

## Evaluation of Hemoglobin and Some Biochemical Parameters in Patients with Mixed Intestinal Parasitic Infections

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### ABSTRACT

Intestinal parasitic infections are prevalent diseases that can lead to various health issues, hindering growth and physical development. Young children, particularly those under five years old, are the most susceptible to these infections. During the period from 1<sup>st</sup> March to 1<sup>st</sup> November 2024, (723) stool samples were collected from (419 males and 304 females) with ages ranging from one day to old age persons in Baqubah city. The results showed that prevalence of intestinal parasitic infection was 389 (53.8%) from the total 723 samples. There was no significant difference between positive and negative samples. The intestinal parasitic infections were distributed according to the four age groups as shown in table (2). In the first age group (0-<10) years, the positive rate of male samples was 69 (9.5%) and the positive rate of female samples was 60 (8.3%). In the second age group (10-<20) years, the positive male and female rates were 58 (8.0%) and 64, (8.9%) respectively, in the third age group (20-<30) years, the positive male and female rates were 27 (3.7%) and 47 (6.5%) respectively, while in the fourth age group ( $\geq 30$ ) years, the positive male and female rates were 209 (28.9%) and 180 (24.9%) respectively. The distribution of intestinal parasitic infections according to food intake showed that the positive indoor samples were 148 (20.5%), while the outdoor positive samples were 11(1.5%), and the mixed positive samples were 230 (31.8%), with highly significant differences ( $P<0.01$ ) with regard to hemoglobin levels, it was found that the total number of samples examined to be 295 (40.8%), 80(11.1%), 14(1.9%) for hypo, normal and hyper levels respectively. The level of total serum protein showed that the hypo levels were 289 (40.0%) samples: 73 (10.1%) of them were in the age group (0-<10) years, 102 (14.1%) in the age group (10-<20) years, 51 (7.1%), 63 (8.7%) samples were in the age groups (20-<30) and ( $\geq 30$ ) years respectively.

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### 1- INTRODUCTION

Intestinal parasitic infections are considered as one of the most important healthy problems throughout the world especially in the tropical and subtropical countries [1]. The World Health Organization (WHO) reports that around 1.5 billion people, or 24% of the global population, are affected by intestinal parasitic infections (IPIs), primarily due to soil-transmitted helminths such as *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), and hookworms like *Ancylostoma duodenale* and *Necator americanus* [2]. In certain regions of sub-Saharan Africa (SSA), over half of the population is affected by intestinal parasitic infections (IPIs). The most

prevalent intestinal protozoa in developing nations include *Giardia lamblia*, *Entamoeba histolytica*, and *Cryptosporidium* [3]. Intestinal protozoal infections are more frequently observed than helminthic infections in developed countries [4]. Intestinal parasites live alongside gut bacteria, indicating that the gut microbiota may play a role in affecting the pathophysiology of intestinal parasitic infections (IPIs) [5]. The gut microbiota is vital for sustaining balance and overall health in the body, significantly influencing immune system development and cellular metabolism [6], the gut microbiota aids in defending against opportunistic pathogens, supports the formation of new blood vessels, assists in repairing damage to epithelial cells, regulates energy metabolism, and helps in acquiring essential nutrients [7]. The impact of intestinal parasitic infections (IPIs) on the microbial environment of the human gut remains largely unclear. Most studies investigating these relationships have been conducted using animal models [8], recent research involving human subjects has indicated that intestinal parasites can alter gut microbial communities [9]. The presence of specific intestinal parasites in the gut can lead to changes in gut composition that may be either beneficial or harmful, depending on the type of parasite involved [10]. Our study aimed to evaluate hemoglobin and some biochemical parameters in patients with mixed intestinal parasitic infections.

## 2- MATERIAL AND METHOD

Between March 1st and November 1st, 2024, a total of (723) stool samples were gathered from (419) males and 304 females, ranging in age from newborns to elderly individuals in Baqubah city. The samples were collected in sterile, clean, dry plastic cups with light lids designed for this purpose, with each cup labeled with a unique identifier corresponding to the patient. Data for each participant were recorded using a specially designed questionnaire, which included information such as the patient's name, sample number, age, gender, address, water source, food supply, and other relevant details.

