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Impact of *Enterobius vermicularis* infection on IgE levels among patients in Kirkuk city

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Abstract

Enterobius vermicularis is the most prevalent parasitic worm that causes Enterobiasis infections. The purpose of this study was to determine the concentration of IgE antibody in children infected with *E. vermicularis* by using miniVIDAS technique. Blood samples were collected from people infected with pinworms in primary health care centers in Kirkuk city (104 children and 66 adults), whose ages ranged from 1 - 65 years, for both genders, in addition to 50 samples as a control group. The results of the study showed a significant increase in IgE levels for children and adults at the probability level of 0.001 and 0.05 (330.76 ± 72.07), (73.87 ± 51.79) respectively compared with control group the mean serum total IgE was (34.43 ± 26.79), (46.19 ± 33.33) respectively, The aim of this study was to investigate a probable correlation between the level of IgE and *E. vermicularis* infection, we compared patients who were positive or negative for enterobiasis regarding IgE levels and control group.

Keywords: *Enterobius vermicularis*, Immunoglobulin IgE, intestinal helminthes, immune response

Introduction

Intestinal parasitic infection caused by parasitic helminthes are one of main causes of health problems in worldwide, especially in tropic and sub tropic countries, over than 200 million individuals infected with *Enterobius vermicularis* (Guimaraes & Nutman, 2018) ^[14], Parasitic infection has a significant impact on public health, especially on people living within low standard of living and low levels of awareness (Mutlag *et al.*, 2019) ^[21]. Parasitic helminths in humans are characterized by their propensity to stay in the host for extended periods and their failure to trigger protective immunity until years or even decades after exposure (Ahmed & Jasim, 2023) ^[2].

Humans are the final host for *E. vermicularis*, and the life cycle takes place in all its stages in the digestive system because these worms live in the caecum, colon and rectum, but in general they roam along the alimentary canal from the stomach to the anus, attached to the mucous folds of their lips, and their life cycle simple and direct and does not need an intermediate host (Sharma *et al.*, 2018) ^[23], Routine examinations of a stool sample give a positive diagnosis in only 5-15 % of infected subjects (Cook, 1994) ^[10], The best way to diagnose these worms is to use the scotch tape test, which requires the eggs to be demonstrated. Unlike other intestinal nematodes, pinworms can only be diagnosed by this approach, which is best performed at night or early in the morning. (Al-Jaf *et al.*, 2018) ^[7], and another method, through PCR technology (Yahya *et al.*, 2023) ^[25].

Autoinfection occurs when an individual spreads an infection to themselves, typically by scratching the anal region and then ingesting the contaminated material (fecal-oral transmission). Retroinfection, as described by Horne in 2002, is an uncommon method of infection when eggs near the anus hatch into larvae that go back to the rectum and then to the gut to develop into adult worms (Al-Daoudy *et al.*, 2020) ^[4].

Generally, Enterobiasis is considered as a symptomatic diseases, however, with heavy worm burdens, neurological symptoms such as restlessness, nervousness distraction and irritability, nocturnal enuresis and vaginal pruritus and appendicitis (Abbas *et al.*, 2021) ^[1] and another symptom of the infection is enuresis (Al-Daoudy *et al.*, 2020) ^[4].

The occurrence of intestinal parasites differs depending on geographical location and is influenced by variables such as climate, poverty, malnutrition, high population density, personal and communal cleanliness, and circumstances favorable for the development and transmission of intestinal parasites (Ahmed *et al.*, 2018) ^[3].

One of the most intricate systems in the body, the immune system exhibits several clues that Host species' immune responses differ from those of many other species depending on factors including the environment and stage of the life cycle (Al-Kabee, 2014)^[8].

IgE antibody is a well-known antibody that is implicated in various hypersensitivity reactions and may also aid in parasite protection (Al-Hashemy, 2019)^[6]. It is purported that IgE antibody is secreted from β and plasma cells (Mukai *et al.*, 2016)^[20]. IgE, which has a plasma half-life of less than a day, can persist for weeks or months. Its primary function is to protect against parasitic infections, such as those caused by helminths. This is achieved through the activation of Th2 assisted T cells, which generate antibodies to IgE (Fitzsimmons *et al.*, 2014)^[13]. Elevated levels of total IgE in the serum are indicative of either chronic parasitic infection or an interaction between IgE levels and parasitic infection; the nature of the helminths and the duration of the infection determine the interaction (Ripa *et al.*, 2010)^[22]. Research suggests that individuals with the highest total IgE levels are re-infected following helminth infections treatment in endemic locations (Solmaz *et al.*, 2018)^[24].

