

**Erbil polytechnic university**  
**Erbil Health Technical & Medical College**  
**MLT department**  
**Fourth stage**



## **Correlation between intestinal parasites and some blood tests**

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### **Graduate project**

A research to the council of the Erbil Health Technical and Medical College at Erbil Polytechnic University in partial fulfilment of the requirement for the bachelor degree in Medical Laboratory Technology for the academic year 2022 – 2023.

### **Date of Submission:**

April. 26<sup>th</sup> .2023

(قل هل يستوي الذين يعلمون والذين لا يعلمون إنما يتذكر أولو الألباب).

[الزمر ٩]

## **ACKNOWLEDGMENT**

First of all, we would like to thank the Almighty God for his enduring grace, guidance, and protection that he has bestowed upon us during this research project

The researchers also like to express their sincerest gratitude to their supervisor, Assist. Prof. Dr. Himdad Hawez Mawlood for him continuous support in their research, for him patience, motivation, and immense knowledge. Him guidance helped them throughout their research and writing of their thesis

Our thanks and appreciations also go to Erbil teaching hospital, Mihrabani Surgical hospital and Erbil central laboratory. Thanks for every volunteers for their support to the project

## **Abstract**

**Background:** Parasitic infections, caused by intestinal helminths and protozoan parasites, are among the most prevalent infections in humans in developing countries. In developed countries, protozoan parasites more commonly cause gastrointestinal infections compared to helminths. Intestinal parasites cause a significant morbidity and mortality in endemic countries.

Helminths are worms with many cells. Nematodes (roundworms), cestodes (tapeworms), and trematodes (flatworms) are among the most common helminths that inhabit the human gut. Usually, helminths cannot multiply in the human body.

**Aim of study:** This study aimed to investigate correlation between intestinal parasites and vitamin B12 also which parameters in complete blood count (CBC) alter, also to aware people to protect cleanliness to avoid intestinal parasites and its complications.

**Results:** This study included 88 patients from both genders and different ages. infected patients intestinal parasitic infection with different ages where was from 88 suspected patients. Among aged(5\_15) years 2 people were infected with intestinal parasitic infection, among aged (15\_25) years 10 people were infected ,among (25\_35) years only 2 people were infected ,among (35\_45)years 2 people were infected ,among (45\_55)years no one was infected with parasitic infection.

**Conclusion:** CBC: results showed decreases (HGB,RBC,MCV) ,and elevated(WBC) due to intestinal parasitic infection.

Vitamin B12 :the results showed decreased level of vit b12 due to intestinal parasitic infection.

**Keywords:** Intestinal parasites, CBC parameters, Vitamin B12.

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## List of abbreviations

Abbreviations	Meaning
IPI	Intestinal parasite infection
GIT	Gastro intestinal tract
CBC	Complete blood count
Vit B12	Vitamin B12
Troph	Trophozoite

## Introduction

Intestinal parasitic infections (IPI) are a serious public health problem throughout the world particularly in developing countries (Gebretsadik *et al.*, 2018). They affect an estimated 3.5 billion persons and cause clinical morbidity in approximately 450 million (Sackey *et al.*, 2001). Intestinal parasitic infection is a significant public health problem, one of the 17 most neglected tropical diseases and fourth leading cause of communicable diseases (Blessing *et al.*, 2022).

The main intestinal parasites affecting humans include *Entamoeba histolytica*, *Giardia lamblia*, *Hymenolepis nana*, *Cryptosporidium* sp. *Taenia saginata*, *Enterobius vermicularis*, *Ascaris lumbricoides*, *Trichuris Trichur* and Hookworms. Children are more likely to infect with parasites and intestinal parasites in particular for many reasons, including lack of health awareness and lack of hygiene, as well as decreased immune response compared to adults. (Al-Hasheme *et al.*, 2020). Intestinal parasitic infections are responsible for morbidity and mortality worldwide, particularly in low-income countries. Eating not well or uncooked animal food, drinking contaminated water, dermal absorption, and faecal-oral routes are some ways that the disease is spread. Factors contributing to the high rate of transmission of intestinal parasites include, but are not limited to, poor environment and sanitation, poor nutrition, overpopulation, contaminated water, poor housing and climatic conditions (Blessing *et al.*, 2022).

