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EFFECT OF DIFFERENT SUTURE MATERIALS AND TECHNIQUES ON GASTRIC WALL TISSUE HEALING IN GASTROTOMY SURGERY IN DOGS

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ABSTRACT
Background: Helminth infections remain a relevant health problem among preschool children, particularly in the Khorezm region. Objective: To assess the clinical and biochemical profile associated with parasitological findings in preschool-aged boys. Methods: The study included 45 boys aged 1–7 years. Questionnaire data, anthropometric parameters, hematological and biochemical tests, coagulation indicators, and parasitological records were analyzed. Results: Parasitological agents were recorded in 91.1% of children, most commonly Enterobius vermicularis and Ascaris lumbricoides. Most source-reported severity classifications were mild, and mixed parasitological findings were frequent. Hemoglobin, total protein, and calcium values below the thresholds used in the source tables were also observed. Conclusion: Parasitological findings were frequent in this local cohort and were accompanied by hematological and metabolic abnormalities. Because the analysis was based on a small boys-only sample and on source records with incomplete agent-specific diagnostic documentation, the findings should be interpreted as preliminary and should not be generalized as regional prevalence estimates.

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Keywords: *helminth infections, parasitic diseases, preschool children, Khorezm region, Enterobius vermicularis, Ascaris lumbricoides, mixed parasitic infections, hemoglobin, biochemical markers, parasitological screening.*

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Introduction

Helminth infections and intestinal parasitic diseases remain among the most widespread infectious conditions affecting children in many regions of the world. Soil-transmitted helminth infections are acquired through exposure to infective stages associated with contaminated soil, food, or water, whereas enterobiasis is efficiently maintained by close contact and contaminated hands, bedding, toys, and household surfaces. Children in organized preschool settings may be particularly vulnerable because of close contact, shared objects, and incompletely developed personal hygiene habits (Centers for Disease Control and Prevention, 2024a, 2024b; Hotez et al., 2008; Wendt et al., 2019; World Health Organization, 2023).

The clinical significance of helminth infection extends beyond identification of the causative agent. Helminth infections may adversely influence nutritional status through iron and protein loss, impaired nutrient absorption, reduced appetite, intestinal inflammation, and lower physical activity. These mechanisms are particularly important in childhood, when growth and neurodevelopment depend on

adequate nutrition and metabolic stability (Bethony et al., 2006; Jourdan et al., 2018; World Health Organization, 2023).

Environmental and household conditions can influence the persistence and transmission of intestinal parasites. Sanitation, safe water access, hygiene behavior, and repeated exposure are important determinants of fecal–oral transmission and reinfection. Evidence from systematic reviews supports the relevance of water, sanitation, and hygiene measures in reducing soil-transmitted helminth exposure, although local epidemiological patterns can differ by setting (Freeman et al., 2017; Strunz et al., 2014; UNICEF & World Health Organization, 2025).

Laboratory findings in parasitic diseases require cautious interpretation. Eosinophilia may be absent in chronic or predominantly intestinal infection, while reduced hemoglobin, total protein, or altered mineral values may reflect nutrition, inflammation, dietary factors, concomitant disease, or parasitic infection. Laboratory markers therefore should be interpreted as components of an integrated clinical and parasitological assessment rather than as stand-alone diagnostic criteria (Bethony et al., 2006; Else et al., 2020; Wendt et al., 2019).

The scientific and practical value of the present study lies in the description of a local cohort of preschool boys, with emphasis on parasitological findings and the accompanying hematological, biochemical, and coagulation profile. Given the study design and available source documentation, the results are interpreted as descriptive and hypothesis-generating.

Aim of the Study

The aim of the study was to investigate the clinical and biochemical characteristics associated with helminth infections and other intestinal parasitic findings in preschool-aged boys living in the Khorezm region and to identify laboratory markers that may have additional diagnostic and monitoring value.

Materials and Methods

Study design and setting

This observational analytical study was based on secondary analysis of a fragment of the examination database collected at Preschool Educational Institution No. 39 in Urgench, Khorezm region. The study focused on medical, sanitary, clinical, anthropometric, parasitological, hematological, biochemical, and coagulation characteristics recorded in the source database.

