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RESEARCH ARTICLE

PREVALENCE AND EFFECT OF ASCARIS LUMBRICOIDES, ENTEROBIUS VERMICULARIS AND HYMENOLEPIS NANA ON THE ACCOMPANYING BLOOD PICTURE IN IBEN KOLDOON HOSPITAL, LAHAJ- YEMEN

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Abstract

Intestinal parasitic infections, are the most common infections worldwide. Various epidemiological studies in Yemen and the neighboring countries, indicate that the prevalence of intestinal parasites is high, especially in developing countries.

This study was aims to investigate the prevalence of infection with Intestinal Parasites Worms (IPW), *Ascaris lumbricoides*, *Enterobius vermicularis* and *Hymenolepis nana* and its impact on the blood picture among patients attending Ibn Khaldoon hospital in Lahaj governorate - Yemen.

A cross-sectional study was conducted from October 2019 to October 2020, to assess the prevalence of infection parasites worms (IPW) and associated risk factors. This study included 645 patients from both sexes and different ages. Stool samples were examined microscopically using direct wet-mount, formal-ether concentration techniques and Saturated sodium chloride floatation technique. We analyzed the blood picture of the infected and uninfected people and focused on the three pictures of white blood cells (WBC), hemoglobin (Hb) and eosinophil (E). A structured questionnaire, was used to obtain information regarding the associated risk factors. Data were analyzed using SPSS version 20.

The results showed that (94.88%) were positive and 33 cases (5.12%) were negative. And among the (94.88%) positive cases, (59,53%) cases were positive with intestinal helminthes (IH). The infection rate for males (47.65%) cases and for females (42.97%) cases, and the statistical analysis showed a significant difference at the level of significance ($P<0.05$). Also, some hematological parameters of the blood picture taken from the patients showed significant differences compared to the control group, where the level of (Hb) decreased (10.19 g/dL) and a slight increase in the number of (WBC) 6990 cells/mm^3 and a rise in (E) cells 671.74). cell/mm^3.

In conclusion, the necessity of spreading health education among members of the community and showing the danger of infection with IPW in particular and parasites in general. In relation with blood picture examinations showed a statistically significant difference ($P=0.00$) in the three age groups. Where the values of WBC 8.49 Mean and (E) 11.174 Mean were more elevated in the first age group, while they decreased in the second and third age groups, while the level of Hb was the most low (8.420 Mean). In the first, second and third age groups.

Keywords: Intestinal parasitic worms, White blood cells, Eosinophil, Hemoglobin, Blood picture.

Introduction:

Intestinal parasites are considered as a major public health problem worldwide especially in developing countries [1]. Both protozoa and helminthes are two categories of pathogenic and non-pathogenic parasites that cause intestinal tract infection where, represents common intestinal parasites in tropical and subtropical areas include Soil-transmitted helminth (STH) [2]. The infections are among the most common worldwide. More than 1.5 billion people, or 24% of the world's population, are infected with STH worldwide [3]**.** An estimate in 2010 showed that globally, 438.9 million people were infected with hookworm, of these people, 819 million were infected with *A. lumbricoides*, and 50–75 million with *H. nana* [4]**.** *Enterobius vermicularis* 200 million cases worldwide [5]**,** with the vast majority of STH infections occurring in Asia [6]**.** The largest incidence rates are in sub-Saharan Africa, America, China and East Asia [7]**.** Only few studies have reported in Yemen have focused on the prevalence and distribution of intestinal parasitic infections among patients [8, 9, 10, 11]. Furthermore, there was limited information on the basic awareness of communities about the cause, transmission, and infection prevention of parasites in Yemen [12, 13]. Several studies have been conducted that have shown the effect of intestinal parasites on blood parameters, its cause many health problems, such as anemia, Anemia in the case of parasitic infection, where iron deficiency occurs in the blood of the infected person either due to a deficiency of folic acid or vitamin B12 [14]. More than 3.2 million deaths of children under the age of 20 years, especially in developing countries, and the infection of people intestinal parasites make the body vulnerable to other diseases associated with such as appendicitis or hepatitis and biochemical changes in the blood parameters of infected patients [15]. In the Algharbia governorate of Egypt, a study was conducted on school-age children that showed a link between (IH) and anemia [16]**.** A study was also conducted in Babil province in Iraq on the effect of some intestinal parasites and its effect on some aspects of physiological blood significant increase were noticed in total count and differential counts of WBC [17]**.** Variose study [18] conducted an epidemiological study of intestinal parasites and their effect on blood standards in the province of Babylon in central Iraq.Therefore, this study was designed to know the infection rate with (IH), and to assess the effects of intestinal parasite infection on the blood picture of patients in Lahaj governorate, Yemen.

Material and Methods

This survey study is a summary of a master's thesis, submitted to the College of Education, Aden, University of Aden.

Study Area

Lahaj Governorate (**Fig. 1**) is situated in the south west of the Republic of Yemen at longitude (43˚-46˚) east Greenwich, and between latitude (12˚-14˚) north of the Equator. It's far from the capital of Sana'a, where it is located in the south-eastern part of it, about (337Km^2), an area with fertile soil, because it is located on the Delta of Tuban, and is characterized by prosperity in agriculture.

