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Differences in Eosinophil and Basophil Counts Before and After Administration of Pyrantel Pamoate Among Waste Collection Workers at the Terjun Landfill, Medan Marelan District, Infected with Soil-Transmitted Helminths (STH)

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Abstract: Helminthiasis remains a significant public health concern worldwide. Soil-transmitted helminths (STH) are a group of intestinal parasites transmitted through contaminated soil that can cause infections in humans. Basophils and eosinophils are types of white blood cells that play crucial roles in the immune response against STH infections. When infected with STH, the human body triggers an immune reaction that increases the eosinophil and basophil counts in the bloodstream. To determine the differences in eosinophil and basophil counts before and after the administration of pyrantel pamoate among waste collectors infected with STH at the Terjun Landfill, Medan Marelan District. This study employed a pre-test post-test without control group design to assess changes in eosinophil and basophil counts before and after the administration of pyrantel pamoate. Out of 104 waste collectors who agreed to undergo fecal examination, 35 individuals tested positive for STH infection using the direct smear method. Complete blood count (CBC) tests were performed on these 35 individuals prior to treatment using a hematology analyzer. One week after the administration of pyrantel pamoate, the same individuals underwent repeat CBC testing. Among the 35 STH-infected samples, the mean eosinophil count before treatment was **10.310%**, which decreased to **1.085%** after treatment. The mean basophil count before treatment was **0.942%**, and dropped to **0.000%** after treatment. Statistical analysis revealed a significant difference ($p < 0.05$) in both eosinophil and basophil counts before and after pyrantel pamoate administration. There was a significant difference in eosinophil and basophil counts before and after the administration of pyrantel pamoate among waste collectors infected with STH, indicating that antiparasitic treatment effectively reduced immune response markers associated with STH infection.

Keywords: Community Service, Education

Introduction

The incidence of helminth infection remains a serious public health problem worldwide. Soil-transmitted helminths (STH) are a group of intestinal parasites transmitted through contaminated soil that cause infections in humans (Loukas et al, 2021) . STH infections are among the most common parasitic diseases, particularly in developing countries, and represent a major cause of public health problems. Therefore, controlling STH infections is a primary priority in efforts to improve community health (Khurana et al, 2021).

According to data from the World Health Organization (WHO, 2020), more than 1.5 billion people, or approximately 24% of the world's population, are infected with soil-transmitted helminths(Andrade et al., 2001). The highest prevalence is found in Sub-Saharan Africa, the Americas, China, and East Asia (Parija et al, 2017). In Indonesia, the prevalence of helminth infections remains high, ranging from 45% to 65%.

The main helminth species that infect humans include roundworms (Ascaris lumbricoides), whipworms (Trichuris trichiura), and hookworms (Necator americanus and Ancylostoma duodenale). Other species that can also infect humans include Strongyloides stercoralis, several Parastrongyloides species, Oxyuris vermicularis, and Trichinella spiralis. Personal hygiene plays a crucial role since it can determine the spread of worms in the human body. These parasites are typically found in unhygienic environments, particularly in densely populated urban or slum areas. Human infection with STH occurs through several routes, including transmission via vectors, larval penetration through the skin, and ingestion of food contaminated with infective eggs (Subahar, n.d.).

Treatment for STH infections can be carried out through mass administration of antihelminthic agents. Several regions in Indonesia have implemented such programs using various types of anthelmintic drugs, with varying degrees of success. The most commonly used anthelmintic agent is pyrantel pamoate, often administered alone or in combination with other antiparasitic agents (Amalia et al, 2022).

Basophils and eosinophils are types of white blood cells that play significant roles in the immune response against STH infections. These parasitic infections stimulate the body's immune system, leading to an increase in basophil and eosinophil counts in the bloodstream. Basophils help regulate the adaptive immune response by mediating antibody production and the activation of specific T cells to combat infection. Eosinophils, on the other hand, are involved in the immune response to parasitic infections, including STH. During infection, the number of eosinophils in the blood increases, enhancing intestinal peristalsis to help expel the parasites (Jacob et al, 2022).