Study population

The sample consisted of 45 boys aged 1–7 years. Within this manuscript, the term “preschool-aged” is used operationally for the boys represented in the participating preschool institution and does not imply use of a separate international age classification. The final analysis included children whose records contained the key examination components required for the study: questionnaire data, anthropometric measurements, complete blood count, biochemical blood analysis, and parasitological examination. Because the sample was limited and included only boys, the results are considered preliminary and descriptive rather than estimates for the entire preschool population of the Khorezm region.

Clinical and anthropometric assessment

The examination program included collection of demographic and questionnaire information, assessment of place of residence, and anthropometric measurements. Body weight, height, and body mass index were analyzed descriptively as indicators of physical development. Anthropometric z-scores were not available in the source database and were not retrospectively generated; therefore, no standardized nutritional-status categories were assigned. Future age-standardized analyses should use the WHO Child Growth Standards for children up to 5 years and the WHO growth reference for children older than 5 years (de Onis et al., 2007; World Health Organization, 2006).

Laboratory assessment

Hematological, biochemical, and coagulation tests were performed at the private clinic “Elizavita.” The assessed indicators included hemoglobin concentration, erythrocyte count, hematocrit, platelet count,

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leukocyte count, leukocyte differential, erythrocyte sedimentation rate, total protein, glucose, urea, creatinine, total bilirubin and its fractions, alanine aminotransferase, aspartate aminotransferase, calcium, and selected hemostasis indicators. Frequencies of abnormal values were retained exactly as classified in the original source tables; no age-specific reclassification was performed. Accordingly, these frequencies should be interpreted as source-threshold classifications rather than standardized clinical prevalence estimates. This is particularly important for hemoglobin, for which age-specific interpretation is recommended in current WHO guidance (World Health Organization, 2024).

Parasitological assessment and source-data constraints

The source database recorded parasitological examination performed at the regional Sanitary and Epidemiological Service and contained the presence or absence of parasitic agents, the named agent, the number of agents recorded in each child, and source-reported severity categories. The database fragment available for this secondary analysis did not preserve the specimen-specific or agent-specific diagnostic protocol for every reported organism, and no independent re-identification was possible. Therefore, all parasitological labels and severity categories are reproduced as recorded in the source dataset without reclassification. This limitation is relevant because standard diagnostic approaches differ by organism: the perianal tape test is the most common diagnostic method for *Enterobius vermicularis*, whereas *Toxocara* eggs are not expected in human stool and suspected human toxocariasis is evaluated primarily by clinical and serologic criteria (Centers for Disease Control and Prevention, 2024c; Centers for Disease Control and Prevention, n.d.). For dataset classification, mixed parasitological findings were defined as simultaneous recording of two or more agents in one child.

Statistical analysis

Descriptive statistics included absolute and relative frequencies, mean values with standard deviation (M ± SD), and median with interquartile range Me (Q1–Q3). Spearman's rank correlation coefficient was used to assess relationships between the number of recorded parasitic agents and selected laboratory parameters. The source analysis used $p < .05$ as the nominal significance threshold. Because the study was exploratory, the sample was small, and no adjustment for multiple comparisons was applied, p values are interpreted cautiously and alongside effect size and clinical relevance (Wasserstein et al., 2019).

Results

General characteristics of the examined group

The examined children were residents of the Khorezm region. In the analyzed dataset, the largest proportions of participants came from Urgench city and from the Urgench, Khanka, Khiva, and Koshkupyr districts. The mean age of the participants was 4.3 ± 1.7 years, and the median age was 4.0 years (3.0–6.0). The mean body weight was 19.6 ± 5.9 kg, the mean height was 106.8 ± 20.5 cm, and the mean body mass index was 17.1 ± 3.4 kg/m² (Table 1).

Table 1. Characteristics of the examined group

Indicator	Value
Number of children	45
Sex	Boys - 45 (100%)
Age, years	4.3 ± 1.7; Me 4.0 (3.0-6.0)
Body weight, kg	19.6 ± 5.9; Me 19.0 (15.0-25.0)
Height, cm	106.8 ± 20.5; Me 107.0 (95.0-127.0)
Body mass index, kg/m²	17.1 ± 3.4; Me 16.2 (15.0-18.8)

Parasitological findings

Parasitological agents were recorded in 41 of 45 children, corresponding to 91.1% of the examined group. In 4 children (8.9%), no parasitic agents were identified in the submitted samples. A total of 76

parasitological findings were recorded because some children had mixed findings. *Enterobius vermicularis* was recorded in 28 cases (62.2%), *Ascaris lumbricoides* in 24 children (53.3%), *Hymenolepis spp.* in 11 children (24.4%), *Giardia/Lamblia intestinalis* in 9 children (20.0%), and *Toxocara spp.* in 4 children (8.9%) (Table 2, Figure 1).

