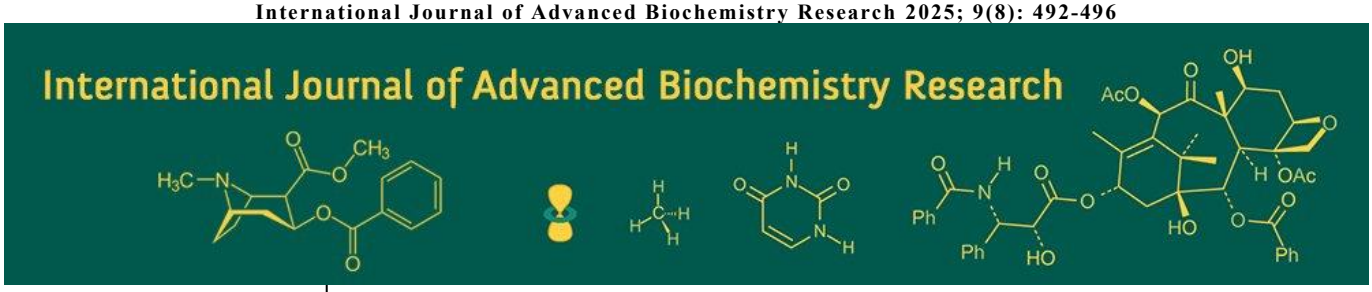

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Impact of *Enterobius vermicularis* infection on some blood parameters in children from Hilla City

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Abstract
Enterobiasiss is a gastrointestinal infection caused by the intestinal helminthic parasite *E. vermicularis*. Compared to adults, children are more prone to infection. The research aimed to investigate the rate of *E. vermicularis* infection in children in Hilla City according to specific blood parameters and demographic characteristics.
This investigation involved 180 children, consisting of 90 males and 90 females. The Scotch tape identified an infection in the children, who ranged in age from 2 to 12.
Samples were collected using standard methods. Biochemical and hematological tests were performed to evaluate hemoglobin, hematocrit, white blood cells, total protein, albumin, and serum iron levels on venous blood samples. According to the results, children under the age of eight had the largest number, while those over ten had the lowest. Results showed that the most common clinical symptom was anal itching, 58.5% (31/53), followed by abdominal pain, 41.5% (22/53), and then loss of appetite, 28.3% (15/53). The symptoms of sleep disturbances and the normal symptoms were less common, appearing in 10 and 8 cases. The findings indicated that hemoglobin levels were severely impacted by pinworm infection and that there was a significant difference between the infected and non-infected groups. Hemoglobin levels were lower in the infected group in contrast to the control group; approximately 60.3% of infected children had hemoglobin levels below normal (mild anemia). Hematocrit values were reduced in the infected group compared to the control, significantly. Serum iron is lower in the infected group compared to the control. Total protein content in blood and albumin was slightly but significantly reduced in infected children.

Keywords: Blood parameters, *Entrobius vermicularis*, anima, children, Iraq

Introduction
Entrobius vermicularis was originally described by Karl Linnaeus in 1758, when he termed it Oxyuris *vermicularis* [1]. In the past, the medical condition was referred to as oxyriasis. In addition to DNA samples from ancient human residues of coprolite from North and South America, *Entrobius vermicularis*, the earliest known parasite, was discovered in mummified human remains from ancient Egypt [2]. Hugot described E. gregoii, a second human-infecting species of Entamoeba *vermicularis*, in 1983 [3]. At least 200 million individuals worldwide are thought to be infected, mostly children [4]. Inadequate personal hygiene, unsanitary surroundings, and tainted food are linked to an epidemic of *E. vermicularis* infection [5]. Parasites need resources to perform vital tasks like growth and reproduction, and they are reliant on their host for existence. In essence, lipids, amino acids, and carbs are the nutrients needed from the host [6]. According to Fan *et al*. (2019), mature females measure around 8–13 mm, whereas adult males measure 2–5 mm. Both ends of the female are pointy, and her diameter is somewhat less than 1 mm [7]. One spicule, measuring between 100 and 141 µm and with posterior ends that are significantly curled ventrally, is what distinguishes males. The papillae support the noticeable caudal alae. Pinworms get their name from the way the rear end of females is stretched into a long, thin point. The lonesome vagina, leading to the paired uteri, oviducts, and ovaries, is where the vulva opens between the first and second thirds of the body [8, 9]. According to several studies, the pinworm infection causes significant alterations in the biochemistry of blood as well as other elements including white blood cells, red blood cells, immunological components like cytokines and other enzymes, and minerals [11, 12].