Materials and Methods

Samples of study

The present study ran from September 2022 to September 2023 in Kirkuk City. The examination was conducted on a group of people infected with the pinworm parasite. Blood samples were collected from patient and control group after taking permission. All blood sample were measured for the

amount of IgE. About 2ml of venous blood was collected including children and adults and both genders. The number included 66 samples from adults, 25 samples used as a control group and 104 samples from children, with 25 samples from the control group. The examination was conducted in the laboratory using the MiniVIDAS device, and the kit was from a company VIDAS of French origin. The samples and kit were placed at room temperature, and after the device was calibrated, the test strips were placed inside the device, and 200 μ l of serum were placed in them. The device began to perform the examination automatically, and after about 45 minutes, the test was completed. Get the result printed on the special papers attached to the device.

Statistical analysis

The data was gathered, summarized, analyzed, and presented using the statistical software SPSS version 28 and Microsoft Office Excel 2010. The Chi-square test was utilized to examine the relationship between two categorical variables.

Results and Discussion

The study included measuring the level of serum IgE by IgE miniVIDAS kit, 104 blood serum sample were tested from infected individuals with *E. vermicularis* parasite (positive in direct smear test). And 25 serum sample healthy children as a control groups. The results showed increased significantly ($p \leq 0.001$) in IgE level (330.76 ± 72.07) in an infected group compared with control group (34.43 ± 26.79) as shown in Table 1.

Table 1: IgE antibodies concentrations for children infected with *E. vermicularis*

IgE	Children						t. test	P. value
	Cases (No. 104)			Control (No. 25)				
	Mean \pm SD	SE	Min-Max	Mean \pm SD	SE	Min-Max		
	330.76 \pm 72.07	7.07	216.80-468.87	34.43 \pm 26.79	5.36	2.55-96.04	20.176	<0.001

Table 2 shows the concentration of IgE antibody among adult in Kirkuk city infected with *E. vermicularis*, The results showed increased significantly ($p \leq 0.05$) in IgE level

(73.87 ± 51.79) in an infected group compared with control group (46.19 ± 33.33), adult individuals with the *E. vermicularis* parasite had significantly higher levels of IgE.

Table 2: IgE antibodies concentrations for adult infected with *E. vermicularis*

IgE	Adult						t. test	P. value
	Cases (No. 66)			Control (No. 25)				
	Mean \pm SD	SE	Min-Max	Mean \pm SD	SE	Min-Max		
	73.87 \pm 51.79	6.37	12.87-189.56	46.19 \pm 33.33	6.67	3.39-109.98	2.480	0.015

The results are higher and are consistent with the result of (Solmaz *et al.*, 2018)^[24], that observed increase in IgE level 393.10 ± 159.83 IU/ml in patient with *E. vermicularis* compared with control group (228.90 ± 84.40) in Turkey. and agree with (Hadi & Al-Awadi, 2022)^[15] in Kufa city, Iraq, who observed that the level of IgE increased significantly in patients with pin worm infection (120.25 ± 8.7) compared with control group (96.22 ± 11.9), and agree with (Al-Daoudy & Al-Bazzaz, 2020)^[4], Erbil province, Iraq, who were found serum total IgE in comparison with the enterobiasis positive - negative group (170.26 ± 216.28), (69.17 ± 129.01) respectively

The ability of helminthes to influence their host's immune system in order to secure their survival, and the host's tendency to mount an immunological defense against other infections (Filbey *et al.*, 2019)^[12]. IgE primarily functions in the immune response against parasites like helminths.

Elevated levels of IgE have been seen in individuals infected with helminths or parasites. Higher IgE levels were seen in worm infections compared to parasite infections (Bengul *et al.*, 1996)^[9].

A high level of IgE indicates that it plays an important role in the immune defense against most parasitic worms (Erbk, 2007)^[11]. Immunoglobulin has a role in the host's defense against toxins, as tissue injury is the main trigger of immune responses in Th2 cells (Mukai *et al.*, 2016; Kelly & Grayson, 2016)^[20, 18]. The duration of infection and the type of helminths affect the level of IgE in the blood and the number of eosinophils (Ripa *et al.*, 2010)^[22].

The helminths can induce suppressor T cells and lead to allow response against environment allergens. Interleukin -10 reduces Trans forming growth factor beta (TGF-B) (Kilon, 2004)^[19], production of polyclonal IgE

against helminthes is common characteristic in atopic individuals (Hagel, 1993) [16].

Conclusion

The immunological response resulting from a parasite infection is multifaceted and intricate. Antiparasitic stimuli cause a strong Th2 response in parasitic worms, particularly *E. vermicularis*, which results in the synthesis of IgE immunoglobulin through the production of interleukin-4 and interleukin-5.

The study's findings indicate that individuals with the *E. vermicularis* parasite have greater antibody levels of IgE compared with control group and that age is the determining factor in its height. The findings documented in the literature raise concerns regarding the connection between allergy and parasite infection. To distinctly ascertain the causal link between helminthic infections and IgE concentration, long-term research must be carried out.

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