Fig. 1: Lahaj Governorate, Yemen adapted by https://www.dreamstime.com/royalty-free-stock-photos-yemen-map-image8640398

Study population:

The sampling method of patients attending the hospital was used to select the study participants after explaining the objectives of the study with the patients. Patients belong to both sexes. Their ages range from one year to over sixty years old. The adults men and women work in different jobs, such as agriculture,teaching, few of them work in self-employment

Data collection:

Data were collected by interviewing and observing the participant. The questionnaire was coded and prepared in English and then translated into mother toung (Arabic), and back to English to analysis and evaluation. The questionnaire was pre-tested on a small number of patients (7-15). The collected data were checked daily for consistency and accuracy. Standardized procedures were strictly followed during collection and processing of faecal specimens. For quality control, two experienced microscopist worked independently to detect the presence of parasites in faecal samples.

Collection of stool samples:

A total of 645 samples were collected between October 2019 and October 2020 from Ibn Koldoon hospital. From each patient approximately 5-10 g (Only one time) of fresh sample was taken using a wooden spatula ensuring that the sample was not contaminated with urine or water in a clean sterile screw disposable plastic container labeled clearly with patients name, gender, age, address and date of collection. The collected stool samples were

macroscopically examined then, divided into two parts: The first part of the specimen was preserved in 10% formalin in one vial and the second stool was processed immediately for microscopic examination. The examinations were done in the laboratories of Ibn-Koldoon hospital, and then the results confirmed in laboratories of Faculty of Sciences, department of biology, Aden University by using the following methods:

Macroscopic Examination

The stool samples were examined with the naked eyes, for color, consistency and the presence of any adult helminthes, mucus and blood.

Microscopic Examination

Wet preparation technique

About 2 mg of faces were mixed with one or two drops of physiological saline (0.9 gm/dl) on a slide and covered with a cover-glass and examined microscopically, method were done as discriebed by [19]. Iodine wet mounts, Methylene blue wet mounts, Eosin stain 5g\1(0.5%w\v), Trichrome stain, all methods were done as discriebed by [20].

Saturated sodium chloride floatation technique

The saturated sodium chloride technique is a useful and inexpensive method of concentrating hookworm or *Ascaris* eggs, e.g. in field surveys. This technique was done according to [20].

Formalin – Ether sedimentation technique:

All specimens were kept in refrigerator set at 4 ºC for not more than 24 hour before examination. These specimens were used for formalin-ether sedimentation. Approximately 2 g of stool were emulsified in a wax-paper cup using applicator sticks in 20 ml of distilled water. Half of this suspension was then filtered through two layers of gauze into each of two 15 ml-conical tubes and centrifuged at 1,500 r.p.m. for 2 min [21]. Permanently stained preparations of stool specimens were made with material preserved in polyvinyl alcohol by use of Wheatley's (**35**) modified trichrome stain (HIMedia Laboratories Pvt. Ltd.).

Blood samples

Blood samples were collected from infected suspected patients and non-infected attending healthy people (384 + 33=417 blood samples), with symptoms for intestinal parasitic infection and controls; a sample of blood consisting of 5milliliters obtained from anticubital and/or jugular vein by a sterile disposable syringe from each patients and including the control group.

Microscopy and HB, Eosinophil and WBC concentration determination

About 3 ml of whole blood was collected into EDTA anticoagulated tubes to perform the concentration determination. Total White Blood Cell Count, Eosinophil Count weren performed according to [22, 23]. Haemoglobin determination was performed by using Sahli method according to [23]. Total white blood cell count, eosinophil count and haemoglobin determination were converted by using the Mindray Auto haematology analyzer (BC-2800, Shenzhen Mindray Bio-Medical Electronics Co., Ltd).

Calculators of converting units

Converting units from 10^3/µl count WBC to WBC cells/mm^3 , and from % count Eos. to cells/mm^3 Eos., were done according to the law of Calculators available at: (https://www.merckmanuals.com/medical-calculators/AbsEoCount.htm).

$$\text{WBC cell/mm}^3 = \text{WBC } 10^3/\ \mu\text{l} \times 1000$$

$$\text{Eosinophil cell/ mm}^3 = \frac{\text{Eosinophil Diff (\%)} \times \text{WBC } 10^3/\ \mu\text{l} \times 1000}{100}$$

Statistical Methods:

Data were transferred to SPSS software version 20 for statistical analysis. Descriptive statistics were used to show the distribution of IPW in terms of sex, age, and diagnosis year. Chi-square (χ^2) test was used to assess the association between variables, and the variables, significant at the univariate analysis, were then included in the multivariate analysis [24]. A *p*-value of < 0.05 was considered statistically significant.

Results:

A total of 645 samples were collected from patients were referred to a parasitological laboratory for faecal examination. All of those patients were complaining from different gastrointestinal symptoms. The patients had a single stool sample subjected to parasitological methods thick smear reading attending to Ibn- Koldoon hospital, in Lahaj governorate, Yemen, which.

