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The Relationship Between Single and Mixed Worm Infections and the Nutritional Status of Students at SDN 060824 Medan City

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ABSTRACT

Worm infections are a significant health issue among children, especially in areas with inadequate sanitation. This study aims to identify the results of fecal examinations for worm infections in children at SDN 060824, Medan City, and examine the relationship between single and mixed worm infections and their nutritional status. This research uses an observational analytic method with a cross-sectional approach. The sample consists of 50 students selected randomly, with data collected through fecal examination and nutritional status measurement. The results indicate that 4% of students tested positive for worm infections, while 96% were uninfected. Statistical analysis revealed no significant relationship between worm infections and students' nutritional status (p>0.05). This study concludes that worm infections among students in the study location do not directly impact their nutritional status. These findings provide a basis for the government and health agencies to focus on broader preventive programs for worm infections to support the overall health of children.

Keywords: *Worm infection, nutritional status, elementary students, Medan City, child health, cross-sectional analysis.*

INTRODUCTION

The Indonesian population suffers from many infectious diseases, including worm infections. Worm infection is an intestinal parasitic infection transmitted through soil, classified as an intestinal nematode, also known as soil-transmitted helminths (STH). Worm infection is considered positive if at least one type of worm egg is found in the tested sample. Soil-transmitted helminths (STH) species that are transmitted through soil include *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), *Ancylostoma duodenale*, and hookworm (*Necator americanus*). According to CDC data from 2022, approximately 807 million to 1.21 billion people are infected with *Ascaris lumbricoides* (roundworm), and about 604 million to 795 million people are infected with *Trichuris trichiura* (whipworm), as well as *Ancylostoma duodenalis* and *Necator americanus* (hookworm) (CDC, 2022). WHO estimates that around 487 million people in Southeast Asia are affected by worm diseases (WHO, 2022). In Indonesia, nematode infections remain a serious public health issue, with relatively high morbidity rates. Based on data from several research institutions in Indonesia, some villages in Sumatra (78%), West Java (90%), and Kalimantan (79%) are infected with roundworms, as well as in West Nusa Tenggara (92%). The prevalence of *Trichuris trichiura* is also very high in Sumatra (83%), Sulawesi (83%), Kalimantan (83%), West Java (91%), and West Nusa Tenggara (84%). The prevalence of

hookworm in various regions of Indonesia currently ranges from 30-50%. In North Sumatra, particularly Medan City, the prevalence of nematodes in children ranges from 60–70% (Maqfirah et al., 2024).

Factors influencing nematode infection include environmental health, economic factors, and human factors. Nematode infections occur through contaminated water and food, so monitoring water and food cleanliness is crucial. Environmental remediation includes providing clean water, managing latrines, waste management, and other measures. On the other hand, human factors may involve personal hygiene. Both are interconnected, meaning personal hygiene should be accompanied by or supported by good environmental cleanliness. For example, washing hands before eating requires clean water that meets health standards (Wulandari & Purhadi, 2020).

For most people, nematode infection is considered a non-threatening disease. Worm infections can cause malnutrition, as the worms absorb all nutrients, which eventually leads to impaired mental and physical development in children. Children are more vulnerable to this disease due to their weaker immune systems, resulting in stunting, shorter stature than their peers, and reduced intelligence. In some cases, the child could die (BUTAR et al., 2021).

A person's nutritional status is determined by their food intake and requirements. Good nutritional status is achieved when food intake and body needs are balanced. Nutritional needs are unique to each individual and depend on age, gender, activity level, weight, and height (Amalia et al., 2021). Previous research has shown that the nutritional status of children infected with worms declines and becomes suboptimal (Maqfirah et al., 2024). Therefore, after careful consideration, I believe that research on the incidence of worm infections remains essential.

This study aims to illustrate the results of worm examinations in stool samples from children at SDN 060824, Medan City, and to examine the relationship between single and mixed worm infections and children's nutritional status. Specifically, this research will provide the researcher with a deeper understanding of the impact of worm infections on children’s nutritional status. Furthermore, the results of this study are expected to provide valuable information to the community regarding the relationship between worm infections and children's nutritional status. Health authorities and institutions can also use this research as a guideline in formulating relevant policies to improve children’s health in relation to worm infections.

