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Prevalence of Enterobiasis Infection Among School-Aged Children in the Kebon Kongok Landfill Area, West Lombok

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Abstract: Enterobiasis, also known as pinworm infection, is a parasitic infestation that predominantly affects children and is caused by the *Enterobius vermicularis* parasite. Worm infections can significantly impact an individual's productivity and immune system. This study aims to document the occurrence of enterobiasis among children aged 6 to 9 years in the Kebon Kongok landfill area of West Lombok Regency. Data collection involved the administration of the cellophane tape method and a questionnaire filled by the parents or guardians of the participating children. Among the 188 participants, 36 children (19.15%) were identified as having enterobiasis. Notably, boys exhibited a higher prevalence than girls, and the most common age for enterobiasis was 7 years. Statistical analysis revealed that the child's age, their habit of playing in the dirt, and the parents' or guardians' age are pivotal factors influencing the incidence of enterobiasis in the Kebon Kongok landfill area of West Lombok Regency.

Keywords: Children; Enterobiasis; Landfill; Parasites

Introduction

Parasitic worms commonly infest the digestive tract, causing various diseases. These parasitic infections can significantly impact the health and productivity of individuals by compromising their nutritional status. Worm infestations disrupt the processes of food intake, digestion, absorption, and metabolism. Among children, the most significant consequences are the potential decline in cognitive abilities and overall productivity. This is particularly concerning as children represent the future generation of our nation (Swirya & Romadilah, 2013).

Enterobiasis, commonly referred to as pinworm infection, is a parasitic infestation predominantly affecting children. It is caused by the parasitic pinworm, Enterobius vermicularis (Huh, 2018). Enterobiasis is typically contracted through the ingestion of pinworm eggs, which can be found on surfaces such as nails, clothing, toys, or bedding. Inhalation of these eggs from dust is another possible route of infection. This parasitic disease often arises due to autoinfection, as female worms migrate to the anus, leading to the deposition of eggs and causing intense itching, particularly at night. Scratching can result in contact between the anus, fingers, and mouth, facilitating recurrent infections. Furthermore, the highly infectious eggs can contaminate various household items, potentially leading to the infection of the entire family. Inadequate hygiene conditions often contribute to the spread of this infection. Another mode of infection involves the hatching of third-stage larvae on the anal mucosa, followed by migration into the intestine (Lucius et al., 2017).

Intestinal parasitic infections continue to exhibit a significant and widespread prevalence in Indonesia, ranging from 45% to 65%. In areas characterized by inadequate sanitation, this prevalence can escalate to alarming rates of up to 80%. For instance, in West Lombok Regency, the prevalence of worm infestations among junior high school students has been reported as high as 34% (Wibowo, 2019), while among elementary

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school students, it stands at 24.2% (Murti, 2016). It is imperative to underscore that certain regions demand heightened attention due to the potential for elevated prevalence rates attributed to unsanitary environments and inadequate sanitation facilities, particularly in areas like final waste disposal sites.

The Kebun Kongok final waste disposal site (landfill) serves as the primary waste disposal facility for Mataram city and West Lombok Regency, accommodating approximately 300 tons of waste daily (Ministry of Environment and Forestry of Indonesia, 2020). This substantial volume of waste significantly impacts the environmental quality, including water, air, and soil. Such conditions create a conducive environment for the proliferation of parasitic microbes affecting humans and leading to diseases like enterobiasis. Given this context, this research aims to investigate the prevalence of *Enterobius vermicularis* infections in children within the Kebun Kongok landfill area of West Lombok.

Method

Research Design

This research employed a cross-sectional approach and was carried out in Suka Makmur Village, located within the Gerung District of West Lombok Regency. The selection of this village was predicated on its proximity to the Kebon Kongok landfill. According to the Basic Education Data provided by the Directorate General of Early Childhood Education, Basic Education, and Secondary Education of Indonesia (2023), Suka Makmur Village hosts three State Elementary Schools (SDN), specifically SDN 1 Suka Makmur, SDN 2 Suka Makmur, and SDN 3 Suka Makmur. Consequently, these three schools were chosen as the sampling locations for this study.

Sample Collection

This study used a comprehensive total sampling technique to assess the prevalence of enterobiasis in the vicinity of the Kebon Kongok landfill. All students enrolled in grades 1, 2, and 3 across the three selected elementary schools were included as the study's sample population. An initial evaluation revealed a total of 223 children attending grades 1, 2, and 3 at SDN 1, 2, and 3 Suka Makmur. Ultimately, 188 participants voluntarily chose to take part in this research.

The sampling process involves parents or guardians of the students, who were informed about the sampling procedures through a school-based orientation. They were provided with a sampling kit comprising glass slides, cellophane tapes, and wooden sticks. Parents or guardians were instructed to collect samples from their children in the morning, immediately upon waking (prior to bathing), and return the kit to the school at the same day or the following day.

Samples for enterobiasis were collected by affixing cellophane tapes to the exterior of the anus and subsequently transferring them onto glass slides. These samples were then subjected to analysis at the Parasitology Laboratory within the Faculty of Medicine at Mataram University. A positive diagnosis of enterobiasis infection was established when the presence of *E. vermicularis* eggs was detected in the sample.