The parasites load of these 645 stool specimens collected from patients positive and negative slides are shown in **(Fig 2)**. Results showed 612 (94.88%) cases were positive, and 33 (5.12%) negative. A total number of 645 patients were examined 384 patients were infected with *A. lumbricoides* , *H. nana* and *E. vermicularis*. There were 207/384 (53.91%) male, 177/384 (46.09%) female, and 36/384 (9.38%) were positive with both helmenthes and protozoan infections. The overall geometric mean

faecal egg count for *A. lumbricoides* it was 258, for *H. nana* was 51 and the respective estimate for *E. vermicularis* 33 . According to sex the 645 patients were distributed as follows; *A. lumbricoides* 258 patients (123 males and 135 females) with X^2= 0.558, *P-value* = 0.455, *H. nana* 51 patients (27 males and 24 females) with X^2= 0,176, *P-value* = 0.674, *E. vermicularis* 33 patients (30 males and 3 females) with X^2= 22.091, *P-value* = 0.000. **(Table 1**).

Table 2, showed the number of infected and the percentage of infection with parasitic helminthes according to age groups, where the studied samples were divided into three age groups. Most of the study participants, 228/384 (59.38%) were found in the age group of 20 and more years of old. It was found that the highest incidence of *A. lumbricoides* parasite was within the third age group (156) followed by the second category (66) and the lowest infection rate was in the first category (36). Statistical analysis showed high significant differences at (P<0.05) where P = 0.00. Followed by the infection with *H. nana* parasite, the highest infection was in the third category (30). Then the second age group (15) and the least infection within the first age group (6) and between the statistical analysis and high significant differences at (P<0.05) where P = 0.00. As for the *E. vermicularis* parasite, the highest infection was within the third age group 21) followed by the second category (9) and the lowest infection rate was for the first category (3). The statistical analysis showed high significant differences at (P<0.05) where P = 0.00.

The hematological parameters included RBCs, Hb, PCV, WBC, Neo., Bas., Eos., Lym., Mon., PL., MCV, MCH, and MCHC. The results of the current study showed the effect of the infection of intestinal parasites on some of the hematological parameters, whether increase or decrease (P< 0.05). The results also showed that other hematological parameters did not affect that infection. The blood analysis examinations were performed for hematology profile among patients and different groups of patients who were with intestinal helminthes infected. These examinations included (CBC), with the focus on total (WBC), Eeo. count and (Hb) determination. Helminthes infection is associated with an increased frequency of eosinophils but decreased frequencies of neutrophils, lymphocytes, and monocytes as shown in **(Table 3)**, INF individuals differed from UN individuals in exhibiting significantly lower Hb. levels (P<0.000), Hct. (P= 0.003) and RBC counts (P= 0.000). In contrast, INF individuals had significantly increased numbers of Eos. (P<0.0001) and WBC counts (P= 0.659). Hematological changes caused by intestinal helminths (*A. lumbricoides, H. nana and E. vermicularis*) reflexed by **(Table 4)**, results shows the blood analysers of the infection according to age groups. Significant differences were found in WBC and eosinophil number as well as Hb, and through statistical analysis, significant differences emerged at the level of significance (p< 0.05) where the value of *P. value* was equal to (0.000). The results indicate a slight rise in WBC in the first age group (1-9). While it was lower in the second and the third age group (10-19 and ≥20). As a noticeable rise in Eos. cells appeared, as it was the highest in the first age group and equal in the rise in the other two groups (10-19; ≥20), and a decrease in the level of Hb appeared and the first age group (1 - 9) was the most severe,

White blood cells determination (WBC count): This examination was performed for three different groups of ages. and each group included 45, 111 and 228 patients. The mean value ± S.D. of total WBC count for the 1st , 2nd and 3rd groups was 8.4913 ± 3.66958, 6.0976 ± 2.49742 and 7.1446 ± 3.64568 respectively (**Table 5**).

Hemoglobin determination (Hb): This examination was performed for the same three groups of ages as mentioned above. The mean value ± S.D of Hb is 8.4200 ± 1.05240, 10.3712 ± 1.57170 and 10.8610 ± 1.52264 gm/dl for 1st, 2nd and 3rd group respectively (**Table 5**).

Eosinophil count: This examination was also performed for three different groups of ages. and each group included, mentioned previously with WBC count. The mean value ± S.D of eosinophil count is 11.1756 ± 3.34325, 9.8414 ± 3.35661 and 9.9575 ± 3.45548 for the 1st, 2nd and 3rd group respectively (**Table 5**).

A comparison between those infected with the (IH), *A. Lumbricoides*, *H. nana* and *E. vermicularis* and non-infected subjects (control group) showed in the following hematologic markers WBC / Eos. / Hb, clear effects to the blood components (**Fig 3**).

This is shown by the comparison (**Table 5**), above, where the study found that the WBC values did not differ significantly between their values for the infected (6990 cells per cubic milliliter) and the non-infected (7040 cells per milliliter). It also found that there was a noticeable effect on the values of (E), as it was found in the infected with a significant increase (671.74 cells per cubic milliliter of blood). As for the non-infected (the control group), the values were low (130.94 cells per cubic milliliter). As for the Hb level, it was lower among the infected, reaching (10.19 grams per deciliter), while the uninfected people was relatively high, reaching (12.86 grams per deciliter).