METHOD

This study is experimental, with both learning and control groups randomly selected and an intervention variable applied to the research group. It is thus an observational analytic study that uses a cross-sectional method and a true experimental approach. The research aims to identify the relationship between single and mixed worm infections and the nutritional status of elementary students at SDN 060824, Medan City. The study was conducted in September 2024 at SDN 060824, Medan City, and at the Parasitology Laboratory at the University of North Sumatra. The population included 90 students who met the predefined criteria, with a sample size of 50 students representing a portion of the population. Cluster Random Sampling was used, allowing each population member an equal chance of selection. Proportional stratified random sampling was also used, calculated with the formula :

$$N = \left(\frac{\text{Population per school level}}{\text{Total population}} \right) \times 85$$

Inclusion criteria included willingness to provide a stool sample, participation in the study, enrollment in grades four to six, and a normal weight status. Exclusion criteria applied to subjects who did not return the stool sample container or withdrew from the study. Operational definitions of variables were established to ensure accurate data collection and analysis. Key variables included: single worm infection (defined as the presence of a single type of intestinal parasitic worm), mixed worm infection (presence of multiple parasitic worm types in the intestines), nutritional status (determined by nutrient intake and utilization and classified as underweight, normal, overweight, or obese), and academic performance (based on school report card scores, classified as good or poor).

The research instruments included questionnaires and experimental samples. Data was collected primarily through questionnaires filled out by the students of SDN 060824, Medan City. Primary data consisted of respondent information such as name, gender, birthdate, address, phone number, and physical measurements of weight and height. Measurements were taken using a digital scale with 0.1 kg precision and a microtoise for height, ensuring accuracy by maintaining proper stance during measurements. Stool samples were analyzed in the parasitology laboratory using the Kato-Katz technique to identify worm eggs. Data analysis involved univariate (descriptive) analysis to understand the characteristics of the sample and the distribution of variables, with results presented as frequency, mean, maximum, and minimum values. Bivariate analysis was conducted to assess the relationship between independent and dependent variables using chi-square tests. When over 20% of expected frequencies were higher than assumptions, Fisher's test was applied. A p-value greater than 0.05 was interpreted as showing no significant association between independent and dependent variables.

RESULTS AND DISCUSSION

Table 1 Respondent Characteristics

Characteristic	F	%
Gender		
Man	28	56%
Woman	22	44%
Age		
9 Years	7	14%
10 Years	18	36%
11 Years	20	40%
12 Years	4	8%
13 Years	1	2%
Weight		
18-24 kg	14	28%
25-31 kg	22	44%
32-38 kg	8	16%
39-47 kg	6	12%
Height		
115-127 cm	11	22%
128-133 cm	16	32%
134-140 cm	15	30%
141-157 cm	8	16%
Learning Achievement		
Less	11	22%
Good	39	78%

Characteristic	F	%
Status Gizi/ IMT		
Normal	44	88%
Abnormal	6	12%
Worm Status		
Negative	48	96%
Positive	2	4%
Total	50	100%

Based on table 1 above, it shows that of the 50 respondents between male and female students at SDN 060824 Medan City, most of them are male, namely 28 people (56%), while female students are 22 people (44%). At the age of 11 years with a total of 20 people (40%) in weight, it shows that students are more dominating with a weight of 25-31 kg and a student height of 128-133 cm 16 people (32%). In student learning achievement, students were dominated by students who had good scores as many as 39 people (78%). The results of anthropometric measurements showed that 6 children (12%) had undernutrition/abnormal nutritional status, showing the results of stool examinations carried out on 50 students, 2 children (2.9%) were positive for worm infection and 48 children (96%) were negative.

Average and Standard Deviation of Variable Characteristics

Table 2. Average and Standard Deviation of Variable Characteristics

Characteristic	n	Rerata±SB	Minimal	Maximum
Age (years)	50	10.4±0.90	9	13
IMT/U (SD)	50	0.65±1.03	-3	1,6
Weight (kg)	50	29±7.05 PM	18	47
Height (cm)	50	133.4±8.37	115	157

Table 2 shows that the results of anthropometric measurements obtained the average body weight is 29±7.05 kg, the average height is 133.4±8.37 cm and the average BMI score is 0.65 ± 1.03.

Analysis of the Relationship between Worm Infection and Nutritional Status

Table 3. The Relationship of Worms to Nutritional Status

Nutritional Status	Sum	Percentage (%)	Worm Status				P - Value
			Negative	%	Positive	%	
Normal	44	88%	42	95,5%	2	4,5%	0,772
Abnormal	6	12%	6	100%	0	0%	
Total	50	100%	48	96%	2	4%	

Based on the results of the study, it was shown that the majority of SDN students 060824 have good nutritional status, with a total of 42 well-nourished and worm-negative students (95.5%) while children with good nutritional status and positive for worms amounted to 2 people (4.5%). The results of *the chi-square test* stated that there was no relationship between worm infection and the nutritional status of students of SDN 060824 Medan City with a sig value of 0.772 which means > 0.05 (p>0.05).

