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Comparative analysis of cholesterol and hemoglobin levels in dewormed and non-dewormed school-age children

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ABSTRACT

Introduction: Helminth infections continue to be a significant public health concern among school-age children, particularly in areas with inadequate sanitation. Chronic helminthiasis can impair nutrient absorption, disrupt lipid metabolism, and contribute to anemia. Regular deworming is recommended as a preventive strategy, yet evidence regarding its biochemical impact on cholesterol and hemoglobin levels remains limited. This study aimed to compare cholesterol and hemoglobin levels between dewormed and non-dewormed school-age children.

Methods: A comparative descriptive design was employed involving 30 school-age children, consisting of 15 who routinely consumed deworming medication and 15 who did not. Blood samples were collected by trained health personnel and analyzed in a clinical laboratory. Hemoglobin levels were measured using a photometric method, while total cholesterol levels were determined using an enzymatic method. Descriptive analysis was used to compare mean values between groups.

Results: Children who routinely consumed deworming medication showed lower mean cholesterol levels (152.9 mg/dL) compared with the control group (169.7 mg/dL). Mean hemoglobin levels were also higher in the dewormed group (12.31 g/dL) than in the non-dewormed group (11.86 g/dL). Although not all children fell within the normal reference ranges, the dewormed group demonstrated more stable biochemical profiles overall. These findings suggest that regular deworming may support healthier lipid metabolism and maintain hemoglobin levels within acceptable limits.

Conclusion: The results suggest that periodic deworming has a positive impact on the biochemical status of school-age children. A reduced helminth burden may improve nutrient absorption, stabilize lipid profiles, and prevent chronic blood loss, which can lead to anemia. However, variations between individuals highlight the role of external factors such as diet, sanitation, and reinfection risk. Regular deworming appears to promote better cholesterol and hemoglobin profiles among school-age children, underscoring its importance in child health programs.

Keywords: Anemia, Cholesterol, Deworming, Hemoglobin, School-Age Children.

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INTRODUCTION

Anemia and abnormal lipid profiles remain significant yet often overlooked public health issues among school-age children worldwide. In low- and middle-income countries, these problems are further exacerbated by persistent parasitic infections, inadequate nutritional intake, and limited access to preventive health programs (Akib and Rukinah, 2024). Soil-transmitted helminths (STH), particularly Ascaris lumbricoides, Trichuris trichiura, and hookworms, are among the most common chronic infections contributing to poor nutritional and hematological outcomes in this age group (Almeida *et al.*, 2022). Their presence can impair nutrient absorption, disrupt metabolic processes, and induce chronic blood loss, ultimately increasing the risk of anemia and altering lipid metabolism. As a result, children living in endemic areas are frequently exposed to a cycle of infection, malnutrition, and impaired growth conditions that threaten physical development, cognitive performance, and academic achievement (Anwar *et al.*, 2018).

Despite global efforts to reduce the prevalence of helminth infections, the World Health Organization (WHO) reports that more than 800 million children remain at risk, especially those residing in tropical regions with inadequate sanitation and hygiene practices (Chauhan *et al.*, 2025). School-age children are particularly vulnerable due to behavioral factors, including close contact with contaminated soil, inconsistent handwashing habits, and limited awareness of personal hygiene. The physiological burden of helminthiasis on this population is reflected in indicators such as hemoglobin concentration and lipid profiles (Degarege *et al.*, 2022). Chronic infections caused by hookworms, for instance, can lead to sustained blood loss and iron deficiency, resulting in reduced hemoglobin levels. Conversely, intestinal nematodes can interfere with fat absorption, which in turn affects cholesterol synthesis and overall lipid metabolism (Djuardi *et al.*, 2021).

Deworming programs have long been recognized as an effective strategy to break the cycle of infection and its associated physiological consequences. Administration of anthelmintic drugs, such as albendazole or mebendazole, at regular intervals has been shown to reduce parasitic loads, enhance nutrient absorption, and improve children's overall health status (Girum and Wasie, 2018). However, although many studies have reported individual associations between helminth infections and hematological or metabolic parameters, research examining the combined effects of routine deworming on both hemoglobin and cholesterol levels remains limited (Jolly *et al.*, 2023). Moreover, existing literature rarely compares these outcomes between children who consistently participate in deworming programs and those who do not, despite the potential implications for public health planning and school-based intervention strategies (Husen *et al.*, 2022).

The interaction between helminth infections and lipid profiles is particularly complex and understudied. Some evidence suggests that parasitic worms may lower cholesterol levels by consuming host lipids or impairing intestinal absorption (Litaqia and Cahya Mulat, 2025). At the same time, other findings suggest that post-deworming normalization may lead to an increase in cholesterol levels as nutrient uptake improves. These contradictory patterns highlight the need for more targeted research examining how routine deworming affects lipid metabolism in children. Similarly, while the relationship between helminthiasis and anemia is well-documented, few studies provide comparative data assessing whether sustained participation in deworming programs yields measurable, long-term improvements in hemoglobin concentrations.