Intestinal parasites are an important cause of many pathological effects such as Diarrhea, Abdominal pain. Anorexia, weight loss, flatulence, vomiting, nausea, fever and bowel blockage. Some intestinal parasites can also impede the absorption of digested nutrients such as carbohydrates, proteins, vitamins, and minerals important for human health [9] (Al-Hasheme *et al.*, 2020)[8,9]. *Giardia lamblia* is one of the important intestinal parasites that cause both acute and chronic diarrheal diseases in human. *Giardia* is a flagellated protozoa, has two forms, cyst and trophozoite. Infection is initiated by ingestion of cysts from contaminated food and water and by person-to-person contact. Trophozoites of *Giardia* colonize the lumen of the small intestine but do not invade the epithelium or deeper layers of the mucosa. Infections with *Giardia* are usually self-limited in immune competent individuals. Mucosal defenses against *Giardia* must act in the small intestine. Secretory antibodies against *Giardia* play a central role in anti-giardial defense and clearance of parasite. Patient deficient for the production of IgA, the major



immunoglobulin in mucosal secretions, appear to have slightly increased incidence of Giardia infections (Zarebavani et al. ,2012)[10].

*Entamoeba histolytica* is the third-leading cause of parasitic mortality globally. *Entamoeba histolytica* infection generally does not cause symptoms, but the parasite has potent pathogenic potential. The origins, benefits, and triggers of amoebic virulence are complex. Amoebic pathogenesis entails depletion of the host mucosal barrier, adherence to the colonic lumen, cytotoxicity and invasion of the colonic epithelium.( Marie et and Petri Jr. 2014)[11]. Vitamin B12 is an essential micronutrient, as humans have no capacity to produce the vitamin and it needs to be ingested from animal proteins. The ingested Vitamin B12 undergoes a complex process of absorption and assimilation. (Romain et al., 2016)[12].

Folate must be digested by pancreatic juice in the duodenum, where *G. intestinalis* usually colonizes. Damage of intestinal epithelium occurs by adherent trophozoites of *G. intestinalis*. It has been proposed as one important mechanism in the pathogenesis of infection. Giardiasis can cause vitamin B12 deficiency, bowel inflammation and interfere with folate absorption. (Arbabi et al., 2015)[13]. Vitamin D is the collective name for cholecalciferol (vitamin D3) and ergocalciferol (vitamin D2), which are precursors of hormones with an important role in regulation of the metabolism of calcium and phosphates.(Kulda, 2012).[14]. Hemoglobin is the red dye that found within the red cell. Looses occur in certain pathological conditions including parasitic infection malnutrition, blood loss, and chronic infection, which expressed as anemia White local cells are one of the essential components of blood in peripheral blood, protecting against germs, parasites, tumours, and other diseases five types of white blood cells differ in size, proportions and functions that are as follows: neutrophil eosinophils, basophils calls, lymphocytes and monocytes. (Al-Hasheme et al., 2020)[15,16]. The purpose of this study was to investigate blood parameter like WBC (White blood cells), Eosinophils, Neutrophils, Hemoglobin, serum level of vitamin B12 and vitamin D3 in intestinal parasite infection in comparison to normal subjects.

In current study it was observed in Kurdistan region/Iraq the intestinal parasites infection is limited while protozoan parasites are more prevalence than helminthics this is related to still fast food are not common like western country also most people in our country they eat home maker food. And some causes may be not explained yet.

## **Aim**

This study aimed to investigate correlation between intestinal parasites and vitamin B12 also which parameters in complete blood count (CBC) alter, also to aware people to protect cleanliness to avoid intestinal parasites and its complications.

## **Materials and methods**

### **1. Idea of study**

This study was conducted in the Erbil teaching hospital, Mihrabani Surgical hospital and Erbil central laboratory from October 2022 to March 2023. For this study, a total of 88 patients of both genders and different age groups among patients relations with GIT,also questionnaire formed were used during study some basic questions asked to the participants of study.

### **2. Sample collection**

Stool samples from each patient were collected in a clean, dry, tight fitting cover and analysed in the parasitology lab within 30 minutes. at a hospital. The samples had been examined to see if there were any of the intestinal parasites or not.