Blood samples (5ml) were collected by means of disposable syringes, then each sample was divided to two parts, the first 2 ml put in a EDTA tube for hemoglobin analysis and the second part (3ml) was put in plane tube (Without EDTA) for biochemical analysis including S. iron and total serum protein. Each tube was labeled by a special number for all patients as well as control groups. The stool samples were examined by putting a small amount of bloody and mucoid stool on a dry and clean slide and adding one drop of normal saline and mixed thoroughly, then covered with a cover slip and examined under microscope to detect the trophozoites and cysts of intestinal protozoa and eggs of intestinal helminthes.

### Statistical analysis

The statistical analysis was carried out using the analytical program Graph Pad Prism, and comparisons were done using t test and Qi squire as needed. If the P value was less than 0.05, the data difference was deemed significant, and if it was more than 0.05, the data were deemed non-significant.

## 3- RESULTS AND DISCUSSION

The results in table (1) showed that prevalence of intestinal parasitic infection was 389 (53.8%) from the total 723 samples. There was no significant difference between positive and negative samples.

**Table (1): distribution of positive and negative samples among the total examined samples**

| Total    | No. | % of total No. |
|----------|-----|----------------|
| Positive | 389 | 53.8           |
| Negative | 334 | 46.2           |
| Total    | 723 | 100.0          |

These results agreed with [11] who reported the highest rates of infection. However they disagreed with others such as [12], who recorded the lowest rates of infection. This may be due to the large number of samples examined from the first two age groups which were exposed to infection because of the bad habits and the overcrowding in schools and families [12].

The intestinal parasitic infections were distributed according to the four age groups as shown in table (2). In the first age group (0-<10) years, the positive rate of male samples was 69 (9.5%) and the positive rate of female samples

was 60 (8.3%). In the second age group (10-<20) years, the positive male and female rates were 58 (8.0%) and 64, (8.9%) respectively, in the third age group (20-<30) years, the positive male and female rates were 27 (3.7%) and 47 (6.5%) respectively, while in the fourth age group ( $\geq 30$ ) years, the positive male and female rates were 209 (28.9%) and 180 (24.9%) respectively.

**Table (2): Distribution of parasitic infections according to age/year**

| Age groups/year |        |         |        |        |        |           |        | Total<br>No. 723 (100) |        |
|-----------------|--------|---------|--------|--------|--------|-----------|--------|------------------------|--------|
| 0-<10 *         |        | 10-<20* |        | 20-<30 |        | $\geq 30$ |        | Male                   | Female |
| Male            | Female | Male    | Female | Male   | Female | Male      | Female |                        |        |
| %               | %      | %       | %      | %      | %      | %         | %      | %                      | %      |
| 69              | 60     | 58      | 64     | 35     | 27     | 47        | 29     | 209                    | 180    |
| (9.5)           | (8.3)  | (8.0)   | (8.9)  | (4.8)  | (3.7)  | (6.5)     | (4.0)  | (28.9)                 | (24.9) |

\*  $P < 0.05$

Our findings agreed with many studies carried out inside and outside Iraq such as [14]. This results obtained from concentration methods are commonly more accurate than those obtained from direct methods because of the greater amounts of stool taken in concentration method. The highest percentage of single type infection was 34.7% this provides an overview of the distribution of intestinal parasitic infections based on the infection type. The findings align with those reported by [12], [14] in Baghdad and Mosul, higher rates of single infections were reported compared to (double and triple infections). The single infection of *E. histolytica* and *G. lamblia* were the higher when compared with single infections occurring with helminths like *A. lumbricoides*, *T. saginata*, *H. nana*, *E. vermicularis*. The results agreed with those recorded by [12], [13] and [14] who indicated the higher rate of *E. histolytica* infection.

Results in table (3) showed the prevalence of intestinal parasitic infections according to sex; 209 (28.9%) out of the 389 positive samples were males and 180 (24.9%) were females, with no significant difference.