Analysis of the Relationship between Worm Infection and Learning Achievement

Table 4 The Relationship of Worms to Learning Achievement

Learning Achievement	Sum	Percentage (%)	Worm Status				P - Value
			Negative	%	Positive	%	
Less	11	22%	11	100%	0	0%	
Good	39	78%	37	94,9%	2	5,1%	0,605
Total	50	100%	48	96%	2	4%	

Based on table 4 above, it shows that the majority of students of SDN 060824 Medan City have good learning achievements, with a total of 37 students with good and negative achievements with worms amounting to 37 people (94.9%) while students with good achievements and affected by worms amounting to 2 people (5.1%). The results of *the chi-square test* stated that there was no relationship between worm infection and the learning achievement of students of SDN 060824 Medan City, with a sig value of 0.605 which means > 0.05 (p>0.05).

Analysis of the Relationship between Nutritional Status and Learning Achievement

Table 5 Relationship of Nutritional Status to Learning Achievement

Learning Achievement	Sum	Percentage (%)	Nutritional Status				P - Value
			Normal	%	Abnormal	%	
Less	11	22%	10	90,9%	1	9,1%	
Good	39	78%	34	87,2%	5	12,8%	0,604
Total	50	100%	44	88%	6	12%	

Table 5 shows that there is no significant relationship between nutritional status and learning achievement p=0.604 in elementary school children at SDN 060824 Medan City.

Analysis of the Relationship between Personal Hygiene and Nutritional Status and Worms

Table 6 The Relationship of Personal Hygiene to Nutritional Status

Personal Hygiene	Sum	Percentage (%)	Nutritional Status				P - Value
			Normal	%	Abnormal	%	
Good	44	88%	38	86,4%	6	13,6%	
Bad	6	12%	6	100%	0	0%	0,444
Total	50	100%	44	88%	6	12%	

Table 6 shows that there is no significant relationship between personal hygiene and learning achievement p=0.444 in elementary school children at SDN 060824 Medan City.

Analysis of the Relationship of Personal Hygiene to Worm Infection

Table 7 The Relationship of Personal Hygiene to Worm Infections

Personal Hygiene	Sum	Percentage (%)	Worm Infections				P - Value
			Negative	%	Positive	%	

Good	44	88%	42	95,5%	2	4,5%	
Bad	6	12%	6	100%	0	0%	0,772
Total	50	100%	48	96%	2	4%	

Based on Table 7, the majority of students at SDN 060824 Medan City maintain good personal hygiene. A total of 42 students (95.5%) had good hygiene and tested negative for worm infections, while 2 students (4.5%) with good hygiene tested positive. The chi-square test results show no significant relationship between personal hygiene and worm infections among students at SDN 060824, with a significance value of 0.772, which is > 0.05 (p > 0.05).

The study shows that respondents are aged between 9 and 13 years. Worm infections are influenced by age; as age increases, infection rates decrease. This trend is linked to children's play patterns, daily activities, personal hygiene, and immunity. Children tend to play more, and their hygiene and immunity are lower, making them more susceptible to worm infections (Fauziah et al., 2022).

The results indicate that most respondents are male (56%). Worm infections were found across all ages and genders. In children, worm infections are linked to daily play activities. Boys, who prefer outdoor play and tend to interact with soil, are more vulnerable. Playing on soil, which often serves as a breeding ground for worms, and not washing hands after play make it easy for worms to enter the body (Maqfirah et al., 2024).

The study on infection status shows that most children were uninfected (48, or 96%), while 2 children (4%) were infected. Laboratory results indicating Ascaris lumbricoides infections suggest poor health behaviors in children. This age group is particularly susceptible to Ascaris lumbricoides infections, often caused by barefoot play, which allows worm eggs to enter through fingernails and toenails (Mohpul & Jabal, 2020). Factors like open defecation and lack of latrines contaminate soil, spreading Ascaris lumbricoides eggs. Using contaminated water also facilitates worm transmission. The spread patterns of Ascaris lumbricoides and Trichuris trichiura are similar, particularly in hot, humid areas with poor sanitation and personal hygiene, where school-aged children are the most affected (Miratunisa et al., 2017). Worms enter the body through contact with contaminated soil or water, moving to the bloodstream and targeting organs. They grow and reproduce in the intestines (Astuti et al., 2019).

The study's results show no significant relationship between worm infection and nutritional status among students, with a significance value of 0.772 (p > 0.05). However, poor nutrition can increase susceptibility to infections. This aligns with Maghfirah et al., (2024), whose research on the relationship between worm infections and nutritional status among elementary students found no significant correlation. This differs from Rui Soares' study in MALIANA Hospital, Timor Leste, which found a significant relationship with a p-value of 0.012 (p < 0.05). Ascaris lumbricoides infections reduce immunity, hinder growth, and cause nutrient and iron deficiencies, leading to anemia in children (Fauziah et al., 2022). They also disrupt nutrient absorption and metabolism, impairing growth and cognitive development, particularly in infected children with poor nutrition (Koehler et al., 2021).