Thus, both basophils and eosinophils play essential roles in the immune response to helminth infections and in the evaluation of treatment with pyrantel pamoate. Measuring basophil and eosinophil levels in the blood of STH-infected individuals can help assess the effectiveness of pyrantel pamoate therapy. Previous studies have shown that changes in basophil counts are associated with the efficacy of anthelmintic treatment, and that

basophils play an important role in host defense against helminth infections(Obata-Ninomiya et al, 2020).

The objectives of this study were: (1) to determine the mean eosinophil count before administration of pyrantel pamoate among waste collectors infected with STH; (2) to determine the mean eosinophil count after administration of pyrantel pamoate among the same subjects; (3) to determine the mean basophil count before pyrantel pamoate administration; (4) to determine the mean basophil count after treatment; and (5) to analyze the differences in eosinophil and basophil counts before and after pyrantel pamoate administration among waste collectors infected with STH.

Methodology

This study employed a pre-test post-test design without a control group, aimed at observing the differences in eosinophil and basophil counts before and after the administration of pyrantel pamoate among waste collectors infected with soil-transmitted helminths (STH).

The sampling location was at the Terjun Landfill (TPA Terjun), located in Paya Pasir, Medan Marelan District. The examination for helminth eggs was conducted at the Parasitology Laboratory, Faculty of Medicine, Universitas Muhammadiyah Sumatera Utara, while the analysis of eosinophil and basophil counts was carried out at the Laboratory of the North Sumatra Provincial Health Office. The population of this study consisted of all waste collection workers at the Terjun Landfill (TPA Terjun), Paya Pasir, Medan Marelan District. The research sample included waste collectors at the same location who met the inclusion and exclusion criteria established for the study.

Inclusion Criteria:

1. Waste collection workers who are infected with soil-transmitted helminths (STH).
2. Waste collection workers who are willing to take pyrantel pamoate and have been confirmed not to suffer from any malignant diseases that could significantly affect eosinophil and basophil counts, and who have not taken any other medications within the past month.
3. Waste collection workers who are willing to have their blood drawn for the examination of eosinophil and basophil counts.
4. Waste collection workers who agree to participate as study subjects and have signed the informed consent form.

Exclusion Criteria:

1. Waste collection workers who have known allergies.
2. Waste collection workers who refuse to have their blood samples taken twice or refuse to provide stool samples.
3. Waste collection workers who refuse to take the deworming medication.

1The sample size was calculated using the formula for analytic studies with paired data as follows:

$$n = \left(\frac{(Z\alpha + Z\beta)S}{X1 - X2}\right)^2$$

Description:

n: minimum sample size

$Z\alpha$: alpha standard deviation, set by the researcher at **1.64**

$Z\beta$: beta standard deviation, set by the researcher at **1.28**

S : standard deviation of the difference between groups, set by the researcher at **4**

$X_1–X_2$: minimum mean difference considered significant, set by the researcher at **2**

Based on these calculations, the minimum sample size required for this study was 35 participants infected with soil-transmitted helminths (STH).

Blood sampling in this study was conducted using a hematology analyzer to measure eosinophil and basophil counts. The instruments used included a blood sample collection set, test tubes, an automatic hematology analyzer, adhesive plaster, a tourniquet, and 70% alcohol swabs, while the main material used was blood samples obtained from the participants. The purpose of the analysis was to describe and evaluate the study variables comprehensively. Descriptive analysis was employed to identify the characteristics of the study subjects who met the inclusion criteria and participated as samples. Numerical data were organized into tables displaying the mean and standard deviation values to demonstrate the presence of STH infection, as well as the eosinophil and basophil counts before and after the administration of pyrantel pamoate among waste collectors at the Terjun Landfill, Medan Marelan District. Furthermore, analytical testing was performed to examine the research hypothesis, focusing on determining differences in eosinophil counts before and after pyrantel pamoate treatment in STH-infected participants. To analyze these paired data, the non-parametric Wilcoxon test was applied, as it is suitable for assessing differences in non-normally distributed variables between two related samples

Result and Discussion

Table 1. Frequency Distribution of Stool Examination Results

Result	N	% Examination
Positive	35	33.7%
Negative	69	66.3%
Total	**104**	**100%**

A total of 104 stool samples were examined in this study. Based on the results, 35 individuals (33.7%) tested positive for soil-transmitted helminth (STH) infection, while 69 individuals (66.3%) tested negative. These findings indicate that approximately one-third of the waste collection workers examined were infected with STH.

