

## RESEARCH ARTICLE

# Prevalence of Intestinal Parasitic Infestation in Anemic Patients Attended to Al-Diwaniyah Teaching Hospital at Al-Qadisiyah Province/Iraq

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## ABSTRACT

The present study was conducted from November 2016 to October 2018 at Al-Diwaniyah Teaching Hospital (Al-Qadisiyah province/Iraq) to investigate the prevalence of intestinal parasites in anemic patients using conventional classical methods. Stool and blood samples were collected from 974 patients to detect the parasite, the RBC count, PVC, and the Hb level. The result shows that overall of anemic patients, the parasitic infestation was 64% were positives. Among positive infected patients, exhibiting multiple parasitic infestations accounted for 45 %, while patients with single parasitic infestation accounted for 55%. The wet amount and staining method were used to detect the intestinal parasite, and the results show protozoans trophozoite and cyst of *Entamoeba histolytica*, *Giardia lamblia*, *Balantidium coli*, and the oocyst of *Cryptosporidium* while the result detects the egg of helminthes were *Enterobius vermicularis*, *Trichuris trichiura*, *Ascaris lumbricoides*, *Ancylostoma duodenale* and *Strongyloides stercoralis*.

Concerning social factors (age, gender, and residence), significant elevation ( $p < 0.05$ ) were observed in groups of  $< 10$  years (85.87%), males (69.57%), and rural areas (80.37%). Values (Mean  $\pm$  Standard error) of RBCs indices showed that there were significant decreases ( $p < 0.05$ ) in total RBCs count [ $(3.87 \pm 0.23) \times 10^6/\mu\text{L}$ ], Hb [ $(10.62 \pm 0.86)$  g/dL], MCH [ $(27.44 \pm 1.36)$  pg], and MCHC [ $(27.87 \pm 2.75)$  g/dl]; and significant increases ( $p < 0.05$ ) in values of PCV [ $(38.11 \pm 1.49)$  %], and MCV [ $(98.48 \pm 3.65)$  fl]. Macrocytic (62.26%) and normocytic (51.73%) were the commonest types of anemia reported among infested and non-infested patients, respectively. Association between species of intestinal parasites and type of anemia were detected in this study. It showed that *E. vermicularis* (91.19%), *B. coli* (45.59%), and *A. duodenale* (91.67%) were significantly prevalent ( $p < 0.05$ ) among macrocytic, normocytic and microcytic anemic patients, respectively.

**Keywords:** Al-Diwaniyah, Al-Qadisiyah, Intestinal parasite, Iraq, Patient.

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## INTRODUCTION

Parasitic diseases are one of the largest public health problems in both developing and developed countries, which infect many bodily organs/tissues especially digestive system resulting in significant morbidities and mortalities.<sup>1,2</sup> In developed countries, protozoan parasites tend to be more prevalent among gastrointestinal infections compared to helminths.<sup>3</sup> The most common intestinal protozoan diseases reported in humans include cryptosporidiosis, balantidiasis, giardiasis, and amoebiasis; whereas, cestodes, nematodes, and trematodes are the most common intestinal helminthic parasites.<sup>4,5,6</sup> Although many countries joined under world health organization (WHO) has pledged to address the problem in collaboration with multinational pharmaceutical companies who have committed to providing antihelminthic drugs free of charge or at a reduced cost.<sup>7</sup> However, these infections still

worldwide existence, mainly in low socioeconomic status and poor sanitation conditions that appeared with higher rates of parasitic disease prevalence.<sup>8</sup>

Several environmental, social, geographical, and other factors can affect the distribution of intestinal parasites. In addition, parasitic infections can impose on health and social problems such as poor absorption of nutrients, impaired work capacity and severe weakness,<sup>9,10</sup> chronic diarrhea,<sup>11</sup> anemia,<sup>12</sup> and even reduced growth rate, low attention span, and learning disabilities.<sup>13</sup> Persistent diarrhea with other digestive disorders as abdominal pain is the major communicable global burden disease second only to respiratory infections, which conceived that parasitic infections are the main pathogens to be considered.<sup>14</sup> Anemia continues to be global problem as it has multi-factorial causes ranging from micronutrient deficiencies such as iron, folate and vitamin B12; and infectious pathogens such as parasites, bacteria and viruses.<sup>15</sup> Many studies were

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demonstrated the relationship between anemia and parasitic infections that exhibited significantly affects the hematological status, particularly the mean of hemoglobin (Hb) indices.<sup>16</sup>

Today, several diagnostic developed techniques with more sensitivity and specificity are available for diagnosis of parasitic intestinal infections, but they highly expensive to apply on a large number of samples, and most of them are *in vitro* research use only. However, classical methods are still more applicable to the field because as they simple, fast, and cheap.<sup>17</sup> In Iraq, many studies have shown that the prevalence of intestinal parasites among different regions is still widespread.<sup>18</sup> Therefore, the present study aims to investigate the prevalence and types of intestinal parasites among anemic patients in Al-Qadisiyah province, with detection the association of infection rates to social factors, RBCs indices, and of anemia's type among infected patients.