**Table (3): Prevalence of parasitic infections according to sex**

| Gender | Total No. (%) |            | Total       |
|--------|---------------|------------|-------------|
|        | Positive      | Negative   |             |
| Male   | 209 (28.9)    | 210 (29.0) | 419 (58.0)  |
| Female | 180 (24.9)    | 124 (17.2) | 304 (42.0)  |
| Total  | 389 (53.8)    | 334 (46.2) | 723 (100.0) |

The triple parasitic infection rate according to species showed that *E. histolytica*, *G. Lamblia*, *A. lumbricoides* were 13 (1.8%), *E. histolytica*, *G. lamblia*, *H. nana* were 8 (1.1%), *E. histolytica*, *G. lamblia*, *E. vermicularis* were 5 (0.7%), as shows in table (4).

**Table (4): Triple infection according to Species.**

| Total No. of<br>samples<br>examined | No. of<br>samples | %   | <i>E. histolytica</i><br><i>G. Lamblia</i><br><i>A. lumbricoides</i> | %   | <i>E. histolytica</i><br><i>G. lamblia</i><br><i>H. nana</i> | %   | <i>E. histolytica</i><br><i>G. lamblia</i><br><i>E. vermicularis</i> | %   |
|-------------------------------------|-------------------|-----|----------------------------------------------------------------------|-----|--------------------------------------------------------------|-----|----------------------------------------------------------------------|-----|
| 723                                 | 26                | 3.6 | 13                                                                   | 1.8 | 8                                                            | 1.1 | 5                                                                    | 0.7 |

Prevalence of intestinal parasitic infections according to residency was shown below in table (5) as the positive samples were 261 (36.1%) , 128 (17.7) for rural and urban areas respectively, negative samples were 100 (13.8% ) in rural, 234 (32.4%) in urban areas with significant differences ( $P < 0.05$ )

**Table (5): Prevalence of parasitic infections according to residency**

| Area  | Positive<br>No. % | Negative<br>No. % | Total<br>No. % |
|-------|-------------------|-------------------|----------------|
| Rural | 261* (36.1)       | 100 (13.8)        | 361 (49.9)     |
| Urban | 128 (17.7)        | 234 (32.4)        | 362 (50.0)     |
| Total | 389 (53.8)        | 334 (46.6)        | 723 (100.0)    |

\*P<0.05

The results of parasitic infections according to residency agreed with those recorded by [16], carried out in Argentina, Panama, Korea, and Mexico Cities respectively. But they disagreed with the results recorded by [17], of contaminated water from the river for a variety of requirements and also due to usual contact with domestic animals and their products [17].

The distribution of intestinal parasitic infections according to food intake showed that the positive indoor samples were 148 (20.5%), while the outdoor positive samples were 11(1.5%), and the mixed positive samples were 230 (31.8%), with highly significant differences ( $P<0.01$ ), as shown in table (6).

**Table (6): Distribution of parasitic infections according to type of food intake**

| Type of food intake | Total      |            | Total      |
|---------------------|------------|------------|------------|
|                     | Positive % | Negative % |            |
| Indoors             | 148 (20.5) | 278 (38.5) | 426(58.9)  |
| Outdoors            | 11(1.5)    | 10(1.4)    | 20(2.9)    |
| Mixed               | 230(31.8)  | 46(6.4)    | 276(38.2)  |
| Total               | 389(53.8)  | 334(46.2)  | 723(100.0) |

The source of food is considered one of the main pathways that play an important role in transmission of the causative agents at parasitic infections. The higher percentage of infection in people with mixed food intake (31.8%) when compared with that percentage of the people feeding in the house [18]. We suggest that these results are caused by the interferences between rural and urban areas, wide spread of unclean cafeterias and high percentage of people who are in direct contact with soil, raw water and animals most of the time, even if they are feeding in the house. The source of water supply is not less important than the type of food intake in the prevalence of intestinal parasitic infections among people. It was observed that the highest rate of infection with raw water supply which represents and this is because of usual use of raw water in the rural areas besides the low educational level of the people there [19].