Table 2. Demographic Characteristics of Study Subjects

Age Group (Years)	Frequency	Percentage (%)
10–25 years	6	17.14%
26–40 years	8	22.86%
41–55 years	12	34.29%
>55 years	9	25.71%
Total	**35**	**100.00%**
Gender	**Frequency**	**Percentage (%)**
Male	9	25.71%

Age Group (Years)	Frequency	Percentage (%)
Female	26	74.29%
Total	**35**	**100.00%**

Based on the demographic data of the study subjects, there was a variation in the participants' ages, with the highest proportion belonging to the 41–55 years age group. In terms of gender distribution, female participants were more dominant compared to male participants.

Table 3. Frequency Distribution of Stool Examination Results After Administration of Pyrantel Pamoate

Result	N	% Examination
Positive	1	2.9%
Negative	34	97.1%
Total	**35**	**100%**

Based on Table 3, after the administration of pyrantel pamoate, only 1 sample (2.9%) remained positive for soil-transmitted helminth (STH) infection, while 34 samples (97.1%) tested negative. This indicates a significant reduction in the number of STH-positive cases following treatment with pyrantel pamoate.

The normality test for eosinophil and basophil counts was performed using the Shapiro-Wilk test, and the results are shown below.

Table 4. Normality Test Results for Eosinophil and Basophil Counts

Parameter	Sig.	Interpretation
Eosinophil (Before)	0.336	Normally Distributed
Eosinophil (After)	0.000	Not Normally Distributed
Basophil (Before)	0.000	Not Normally Distributed
Basophil (After)	0.000	Not Normally Distributed

As shown in Table 4, the normality test results indicate that **$p < 0.05$**, meaning the data were **not normally distributed**. Therefore, a **non-parametric test** was used to analyze the differences between groups.

Table 5. Comparison of Mean Eosinophil and Basophil Counts

Parameter	Mean ± SD (%)	p-value
Eosinophil (Before)	10.310 ± 5.160	0.000
Eosinophil (After)	1.085 ± 0.742	—
Basophil (Before)	0.942 ± 0.090	0.000
Basophil (After)	0.000 ± 0.000	—

The results of the Wilcoxon test revealed a significant difference ($p < 0.05$) in the mean eosinophil and basophil counts before and after the administration of pyrantel pamoate. This finding suggests that the treatment had a statistically significant effect in reducing eosinophil and basophil levels among waste collection workers infected with soil-transmitted helminths (STH).

Discussion

This study was conducted among waste collection workers who had been confirmed to be infected with soil-transmitted helminths (STH) at the Terjun Landfill (TPA Terjun) in Medan Marelan. The research was carried out after obtaining permission from the landfill authorities and local supervisors. All individuals who participated as research subjects met the established inclusion criteria, namely: waste collectors infected with STH, those willing to take pyrantel pamoate, those who consented to undergo blood sampling and laboratory examinations of eosinophil and basophil counts, and those who provided written informed consent to participate in the study. The primary objective of this research was to determine whether there was a significant difference in eosinophil counts before and after the administration of pyrantel pamoate among waste collection workers infected with STH.

The results of the examination showed that the mean eosinophil count before the administration of pyrantel pamoate was 10.310%, whereas after consumption of pyrantel pamoate, the mean value decreased to 1.085%. This demonstrates a clear reduction in eosinophil levels following the administration of pyrantel pamoate. The Wilcoxon test results showed mean values of (10.310 ± 5.160) before treatment and (1.085 ± 0.742) after treatment, with a p-value < 0.05, indicating a statistically significant effect of pyrantel pamoate administration on eosinophil counts. These findings are consistent with a 2023 study conducted among students at SD Negeri 104231 and SD Negeri 106856 in Batang Kuis District, Deli Serdang Regency, which reported a significant relationship between increased eosinophil counts and infection by soil-transmitted helminths (STH).

This examination also revealed a statistically significant result for basophil levels. The mean basophil count before treatment was 0.942%, while after the administration of pyrantel pamoate, the mean value dropped to 0.00%. These results clearly indicate a decrease in basophil count following treatment. The Wilcoxon test showed mean values of (0.942 ± 0.99) before treatment and (0 ± 0.00) after treatment, with a p-value < 0.05, confirming a statistically significant effect of pyrantel pamoate administration on basophil counts.

