female participants (n = 79)

^{**}Assessed only among male participants (n = 75)

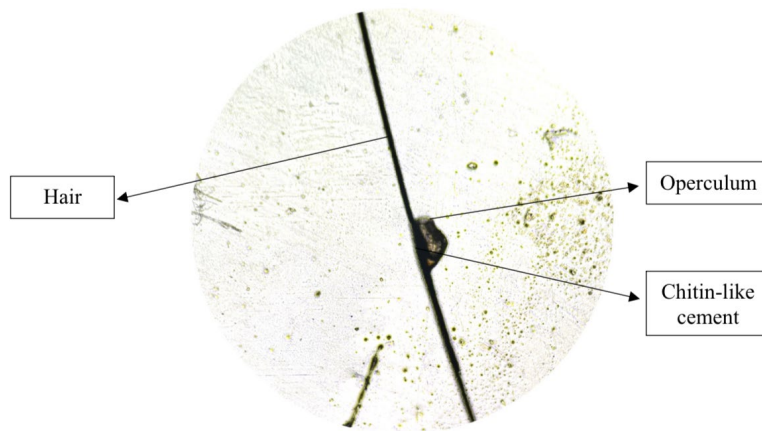


Figure 1. Unhatched nit (egg) of *Pediculus humanus capitis*

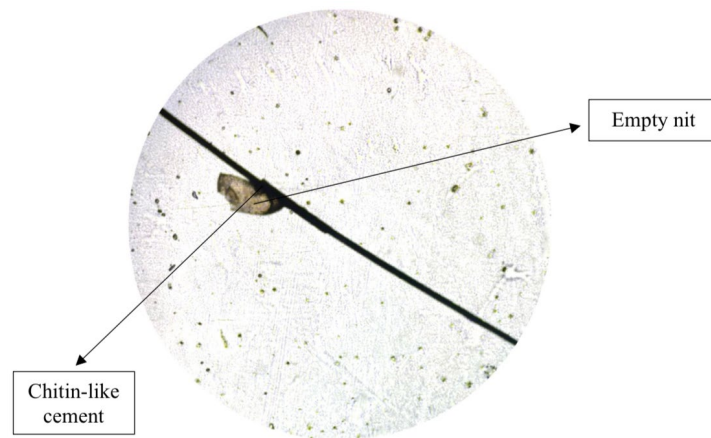


Figure 2. Hatched nit (egg) of *Pediculus humanus capitis*

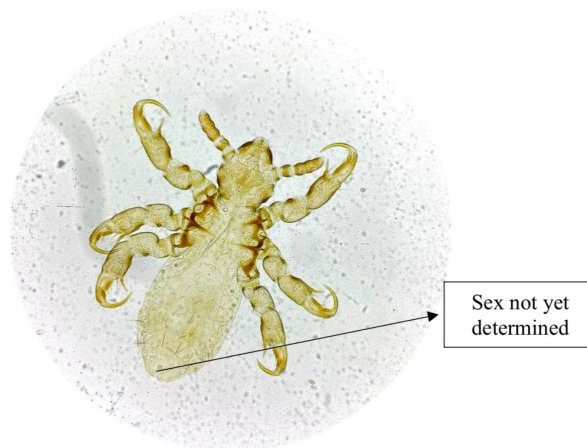


Figure 3. Nymph of *Pediculus humanus capitis*

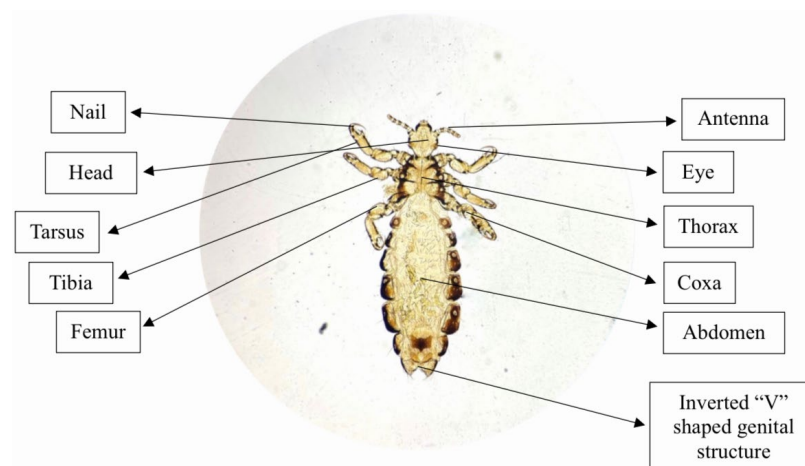


Figure 4. Female *Pediculus humanus capitis*

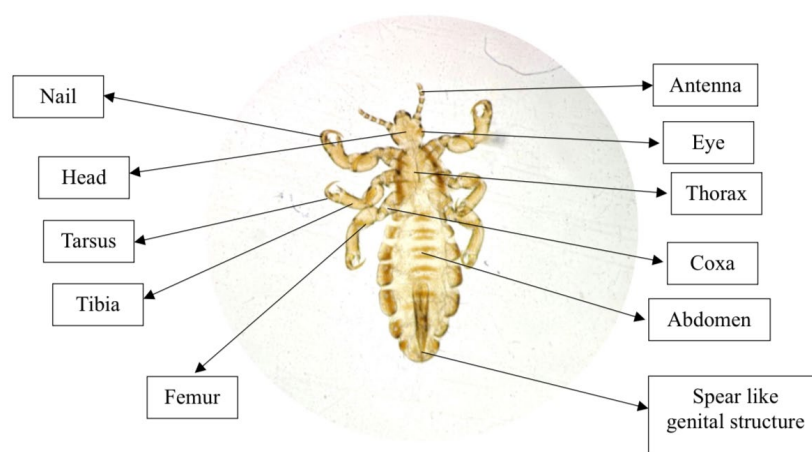


Figure 5. Male *Pediculus humanus capitis*

4. Discussion

Due to this cross-sectional approach in this study, causal relationships cannot be inferred. Therefore, the findings should be interpreted as associations rather than cause-and-effect relationships.

Prevalence of Pediculosis Capitis

Based on a study conducted among 154 research subjects, consisting of 75 boys and 79 girls living in orphanages across three regencies in South Sumatra, Muara Enim, Ogan Komering Ilir, and Musi Banyuasin, pediculosis capitis prevalence reached 37.7%. This finding differs markedly from a study conducted in an orphanage in Kemuning District, Palembang, in 2015, which reported a head lice prevalence of 62%. Another study carried out at Aulia Cendikia Islamic boarding school in Palembang in 2016 reported a lower prevalence of pediculosis capitis of 28.8%.³ The elevated prevalence of pediculosis capitis in South Sumatra aligns with the national rate of 20% reported across Indonesia,⁹ underscoring persistently elevated transmission risks in densely populated regional settings.

Variations in the reported prevalence of pediculosis capitis across different studies may arise