**MATERIALS AND METHODS**

**Samples**

This study was conducted during the period from November 2016 to October 2018 at Al-Diwaniyah Teaching Hospital (Al-Qadisiyah province/Iraq). Of different ages, sexes, and residences; a total of 974 anemic patients with a history of diarrhea, abdominal pain, and/or anemia were subjected for collection of blood and feces as study's samples. A total of 2.5 mL venous blood was drained from each patient using a disposable syringe and put into an Ethylenediaminetetraacetic acid (EDTA) tube. Fecal samples were collected into disposable plastic containers that labeled with identifiable numbers with adding 10% of formalin solution to avoid egg hatching. Related data concerned with age, gender, and residence were recorded.

**Diagnostic methods**

In this study, blood samples were analyzed by an automated hematology analyser (*Sysmex, Germany*) to detect the values of red blood corpuscles (RBCs) indices including total RBCs count, packed cell volume (PCV), hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC).

Whereas, fecal samples were examined at the laboratory to detect the presence of intestinal parasites using three classical conventional methods:

- Direct saline/Iodine wet mount.<sup>19</sup>
- Acid-fast stain /modified ziehl-neelsen stain method.<sup>20</sup>
- Cellophane tape metho. This test was used to identify the worm or eggs of the pinworm parasite.<sup>21</sup>

**Statistical analysis**

All obtained results of diagnostic methods in addition to collecting data related to age, gender, and residence were entered, tabled, figured, and analyzed using two computerized programs, Microsoft office excel (*v<sup>2010</sup>*) and IBM/SPSS (*v<sup>23</sup>*). Chi-square ( $\chi^2$ ) and t-test were applied to detect the significant differences at *p-value* of <0.05.<sup>22,23</sup>

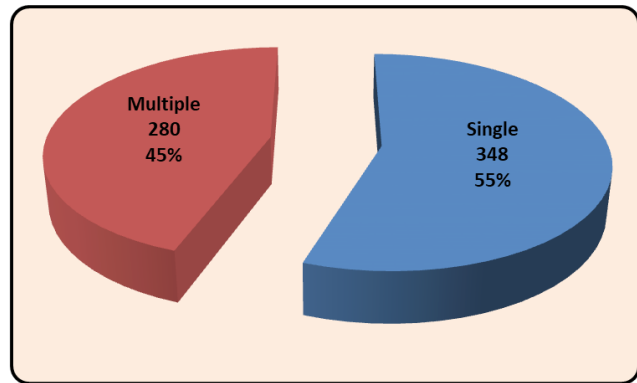
**RESULTS**

Majority of anemic patients showed 64% evidence of parasitic infestation was, the highest of cases were infected with *Entamoeba histolytica*, accounting for 28.82%, while *Strongyloides stercoralis* accounts for the lest frequency of parasitic infestation 2.23%. Other parasitic species ranged from 8.92 up to 26.75%, as shown in Table 1.

Patients exhibiting multiple parasitic infestations accounted for 45%, while patients with single parasitic infestation accounted for 55%, as shown in Figure 1.

The various combination of parasitic infestation and their percentages are demonstrated in Table 2.

Male patients were significantly more liable for parasitic infestation, in whom the percentage was 68.79%, while in female patients the percentage of parasitic infestation was much lower, also the patients living in rural area were significantly more prone to parasitic infestation than those from urban areas,



**Figure 1:** Patients with single parasite versus patients with multiple parasites

**Table 1:** Number of cases according to the type of parasitic infestation

Parasite	Number	Percentage
Entamoeba histolytica	181	28.82
Ascaris lumbricoides	168	26.75
Balantidium coli	112	17.83
Cryptosporidium	112	17.83
Enterobius vermicularis	112	17.83
Giardia lamblia	98	15.61
Ancylostoma duodenale	69	10.99
Trichuris trichiura	56	8.92
Strongyloides stercoralis	14	2.23