The current investigation is to ascertain the primary impact of pinworm infection on blood parameters as well as the relationship between infection and infant age.

Methods

Gathering and analyzing samples of cellophane tape:

The children's anal and perianal regions were repeatedly pressed with the adhesive side of the tape to gather samples. The tape was then adhered to the labeled glass slide, placed within a sterile, clean nylon envelope, and securely sealed. With the assistance of the mothers of the children, this technique was used at early morning or night in the prior to bathing, using the restroom, or defecating [12, 13]. The samples were brought to the Microbiology Laboratory at Babylon University's College of Science, where they were examined using a light microscope (1000x). For the purpose of gathering and testing the blood sample, 180 children had four milliliters of venous blood extracted; 67 of these children had enterobiasis (enterobiasis -positive group), whereas 25 did not (enterobiasis-negative group). The samples were collected at Hilla Teaching Hospital. The blood samples were obtained in test tubes that had not been heparinized [14]. and transported to the Microbiology Laboratory of the College of Science, and they were centrifuged at 3000 rpm for 5 min. Samples are divided into two categories of tubes EDTA tubes for hematological parameters and plain tubes for serum separation. After letting the serum samples coagulate for 20 to 30 min at room temperature, they were centrifuged for 10 min at 3000 rpm. Before being subjected to biochemical examination, the separated serum was aliquoted into labeled Eppendorf tubes and kept at -20 °C. Using the Sysmex XN-Series automated hematology analyzer, hematological parameters such as hemoglobin (g/dL) and hemocrit (%) were analyzed [9].

The same device was also used to study white blood cells (WBCs, $\times 10^3/\mu L$) using flow cytometry-based counting. The following biochemical parameters were evaluated: The Biuret technique was used to calculate the total protein (g/dL). The Bromocresol Green (BCG) dye-binding technique was used to assay albumin (g/dL). The Ferrozine-based colorimetric technique is used to quantify serum iron levels (µg/dL). In accordance with the guidelines provided by the manufacturers, all biochemical tests were carried out using a fully automated clinical chemistry analyzer (Roche Cobas c311) and standardized diagnostic kits from globally renowned manufacturers [15].

A completely automated hematology analyzer based on the automated microhematocrit technique and the cyanmethemoglobin method was utilized to test hemoglobin and hematocrit, respectively. Using flow cytometry or impedance-based detection with an automated hematology analyzer, white blood cells (WBCs) are identified. The Biuret technique and the Bromocresol Green (BCG) method were used to quantify total protein and albumin, respectively. Serum Iron: Determined in accordance with the manufacturer's instructions using a colorimetric test based on ferrocyanine [16].

Every day, quality control measures were put in place to guarantee the precision and repeatability of the outcomes. Babylon University provided the principals of the foundations where the research sample was conducted with a supporting official letter. The foundations' principals provided written consent, and the parents of the children who participated gave their verbal consent. Following an explanation of the ailment, the sample procedure, the study, and its significance for the children's health, the parents were briefed on the test results. Parents were assured that the information collected would be utilized exclusively for the study and would not be used for any other reason. statistical analysis and data input. The Statistical Package for Social Sciences (SPSS) version 22.0 was used to code the gathered data using a newly created coding scheme. The chi-square test was used to examine and evaluate the relationship between the two variables in this investigation. The counting numbers and percentages of various variables were described using frequency analysis. The difference between the two groups based on serum parameters was examined using the t-test. The threshold for statistical significance was set at $P< 0.05$.