Table 2. Distribution of parasitic agents and source-reported severity classification

Parasitic agent	n	% of 45	Mild	Moderate	Severe
Enterobius vermicularis	28	62.2	26	2	0
Ascaris lumbricoides	24	53.3	19	5	0
Hymenolepis spp.	11	24.4	11	0	0
Giardia/Lamblia intestinalis	9	20.0	8	1	0
Toxocara spp., total	4	8.9	4	0	0

Note. Agent names, counts, percentages, and Mild/Moderate/Severe categories are reproduced from the author-provided source data. Parasite-specific quantitative egg counts and the criteria used to assign severity categories were not available for independent verification.

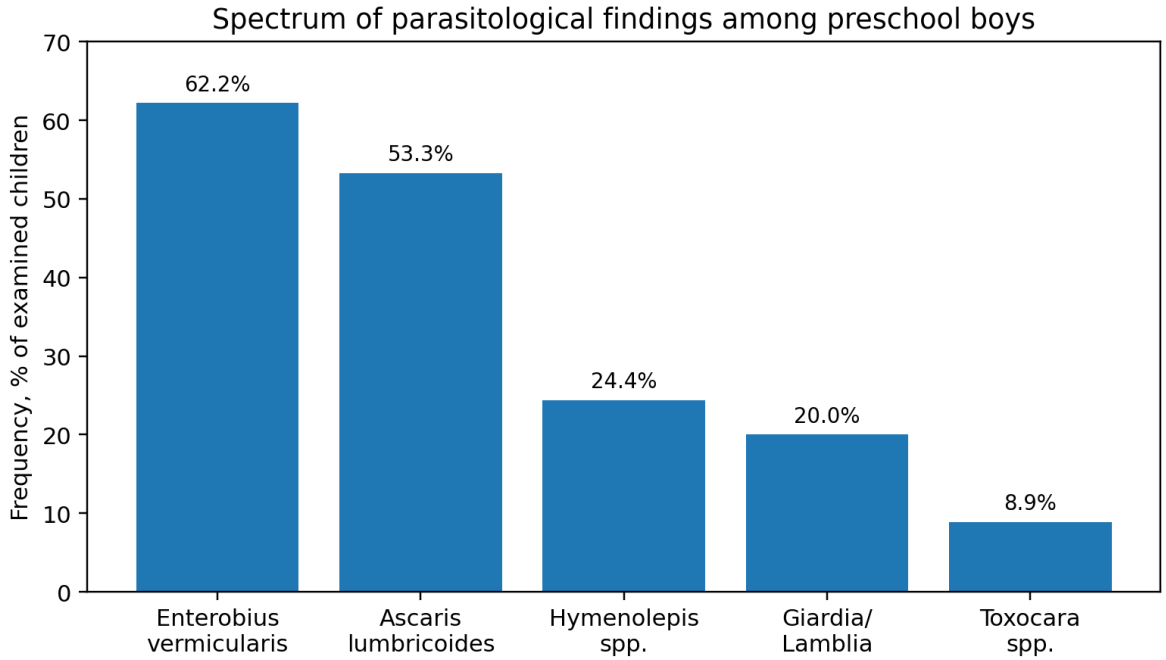


Figure 1. Spectrum of parasitological findings among the examined children

Source-reported intensity and mixed parasitological findings

In the source dataset, most recorded findings were classified as mild. Mild classification accounted for 68 of 76 parasitological findings (89.5%). Moderate classification was recorded in 8 cases (10.5%), including 2 cases of enterobiasis, 5 cases of ascariasis, and 1 case of giardiasis. No severe cases were recorded. Two agents were recorded in 29 children (64.4%), and three agents were recorded simultaneously in 3 children (6.7%) (Table 3). Because quantitative egg counts and classification criteria were not available, these categories are reported descriptively and should not be interpreted as independently verified infection-intensity grades.