A skilled phlebotomist who is a member of the research team collected around 5ml of blood samples. The research team took samples via venipuncture and appropriately 2ml of blood put it in a tube with EDTA(anticoagulant)then runned directly by swelab machine

For serological samples 3ml of blood put it in gel tube. then some of them delivered back to the Mehabani laboratory. The gel tubes centrifuged around 5000rpm for 10 minutes and the serum was stored in an eppendorf tube and kept in -20 C.in refrigerator.

## Procedures

### I. Stool examination

Before being studied under a microscope, the stool samples were examined macroscopically for color, consistency and the presence of blood or mucus.

Microscopic analysis: To detect the trophozoite and cyst stages for protozoa also observed ,eggs ,larva and adults of worms. all stool samples were examined microscopically by the direct wet mount method with normal saline at low and high power (10 X and 40x).

### 2. Complete blood Count (CBC)

Two ml of venous blood was collected using a sterile syringe with a needle and transferred to an EDTA tube for hematological profile analysis. Complete blood cell count was performed using swelab hematological analyzer.

### 3. Vitamin B12

Three ml of venous blood was collected using a sterile syringe with a needle and transferred to a gel tube for chemical analysis. Vitamin B12 was performed using Cobas E411 chemical analyzer.

## Results

A total of 88 patients included in this study of both genders and different age groups among patients relations with GIT problems.

## General Stool Examination

Table (1) prevalence of gastrointestinal tract infection among total patients by age group

<b>Samples Age Group</b>	<b>Case No</b>	<b>No Parasite Infection</b>	<b>Parasite Infection</b>	<b>Types of Parasite</b>
5-15	2	0(0.00%)	2(12.50%)	<i>Enterobius vermicularis</i> (cyst).
15-25	44	34(47.22%)	10(62.50%)	Giardia lamblia(cyst). Entamoeba histolytica (cyst, trophozoite).
25-35	30	28(38.89%)	2(12.50%)	Giardia lamblia(cyst).
35-45	6	4(5.56%)	2(12.50%)	<i>Entamoeba histolytica</i> (cyst).
45-55	6	6(8.33%)	0(0.00%)	<i>No one</i>
<b>Total</b>	<b>88</b>	<b>72(81.82%)</b>	<b>16(18.18%)</b>	

This study included 88 patients from both genders and different ages: Table (1) numbers of infected patients with intestinal parasitic infection, This table shows the number of infected patients intestinal parasitic infection with different ages where was from 88 suspected patients. Among aged(5\_15) years 2 people were infected with intestinal parasitic infection, among aged (15\_25) years 10 people were infected ,among (25\_35) years only 2 people were infected ,among (35\_45)years 2 people were infected ,among (45\_55)years no one was infected with parasitic infection.

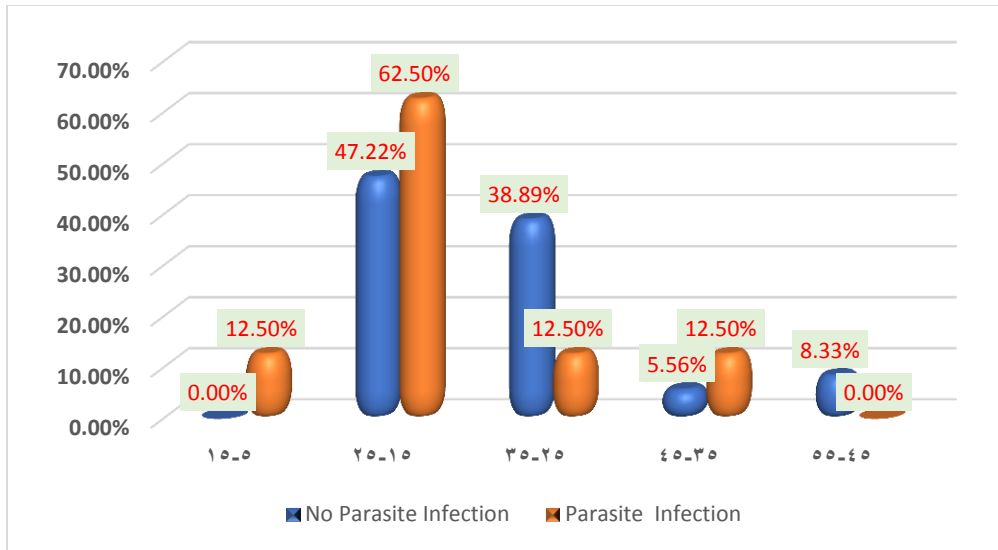


Figure 1 prevalence of gastrointestinal tract infection among total patients by age group.