Results

The prevalence of pinworm infection was 29.4% (53/180) using the cellophane tape method, slightly higher among females, 37.8% (34/90), compared with males, 21.1% (19/90), However, significant ($P< 0.05$). (Table 1)

Table 1: The total rate of infection with *E. vermicularis*

Sex	No. of samples	Positive	Percentage
Female	90	34	37.8%
male	90	19	21.1%
total	180	53	29.4%

*P-value = 0.371 (NS)

Incidence of *E. vermicularis* infection according to age group

The results showed that the overall infection rate of the parasite *E. vermicularis* among children aged 2 to 12 years was 29.4% (53/180). When analyzing the results by age group and gender, variations in infection rates were observed. Females between the ages of two and four had the highest infection rate, at 48% (12/25) males was 20% (6/30).at age between five to eight femals infaction rate was 37.1% (15/35), males 23.3% (7/30). However, when using the Chi -square test to analyze the significance of the differences between genders and different age groups, it was found that these differences were not statistically significant ($P< 0.05$). (Table 2)

Table 2: Incidence of *E. vermicularis* infection according to age group

Age (years)	Sex	No. of samples	Positive	Percentage
2 - 4	Female	25	12	48%
	Male	30	6	20%
5 - 8	Female	35	13	37.1%
	Male	30	7	23.3%
9 - 12	Female	30	9	30%
	Male	30	6	20%
Total	-	180	53	29.4%

Incidence of *E. vermicularis* infection according to clinical symptoms

As shown in (Table 3), a study of symptoms that are common in parasitic infections. The most common symptom was anal itching (seen in 31 of the 53 simple cases). Abdominal pain followed (22 cases), then loss of appetite (15 cases). The symptoms of sleep disturbances and the normal symptoms were less common, appearing in 10 and 8

cases, respectively. Some children showed more than one symptom, so the total percentages exceed 100%. There was no statistically significant difference for any of the symptoms studied all values (P< 0.05).

Table 3: Incidence of *E. vermicularis* infection according to clinical symptoms

Clinical presentation	No. of infected samples	The percentage of total infections n=53
Anal itching	31	58.5%
Abdominal pain	22	41.5%
Loss of appetite	15	28.3%
Sleep disturbances	10	18.9%
Without symptoms	8	15.1%

Serum levels of selected biochemical parameters:

As shown in (Table 4), the study showed statistically significant differences between children infected and uninfected with *E. vermicularis* in several biochemical parameters. Significant decreases were observed in hemoglobin, hematocrit, total protein, albumin, and serum iron levels in infected children ($p \leq 0.005$), indicating the impact of the infection on nutritional status and the presence of signs of anemia. However, there were notable variations in the two groups' white blood cell counts ($p = 0.052$).

The distribution of *E. vermicularis* infection across different age groups revealed notable patterns. The highest prevalence was observed among children aged 2–4 years. Although the differences in infection rates across age groups were not statistically significant in this study ($P< 0.005$) the observed trend supports previous research suggesting that age is a relevant risk factor for *E. vermicularis* infection. The gradual rise in prevalence from preschool to primary school ages highlights the need for targeted educational and preventive interventions, particularly in school environments. Among the infected children (n = 53), the most frequently reported symptom was perianal itching, observed in 28 cases (52.8%). Abdominal pain was present in 21 cases (39.6%), while sleep disturbances and irritability were reported in 17 (32.1%) and 15 (28.3%) cases, respectively.