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Table 3. Distribution of parasitological findings by number of agents

Parasitological result category	n	%
No parasitic agents detected	4	8.9
One parasitic agent detected	9	20.0
Two parasitic agents detected	29	64.4
Three parasitic agents detected	3	6.7

Hematological profile

The mean hemoglobin concentration was 98.2 ± 10.6 g/L, and the median was 100.0 g/L (90.0–105.0). Hemoglobin was classified as reduced in 37 children (82.2%) according to the source-table threshold. The mean platelet count was 237.6 ± 80.0 ×10⁹/L; values below 180 ×10⁹/L were recorded in 7 children (15.6%), while values above 320 ×10⁹/L were recorded in 9 children (20.0%). The mean leukocyte count was 5.6 ± 1.8 ×10⁹/L; values below 4.0 ×10⁹/L and above 9.0 ×10⁹/L were each found in 2 children (4.4%). The mean eosinophil percentage was 1.7 ± 2.0%, and values above 5% were found in 4 children (8.9%). ESR values above 10 mm/h were recorded in 16 children (35.6%) (Table 4).

Table 4. Hematological parameters

Parameter	M ± SD	Me (Q1-Q3)	Frequency of abnormalities, n (%)
Hemoglobin, g/L	98.2 ± 10.6	100.0 (90.0-105.0)	37 (82.2)
Platelets, ×10⁹/L	237.6 ± 80.0	193.0 (184.0-310.0)	<180: 7 (15.6); >320: 9 (20.0)
Leukocytes, ×10⁹/L	5.6 ± 1.8	4.7 (4.1-7.0)	<4.0: 2 (4.4); >9.0: 2 (4.4)
Eosinophils, %	1.7 ± 2.0	0.9 (0.6-1.4)	>5%: 4 (8.9)
ESR, mm/h	21.7 ± 32.0	2.5 (2.1-14.2)	>10 mm/h: 16 (35.6)

Note. Abnormality frequencies are reproduced from the thresholds used in the source tables and were not reclassified by age.

Biochemical profile

The mean total protein level was 63.6 ± 7.4 g/L, with a median of 64.2 g/L (60.2–67.4). A total protein level below 60 g/L was recorded in 11 children (24.4%). The mean glucose level was 4.8 ± 1.0 mmol/L; values below 3.3 mmol/L were recorded in 2 children (4.4%), while values above 5.5 mmol/L were recorded in 9 children (20.0%). Total bilirubin averaged 17.0 ± 3.9 µmol/L, and values above 20.5 µmol/L were found in 7 children (15.6%). ALT values above 35 U/L were recorded in 6 children (13.3%), while AST values above 35 U/L were recorded in 1 child (2.2%). Calcium levels below 2.0 mmol/L were found in 17 children (37.8%) (Table 5).

Table 5. Biochemical characteristics

Parameter	M ± SD	Me (Q1-Q3)	Frequency of abnormalities, n (%)
Total protein, g/L	63.6 ± 7.4	64.2 (60.2-67.4)	<60 g/L: 11 (24.4)
Glucose, mmol/L	4.8 ± 1.0	4.6 (4.1-5.4)	<3.3: 2 (4.4); >5.5: 9 (20.0)
Urea, mmol/L	4.8 ± 4.1	3.2 (2.5-6.3)	Variability of values
Creatinine, µmol/L	52.2 ± 17.7	53.2 (38.0-68.0)	No group-level interpretation
Total bilirubin, µmol/L	17.0 ± 3.9	16.2 (14.2-19.8)	>20.5: 7 (15.6)
ALT, U/L	25.8 ± 8.0	24.0 (21.0-30.0)	>35: 6 (13.3)
AST, U/L	19.3 ± 5.5	19.0 (15.6-22.0)	>35: 1 (2.2)
Calcium, mmol/L	2.1 ± 0.2	2.0 (2.0-2.2)	<2.0: 17 (37.8)

Note. Threshold-based frequencies are reproduced from the source tables. Fasting status and age-specific biochemical reference intervals were not available for reclassification.