This knowledge gap is significant in regions where helminth infections remain endemic and deworming programs are inconsistently implemented. Variations in diet, sanitation, and reinfection rates can influence biochemical outcomes, underscoring the need for context-specific

evidence. In Indonesia, helminthiasis continues to affect many school-age children, yet the biochemical benefits of preventive deworming are still poorly documented. The present study addresses this gap by comparing cholesterol and hemoglobin levels between children who routinely take deworming medication and those who do not. The novelty of this research lies in its dual-parameter comparative approach. Unlike previous studies that typically focus on anemia or lipid metabolism separately, this study evaluates both hemoglobin and cholesterol within the same population. This provides a more comprehensive picture of how regular deworming may improve children's metabolic and hematological status. By examining two physiologically related indicators, the study highlights the broader impact of helminth infections and the potential of deworming to mitigate these effects.

Furthermore, the study offers real-world evidence from a school-based cohort, reflecting actual adherence patterns and environmental exposures. Unlike controlled clinical trials, this observational design captures the practical differences between children who consistently participate in deworming programs and those who do not. The findings, which show lower cholesterol and higher hemoglobin levels among children who routinely consume deworming medication, reinforce the importance of sustained participation and support the integration of biochemical monitoring into school health programs. Although helminthiasis remains a challenge in resource-limited settings, research on the metabolic effects of routine deworming is still limited. This study helps fill that gap by providing new comparative data on cholesterol and hemoglobin levels, strengthening the evidence base for preventive deworming programs, and supporting policy efforts to enhance children's overall health and development.

RESEARCH METHODOLOGY

This study employed a descriptive comparative design to examine the differences in cholesterol and hemoglobin levels between school-age children who regularly consumed deworming medication and those who did not. The research was conducted in October and involved a total sample of 30 children selected through purposive sampling based on established inclusion criteria, including age range, willingness to participate, and absence of acute illness. The sample was divided into two equal groups: 15 children with a documented history of regular deworming and 15 children who had not taken deworming medication within the recommended schedule.

Data collection was carried out over three consecutive days. Venous blood samples were obtained by trained healthcare personnel following aseptic techniques and standard phlebotomy procedures. Hemoglobin concentration was measured using a calibrated photometric method, while total cholesterol levels were analyzed using an enzymatic assay in accordance with laboratory operational standards. All examinations were performed in a certified laboratory, adhering to internal quality control protocols to ensure accuracy and reliability of results.

Sociodemographic characteristics were documented to support comparative interpretation. Laboratory results were processed using descriptive statistical analysis, including calculation of means, standard deviations, and value ranges. A comparative assessment was conducted to identify biochemical differences between the routinely dewormed group and the control group. This study received ethical approval from the Institutional Ethics Committee of Politeknik Sandi Karsa Makassar. Written informed consent was obtained from the parents or guardians of all participating children, and assent was also obtained from the children themselves. All procedures complied with ethical principles for research involving minors, including confidentiality, voluntary participation, and the right to withdraw at any time without penalty.

RESULT

A total of 30 school-age children participated in this study, comprising 15 children who routinely took deworming medication and 15 children in the control group. Laboratory analysis was conducted to compare cholesterol and hemoglobin levels between the two groups. Descriptive statistics were generated to summarize the distribution, mean values, and variability of both biochemical parameters. The results presented in the following tables provide a clear comparison of cholesterol and hemoglobin levels, highlighting the physiological differences associated with routine deworming practices among school-age children. These findings form the basis for further interpretation in the subsequent discussion.

Table 1. Cholesterol and Hemoglobin Levels in Deworming and Control Groups.

No	Code	Group	Cholesterol (mg/dL)	Hemoglobin (g/dL)
1	O1	Deworming	143	12.2
2	O2	Deworming	149	12.4
3	O3	Deworming	156	12.8
4	O4	Deworming	160	12.6
5	O5	Deworming	158	12.9
6	O6	Deworming	152	12.7
7	O7	Deworming	147	12.3
8	O8	Deworming	150	12.5
9	O9	Deworming	154	11.5
10	O10	Deworming	159	11.8
11	O11	Deworming	145	11.6
12	O12	Deworming	151	11.7
13	O13	Deworming	148	11.9
14	O14	Deworming	155	11.8
15	O15	Deworming	161	11.6
16	K1	Control	166	12.1
17	K2	Control	168	12.0
18	K3	Control	169	12.2
19	K4	Control	165	12.1
20	K5	Control	167	12.3
21	K6	Control	170	12.0
22	K7	Control	168	12.1
23	K8	Control	166	12.2
24	K9	Control	169	12.1
25	K10	Control	172	11.5
26	K11	Control	175	11.6
27	K12	Control	178	11.4
28	K13	Control	174	11.7
29	K14	Control	176	11.5
30	K15	Control	171	11.4