Despite the higher frequency of these symptoms among infected individuals compared to non-infected children, statistical analysis revealed no significant associations ($p< 0.05$) for all symptoms. The comparative analysis of biochemical markers between infected (n = 53) and non-infected (n = 127) children revealed significant differences in several parameters. Haemoglobin levels were lower in infected children (mean: 11.5 ± 1.2 g/dL) compared to non-infected (11.9 ± 1.0 g/dL), with a highly significant difference (P =0.001) .Approximately 60.3% of infected children had haemoglobin levels below the normal threshold. Haematocrit values were similarly reduced in the infected group (35.1 ± 2.6%) compared to controls (36.0 ± 2.4%) ($p = 0.001$). Serum Iron levels were significantly lower in the infected group (55.0 ± 10.5 µg/dL vs. 60.5 ± 9.2 µg/dL ;$p = 0.000$,(and nearly 57% of infected children showed levels suggestive of iron deficiency. Total Protein and Albumin levels were slightly but significantly reduced in infected children (6.5 ± 0.4 g/dL and 3.9 ± 0.3 g/dL) compared to non-infected (6.6 ± 0.3 g/dL) and (4.0 ± 0.2 g/dL), with p-values of 0.002 and ,0.000 respectively. In contrast, White Blood Cell (WBC) counts showed a slight elevation in the infected group (8.2 ± 1.4 $\times 10^3/\mu L$ vs. 7.9 ± 1.3 $\times 10^3/\mu L$), but the difference was not statistically significant ($p = 0.052$).