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Coagulation profile

The coagulation profile included activated partial thromboplastin time, prothrombin time, prothrombin index, international normalized ratio, thrombin time, fibrinogen, and D-dimer. The results showed considerable interindividual variability. The source data contained heterogeneous measurement documentation; therefore, these parameters are presented descriptively and were not used for diagnostic classification or inferential analysis (Table 6).

Table 6. Coagulation parameters

Parameter	M ± SD	Me (Q1-Q3)
Activated partial thromboplastin time (APTT), s	23.7 ± 4.8	24.0 (20.0-26.0)
Prothrombin time (PT), s	10.0 ± 2.6	9.2 (8.2-11.3)
Prothrombin index (PTI), %	131.9 ± 25.4	130.0 (110.0-150.0)
International normalized ratio (INR)	0.8 ± 0.1	0.8 (0.7-0.9)
Thrombin time, s	14.6 ± 4.0	14.0 (12.0-16.0)
Fibrinogen	5.9 ± 1.3	5.7 (4.8-6.4)
D-dimer, μg/mL	1.0 ± 0.2	0.9 (0.8-1.1)

Note. Values are reproduced unchanged from the source data. The fibrinogen unit was not specified in the available source table and has not been inferred or added.

Correlation analysis

The number of parasitic agents recorded in an individual child showed a weak positive correlation with total bilirubin level (rho = 0.31; p = .040). The association with hemoglobin level was weak and statistically insignificant (rho = -0.06; p = .678), and the correlation with eosinophil percentage was also weak and statistically insignificant (rho = 0.15; p = .324) (Table 7). Because three correlations were examined and no multiplicity adjustment was applied, the p = .040 result is interpreted as exploratory rather than confirmatory.

Table 7. Correlation between parasitic burden and selected laboratory indicators

Compared variables	Spearman rho	p value	Interpretation
Number of parasitic agents and total bilirubin	0.31	.040	Weak positive association
Number of parasitic agents and hemoglobin	-0.06	.678	Weak, statistically insignificant
Number of parasitic agents and eosinophils	0.15	.324	Weak, statistically insignificant

Note. p values are unadjusted for multiple comparisons. The reported rho values and p values are author-provided data and are reproduced unchanged.

Discussion

The present study showed a high frequency of parasitological findings in this local cohort of preschool boys. *Enterobius vermicularis* and *Ascaris lumbricoides* were the most frequently recorded agents. Their prominence is epidemiologically plausible because enterobiasis is readily maintained in close-contact groups, whereas ascariasis and other soil-transmitted helminth infections are associated with fecal–oral exposure to contaminated soil, food, or water (Centers for Disease Control and Prevention, 2024a, 2024b; Wendt et al., 2019; World Health Organization, 2023).

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The parasitological results must nevertheless be interpreted in light of the source-record limitations. The available database did not retain the agent-specific diagnostic technique for every entry. This is particularly important for the recorded *Enterobius vermicularis* and *Toxocara spp.* findings. Standard practice commonly uses a perianal tape test for *Enterobius vermicularis*, while human toxocariasis is not established by detection of *Toxocara* eggs in human stool because humans do not harbor egg-producing adult worms; clinical and serologic assessment is used instead (Centers for Disease Control and Prevention, 2024c; Centers for Disease Control and Prevention, n.d.). The present analysis therefore preserves the author-provided labels but treats them as laboratory-recorded findings rather than independently revalidated species diagnoses.

Mixed parasitological findings were common: two agents were recorded in almost two thirds of children and three agents in a smaller subgroup. Mixed findings may reflect repeated exposure to different transmission routes and can complicate interpretation of symptoms and laboratory abnormalities. The source dataset also classified most findings as mild, but quantitative egg counts and parasite-specific classification criteria were not available. Consequently, the mild and moderate categories should be regarded as source-reported descriptors rather than independently verified measures of infection intensity.

Anthropometric measurements provided useful descriptive context, but the absence of age-standardized z-scores limits nutritional interpretation. Because the sample spans ages 1–7 years, standardized future analyses should use the WHO Child Growth Standards for children up to age 5 and the WHO 5–19-year growth reference for older children (de Onis et al., 2007; World Health Organization, 2006).