The combined data show apparent differences between the deworming group and the control group in terms of cholesterol and hemoglobin levels among school-aged children. Children who regularly consumed deworming medication demonstrated lower and more stable cholesterol values, ranging from 143 to 161 mg/dL, with a mean of 152.9 mg/dL. These values fall well within the recommended normal range (<170 mg/dL) for children. In contrast, the control group presented consistently higher cholesterol values (165–178 mg/dL), with a mean of 169.7 mg/dL, approaching the upper limit of normal, and several children exceeded ideal thresholds. Hemoglobin levels also showed a favorable pattern among children in the deworming group, with values ranging from 11.5 to 12.9 g/dL and an average of 12.31 g/dL. These results indicate a generally adequate hematological status.

Meanwhile, the control group showed slightly lower hemoglobin values, ranging from 11.4–12.3 g/dL, with a mean of 11.86 g/dL. These findings suggest a tendency toward borderline anemia in some children without routine deworming. Overall, the combined table indicates that children who regularly consume deworming medication tend to have better metabolic and hematological profiles, as reflected in lower cholesterol levels and higher hemoglobin levels compared to the control group. This pattern supports the role of routine deworming in enhancing nutrient absorption and alleviating the physiological burden of intestinal helminths, potentially leading to improved overall health outcomes.

Table 2. Descriptive Analysis of Cholesterol and Hemoglobin Levels

Parameter	Group	n	Mean	SD	Min	Max
Cholesterol (mg/dL)	Deworming	15	152.9	6.1	143	161
	Control	15	169.7	4.2	165	178
Hemoglobin (g/dL)	Deworming	15	12.31	0.52	11.5	12.9
	Control	15	11.86	0.29	11.4	12.3

The combined descriptive analysis shows apparent physiological differences between children who routinely consumed deworming medication and those in the control group. The mean cholesterol level in the deworming group (152.9 mg/dL) is notably lower and remains within the ideal range for school-aged children (<170 mg/dL). In contrast, the control group exhibits a higher mean cholesterol level (169.7 mg/dL), which approaches the upper limit of the normal range, with some values slightly exceeding the ideal threshold. This suggests that deworming may contribute to more stable lipid metabolism, possibly due to improved intestinal absorption following the elimination of helminths. Hemoglobin levels also show a positive trend in the deworming group, with a mean of 12.31 g/dL, which is well within the normal range for school-aged children.

Meanwhile, the control group demonstrates a lower mean hemoglobin value (11.86 g/dL), nearing the lower boundary of normal and indicating a greater tendency toward borderline anemia. These differences align with the understanding that helminth infections can interfere with nutrient absorption and cause chronic mild blood loss, which in turn affects hemoglobin concentration. Routine deworming, therefore, appears to support a better hematological status by reducing the parasitic burden and restoring normal nutrient uptake.

The analysis reveals that school-aged children who routinely consume deworming medication show healthier biochemical profiles than those who do not. The deworming group exhibits lower mean cholesterol levels and higher mean hemoglobin levels, both of which fall within normal physiological ranges. In contrast, the control group exhibits higher cholesterol levels and slightly reduced hemoglobin values, suggesting potential impacts of untreated helminth infections on lipid metabolism and hematological function.

DISCUSSION

The findings of this study demonstrate notable differences in cholesterol and hemoglobin levels between school-aged children who routinely consume deworming medication and those who do not. These results contribute essential evidence to the growing body of literature that highlights the metabolic and hematological impact of helminth infections in children living in endemic areas. Given that helminthiasis is closely associated with impaired nutrient absorption, reduced appetite, chronic inflammation, and risk of anemia, the observed patterns in lipid and blood profiles between the two groups can be interpreted as meaningful indicators of health benefits resulting from routine deworming (Lo *et al.*, 2018).

The mean cholesterol level of children in the deworming group was 152.9 mg/dL, which falls comfortably within the recommended normal range for school-aged children. In contrast, the control group recorded a substantially higher mean cholesterol level of 169.7 mg/dL, approaching the upper limit of expected values. Several factors may explain this difference. Previous studies have shown that helminth infections, particularly those caused by soil-transmitted helminths, can alter lipid metabolism through mechanisms such as intestinal mucosal damage, nutrient competition, and modulation of host metabolism. Chronic parasitic infections can impair the efficiency of fat absorption, leading to fluctuations in lipid levels (Moshi *et al.*, 2023). Once helminths are eliminated through timely deworming, nutrient absorption is restored, contributing to more stable lipid profiles. Furthermore, helminths utilize host lipids as part of their metabolic requirements, which can indirectly affect serum lipid concentrations. Therefore, the lower and more stable cholesterol values in the deworming group likely reflect improved metabolic balance and reduced parasitic burden (Molla and Mamo, 2018).