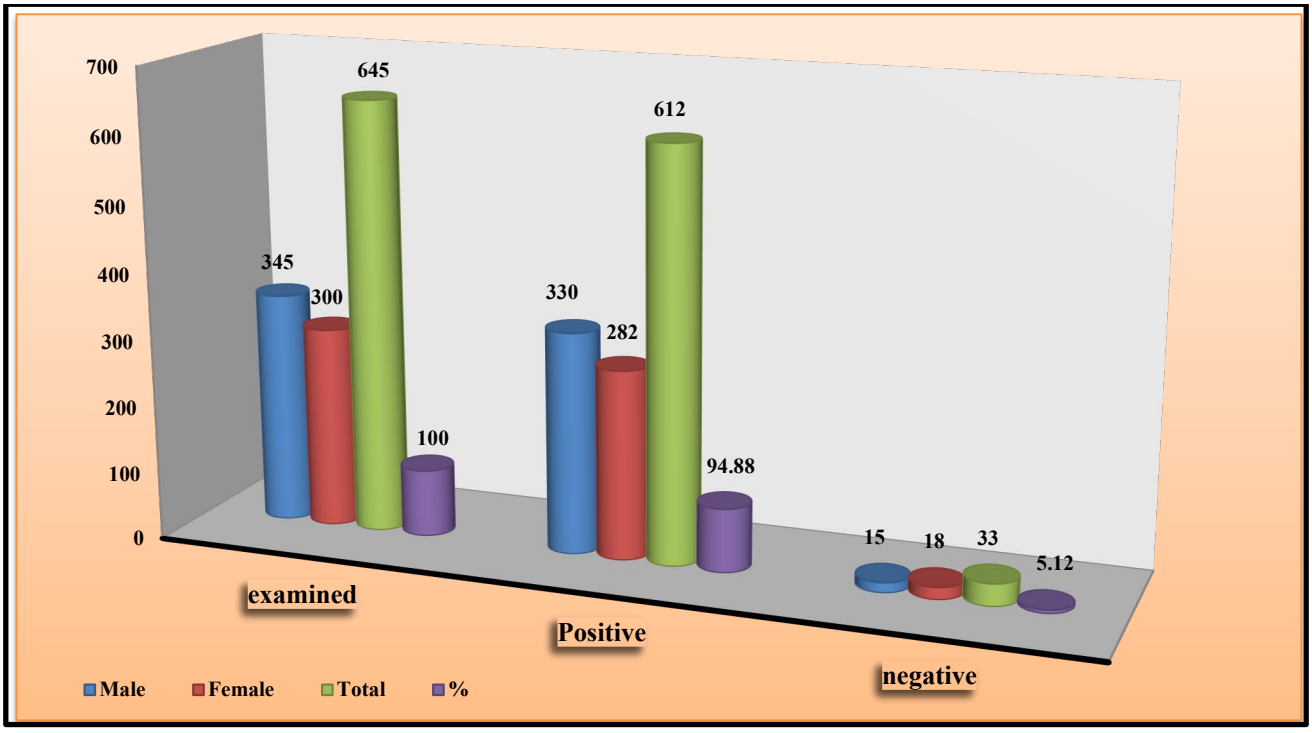

Fig. 2: Prevalence rates of intestinal parasites *(A. lumbricoides , H. nana* and *E. Vermicularis*).

Table (1): Prevalence of intestinal parasites infection by sex.

Type of helminths	Positive. No		Total	X^2	P-value
	Male	Female			
A. lumbricoides	123	135	258	0.558	0.455
H. nana	27	24	51	0,176	0.674
E. vermicularis	30	3	33	22.091	0.000
A. lumbricoides +E. vermicularis	3	3	6	0.000	1.000
lumbricoides + H. nana + E. histolytica	12	6	18	2.000	0.167
A. lumbricoides +E. vermicularis + E. histolytica	6	3	9	1.000	0.317
lumbricoides + H. nana + G. lamblia.	0	3	3	-	-
A. lumbricoides + E. vermicularis + G. lamblia	3	0	3	-	-
H. nana + E. vermicularis + E. histolytica	3	0	3	-	-
	207 (53.91%) X^2=448.65 P-value =0.00	**177 (46.09%) X^2=569.39 P-value =0.00**	**384**	**1273.55**	**0.000**

Significant at *P- value* < 0.05. X^2 : Chi Square. No : Number

Table (2): Prevalence of intestinal parasites infection among patients by age group.

Type of helminths	1 _ 9 No (%)	10_19 No (%)	20 and more No (%)	Total	X^2	P-value
A. lumbricoides	36 (9.38%)	66 (17.19%)	156 (40.63%)	258 (67.19%)	90.698	0.000
H. nana	6 (1.56%)	15 (3.90%)	30 (7.81%)	51 (13.28%)	17.294	0.000
E. vermicularis	3 (0.78%)	9 (2.34%)	21 (5.47%)	33 (8.59%)	15.273	0.000
A. lumbricoides + E. vermicularis	0	0	6 (1.56%)	6 (1.56%)	0.00	0.00
A. lumbricoides + H. nana + E. histolytica	0	12 (3.13%)	6 (1.56%)	18 (4.69%)	2.000	0.157
A. lumbricoides + E. vermicularis+ E. histolytica	0	6 (1.56%)	3 (0.78%)	9 (2.34%)	1.000	0.317
A. lumbricoides + H. nana + G. lamblia	0	0	3 (0.78%)	3 (0.78%)	-	-
A. lumbricoides + E. vermicularis+ G. lamblia	0	3 (0.78%)	0	3 (0.78%)	-	-
H. nana + E. vermicularis + E. histolytica	0	0	3 (0.78%)	3 (0.78%)	-	-
Total	**45 (11.72%)**	**111 (28.91%)**	**228 (59.38%)**	**384(100%)**	**1273.547**	**0.000**

In the first age group G1 (1 - 9 years) 45 samples and the parasite *A. lumbricoides* occupied the highest infection rate as it reached 36/45 (80%) in a single case and the lowest infection rate was *E. vermicularis* it reached 3/45 (6.7%).