The relationship between worm infection status and academic performance showed no significant effect, with a p-value of 0.605 > 0.05. Among 50 students, 11 had poor academic performance, while 39 performed well. Worm infections can hinder learning in elementary school students, causing fatigue, reduced concentration, headaches, lack of motivation, and increased school absenteeism, negatively impacting academic performance (Sari et al., 2023)

Using Fisher's Exact Test on 50 students at SDN 060824, Medan City, a p-value of 0.604 indicated no significant relationship between nutritional status and academic performance. These findings are consistent with Meilita's 2020 study at St. Francis Xavier Catholic Elementary School, which also showed no significant relationship between nutrition and academic performance among elementary students (p = 0.951) (Rawung et al., 2020).

Overnutrition and obesity in children may affect academic performance. Obesity is linked to cognitive impairment, reducing memory, language, and attention due to decreased brain-derived neurotrophic factor (BDNF) in the hypothalamus, affecting neuron development (Agustí et al., 2018). According to Precious et al., (2023), school-aged children need nutrient-rich food to support growth and development. Nutritionally deficient children may lack energy, feel unmotivated, and have difficulty concentrating in class, affecting their academic outcomes. Dicky's study in Medan with 56 participants found no correlation between nutritional status (BMI/U) and academic performance (p = 0.051) (Dicky, 2018). A study by Soheilipour et al. on 829 children in Iran found no statistically significant relationship between nutritional status and academic achievement (p = 0.9) (Soheilipour et al., 2019).

These results suggest that academic performance is not always influenced by nutritional status. Children with overnutrition, obesity, or malnutrition can still perform well academically. Nutritional status is one of many factors that may impact learning. Academic performance can be affected by internal factors (e.g., physiological, nutritional, and psychological) and external factors (Rawung et al., 2020).

Nutritional status is an important factor in child development and growth. Proper nutrition supports optimal physical growth, which includes brain development, crucial for intelligence. Adequate nutrition can enhance educational quality, as reflected by improved school test scores. Thus, children's nutritional status can significantly impact academic performance (Anoit et al., 2024).

The relationship between personal hygiene and nutritional status showed no significant association, with a p-value of 0.444 > 0.05. Of the students with good hygiene, 86.4% had normal nutrition, while 13.6% were undernourished. This aligns with Lida Arifin's research at Sumbang Health Center II, which found no significant relationship between hygiene behavior and nutritional status among school children. The study also aligns with Ade Amelyani's 2024 research on intestinal parasitic infections and nutritional status, which found no link between personal hygiene and nutritional status (Saputri et al., 2024).

The study also showed no significant relationship between hygiene and worm infection status, with a p-value of 0.772 > 0.05. Among students with good hygiene, 4.5% tested positive for worm infections, while 95.5% tested negative. This aligns with Friska's 2022 study at SDN 1 Pahandut Seberang, which found no meaningful relationship between hygiene and worm infections. Sixteen students with poor hygiene had no worm eggs in their feces, possibly due to preventive deworming treatments. Regular deworming every six months can prevent worm infections (Arifin & Purnamasari, 2018).

Worm infections are caused by parasitic worms, posing serious health risks to children, including malnutrition, weakened immunity, reduced concentration, and impaired growth. In this study, A. lumbricoides was identified in stool samples. Transmission occurs through contaminated food or water and contact with infected soil. Poor hygiene habits, such as unwashed hands and untrimmed nails, increase infection risk (Welan, 2019).

Transmission often occurs through accidental ingestion of contaminated food or drink or contact with contaminated soil. Washing hands with soap and running water before and after eating prevents worm egg ingestion. Failure to wash hands allows worm eggs on dirty hands or nails to enter the body. Washing hands after defecation and urination is also essential, as feces are a primary source of worm spread. Thus, proper handwashing practices are crucial (Welan, 2019).

Although this study found no significant relationship between personal hygiene and worm infections, maintaining personal hygiene remains essential, especially for elementary school children, who are at higher risk due to limited awareness and knowledge about hygiene practices (Wardanah, 2018)

CONCLUSION

Based on the results of this study, it is concluded that the majority of respondents were male students who generally have a normal nutritional status and good academic performance. The prevalence of worm infections among students in grades IV to VI at SDN 060824 Medan City was found to be 4% out of a total of 50 students studied. Analysis revealed no significant relationship between worm infections and either nutritional status or academic performance. Additionally, there was no significant correlation between nutritional status and academic performance among the students in this school. This study recommends that schools enhance cooperation among teachers to provide education on personal hygiene and environmental cleanliness to prevent worm infections. Health workers are also expected to actively provide counseling on the dangers of worm infections and encourage the community to routinely monitor the health of young children. Future research is advised to expand the scope of the study, not only at the elementary school level but also at kindergartens, early childhood education centers (PAUD), or hospitals in Medan City, to achieve more comprehensive results across different age groups.

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