This finding is consistent with a 2019 study conducted at SDN Jati Agung, South Lampung Regency, which reported a significant correlation ($p < 0.05$) between increased basophil counts and the prevalence of soil-transmitted helminth (STH) infections (Din, 2019).

Pyrantel pamoate has been proven to be highly effective in treating helminth infections, as indicated by the reduction of both eosinophil and basophil levels in the blood following therapy 81. Pyrantel pamoate is an anthelmintic agent that acts against intestinal nematodes. Its active compound, pyrantel, is typically administered as a single-dose treatment. Pyrantel pamoate exerts minimal effects on the liver, meaning it has low hepatotoxicity and is well-tolerated even by individuals with mild hepatic conditions (Din, 2019).

According to the World Health Organization (WHO, 2023), pyrantel pamoate is one of the recommended anthelmintic drugs for treating intestinal helminth infections. The drug's effectiveness was demonstrated in a randomized controlled trial (RCT) conducted between October 2017 and February 2018 in Bangli, Bali, involving 600 children and adults,

of whom 392 were infected with *Trichuris trichiura*. The study showed that pyrantel pamoate treatment resulted in a significantly higher parasite clearance rate compared to other treatments, confirming its superior antiparasitic efficacy (Dale et al, 2024).

Eosinophils constitute up to 6% of nucleated cells in the bone marrow and are routinely examined as part of a Complete Blood Count (CBC). The normal range for eosinophils is 450–500 cells/μL. When eosinophil levels exceed this range, the condition is known as eosinophilia, while levels above 1,500 cells/μL are classified as hypereosinophilia, a rare and uncommon disorder. Eosinophils have been shown to possess the ability to kill *Strongyloides stercoralis* larvae and also act as antigen-presenting cells, stimulating T-cell proliferation, Th2 cytokine production, and B-cell activation (Ryan, 2018).

In cases of bacterial infection, eosinophils demonstrate their ability to kill bacteria through both intracellular and extracellular mechanisms, which vary depending on the specific pathogen involved (Kouroushis, 2022). In parasitic infections, eosinophils are not equally effective against all types of helminths; however, under certain circumstances, they contribute significantly to host protection against parasitic infections, particularly nematode larvae. During reinfection, eosinophils tend to migrate and accumulate at the site where the larvae are located before they mature into adult worms (Ramirez et al, 2018).

Basophils, on the other hand, are often used as diagnostic indicators in certain immune reactions such as allergies. Their allergic reactivity also occurs during ectoparasitic infections within lesion tissues. Thymic Stromal Lymphopoietin (TSLP), which is induced during helminth infections, promotes basophil proliferation and triggers a Th2 cytokine response, particularly in *Trichinella* infections (Yasuda & Kuroda, 2019).

Conclusion

Based on the results of this study, it can be concluded that there was a significant difference in eosinophil and basophil counts before and after the administration of pyrantel pamoate among waste collection workers infected with soil-transmitted helminths (STH). The mean eosinophil count before treatment was 10.310%, while after the administration of pyrantel pamoate, the mean decreased to 1.085%. Similarly, the mean basophil count before treatment was 0.942%, which dropped to 0.00% after treatment. These findings indicate that pyrantel pamoate effectively reduced eosinophil and basophil levels, demonstrating its positive therapeutic impact in minimizing immune responses triggered by STH infection. The results also suggest that pyrantel pamoate plays a significant role in improving hematological parameters associated with helminth infections among waste collectors exposed to contaminated environments.

In light of these findings, future research is encouraged to expand upon this study by exploring different parameters of differential white blood cell counts and employing alternative blood analysis instruments to compare measurement accuracy. Studies using varied dosages of pyrantel pamoate could also provide deeper insight into dose-dependent therapeutic responses. Additionally, employing different stool examination methods may yield more precise diagnostic results and enhance the evaluation of treatment effectiveness. Such approaches would contribute to a more comprehensive understanding of the

relationship between helminth infections, immune cell activity, and the efficacy of anthelmintic therapy in populations at high risk of STH exposure.

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