As for **the second age group, G2** (10-19), the incidence of intestinal helminths in this group was (111) samples, and the

parasitoid *A. lumbricoides* showed an infection rate of 66/111 (59.5%) as the highest infection rate, and the lowest rate was

E. vermicularis 9/111 (8.1%) as a single infection.

The third age group G3 (20 and more) was the incidence of intestinal parasitic religions 228 samples, and the parasite

A.lumbricoides occupied the highest single infection rate as it reached 156 (68.4%) and *E. vermicularis* was the lowest single infection rate as it was 21 (9.2%).

Table (3): Infection with intestinal helminths *(A lumbricoides, H. nana and E. Vermicularis*) and hematology profile among patients.

	INF (n = 384)	UN (n=33)	P- value
Hb g/ dl (Range)	10.31 (9.00 – 11.00)	12.95 (10.00 – 15)	0.000
RBC 10^6/µl (Range)	4.07 (3.85 – 4.55)	4.53 (3.19 – 6.33)	0.000
WBC 10^3/µl (Range)	7.44 (5.36 – 11.35)	7.04 (2.49 – 19.58)	0.659
HCT% (Range)	32.72 (28.40 – 33.40)	36.87 (24.70 – 49.60)	0.003
PLT 10^3/µl (Range)	278.400 (312 – 392)	321.972 (33 – 681)	0.207
Neutrophil 10^3/µl (Range)	44.230 (44 – 66)	44.630 (12 – 85.40)	0.910
Lymphocyte10^3/µl (Range)	39.95 (22 – 43)	42.43 (11.20 – 75.50)	0.469
Monocyte10^3/µl (Range)	8.390 (5 – 8)	9.600 (2.50 – 19.00)	0.97
Eosinophil 10^3/µl (Range)	11.45 (10 – 13)	1.95 (0.1 – 4.90)	0.000
Basophil 10^3/µl (Range)	0.72 (0.0 – 0.0)	0.94 (0.2 – 5)	0.324

RBC; red blood cell; **WBC;** white blood cell; **(Neu.);** Neutrophil; **(Lym.);** Lymphocyte; **(Mon.);** Monocyte; **(Bas.);** Basophil; **(Hct);** haematocrit; **(PL);** Platelets**; (Hb);** Hemoglobin; **(INF);** Helminthes - infected; **(UN);** uninfected.

Table (4): The blood analyzer examinations for intestinal helminthes.

Subject	No	Age group	T.W.B.C count		P. value	Eosinophil count		P. value	Haemoglobin Hb determination g/dl		P.value
			Mean ±S.D	Rang		Mean ±S.D	Rang		Mean ±S.D	Rang	
Group (1)	45	1__9	8.4913 3.66958	3.81_ 16.70	0.000	11.1756 3.34325	5.00- 15.70	0.000	8.4200 1.05240	6.00 –9.70	0.000
Group (2)	111	10 __ 19	6.0976 2.49742	2.0 _ 13.40	0.000	9.8414 3.35661	3.50_ 16.00	0.000	10.3712 1.57170	5.20 –14.00	0.000
Group (3)	228	20 and more	7.1446 3.64568	1.22_ 19.60	0.000	9.9575 3.45548	2.20_ 17.60	0.000	10.8610 1.52264	7.10 –14.80	0.000

WBC (10^3/µl)
Eosinophil (10^3/µl)
Hb (g/ dl)

Table (5): White blood cells, Eosinophil. and Hb for patients infected and non-infected with intestinal helminthes.

Infected No	WBC cell/mm3 (mean)	non infected persons No	WBC cell/mm3 (mean)
384	6990	33	7040
Infected No	Eosinophil cell/mm3 (mean)	non infected (persons No)	Eosinophil cell/mm3 (mean)
384	671.74	33	130.94
Infected No	Hb level g/dl (mean)	non infected (persons No)	Hb level g/dl(mean)
384	10.19	33	12.86

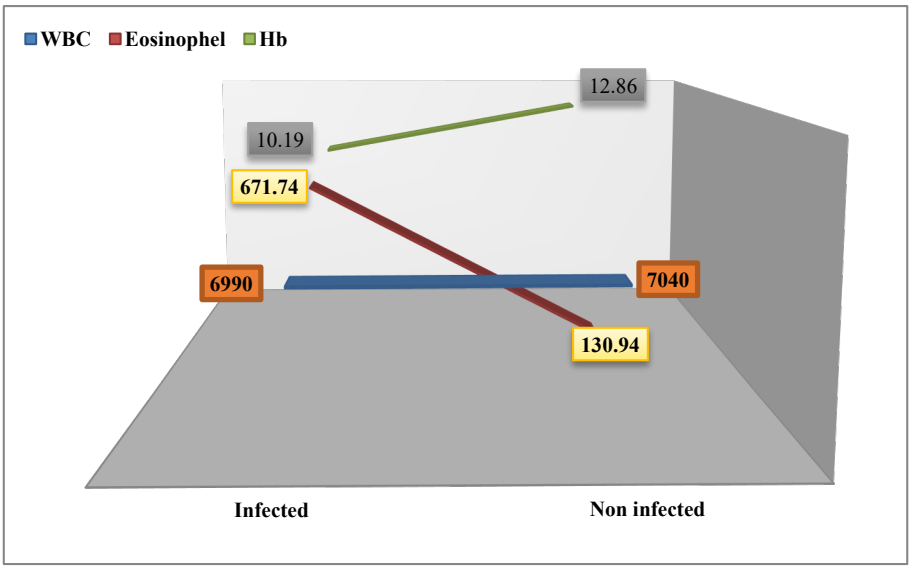

Fig. 3: A comparison blood analyzer between the infected and non-infected with intestinal helminths.