### General Stool Examination and CBC Parameters

Table 2 relations between parasitic infection and haematological parameters (HGB,RBC,MCV , WBC and RDW).

Samples Age Group	Case No	No Parasite Infection/GSE	Parasite Infection/GSE	Parameter changes/hematology analyzer			
				HGB	RBC	MCV	WBC
5-15	2	0	2	0	0	0	0
15-25	44	34	10	0	16	14	8
25-35	30	28	2	4	10	6	2
35-45	6	4	2	0	0	0	4
45-55	6	6	0	0	4	2	0

**Table 2** showed haematological parameters among different ages with intestinal parasitic infection and without intestinal parasitic infection, The results in CBC test showed that there were changes (decrease) these parameters (RBC, HGB, MCV) and increase (WBC) among all the patients ,among 2 cases with age group of (5 \_ 15) years there is no change in WBC parameter ,among 44cases with age group of (15\_25)years only in 8 people WBC was changed in 14 people MCV was changed and in 16 people RBC was changed , among 30 cases with age group of (25\_34) years in 2 people WBC was changed in 6 people MCV was changed and in 4 people HGB was changed,among 6 cases with age group of (35\_45)years in 4 people WBC was changed ,among 6 cases with age group of (45\_55)years in 2 people MCV was changed ,and in 4 people RBC was changed.