due to multiple contributing factors, including transmission through shared head-related personal items, socioeconomic status, population density, age, individual characteristics (such as hair length and hair type), level of knowledge, personal hygiene practices, and environmental conditions.²

Association Between Shared Personal Item Use and Pediculosis Capitis

The use of shared personal items refers to the habit of using one or more objects interchangeably by multiple individuals, with or without clear personal ownership, either simultaneously or at different times. This practice commonly arises in high-social-interaction environments, such as orphanages. Analysis of the link between sharing personal items and pediculosis capitis incidence in orphanages across three South Sumatra districts showed that sharing mattresses ($p = 0.038$) and sharing combs ($p = 0.016$) were significantly associated with the occurrence of pediculosis capitis.

These findings are consistent with a study by Sari et al. (2022), which reported significant associations between sharing mattresses ($p = 0.007$) and sharing combs ($p = 0.016$) and pediculosis capitis.⁶

Similarly, Song and Malini (2024) found that sharing combs was associated with the occurrence of pediculosis capitis ($p = 0.003$).¹⁰ In addition, a study conducted by Ratnaningrum et al. (2023) reported that sharing sleeping places was associated with pediculosis capitis ($p = 0.014$).¹¹ Comparable results were also reported by Lukman et al. (2018), who found that sharing bedding or sleeping places ($p < 0.05$) and sharing combs or hair accessories ($p < 0.05$) were significantly associated with the occurrence of pediculosis capitis.⁴