Discussion:

Among 645 patients examined, 612 were found infected with (IH) (94.88%), and 33 were negative (5.12%), this results seems to be same as found by [25, 26]. This conclusion was supported by our results, where the prevalence was considerably higher than the prevalence previously reported from the different governorates in Yemen [27, 28, 29], and an other countries [30, 31, 32]. The commonest (IH) were *A. lumbricoides* 42.16%, *H. nana* 8.33 %, *E . vermicularis* 5.39 %. Similar parasites with partial prevalence were reported from Abb, Yemen, and Cana city, Egypt [33, 28]. However, same species of the intestinal parasite with variant prevalence detected in Sudan and other countries [13, 16, 31]. The presence of certain parasites like *E. vermicularis*, even though it was found in low rate, is alarming. The transmission of such parasites occurs easily (by scratching the anus region and lack of personal hygiene). Autoinfection is common with this parasite [24]. We believe that the reason for this high rate of infection with these helminthes among patients is due to the displacement of people from villages to the city, especially during and after the last war in (2015), the low level of social awareness and health education in addition to the prevalence of poverty among people and their lack of resort to treatment due to the high prices of laboratory tests and high prices for medicines. Parasites can be transmitted by eating contaminated undercooked beef, chicken and fish or other foods, walking barefoot on infected soil, eating unclean raw fruits and vegetables or drinking infected water [34].

Our results showed that the infection rate of (IH) were different between male (53.91%) and female (46.09%). The infection rates were higher among males than among females with a clear same significant (*P-value* =0.00). It is difficult to give explanation for such an observation, but we think that, males are more exposed to out-door eating habits and/or poor personal hygiene behaviour compared to females. In particular, males appeared to have a higher prevalence helminthes rate (51.16%) than females (43.72%), this may be an indication that the two genders are not equally exposed to infection. A same prevalence rate of intestinal parasitosis (Male and female) were reported earlier in Sudan and Peru [35, 32], and not the same as our result and as reported by [36].

Our results are consistent with what researchers found locally, in a study of Yemeni researchers [26], which they conducted on the spread of intestinal parasites infection among school children in Al-Mahwit governorate, and found the male infection rate (46.5%) higher than the infection rate of female (43.5%). In another study in Lahj governorate, the researchers [9], found that the infection rate in males (72%) is higher than females (58%). And in the governorate of Ibb and in a study conducted by [28] about pattern of intestinal parasites infection as a general health problem among school children: a comparative study between rural and urban areas in the Ibb governorate of Yemen found that the infection rate in males (66.15%) was higher than the infection rate in females (50.7%). The positive infection was high in almost of the different areas in Yemen, and the high positive infection returned to use unclean stream water as a source of drinking water instead of sterile and treated water supply. Also, our results are consistent with research from outside Yemen, and the researcher Van and his colleagues from the Marshall Islands [5] concluded that the proportion of infected males (24.5%) and females (20.31%). As for the researcher Anwar and his colleagues [36], it was found that the proportion of infected males is 16.1%. Likewise, the researcher [31] found that the percentage of males with intestinal parasites (8.7%) and females (6.1%). Likewise, the study conducted in Pakistan for Afghan immigrants. Li and his collageus [37] found that in the study of the factors of infection with *E. vermicularis* infection on children of Gaozhou, Guangdong in China in southern China, the

percentage of infection in males was higher than in females where it was (55.63%) (53.73%), respectively. As for Siddig and his collageus [32], his study found on a selected group of primary school children in the Haj Youssef area of Khartoum, Sudan, that the percentage of infection in males (80%) is higher than that of females (60%). Whereas, these values differed for [38] where the infection rate was higher in females (60%) and in males (40%). In one of the researches of Suliman and his colleagues [36], he conducted on school children in the White Nile State in Sudan, indicating that the percentage of females with intestinal parasites (2.1%) is higher than males (0.7%). Also Latifa [39] found that in her thesis workthe infection among females was (65.7%) and males were (60.8%). As for the researcher [40], he had an equal ratio of infection between males and females when studying the prevalence of *H. nana* among primary school children in Burkina Faso (3.2%).