**Table 2:** Number of patients with multiple parasitic infestations

Parasite	Number	Percentage
Enterobius vermicularis + Entamoeba histolytica	28	4.46
Giardia lamblia + Entamoeba histolytica	28	4.46
Cryptosporidium + Entamoeba histolytica	28	4.46
Cryptosporidium + Giardia lamblia	28	4.46
Entamoeba histolytica + Balantidium coli	28	4.46
Trichuris trichiura + Ascaris lumbricoides	28	4.46
Balantidium coli + Giardia lamblia	14	2.23
Trichuris trichiura + Entamoeba histolytica	14	2.23
Enterobius vermicularis + Ascaris lumbricoides	14	2.23
Balantidium coli + Enterobius vermicularis	14	2.23
Balantidium coli + Cryptosporidium	14	2.23
Enterobius vermicularis + Giardia lamblia+Balantidium coli	14	2.23
Ascaris lumbricoides + Balantidium coli	14	2.23
Ascaris lumbricoides + Entamoeba histolytica	14	2.23

while the patients with parasitic infestation were significantly younger than those without parasitic infestation.

The proportion of patients with macrocytic anemia was significantly higher in those with a parasitic infestation, 62.26% versus 8.09%, and more severely anemic than those without parasitic infestation, as shown in Table 3.

Microcytic anemia was the major type of anemia seen in patients with the following type of parasitic infestation: *Ancylostoma duodenale*, *Trichuris trichiura*, *Strongyloides stercoralis*. Macrocytic anemia was the major type of anemia seen in patients with following parasites: *Ascaris lumbricoides*. Normocytic anemia was the major type of anemia in patients with the following parasites: *Enterobius vermicularis* and *Balantidium coli*.

## DISCUSSION

Intestinal parasitic infestations still continue to be the most common cause of chronic infections in communities living in resources poor countries situated in the tropics and sub-

tropics.<sup>24</sup> Despite the attempts for controlling or reducing the prevalence of intestinal parasites in affected regions, these pathogens remained show remarkable resilience to maintain a stable population in their hosts.<sup>25</sup> It poorly understood to what extent intestinal parasites can contribute to the clinical symptoms of anemia, abdominal pain and/or diarrhea. The results of the present study showed that 64.48% of anemic patients were infected with intestinal parasites. Many previous studies carried out in Iraq and other neighboring and other adjacent countries have reported wide ranges of variation in prevalence of intestinal parasites as followings; 46.53%<sup>26</sup> and 57.95%<sup>27</sup> in Iraq, 10.66%<sup>28</sup> and 38%<sup>29</sup> in Iran, 32.2%<sup>30</sup> and 47.01%<sup>31</sup> in Kingdom of Saudi Arabia, 44.6%<sup>32</sup> and 60%<sup>33</sup> in Turkey, 85% in Lebanon,<sup>34</sup> 10.2% in Qatar.<sup>35</sup> Relatively, the stable prevalence of intestinal parasites in Iraq compared to previous studies could be attributed to the absence of awareness and health education, influences of contaminated environments, particularly water resources, and low practical and general improvements to health services and sanitary conditions.

**Table 3:** Association between parasitic infestation and demographic and hematologic parameters

Characteristic	No parasitic infestation n = 346	Parasitic infestation n = 628	Total n = 974	P
Gender				
Male	193 (55.78)	432 (68.79)	625 (64.17)	<0.001 **
Female	153 (44.22)	196 (31.21)	349 (35.83)	
Residency				
Urban	208 (60.12)	165 (26.27)	373 (38.30)	<0.001 **
Rural	138 (39.88)	463 (73.73)	601 (61.70)	
Age	43.15 ± 1.28	27.00 ± 0.93	32.74 ± 0.79	<0.001 **
PCV	22.96 ± 0.30	22.12 ± 0.31	22.41 ± 0.23	0.048 *
RBC	23.56 ± 0.42	24.70 ± 0.17	24.29 ± 0.19	0.004**
Hb	6.87 ± 0.06	6.51 ± 0.04	6.64 ± 0.04	<0.001**
Type of anemia				
Microcytic	139 (40.17)	167 (26.59)	306 (31.42)	<0.001**
Normocytic	179 (51.73)	70 (11.15)	249 (25.56)	
Macrocytic	28 (8.09)	391 (62.26)	419 (43.02)	

Data were expressed as either means standard error of mean or number (%); \* significant at P ≤ 0.05; \*\* highly significant at p ≤ 0.01

**Table 4:** Type of anemia seen in association with a certain parasite

Parasite	Microcytic		Normocytic		Macrocytic		P-value
	No.	%	No.	%	No.	%	
<i>Entamoeba histolytica</i>	14	12.61	0	0.00	27	12.92	0.130
<i>Enterobius vermicularis</i>	0	0.00	14	50.00	28	13.40	<0.001
<i>Giardia lamblia</i>	0	0.00	0	0.00	14	6.70	0.008
<i>Strongyloides stercoralis</i>	14	12.61	0	0.00	0	0.00	<0.001
<i>Ascaris lumbricoides</i>	0	0.00	0	0.00	98	46.89	<0.001
<i>Balantidium coli</i>	0	0.00	14	50.00	0	0.00	<0.001
<i>Trichuris trichiura</i>	14	12.61	0	0.00	0	0.00	<0.001
<i>Cryptosporidium</i>	14	12.61	0	0.00	28	13.40	0.121
<i>Ancylostoma duodenale</i>	55	49.55	0	0.00	14	6.70	<0.001