Questionnaire

In addition to the collection of samples using cellophane tapes, parents or guardians of the students were requested to complete a questionnaire. This questionnaire encompasses details about the child's gender, age, and daily routines. Additionally, it gathers information about the age, monthly income, and highest level of education attained by the child's parents or guardians.

Statistical Analysis

The research findings were subjected to statistical analysis using the Chi-square method, with a predetermined significance level of $P < 0.05$. These statistical tests were conducted using SPSS version 22 for data analysis.

Results and Discussion

Enterobiasis, an infection caused by the parasite *Enterobius vermicularis*, poses a significant health concern for children globally, particularly in developing nations. Nevertheless, the prevalence of this ailment has exhibited a declining trend over time. For instance, in 2012, Indonesia reported an enterobiasis infection rate of 31.8% (Ministry of Health of Indonesia, 2012). This research endeavors to discern the current prevalence of enterobiasis in a specific region of Indonesia, focusing on the Kebon Kongok landfill situated in West Lombok Regency.

A total of 188 parents or guardians actively participated in this research, engaging in the anal swab sampling method. These samples were collected in the morning, immediately when the child had just woken up, and subsequently returned to the school for further analysis. The gender distribution among the student participants skewed slightly towards males, constituting 58.51% of the total. The age of the students spanned from 6 to over 9 years old, with 8-year-olds representing the largest cohort at 30.85%.

Among all participants, 36 children (19.15%) tested positive for enterobiasis infection, as evidenced by the presence of parasite eggs in the collected samples

(Figure 1). This prevalence figure falls below the average the Ministry of Health of the Republic of Indonesia recorded in 2012 (Ministry of Health of Indonesia, 2012). It is noteworthy that this lower prevalence may be attributed to the concerted efforts of the Indonesian government's campaign to combat worm infections within the country. This endeavor has taken shape by implementing a Mass Prevention Medication program targeting children aged 1 to 12 years, which has been actively promoted since 2017, as stipulated in the Regulation of the Minister of Health of the Republic of Indonesia Number 15 of 2017.

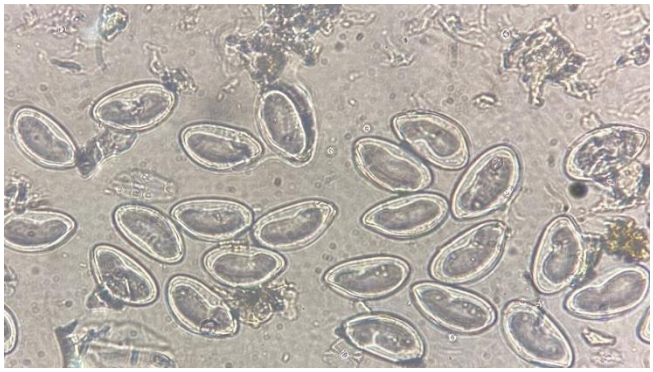

Figure 1. Observation Results (400x Magnification)

Additionally, our study revealed that those aged 7 years had the highest incidence of enterobiasis, constituting 28.57% of the affected group. The prevalence of enterobiasis was slightly higher among boys, standing at 21.82%, in comparison to girls, with a prevalence rate of 15.38% (Table 1). However, these two figures are not statistically significantly different. This aligns with the findings of Gunawerdana et al. (2013) in Sri Lanka, which also reported a higher prevalence of enterobiasis among boys than girls, and suggested that this gender disparity might be attributed to differences in hygiene practices, with boys generally exhibiting lower levels of hygiene compared to girls.

In addition to the enterobiasis sampling, parents or guardians of the students were also administered a questionnaire to gather information about their children's habits. Notably, a significant proportion of students (76.60%) reported frequent engagement in outdoor play, which was balanced by a commendable practice of handwashing, as reported by 87.23% of respondents. When it came to nail care, the majority of students (76.06%) stated they trimmed their nails weekly, while a smaller portion opted for bi-weekly nail cutting (21.28%) or less frequent nail maintenance (2.66%). Furthermore, a substantial number of students (88.83%) were recorded as not having the habit of sucking their fingers or biting their nails. Statistical analysis indicated that age (P = 0.004) and the habit of frequent outdoor play (P = 0.001) held significant associations with the incidence of enterobiasis in the Kebon Kongok landfill area of West Lombok (Table 1).