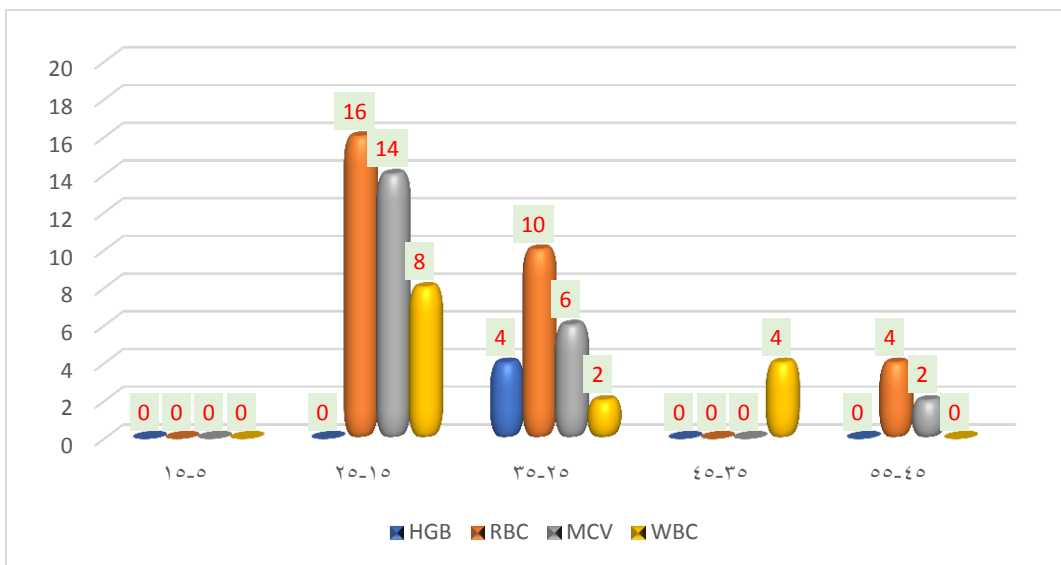


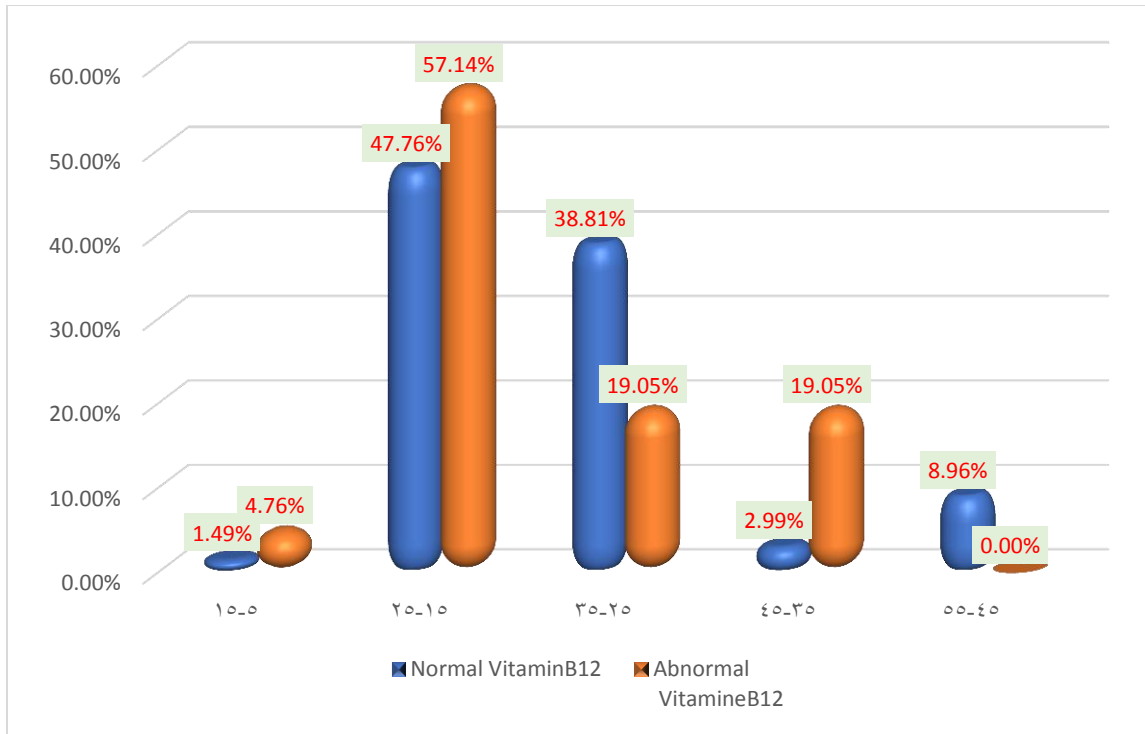
Figure 2 relations between parasitic infection and haematological parameters (HGB,RBC,MCV , WBC and RDW)

### General Stool Examination and Vitamin B12

Table (3) relations between parasitic infection and Vitamin B12.

<b>Samples</b>	<b>Normal VitaminB12</b>	<b>Abnormal I VitamineB12</b>	<b>p-value</b>
<b>Age Group</b>			
5-15	1(1.49%)	1(1.49%)	p<0.05*
15-25	32(47.76%)	12(57.14%)	
25-35	26(38.81%)	4(19.05%)	
35-45	2(2.99%)	4(19.05%)	
45-55	6(8.96%)	0(0.00%)	

Table 3 showed the change in vitamin B12 among different age with or without intestinal parasitic infection , among 2 cases with age group of (5 \_ 15) years only in one person vit b12 was abnormal ,among 44cases with age group of (15\_25)years in 12 persons vitamin b12 was abnormal , among 30 cases with age group of (25\_35) years in 4 persons vit b12 was abnormal , among 6 cases with age group of (35\_45)years in 4 persons vitamin b12 was abnormal, among 6 cases with age group of (45\_55)years in all 6 persons vitamin b12 was normal .



**Figure 3** relations between parasitic infection and Vitamin B12

## Discussion

Among parasitic pathogens more frequently found in human beings, there are the *Enterobius vermicularis*, as well as the intestinal protozoa such as *Giardia lamblia*, *Entamoeba histolytica*. The results showed that total infection with intestinal parasites 16(36.36%) is high in rural areas because there are many people in rural areas who suffering from parasitic infection due to poor sanitation poor public health practices , increasing of vectors & malnutrition states in addition to using of river water directly for drinking & washing . There are 3types of intestinal parasites (table 1) first Infection with *Entamoeba histolytica* regard as critical infection & worldwide distribution . Their cysts transmitted through contaminated food and water hand to mouth contamination . Flies cockroaches serve as vector for *E. histolytica* infection.