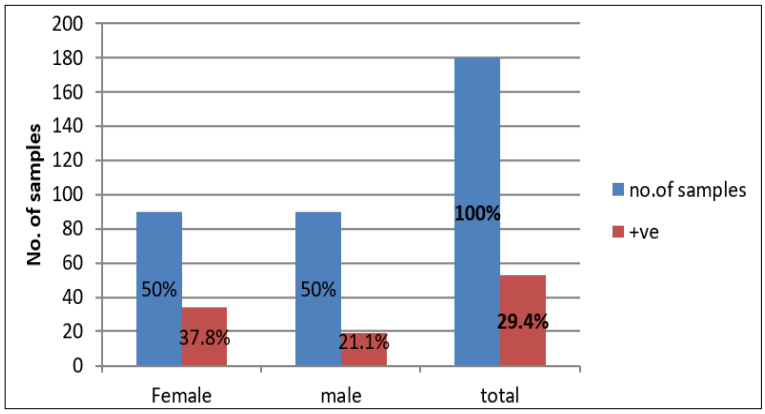

Fig 1: The total infection rate of *E. vermicularis*

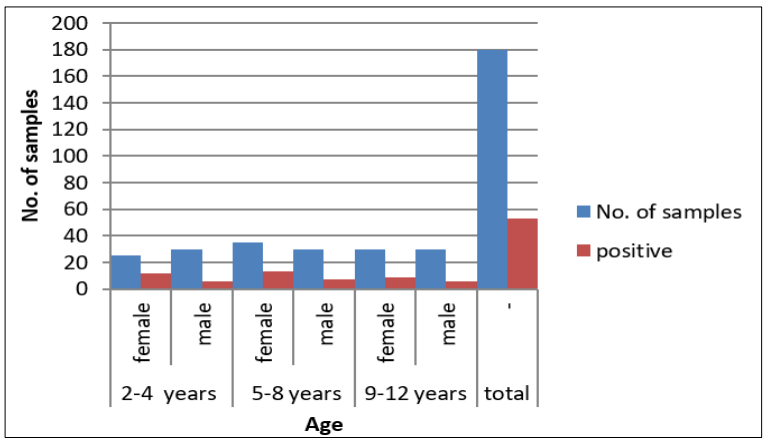

Fig 2: Incidence of *E. vermicularis* infection according to age group

Discussion

Parasitic infection remains a significant concern on public health, particularly among children in developing countries , with pinworm being a common intestinal nematod [12]. Of all the populations, children are the most vulnerable to parasite infection [17]. They could also be carriers without any symptoms, This could be more dangerous and represent certain public health issues. The moderate prevalence of *E. vermicularis* (29.4%) among children in Hilla City is consistent with findings from other developing regions [7]. Although females showed a slightly higher infection rate, the difference was not statistically significant, suggesting that gender alone may not be a determining factor. Likely due to shared behavioural and environmental exposures. Similar findings have been reported in previous studies that supported the notion that gender does not play a significant role in susceptibility [9]. The distribution of *E. vermicularis* infection across different age groups revealed notable patterns [4]. The highest prevalence was observed among children aged 2–4 years, This supports earlier studies indicating that school-aged children are at greater risk due to behavioural factors. Clinical symptoms like perianal itching and abdominal pain were common but non-specific, which highlights the importance of routine screening even in asymptomatic children. Biochemical findings such as reduced haemoglobin children had haemoglobin levels below the normal threshold, and serum iron levels which may reflect chronic nutritional depletion or parasite-induced malabsorption, indicate a possible link between *E. vermicularis* infection and mild anaemia [13]. These results align with prior research that connects helminthic infections to nutritional deficiencies. The lack of significant change in WBC counts suggests a limited inflammatory response [9]. The subtle impact on protein and albumin levels might reflect nutritional stress or impaired absorption in infected children [7].

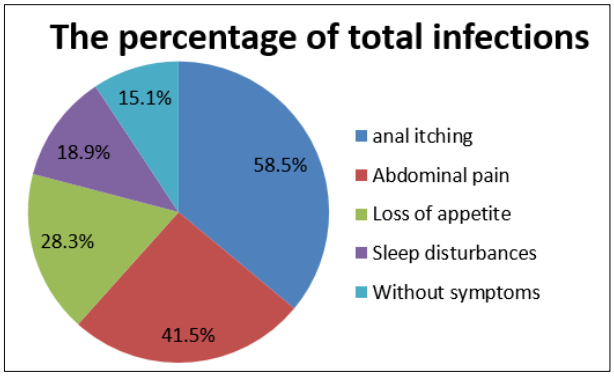

Fig 3: Incidence of *E. vermicularis* infection according to clinical symptoms

Table 4: Shows the meanB serum levels of selected biochemical parameters among children with and without *E. vermicularis* infection. Values are percent as mean ± SD. P-values indicate statistical comparisons between infected and non-infected groups

ParametersS	-ve (mean ± SD)	+ve(mean ± SD)	P-Vlue	Statical significance
Hb (g/dL)	12.3±1.1	11.8 ±1.3	0.092	NSS
WBC ($*10^3\backslash\mu l$)	7.8 ± 1.2	8.2 ±1.3	0.135	NSS
HTC (%)	36.0 ±2.5	35.0 ±2.7	0.156	NSS
Total protein (g/dl)	6.5 ±0.3	6.5 ±0.3	0.075	NSS
Albumin (g\dl)	3.8 ± 0.2	3.8 ±0.2	0.224	NSS
Serum iron (µg\dl)	60.5 ± 9.5	55.5 ± 10.2	0.089	NSS

Conclusion

This study provides valuable insights into the epidemiological and biochemical impact of *E. vermicularis* among children that infected in Al-Hilla city, Iraq. The overall infection rate was moderate, with a slightly higher prevalence in males than females; however, the gender difference was not statistically significant, suggesting that sex is not a major risk factor for pinworm infection [17].

Age-wise distribution indicated a higher prevalence among younger children, particularly those aged 6–8 years, highlighting a potential link between early school-age behaviour and increased exposure risk. Clinical symptoms such as anal itching, irritability, and sleep disturbances were more common among infected children; however, most symptoms did not reach statistical significance, reflecting the often-subtle clinical presentation of the infection [18].

Importantly, the study demonstrated statistically significant differences in several biochemical parameters. Infected children exhibited lower levels of haemoglobin, haematocrit, serum iron, total protein, and albumin compared to non-infected peers. These findings suggest a potential link between *E. vermicularis* infection and mild anaemia or subclinical nutritional deficiency [7]. Despite these changes, white blood cell counts did not differ significantly, indicating that the inflammatory response may not be pronounced in such cases [19].

Overall, while *E. vermicularis* infection is often underestimated due to its mild or non-specific symptoms. This study emphasizes the importance of early detection and management, particularly in school-aged children, to prevent potential nutritional and haematological consequences [20].

