Journal of the Egyptian Society of Parasitology, Vol.45, No.2, August 2015
J. Egypt. Soc. Parasitol. (JESP), 45(2), 2015: 413 - 419

INTESTINAL PARASITIC INFECTIONS AND ATOPIC DISEASES IN CHILDREN: A HOSPITAL BASED STUDY

By
MOHAMED ME. AL GHWASS, HANAA H. EL DASH*, SAYED A. AMIN AND SHIMAA S. HUSSIN
Department of Pediatrics, Faculty of Medicine, Al-Fayoum University, Al-Fayoum Governorate, Egypt (*Correspondence: hanaaeldash@yahoo.com)

Abstract

Different helminth parasites may have different effects on allergy depending on the timing of the exposure. A meta-analysis of many of studies reported the association between the presence of geohelminth eggs in stool samples and asthma provided some evidence for parasite-specific effects. This study evaluated the occurrence of allergy among different intestinal parasitic infected patients.

A cross sectional study was carried out from June, 2013 to October, 2013 in the Pediatric Outpatient Clinic of Al-Fayoum University Hospitals among 55 children aged 2 years to 13 years. The data were collected using ISSAC questionnaire of allergy (International Study of Asthma and Allergies in Childhood) also laboratory analysis of complete blood picture, stool analysis and measurement of total serum IgE were performed for the patients.

Among the patients 27 suffered from allergy and 28 had no allergic complain. Stool examinations showed *Entrobius vermicularis* (15), *Trichostrongylus* species (9), *Hymenolepis nana* (8), Entameba histolytica (8), *Giardia lamblia* (6), and mixed infections (9).

The allergic group by parasitological examination 7 children (25.9%) had *Entrobius vermicularis*; 6 children (22.2%) *Entameba histolytica*; and 2 children (7.4 %) *Giardia lamblia*, with eosinophilic count was higher in the enterobiasis infected children than in protozoa infected ones. There were significantly high IgE levels in mixed parasitic infection (P= 0.006) and with *Entrobius vermicularis* infections (P=0.04). Also statistically significant difference between allergic groups by ISAAC score and the non allergic group regarding Ig E levels (P= 0.03). There was no significant difference between numbers of children with allergy and those without allergy among different parasitic infections. However, a marked significant association between the allergy and parasitic infected children was not declaimed.

Keywords: Al-Fayoum, Children, Allergy, parasitosis

Introduction

Many studies have identified multiple risk factors for the development and progression of atopic diseases. As a result much research is focused on identifying therapies that can be initiated at a young age to prevent disease progression (Jonathan and Spergel, 2010). Also more than 2 billion people might be infected with helminthes, mainly in the developing world (Cairncross *et al,* 2010).

The observation that atopic diseases are very common and helminthic infections relatively uncommon in developed countries and that the inverse is true in many developing countries has led to the speculation that the two phenomena may be inversely associated. The idea is part of a broader hypothesis suggesting that exposure to infections in early childhood reduces the risk of developing allergies, the so-called hygiene hypothesis. However, the relationship between atopic diseases and helminthic infection remains uncertain and controversial (Meike *et al*, 2008).

Most studies have been on intestinal helminthic infection in relation to asthma and atopy, and little is known about the association with other atopic outcomes such as atopic dermatitis and allergic rhinoconjunctivitis. Besides, they focused on the current exposure to helminthic infections, which made it difficult to identify the temporal sequence between the two phenomena (Feary *et al,* 2011). The present study aimed to evaluate the occurrence of allergy among different intestinal parasitic infections, and

detect if parasites could protect from allergy among children between 2 years and 13 years of age.

Patients, Materials and Methods

A cross sectional hospital-based study was conducted on outpatient clinic, at Al-Fayoum University Hospitals. A total of 55 pediatric patients aged 2 years to 13 years, were recruited in the period from June, 2013 to October, 2013. The study groups comprised children with intestinal parasitic infection detected by stool analysis. Exclusion criteria were children who needed emergency treatment or those already received anti-parasitic drugs.