The results showed that the third age group (20 and more) was the most affected with intestinal helminthes, and it reached 228 (59.38%), our finding was in line with studies conducted in [34]. While the first age group (1-9) was the lowest with 45 (11.72%). This might be due to working people who are engaged in agriculture and most likely exposed to infection through contaminated soil, water and food. Other causes may be due to the low hygienic measurements of these patients. This age group, might have also contributed to the higher prevalence of *E. histolytica*. While it was less prevalent in age group 1-9 years old 45 (11.72%).The prevalence of *A. lumbricoides* also peaked in this age class (20 and more), but not that of *H. nana* which showed peak prevalence among younger subjects in age class 1-9. The same results gave by [35]. Our results are consistent with other local research, taking only proportions, and we did not consider age groups. In a joint study by Al-Wabr and Al-Muayyad researchers [26] that, they conducted on the spread of intestinal parasites infection among school children in Al-Mahwit governorate, they found the infection rate in the age group (10-12) was 43% while the infection rate in the age group (7-9) lowest it was 11.5%. Our results were not consistent with other local and external research, taking into account the older age groups always. As for [9], they found that, the percentage of infection in the age group (11-15) was higher 75.75% than in the age group (0-5) was the lowest injury 46.15%. [8] on the pattern of intestinal parasite infection as a general health problem among school children: a comparative study between rural and urban in Ibb governorate in Yemen found that, the age group (10-11) was 31.8% higher than the age group (14- 15) where it was 16.2%, while [39] found that in its study, the age group (9-11) had the highest incidence rate of 70%, while the age group (15-17) was the lowest 52.9%.

Darlan *et al.,* [38] found that in his study on the relationship of (STH) and the level of eosinophil among primary school children in Medan, Indonesia, the incidence rate in the age group (10 years) was 60%, while the age group (<10) was 40%. As for Fan and his colleagues, he found [5] in his study on the prevalence of *E. vermicularis* infection in risk factors among preschool children in the Capital Region of the Republic of the Marshall Islands. He found the infection rate in the age group (5> years), it was significantly higher 32.77% and in age group (<5 years) it was 17.95%. Suliman *et al.,* [36], performed on school children in White Nile State, Sudan, found the age group (10-13) recorded the highest incidence rate of 42.7%, and the age group (14-17) recorded 14.2%. As for AbdElla *et al.,* [33] in his study of Ascaris and intestinal helminths, anemia and eosinophil among residents of Qena governorate in Egypt, it was found that the age group (21>) was the infection rate 52.1%, and the age group (<21) was the injury 47.9%.

Siddig and colleagues [32] found in his study, on a selected group of primary school children in the Haj Youssef area of Khartoum, Sudan, that the percentage of infection in the age group (5-7) was 82.5%, while the percentage of infection in the age group (12 -14) is 55.50%. Bagian *et al.* [40] when studying the prevalence of *H. nana* among Burkina Faso school children, he found that the most affected group was 7 years old with a prevalence of 4.83%, while the lowest group was (11 years) with a prevalence of 1.99% . Infections due to *H. nana* in adult patients are rarely seen. I think the transmission is considered to be due to inside of Yemen and travelling or migration from surrounding countries such as Somalia and Ethiopia. In Pakistan [41] found in his study on the prevalence of *G. intestinalis* and *H. nana* in a number of Afghan refugees from Mianwali, Pakistan the incidence of *H. nana* in the age group (1-15) was 41.8%, and the age group (above 45) it was the lowest 14.5%. The study of Mirisho *et al.,* [31] that showed, about the prevalence of intestinal helminthes among children attending Princess Mary Lewis Children's Hospital showed the incidence of intestinal helminthes was the age group 6-10 years (43.3%), while it was in the age group 0-2 years (1.4%) the least. In Malaysia, according to [36] study, which was about new visions of *E. vermicularis* infection among pre-school children. For a school in an urban area where the infection rate is significant in children in the age group (5-6) where it was 17.5%, while the age group (1-4) was 5.4%.

The results of the current study showed the effect of the blood analyzer among people with (IH) (*E. vermicularis*, *H. nana* and *A. lumbricoides*) compared to the results of the control group. Some values were close to each other, others were far away. The mean Hb level decreased (10.19 g/dl) in those with helminth infections compared to the control group where it was (12.86 g/dl). Anemia is a common occurrence when parasites are infected, and the WHO considered that each value less than (12 g/dl)