In the present study it was found that from the total number of samples examined 295 (40.8%), 80(11.1%), 14(1.9%) were hypo, normal and hyper level respectively for hemoglobin. The hypo level were divided into 93, 94, 47, 61, samples representing (12.9%), (13.0%), (6.5%), (8.4%) for (0-<10) years, (10-<20), (20-<30), ( $\geq 30$ ) years respectively. The normal level included 32 (4.4%), 18 (2.5%), 15 (2.1%) and 15 (2.1%) samples for the above age groups respectively. The hyper level was found in (0-<10) years and (10-<20) years only, which were (0.6%) and (1.3%) respectively with highly significant differences ( $P<0.01$ ), as illustrated in table (7).

**Table (7): Hemoglobin levels (g/ dL) in parasitic infection patients according to the age groups**

| Age group / years | (Hb (g / dL)) |           |          |
|-------------------|---------------|-----------|----------|
|                   | Hypo*%        | Normal%   | Hyper%   |
| 0-<10             | 93 (12.9)     | 32 (4.4 ) | 4 (0.6)  |
| 10-<20            | 94 (13.0)     | 18 (2.5)  | 10 (1.3) |
| 20-<30            | 47 (6.5)      | 15 (2.1 ) | ----     |
| $\geq 30$         | 61 (8.4)      | 15 (2.1)  | ---      |
| Total             | 295 (40.8 )   | 80 (11.1) | 14(1.9 ) |

\* P < 0.01

Table (8) showed the hypo, normal and hyper levels of serum iron. The total number of hypo level were 327 samples (45.0%) which included (98, 108, 53 and 68) samples representing (13.6%, 14.9%, 7.3%, and 9.4%) for (0-<10) years, (10-<20), (20-<30), ( $\geq 30$ ) respectively, and (26, 14, 9, 8) normal level samples represented (3.6%, 1.9%, 1.2%, and 1.1%) for the above age groups respectively and the last only has 5 samples (0.7%) for hyper level, with highly significant differences.

**Table (8): Serum iron levels ( $\mu$  mol / L) in parasitic infected patients according to the age groups**

| Age group / years | S. Iron ( $\mu$ mol / L) |           |          |
|-------------------|--------------------------|-----------|----------|
|                   | Hypo*                    | Normal    | Hyper    |
| 0-<10             | 98 (13.6)                | 26 (3.6 ) | 5 (0.7 ) |
| 10-<20            | 108 (14.9)               | 14 (1.9)  | ---      |
| 20-<30            | 53 (7.3 )                | 9 (1.2)   | ---      |
| $\geq 30$         | 98 (9.4 )                | 8 (1.1 )  | ---      |
| <b>Total</b>      | 327 (45.0)               | 57 (7.9)  | 5 (0.7)  |

\* P < 0.01

The hypo levels recorded the higher percentages in all age groups as compared with those in normal and hyper levels. They were 45%, 40.8%, and 40.8% for iron level and Hb respectively. This may be due to decrease in iron levels leading to decrease in hem production and causing anemia [21].

The level of total serum protein is represented in table (9) which showed that the total number of hypo level were 289 samples (40.0%): 73 (10.1%) of them in the age group (0-<10) years, 102 (14.1%) samples in the age group (10-<20) years, 51 and 63 (7.1%), (8.7%) samples were in the age groups (20-<30) and ( $\geq 30$ ) years respectively. The normal levels were 48 (6.6%), 20(2.8%), 11(1.5%) and 13(1.8%) in (0-<10), (10-<20), (20-<30), and ( $\geq 30$ ) years respectively. There were only 8 samples (1.1%) as a hyper level in the age group (0-<10) years, with a highly significant difference (P< 0.01).