Table 1. Distribution of Children Based on Characteristics and Enterobiasis Infection

Variable	Total (%) (n = 188)	Infected (%)		X^{2a}	*P-value*[b]
		Negative	Positive		
Gender					
Male	110 (58.51)	86 (78.18)	24 (21.82)	1.22	0.269
Female	78 (41.49)	66 (84.62)	12 (15.38)		
Age (year)					
6	23 (12.23)	18 (78.26)	5 (21.74)	15.57	0.004
7	63 (33.51)	45 (71.43)	18 (28.57)		
8	58 (30.85)	46 (79.31)	12 (20.96)		
9	42 (22.34)	41 (97.62)	1 (2.38)		
> 9	2 (1.06)	2 (100.00)	0 (0.00)		
Frequent Playing with Soil					
Yes	144 (76.60)	109 (75.69)	35 (24.31)	10.57	0.001
No	44 (23.40)	43 (97.73)	1 (2.27)		
Frequent Hand-washing					
Yes	164 (87.23)	133 (81.10)	31 (18.90)	0.49	0.824
No	24 (12.77)	19 (79.17)	5 (20.83)		
Nail-clipping					
Once a week	143 (76.06)	113 (79.02)	30 (20.98)	2.90	0.235
Once in 2 weeks	40 (21.28)	34 (85.00)	6 (15.00)		
Once in more than 2 weeks	5 (2.66)	5 (100.00)	0 (0.00)		
Habits of Finger-sucking or Nail-biting					
Yes	21 (11.17)	18 (85.71)	3 (14.29)	0.39	0.535
No	167 (88.83)	134 (80.24)	33 (19.76)		

[a] *Chi-square test for independence*

[b] *Significant at P < 0,05*

According to the Centers for Disease Control and Prevention (CDC, 2020), the populations most susceptible to enterobiasis encompass school-aged children, individuals employed in industrial settings, and family members or caregivers of individuals infected with enterobiasis. The transmission of E. vermicularis typically occurs when a person comes into direct contact with objects contaminated by the eggs of this parasite and subsequently ingests them. This ingestion often happens inadvertently when individuals consume food, as the eggs may be present on their fingers and nails. Therefore, personal hygiene practices play a pivotal role in preventing enterobiasis infections. This entails habits such as thorough handwashing after playing, before and after meals, as well as refraining from nail-biting (CDC, 2020).

This research also collected information concerning the characteristics of students' parents or guardians, including age, income, and educational background. Among the parents or guardians, the most prominent age group recorded was 41 to 50 years, constituting 34.04% of the respondents, followed closely by the age range of 31 to 40 years at 32.98% and the 21 to 30 years range at 25%. Nearly half of the parents or guardians (46.28%) reported a monthly income of less than IDR 500,000. Regarding educational attainment, 36.70% of parents or guardians had completed only elementary school, 28.19% had completed high school, 23.94% had completed junior high school, and the remainder had either no formal education or had completed college. Statistical analysis revealed that the age of parents or guardians (P = 0.011) played a significant role in the incidence of enterobiasis in the Kebon Kongok landfill (Table 2).

Table 2. Distribution of Parents/Guardians based on Characteristics and Enterobiasis Infection

Variable	Total (%) (n = 188)	Infected (%)		X^{2a}	*P-value*[b]
		Negative	Positive		
Age (years)					
≤ 20	5 (2.66)	5 (100.00)	0 (0.00)	12.97	0.011
21 - 30	47 (25.00)	33 (70.21)	14 (29.79)		
31 - 40	62 (32.98)	55 (88.71)	7 (11.29)		
41 - 50	64 (34.04)	49 (76.56)	15 (23.44)		
> 50	10 (5.32)	10 (100.00)	0 (0.00)		
Monthly Income (Rp)					
< 500.000	87 (46.28)	70 (80.46)	17 (19.54)	0.06	0.996
500.000 – 1.000.000	73 (38.83)	59 (80.82)	14 (19.18)		
1.000.000 – 3.000.000	23 (12.23)	19 (82.61)	4 (17.39)		
> 3.000.000	5 (2.66)	4 (80.00)	1 (20.00)		
Educational Level					
No formal Education	9 (4.79)	8 (88.89)	1 (11.11)	5.37	0.251
Elementary	69 (36.70)	50 (72.46)	19 (27.54)		
Junior High	45 (23.94)	38 (84.44)	7 (15.56)		
Senior High	53 (28.19)	45 (84.91)	8 (15.09)		
Collage	12 (6.38)	11 (91.67)	1 (8.33)		

[a] *Chi-square test for independence*
[b] *Significant at P < 0,05*

According to Kim et al. (2010), parental knowledge is a crucial risk factor for enterobiasis infection. Age exhibits a positive correlation with knowledge and reading time but a negative correlation with memory performance (Miller, 2009). This may be pertinent to our study, considering that older parents or guardians (aged 41 to 50 years) dominated the participant group. They might possess adequate knowledge about enterobiasis but might forget to apply it. Furthermore, our study findings align with the research by Khayyat et al. (2021) and Li et al. (2015), which indicate that socio-economic factors, parental education, and monthly income do not exhibit a significant relationship with the incidence of enterobiasis.

Conclusion

Enterobiasis, an infection caused by the parasite *E. vermicularis*, primarily affects school-aged children. This study revealed a relatively low prevalence of enterobiasis in the Kebon Kongok landfill area, at 19.15%. Furthermore, it identified key risk factors, including the child's age, the habit of playing in the dirt, and the parents' age, which significantly contribute to the incidence of enterobiasis in the Kebon Kongok landfill of West Lombok Regency.

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Conflicts of Interest
The authors declare no conflict of interest.

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