is considered an anemia in its report issued [42]. The current study also showed the value of WBC mean for the infected (6.99 × 10^3/µl), which equals (6990 cell/mm^3) according to the law of converting units from 10^3/µl count WBC to WBC cells/mm^3 , calculators are available at: (https://www.merckmanuals.com/medical-calculators/AbsEoCount.htm). An approach to the WBC Mean value of the control group (7.04 × µl/10^3), which equals (7040 cell/mm^3) . As for the value of (mean eosinophil 9.61%), it is equal to (671.74 cell/mm^3) according to the law of converting units from% count (E), to cells/mm^3 (E), Abdul-Kafaji**,** showed a noticeable rise compared to the values of the control group (1.86%), ie equal to 130.94 cell/mm^3 [42]. The decreasing of Hb level that is associated with increasing of (E), and total WBC numbers is found in agreement with results of other researchers [42].This is what [43] went to in his study on physiological variables among children with some intestinal parasites in Diwaniya governorate, where this study showed a decrease in the level of Hb (10.3g / dl) and WBC rise (7700 cells/mm^3) as well as cell values (E), where it was (0.7%). As for the researcher [44], her study conducted on intestinal helminthes and their effect on the level of some blood components in the city of Ramadi showed a decrease in the percentage of hemoglobin level with a range ranging from infected (9.61 - 11.79 g/ml), while the control group when studying it (12.5 g/mm). It also noticed a rise in the number of WBC in a range (6100 - 8900 cell/mm^3) in the affected groups, as well as an increase in the number of eosinophil in patients with a range (285 - 646 cell/mm^3). Another criterion for anemia was established by [33], when the Hb level fell below (11.5 mg/dl) and high (E), (45.28%) among the patients in his study of Ascaris and some intestinal helminths. Eosinophil counts are not diagnostically reliable. Eosinophilia is sporadically present and does not correlate with the severity of the infection. eosinophil counts also do not help in monitoring treatment modalities [29]. Al-Mozan and his collageus [45] found a decrease in the level of Hb in people with helminthes, in males it was found that the level of Hb (11.1 g/100ml) and the level in females was (11.8 g/100ml). As for the WBC level, it was higher than normal, for males it was (8573.5 cell/mm^3), while for females (8385.7 cell/mm^3). Likewise, the level of (E), was found to be low in males (154.3 cell/mm^3), while females were (218.0 cell/mm^3). Ashcroft and his collageus [30] found in his study the low level of Hb in people with intestinal helminthes where the average Hb level (11.0 g/dl) was lower than the normal rate according to the WHO definition of anemia in children where it is less than (11, 5 g/dl). Ayman, [17] found in her study the decrease in the rates of Hb for the injured, where it was between the range (9.61 - 11.79 g/mm^3), and also noticed that the WBC numbers increased by a range of (8900 - 6100 cell/mm^3) compared to the control group (5900 cell/mm^3) as well, height of (E), with a range (284 cell/mm^3 - 646 cell/mm^3).

Conclusion:

The necessity of spreading health education among members of the community and showing the danger of infection with intestinal worms in particular and parasites in general. The hematological parameters showed a statistically significant difference (*P=0.00*) in the three age groups. Where the values of white blood cells (8.49 Mean) and eosinophils (11.174 Mean) were more elevated in the first age group, while they decreased in the second and third age groups, while the level of Hb was the most low (8.420 Mean). In the first, second and third age groups..

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مقالة بحثية

أنتشار و تأثير دودة الصفر الخراطيني، الدودة الشريطية القزمة و الدودة الدبوسية على الصورة الدموية المرافقة لها في مستشفى ابن خلدون، محافظة لحج- اليمن

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المُلخّص

العدوى الطفيلية المعوية، هي أكثر أنواع العدوى شيوعًا في جميع أنحاء العالم. تشير الدراسات الوبائية المختلفة في اليمن والدول الأخرى إلى أن معدل انتشار الطفيليات المعوية مرتفع، خاصة في الدول النامية.

أجريت دراسة مقطعية من أكتوبر 2019 إلى أكتوبر 2020، لتقييم انتشار عدوى الديدان الطفيلية (IPW) وعوامل الخطر المرتبطة بها. شملت هذه الدراسة 645 مريضاً من كلا الجنسين ومختلف الأعمار. تم فحص عينات البراز مجهريًا باستخدام تقنيات التركيز المباشر للرطوبة، وتقنيات تركيز الأثير الرسمي وتقنية تعويم كلوريد الصوديوم المشبع. قمنا بتحليل صورة دم الأشخاص المصابين وغير المصابين وركزنا على الصور الثلاث لخلايا الدم البيضاء (WBC) والهيموغلوبين (Hb) والحمض (E). تم استخدام استبيان منظم للحصول على معلومات تتعلق بعوامل الخطر المرتبطة. تم تحليل البيانات باستخدام الإصدار 20 من SPSS.

بينت النتائج ان (94.88%) كانت ايجابية وسلبية 33 حالة (5.12%). ومن بين (94.88%) حالات إيجابية كانت (53،59%) من الحالات إيجابية مع الديدان المعوية (IH). بلغ معدل الإصابة للذكور (47.65%) للإناث (42.97%) للحالات، وأظهر التحليل الإحصائي فرقاً معنوياً عند مستوى الدلالة .(P <0.05) كما أظهرت بعض المتغيرات الدموية لصورة الدم المأخوذة من المرضى اختلافات معنوية مقارنة بالمجموعة الضابطة، حيث انخفض مستوى الهيموجلوبين (Hb) (10.19 جم / ديسيلتر) وزيادة طفيفة في عدد خلايا الدم البيضاء (WBC). (6990 خلية / مم^3) وارتفاع في خلايا الحمضات (E) 74.671 خلية / مم^3.

في الختام ضرورة نشر التثقيف الصحي بين أفراد المجتمع وبيان خطورة الإصابة بفيروس IPW بشكل خاص والطفيليات بشكل عام. وأظهرت المتغيرات الدموية وجود فرق معتد به إحصائيا (*P = 0.00*) في الفئات العمرية الثلاث. حيث كانت قيم WBC 8.49 المتوسط و (E) 11.174 أعلى ارتفاعا في المجموعة العمرية الأولى، بينما انخفضت في المجموعتين العمريتين الثانية والثالثة ، بينما كان مستوى الهيموغلوبين أقل مستوى (8.420 متوسط). في الفئات العمرية الأولى والثانية والثالثة.

الكلمات المفتاحية: الديدان الطفيلية المعوية، خلايا الدم البيضاء، الحمضات، الهيموجلوبين، بارامترات الدم.

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