These associations may be explained by the fact that sharing sleeping places can facilitate the transmission of head lice through intense head-to-head contact, particularly when one of the individuals sharing the sleeping space is infested with pediculosis capitis.⁴ Children often sleep close together on the same mattress due to the close relationships formed after prolonged cohabitation.⁶ Likewise, the shared use of combs or hair accessories, especially when used interchangeably within short time intervals, may allow lice eggs or adult lice to adhere to these items, thereby increasing the risk of transmission.⁵ Pediculosis capitis is primarily transmitted through direct head-to-head contact; therefore, factors that increase the duration and intensity of direct contact, such as sharing mattresses and combs, are more likely to elevate the risk of transmission compared with other factors.¹

However, this study's results differ from those reported by Yunida et al. (2016), who employed a case-control design and reported no association between sleeping habits or sharing sleeping places ($p = 0.784$) and sharing combs ($p = 0.301$) with the occurrence of pediculosis capitis. These differences may be attributed to variations in study design, as the study by Yunida et al. (2016) used a case-control approach, whereas the present study applied a cross-sectional design, which may result in differences in sensitivity for identifying risk factors related to the transmission of pediculosis capitis.¹²

This study also showed no significant association between sharing bedsheets ($p = 0.304$), blankets ($p = 0.118$), pillows ($p = 0.667$), towels ($p = 0.298$), headscarves ($p = 0.768$), prayer garments (mukenah) ($p = 0.452$), and caps ($p = 0.626$) and the occurrence of pediculosis capitis. These findings are consistent with those of Sari et al. (2022), who reported no significant associations between sharing pillows ($p = 0.208$), towels ($p = 0.872$), bedsheets ($p = 0.946$), and prayer garments ($p = 0.073$).⁶ Variables related to headscarves and prayer garments were assessed exclusively among female participants, while the use of caps was assessed exclusively among male participants, reflecting customary practices. Similarly, Arsinta (2019) reported no association between sharing blankets ($p = 1.000$) and the occurrence of pediculosis capitis.¹³

Biologically, the claws of *Pediculus humanus capitis* are unable to firmly attach to smooth and

slippery surfaces, such as bedsheets or parachute-fabric prayer garments. In addition, bedsheets provide an unfavorable environment for the survival of head lice. The use of prayer garments is also commonly layered with other fabrics, such as headscarves or inner caps (ciput), which minimizes direct contact with hair.⁶

Adult head lice survive up to 30 days on human scalps.¹ However, away from the scalp, adult lice can survive for only one to two days, while their eggs may survive for up to one week.¹⁴ For survival, adult lice require blood meals several times per day; without a blood supply, they will die.¹ Mattresses have longer durations of contact with the head and hair and tend to be cleaned less frequently, allowing them to potentially serve as a medium for the survival of lice or their eggs (nits), particularly in communal living environments such as orphanages. In contrast, bedsheets, pillows, and blankets are generally washed and replaced more frequently, while head lice survive only briefly off the human scalp and require blood for survival. Consequently, the likelihood of transmission through these items is lower.¹ These conditions contribute to the reduced probability of transmission via bedding materials used during sleep.

Nevertheless, Sari et al. (2022) reported contrasting findings, showing significant associations between sharing headscarves ($p = 0.006$) and sharing caps ($p = 0.021$) with the occurrence of pediculosis capitis.⁶ The absence of such associations in the present study may be explained biologically, as the transmission of pediculosis capitis occurs predominantly through direct head-to-head contact rather than indirect contact. Headscarves and caps represent indirect transmission media, which play a relatively minor role in head lice transmission, as transmission via objects or head coverings is reported to occur infrequently.¹ Moreover, when the frequency of shared use is low and accompanied by good hygiene practices, the risk of transmission is further reduced. These factors may explain why sharing headscarves and caps did not show a significant association with the occurrence of pediculosis capitis in this study.

Association Between Residential Sanitation and Pediculosis Capitis

The study conducted in orphanages across three districts of South Sumatra Province revealed significant associations between housing density ($p = 0.002$), ventilation ($p < 0.001$), and lighting ($p < 0.001$) with pediculosis capitis occurrence. These align with Rahmita et al. (2019), who found a significant association between housing density and pediculosis capitis ($p = 0.002$).⁷ This finding should be interpreted cautiously, as no positive cases were observed in the inadequate ventilation group, and other unmeasured factors may have influenced the results. Although ventilation showed a statistical association with pediculosis capitis, this finding

should not be interpreted as a causal relationship. The transmission of pediculosis capitis is not directly influenced by room ventilation but rather by direct head-to-head contact. The observed association is therefore likely influenced by other, more dominant factors, such as housing density and the intensity of interpersonal contact.