Interestingly, the control group not only demonstrated higher mean cholesterol values but also narrower variability, suggesting a consistently elevated lipid pattern. This may indicate chronic low-grade parasitic exposure or other lifestyle and dietary factors influencing lipid metabolism (Ngui *et al.*, 2012). Although this study did not directly assess parasitic infection status at the time of sampling, the consistently higher cholesterol levels in the control group may reflect lingering helminth-related disturbances or compensatory metabolic responses to chronic infection (Yeshi *et al.*, 2022). These findings are consistent with earlier reports indicating that children with untreated helminth infections may experience dysregulation of lipid metabolism, leading to elevated or unstable cholesterol levels (Toussaint Nguélé *et al.*, 2024).

In addition to lipid profiles, hemoglobin levels also differed between the two groups in a clinically meaningful manner. The deworming group exhibited a mean hemoglobin concentration of 12.31 g/dL, within the normal physiological range for school-aged children. In contrast, the control group had a lower mean hemoglobin level of 11.86 g/dL, which borders on the lower threshold of normal and suggests an increased risk for mild anemia (Nuryati, 2024). This finding aligns with well-established evidence that helminth infections, particularly hookworm (Ancylostoma duodenale or Necator americanus), Trichuris trichiura, and Ascaris lumbricoides, can cause chronic intestinal blood loss, impaired iron absorption, and overall reduced nutritional status, all of which contribute to decreased hemoglobin production (Rennie *et al.*, 2021). Routine deworming is expected to disrupt this cycle by reducing or eliminating parasite load, thereby preventing chronic blood loss and improving the absorption of essential nutrients such as iron, folate, and vitamin B12. The higher hemoglobin values in the deworming group underscore the effectiveness of this intervention. Although some children in the deworming group still had hemoglobin values close to the lower limit of normal, this may be influenced by factors such as dietary intake, socioeconomic conditions, or coexisting infections. Nonetheless, the overall trend clearly favors routine deworming as a protective factor for maintaining adequate hemoglobin levels (Salsabila, 2025).

Another notable aspect of the findings is that the control group exhibited a narrower range of hemoglobin values but with lower mean levels. This suggests that even in the absence of routine deworming, children may consistently experience low-level nutrient deficiencies or recurrent parasitic infections (Shokeen, Pooja and Neeraj, 2025). Such conditions could lead to subtle but persistent reductions in hemoglobin levels. The fact that some children in the deworming group had slightly reduced hemoglobin values suggests that deworming alone may not be sufficient to address hematological deficits fully (Subahar *et al.*, 2020). Comprehensive nutritional

interventions, improved sanitation, and health education remain essential components of an effective public health strategy. The results of this study are consistent with previous research, which demonstrates that routine deworming improves hemoglobin levels and supports healthier metabolic function in children. Studies conducted in Indonesia, Bangladesh, and African regions have similarly reported significant improvements in lipid and hematological parameters following deworming interventions. These studies collectively emphasize that deworming not only reduces parasitic burden but also contributes to improved nutrient absorption and overall physiological stability.

Nevertheless, this study has limitations that should be acknowledged. The sample size was relatively small, and parasitic infection status was not independently confirmed at the time of data collection, which limits the ability to attribute changes solely to helminth status. Dietary patterns, socioeconomic factors, and environmental conditions were also not assessed, although these factors are known to influence both cholesterol and hemoglobin levels. Despite these limitations, the observed trends provide valuable evidence supporting the health benefits of routine deworming. The findings highlight that routine deworming plays a significant role in maintaining healthy cholesterol and hemoglobin levels among school-aged children. By reducing parasitic burden and improving nutrient absorption, deworming contributes to better metabolic and hematological outcomes. These results reinforce the importance of deworming programs as part of public health interventions aimed at improving child health, particularly in areas where helminth infections remain prevalent.

CONCLUSION

The study demonstrates that routine deworming has a positive impact on the metabolic and hematological health of school-aged children. Children who regularly consumed deworming medication showed lower and more stable cholesterol levels, as well as higher hemoglobin concentrations, compared to the control group. These findings suggest that reducing the parasitic burden supports improved nutrient absorption and overall physiological balance. Based on these results, it is recommended that school-based deworming programs be maintained and strengthened, especially in areas where helminth infections remain common. Additionally, complementary efforts such as improving nutrition, promoting hygiene practices, and conducting periodic health monitoring are essential to maximize the benefits of deworming and ensure sustained improvements in child health.

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Conflict of Interest

There are no potential conflicts of interest relevant to this article.

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