**Table (9): A total serum protein level (g/ dL) in parasitic infected patients according to the age group**

| Age group / years | T.S. Protein (g / dL) |            |         |
|-------------------|-----------------------|------------|---------|
|                   | Hypo*%                | Normal %   | Hyper%  |
| 0-<10             | 73 (10.1)             | 48 (6.6 )  | 8(1.1 ) |
| 10-<20            | 102 (14.1)            | 20 (2.8)   | ---     |
| 20-<30            | 51 (7.1)              | 11 (1.5 )  | ---     |
| $\geq 30$         | 63 (8.7)              | 13 (1.8)   | ---     |
| <b>Total</b>      | 289 (40.0)            | 92 (12.7 ) | 8(1.1 ) |

\* P < 0.01

Regarding total serum protein and serum albumin, there is an indication of dominance of the hypo level in all age groups on the normal and hyper levels. This may be attributed to intestinal parasitic infections themselves because of the weakened synthesis of serum protein and albumin, and this agreed with what was reported by [24].

## 5- CONCLUSION

According to the results, a mixed of intestinal parasites and worms was found in adults and children, and had an effect inside the human body in reducing hemoglobin and iron.

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## تقييم الهيموغلوبين وبعض المعايير الكيميائية الحيوية لدى المرضى المصابين بالطفيليات المعوية المختلفة

### الخلاصة

تعد العدوى الطفيلية المعوية من الأمراض المعدية الشائعة التي تسبب العديد من المشاكل الصحية وضعف النمو والتطور البدني. والأطفال دون سن الخامسة هم الأكثر عرضة للإصابة بالعدوى. وخلال الفترة من ١ آذار إلى ١ تشرين الثاني ٢٠٢٤، تم جمع (٧٢٣) عينة براز من (٤١٩ ذكر و ٣٠٤ أنثى) تتراوح أعمارهم من يوم واحد إلى كبار السن في مدينة بعقوبة.

أظهرت النتائج أن معدل انتشار العدوى الطفيلية المعوية بلغ ٣٨٩ (٥٣,٨%) من إجمالي ٧٢٣ عينة. ولم يكن هناك فرق كبير بين العينات الإيجابية والسلبية. وتوزعت العدوى الطفيلية المعوية حسب الفئات العمرية الأربع كما هو موضح في الجدول (٢). ففي الفئة العمرية الأولى ( $0 < 10$ ) سنوات، بلغ معدل الإيجابية لعينات الذكور ٦٩ (٩,٥%) ومعدل الإيجابية لعينات الإناث ٦٠ (٨,٣%). وفي الفئة العمرية الثانية ( $10 < 20$ ) سنة، كانت معدلات الذكور والإناث الإيجابية ٥٨ (٨,٠%) و ٦٤ (٨,٩%) على التوالي، وفي الفئة العمرية الثالثة ( $20 < 30$ ) سنة، كانت معدلات الذكور والإناث الإيجابية ٢٧ (٣,٧%) و ٤٧ (٦,٥%) على التوالي، بينما في الفئة العمرية الرابعة ( $30 \leq$ ) سنة، كانت معدلات الذكور والإناث الإيجابية ٢٠٩ (٢٨,٩%) و ١٨٠ (٢٤,٩%) على التوالي.

كما أظهر توزيع الإصابات بالطفيليات المعوية حسب تناول الطعام أن العينات الداخلية الإيجابية كانت ١٤٨ (٢٠,٥%)، في حين كانت العينات الخارجية الإيجابية ١١ (١,٥%)، وكانت العينات الإيجابية المختلطة ٢٣٠ (٣١,٨%)، مع وجود فروق ذات دلالة إحصائية عالية ( $P < 0.01$ ) فيما يتعلق بمستويات الهيموغلوبين، حيث وجد أن العدد الإجمالي للعينات المفحوصة كان ٢٩٥ (٤٠,٨%)، ٨٠ (١١,١%)، ١٤ (١,٩%) لمستويات منخفضة وطبيعية ومفرطة على التوالي.

وأظهر مستوى البروتين الكلي في مصل الدم أن مستويات نقص البروتين كانت ٢٨٩ (٤٠,٠%) عينة: ٧٣ (١٠,١%) منهم في الفئة العمرية ( $0 < 10$ ) سنة، ١٠٢ (١٤,١%) في الفئة العمرية ( $10 < 20$ ) سنة، ٥١ (٧,١%)، ٦٣ (٨,٧%) عينة كانت في الفئات العمرية ( $20 < 30$ ) و ( $30 \leq$ ) سنة على التوالي.