These conditions illustrate that the greater the number of individuals occupying a single room, the easier the transmission of communicable diseases becomes due to the close physical proximity between individuals. Housing density refers to a situation in which the number of occupants is disproportionate to the available space; when it exceeds recommended standards, it may result in uncomfortable and unhealthy living conditions.⁷ Poor lighting conditions in residential environments may be associated with environmental conditions that are less conducive to hygiene and monitoring, which could indirectly facilitate parasite persistence.¹⁴

To date, few previous studies have examined the effects of lighting and ventilation on the occurrence of pediculosis capitis. This may be due to the fact that earlier research on residential sanitation typically focused on only a limited number of variables, such as temperature, humidity, and housing density, resulting in lighting and ventilation receiving less attention. Therefore, the present study provides additional evidence regarding the association between physical housing conditions, particularly lighting and ventilation, and the occurrence of pediculosis capitis.

This study further showed no significant association between room temperature ($p = 0.678$) and humidity ($p = 0.585$) and the occurrence of pediculosis capitis. These findings are consistent with the study by Novatria et al. (2019), which reported no correlation between room temperature ($p = 0.339$) and pediculosis capitis.⁸ These results suggest that other environmental factors, such as shared personal item use and residential sanitation conditions, may play a more dominant role in influencing the occurrence of pediculosis capitis than room temperature alone. Head lice are unable to survive or will die when exposed to environmental or scalp temperatures of 40°C or higher; however, they thrive optimally at temperatures ranging from 29–32°C.¹⁴

The absence of an association between room temperature and humidity and pediculosis capitis in this study may be explained by the fact that most rooms had relatively similar and acceptable temperature and humidity levels, resulting in homogeneous exposure. Such homogeneity reduces data variability and makes it difficult to detect statistically significant associations, even though temperature may theoretically influence lice survival. If ventilation does not ensure effective air exchange, mechanical cooling systems should be added. Poor air circulation, along with unhealthy practices such as improper placement or storage of

clothing, towels, and prayer garments (mukenah), may contribute to the spread of environment-related diseases.¹⁵

However, these findings are inconsistent with those reported by Rahmita et al. (2019), who found a significant association between humidity ($p = 0.009$) and pediculosis capitis.⁷ This discrepancy may be attributed to differences in environmental characteristics and variability in humidity exposure across study locations. Moreover, direct head-to-head contact influenced by housing density is likely a more dominant factor affecting the occurrence of pediculosis capitis (CDC, 2024).¹ Although several variables showed statistically significant associations with pediculosis capitis, these estimates should be interpreted cautiously due to the absence of multivariable adjustment. Therefore, potential confounding factors may have influenced the observed associations.

5. Conclusion

This study shows that pediculosis capitis is still present among children living in orphanages in South Sumatra. Sharing mattresses and combs was found to be associated with the occurrence of pediculosis capitis, whereas the use of bedsheets, blankets, pillows, towels, headscarves, prayer garments (mukenah), and caps showed no association. In terms of residential sanitation, housing density, ventilation, and lighting were associated with the occurrence of pediculosis capitis, while room temperature and humidity showed no association.

Orphanage administrators are advised to limit the sharing of personal items, particularly mattresses and combs, and to improve cleanliness as well as the availability of personal items for each child. Improvements in residential sanitation should be implemented by paying attention to housing density, ventilation, and lighting to meet health standards. In addition, regular health education for children and caregivers regarding the prevention and control of pediculosis capitis is necessary. Future studies are recommended to examine other factors that may influence the occurrence of pediculosis capitis using broader study designs and wider geographical coverage.

6. Author Contribution

QSPI serves as the primary author, responsible for data processing, data analysis and interpretation, and manuscript preparation, including the adaptation of an undergraduate thesis into a journal article. SR and CA served as co-authors, contributing to scientific supervision, methodological guidance, critical review, and manuscript revision. All authors reviewed and approved the final version.

7. Acknowledgements

The authors extend their appreciation to the Faculty of Medicine, Muhammadiyah University of Palembang, administrators, and children of the

orphanages in South Sumatra Province for their willingness to participate in this study, as well as to all parties who provided permission and support, making this research possible.

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