The hematological profile was notable for the high proportion of children whose hemoglobin values fell below the threshold used in the source tables. However, this 82.2% frequency should not be interpreted as an age-standardized estimate of anaemia prevalence because the source analysis did not apply current age-specific WHO haemoglobin cutoffs. Helminth infections can contribute to anemia through nutritional loss, inflammation, reduced intake, and impaired absorption, but anemia in children is multifactorial and requires assessment of iron status, ferritin, inflammatory markers, diet, growth, and concomitant disease (Bethony et al., 2006; World Health Organization, 2024).

Eosinophilia above the source threshold was recorded in only 8.9% of children despite the high frequency of parasitological findings. This supports cautious use of eosinophil percentage as an auxiliary rather than stand-alone screening marker, because eosinophilia may be absent in chronic or predominantly intestinal helminth infection (Else et al., 2020; Wendt et al., 2019).

Biochemical findings included total protein below 60 g/L in 24.4% of children and calcium below 2.0 mmol/L in 37.8%. These abnormalities may reflect diet, nutritional status, malabsorption, inflammation, concomitant disease, or parasitic infection and therefore cannot be attributed to parasites alone. The weak positive correlation between number of recorded parasitic agents and total bilirubin (rho = 0.31; p = .040) should be considered exploratory, particularly because the analysis involved multiple correlations without multiplicity adjustment.

The coagulation data were descriptive only. Heterogeneous source documentation and the absence of a recorded fibrinogen unit limit clinical interpretation and preclude standardized comparison. These values should therefore be treated as descriptive source data rather than evidence of a specific coagulation disorder.

From a public-health perspective, the findings support continued attention to hygiene education, sanitation, safe water and food handling, appropriate case management, and locally appropriate parasitological surveillance. However, this single-institution, boys-only sample of 45 children does not establish regional prevalence and should not by itself be used to justify region-wide screening or treatment policy. Population-level control decisions should be informed by representative epidemiological surveys

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and established WHO criteria (Campbell et al., 2016; Montresor et al., 2020; World Health Organization, 2021, 2023).

Limitations

The study has several limitations. The sample was small, included boys only, and was drawn from one preschool organization. There was no control group. Information on nutritional status, recent antiparasitic treatment, repeated parasitological testing, iron metabolism, inflammatory markers, and vitamin D status was limited or unavailable. The database fragment did not preserve agent-specific parasitological protocols for every reported organism, and the source severity categories could not be independently verified by quantitative egg counts. Laboratory abnormalities were classified using source-table thresholds rather than age-standardized reference ranges. Coagulation documentation included heterogeneous measurement information, with no fibrinogen unit available in the source table. Finally, the correlation analysis was exploratory and did not adjust p values for multiple comparisons.

Practical Implications and Future Directions

For clinical practice within comparable preschool settings, parasitological findings should be interpreted together with symptoms, exposure history, anthropometric status, and laboratory findings rather than by any single marker. Hygiene education should emphasize handwashing, nail care, individual towels, clean bedding, and safe handling of food and water. Children with parasitological findings and abnormal hematological or biochemical values should receive appropriate clinical evaluation and nutritional assessment. Future regional studies should include larger mixed-sex cohorts from multiple institutions and districts, repeated and agent-appropriate parasitological testing, standardized anthropometric z-scores, age-specific laboratory interpretation, iron and mineral metabolism markers, inflammatory markers, and follow-up after intervention.

Conclusion

1. In the analyzed dataset, parasitological findings were recorded in 91.1% of the 45 examined boys.

2. The most frequently recorded agents were *Enterobius vermicularis* and *Ascaris lumbricoides*. Two agents were recorded in 64.4% of children and three agents in 6.7%.

3. According to the thresholds used in the source tables, reduced hemoglobin was recorded in 82.2% of children, total protein below 60 g/L in 24.4%, and calcium below 2.0 mmol/L in 37.8%.

4. Eosinophilia above 5% was recorded in 8.9% of children, indicating that eosinophil percentage alone was not a sensitive marker of parasitological findings in this cohort.

5. Correlation analysis showed a weak positive association between number of recorded parasitic agents and total bilirubin (rho = 0.31; p = .040), while correlations with hemoglobin and eosinophils were weak and statistically insignificant. Because no multiple-comparison adjustment was applied, the bilirubin finding should be considered exploratory.

6. The results support integrated clinical, parasitological, anthropometric, and laboratory assessment, while larger standardized studies are required before regional prevalence estimates or population-level policy recommendations can be made.

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