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References

1. Gillespie SH, Pearson RD. Principles and practice of clinical parasitology. USA: Library of Congress; 2001. p. 573-574.
2. Satoskar AR, Simon GL, Hotez PJ, Tsuji M. Medical parasitology. USA: LandesBioscience; 2009. p. 1-7.
3. Chittenden AM, Ashford RW. *Enterobius gregorii* Hugot 1983; first report in the U.K. Annals of Tropical Medicine and Parasitology. 1987;81(2):195-198.
4. Plorde JJ. Intestinal nematodes. In: Ryan KJ, Ray CG, editors. Sherris medical microbiology, an introduction to infectious disease. 4th ed. New York: McGraw-Hill; 2004. p. 694,766-694,767.
5. Mehlhorn H. Encyclopedia of parasitology. 3rd ed. Heidelberg: Springer-Verlag; 2008.
6. Dalton J, Skelly P, Halton D. Role of the tegument and gut in nutrient uptake by parasitic platyhelminths. Canadian Journal of Zoology. 2004;82:211-232.
7. Al-Shadood HAS. Study the association between *Enterobius vermicularis* infection and enuresis among children in Al-Najaf city. Al-Qadisiya Journal of Veterinary Medicine Science. 2015;14(1):104-108.

8. Roberts LS, Janovy JJ. Gerald D. Schmidt and Larry S. Roberts' foundations of parasitology. 8th ed. USA: Janice Roerig Blong; 2009. p. 447-451.
9. Paniker CKJ, Ghosg S. Paniker's textbook of medical parasitology. 7th ed. India: Jaypee Brothers Medical Publishers; 2013. p. 190-194.
10. Barker N. Adult intestinal stem cells: critical drivers of epithelial homeostasis and regeneration. Nature Reviews Molecular Cell Biology. 2014;15:19-33.
11. Yang CA, Liang C, Lin CL, Hsiao C, Peng C, Lin HC, Chang J. Impact of *Enterobius vermicularis* infection and mebendazole treatment on intestinal microbiota and host immune response. 2017. Available from: https://www.most.gov.tw/.
12. Danko JR. Enterobiasis. In: Satoskar AR, Simon GL, Hotez PJ, Tsuji M, editors. Vademecum medical parasitology. Texas: Landes Bioscience; 2009. p. 2-7.
13. Değerli S, Malatyali E, Özçelik S, Çeliksöz A. Enterobiosis in Sivas, Turkey from past to present, effects on primary school children and potential risk factors. Türkiye Parazitoloji Dergisi. 2009;33(1):95-100.
14. Olivares JL, Fernández R, Fleta J, Ruiz MY, Clavel A. Vitamin B12 and folic acid in children with intestinal parasitic infection. Journal of the American College of Nutrition. 2002;21(2):109-113.
15. Sharma M, Joshi C. Serum mineral and haematobiochemical profile of *Microfilariae* sp. infected cattle in India: its effects on production and therapy.
16. Airauhi LU, Idogun ES. Demographic and biochemical features associated to children infected with intestinal helminths. Pakistan Journal of Medical Sciences. 2008;24(2):269-273.
17. Al-Daoody AA. Prevalence of *Enterobius vermicularis* infection among children of Al-Nusoor kindergarten in Mosul city and the effect of some disinfectants on its eggs viability. Rafidain Journal of Science. 2005;16(6):188-201.
18. Hama AA, Rahemo ZI. Intestinal parasitosis in relation to haemoglobin concentration among primary school children in Babil province, Kurdistan-Iraq. International Journal of Science. 2014;1:96-99.
19. Al-Q BN, Al-W HS. Anemia and enterobiasis among Iraqi children. Journal of the College of Basic Education. 2012;76(1):57-62.
20. Culha G, Ozer C. The distribution of intestinal parasites among Turkish children living in a rural area. Middle East Journal of Family Medicine. 2008;6(7):8-11.