Considering single and mixed infections, the current study reported that a single infection was more common (55.57%) than mixed infection (44.43%). Also, *E. histolytica* (19.77%) was the higher prevalent parasite in patients with single infection; whereas, *Entamoeba histolytica* and *Enterobius vermicularis* (13.26%) were the commonest in patients with mixed infection. These findings that consistent to results showed by<sup>36</sup> might be related to unhygienic habits of patients, presence of asymptomatic carriers who have a constant risk of transmission in their community, and ingestion of contaminated food and water containing the pathogenic parasites.<sup>37</sup>

The present data demonstrate that the prevalence of intestinal parasites was decreased with advanced age, and the highest incidence was detected in patients of < 10 years (85.87%). These results were in agreement with (Sayyari *et al.*, 2005; Amer *et al.*, 2018) and opposed with (Waqar *et al.*, 2014). This might be due to the fact that children are more in contact with contaminated environments.

The significant higher intestinal parasitic infestation of males (69.57%) than females (55.52%) that showed in this study, was corresponding with (Hussein *et al.*, 2011; Osman *et al.*, 2016) and disagreed with (Imam *et al.*, 2015; Amer *et al.*, 2018). These findings could be justified by that males spend most of the time in the streets and exposed to contaminants as they were playing in soil and swimming in rivers, particularly during the summer season.

This study found that the intestinal parasites more common in rural (80.37%) than urban (38.87%) areas, were similar to those detected by (Sayyari *et al.*, 2005; Saheb *et al.*, 2017) and differed with (Albonico *et al.*, 1993; Ahmed, 2013). People living in rural areas might be lack sanitary water supplies, direct-contact with animals, and live close to sources of parasites in social and environmental conditions that predispose to parasitic intestinal infection.

In compared to non-infested, the study results of RBCs indices (M ± SE) of infested patients found that there was a significant decrease (p < 0.05) in values of total RBCs count, Hb, MCH, and MCHC; and significant increases (p < 0.05) in values of PCV, and MCV. However, the current findings were

agreed with.<sup>38</sup> Intestinal parasites could be caused variable disturbances in functions of the gastrointestinal tract (GIT) and even hypervitaminosis with releasing of trophozoites, motile feeding stage of the parasite, which adhere to intestinal villi and suck the chime.<sup>39</sup> Also, mechanical damage for intestinal walls can be occurred with some intestinal parasites.

The majority of the global disease burden of anemia is shouldered by the developing countries as high as two thirds among children under 5 years and nearly half among women.<sup>40</sup> In the present study, macrocytic (62.26%) and normocytic (51.37%) were the more prevalent types of anemia among infested and non-infested patients, respectively. Among infected patients, *E. vermicularis*, *B. coli*, and *A. duodenale* were the commonest parasites among macrocytic (91.19%), normocytic (45.59%), and microcytic (91.67%) anemias; respectively. However, these findings might be detected for the first time nationally and internationally. The correlation of intestinal parasitic infestations with anemia was in agreement with that reported by.<sup>32</sup> However, it suggested that the relationship between parasitic infestations and anemia is a pathogenic-physiologic and socio-economic type.<sup>41</sup> Iron deficiency was accounted for most anemia caused by parasitic infections due to their influences on nutritional status, chronic blood loss, and releasing of anti-clotting factors that ensure continues blood flow.<sup>42</sup> Certain factors were recognized to play important roles such as the lifestyle of an infected person, malnutrition, presence of co-existing conditions or diseases that inhibit immune response, level of the immune response at time of infestation, type/strain and number of infested parasites, and nature of waste products. In addition, low-income countries, overcrowded, hot and humid weather, poor sanitation, and contaminated food and water can act as predisposing factors.<sup>43</sup> Several studies demonstrated the association between infection with intestinal parasites and under-nutrition that increase the susceptibility to infection.<sup>44</sup>

## CONCLUSION

In view of the high prevalence of intestinal parasitic infestation among anemic patients of the current study, preventive

measures must be taken due to great risk population by increasing the knowledge about personal and community health and hygiene. In addition, further studies are required to demonstrate the actual effects for intestinal parasites on values of RBCs indices and investigate the correlation between each species of parasites with the types of anemia.

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