*Giardia lamblia* infection mainly responsible for diarrhea especially in children rather than adults.*E. vermicularis* one of the famous children worms infection especially in crowded area such as schools & orphans . It distributed all over the world . The intestinal infection has a huge



effect on blood cell components, as the CBC result showed that the level of blood components are above and below normal ranges. In table 2 the result shows significant changes in (RBC, HGB, MCV, WBC). W.B.C. is elevated due to intestinal infection especially eosinophils due to ability of eosinophils to destroy the parasites by attachment of parasite wall & secretion of granules act in external parasite wall destructing. The intestinal protozoa affecting blood constituents are *G.lambli*a and *E. histolytica*, this results from high density of these protozoa that leads to decrease in absorption of necessary nutrients for the formation of blood components. Effect of intestinal protozoa on Hb level is more severe in comparison with the effect of intestinal worms. Intestinal protozoa that have more effect on Hb level were *E. histolytica* and *G.lambli*a. In relation with, *E.histolytica* it leads to necrosis of intestinal mucosa causing damage and degeneration of absorption sites of necessary substances, in addition to occurrence of bleeding associated with this process. *G.lambli*a leads to covering sites of absorption of vitamins and other essential nutritional elements since it makes as a barrier in front the transmission of these substances from lumen of intestine to blood stream. These findings suggest that parasitic infections may have a detrimental effect on RBC production and hemoglobin levels, which could lead to anemia. Interestingly, while vitamin B12, RBC count, and Hb levels were decreased in individuals with intestinal parasitic infections, It is worth mentioning that there may be various mechanisms underlying the observed changes in CBC parameters and vitamin B12 levels in individuals with parasitic infections. Intestinal parasitic infections can cause malabsorption, inflammation, and immune responses, which could affect the absorption and utilization of vitamin B12, as well as RBC production and Hb levels. The increased WBC count may be a result of the body's immune response to the parasitic infection.

A study conducted by Khoshnood et al. (2017) investigated the correlation between parasitic infections and CBC parameters in Iranian children. The study found that vitamin B12 levels were significantly decreased in children infected with intestinal parasites compared to non-infected children, suggesting a possible link between parasitic infections and vitamin B12 deficiency (Khoshnood et al., 2017). Another study by Abdel-Magied et al. (2018) conducted in Egypt also reported a significant decrease in vitamin B12 levels in patients with intestinal parasitic infections, indicating a consistent trend across different geographical locations.

In addition to vitamin B12 deficiency, parasitic infections have also been associated with changes in RBC count and Hb levels. A study by Ezeamama et al. (2014) conducted in Nigeria found that children infected with intestinal parasites had significantly lower RBC count and Hb levels compared to non-infected children. Similarly, a study by Khooshideh et al. (2017) in Iran reported a significant decrease in RBC count and Hb levels in patients with parasitic infections. These findings suggest that parasitic infections may have a detrimental effect on RBC production and hemoglobin levels, which could lead to anemia.

Interestingly, while vitamin B12, RBC count, and Hb levels were decreased in individuals with intestinal parasitic infections, WBC count was found to be increased in some studies. A study by Simsek et al. (2015) conducted in Turkey reported a significant increase in WBC count in patients with parasitic infections. Similarly, a study by Da Silva et al. (2018) in Brazil found that children infected with intestinal parasites had significantly higher WBC count compared to non-infected children. These findings suggest that parasitic infections may trigger an inflammatory response, leading to an increase in WBC count.

It is worth mentioning that there may be various mechanisms underlying the observed changes in CBC parameters and vitamin B12 levels in individuals with parasitic infections. Intestinal parasitic infections can cause malabsorption, inflammation, and immune responses, which could affect the absorption and utilization of vitamin B12, as well as RBC production and Hb levels. The increased WBC count may be a result of the body's immune response to the parasitic infection.

## Conclusion

During our research work, we studied the correlation between intestinal parasite infections with complete blood count parameters and vitamin B12. Infection with intestinal parasite infections causes by consumption of contaminated water, infected soil, inadequate sanitation and hygiene, and improper hygiene. It was found that the most infected patients with intestinal parasite infection about (15-25) years old with low serum vitamin B12 and low of some blood parameters include red blood cells, haemoglobin and mean corpuscular volume and high WBC level . Therefore to raise more public knowledge about intestinal parasite infections that may cause

potential complications if left untreated and potential treatment options is warranted for better management of this condition. Indication: the results showed that the intestinal parasite has effect on all blood cell components and vitB12.

CBC: results showed decreases (HGB,RBC,MCV) ,and elevated(WBC) due to intestinal parasitic infection.

Vitamin B12 :the results showed decreased level of vit b12 due to intestinal parasitic infection.

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