All the included children were treated according to the Helsinki Declaration of biomedical ethics (World Medical Association Declaration of Helsinki, 2000) informed consent was obtained from the parents, and the Medical Ethics Committee of Faculty of Medicine, Al- Fayoum University approved the study protocol.

Data of collection was carried out using a field pre-tested interviewing questionnaire covering the following items: Name, age, sex, residence, general and abdominal signs and symptoms. Also parent or guardian of each child was interviewed by using an extended version of the ISAAC (The International Study of Asthma and Allergies in Childhood) questionnaire (Pols *et al*, 2015). The ISAAC score questionnaire consists of eight questions about respiratory symptoms to diagnose asthma, six questions on symptoms of allergic rhino conjunctivitis and seven questions concerning atopic dermatitis. Additional questions included regular intake of medication and physician's confirmation of atopic disease. (Wördemann *et al,* 2006).

Children were subjected to clinical examination including assessment of growth, pallor, organomegaly, tenderness, distension, abdominal examination. Inspection of the skin, eyes, neck, elbows, knees and ankles was performed for any sign of atopic dermatitis, as well as auscultation of the lungs and heart for asthma. The clinical criteria of allergic rhinoconjunctivitis as red, itchy, watery eyes and sneezing, congestion, runny nose, sore throat were carefully examined (Luo *et al*, 2015).

Laboratory examination: a morning stool samples were collected in labeled covered cartoon box. Samples were macroscopically examined for *Enterobius* worms as well as for cestodes gravid segments. Stool samples were microscopically examined as Giemsa direct smear stained and also with modified Ziehl-Neelsen stain when indicated to detect apicomplexan parasites mainly cryptosporidiosis (Shalaby and Shalaby, 2015). Also, venous blood samples were taken for complete blood count, WBCs count with differential count with especial stress on: peripheral blood eosinophil count, measurement of total serum IgE using the IgE quantitative a monoclonal antibody-based enzyme immunoassay (Kim *et al*, 2002).

Statistical analysis: Data were coded and entered using software SPSS (Statistical Package for Social Science) version 15.0. Data were summarized using mean, standard deviation and range for quantitative variables and number and percentage for qualitative variables. Comparison between groups was done using chi-square and Fischer exact test for qualitative variables. P value < 0.05 considered statistically significant.

Results

The most prevalent infection was *Entrobius vermicularis*; 15 children (27.3%) and the least was *Giardia lamblia*; 6 children (10.9%) while *Trichostrongylus* species was 9 (16.4%), *Entameba histolytica* was 8 (14.5%), *Hymenolepis nana* was 8 (14.5%) and mixed infections were 9 (16.4%).

Also by ISAAC score; 27 children (49.1%) in the study group were allergic while 28 children (50.9%) were not allergic. The most prevalent allergy was rhinitis; 12 children (21.8%) and the least were mixed allergic manifestations; 3 children (5.5%) while eczema was 8 (14.5%) and asthma was 4 (7.3%).

There was no significant difference between different blood indices among different parasitic infections. Eosinophilia count among helminthic children was higher than protozoa ones. But, a statistically significant levels of IgE with mixed parasitic infection (P=0.006) and with *Entrobius vermicularis* infections (P=0.04), but in general total IgE levels were high with different parasitic infections.

A significant difference was found between allergic groups by ISAAC score and the non-allergic group regarding IgE levels (P=0.03). Among allergic group the highest mean of IgE was with asthma and the least was with eczema, without significant difference between numbers of children with or without allergy by ISAAC score among different parasitic infections.

Details are shown in tables (1, 2, 3 & 4).

Table 1: CBC findings among different parasitic children

Parasites	Hb gm%	WBCs 10^3/cm	Eosinophilia %	Lymphocyte %	PLT 10^3/cm
Entrobius vermicularis	10.3±0.9	8.1±0.2	5.3±2.3	43.4±9.3	248± 67
Giardia lamblia	10.5±0.5	10±3	3.8±3.3	48.9±10.2	302±60
Entameba histolytica	10.7±0.7	7.9±2.6	4.5±2.6	45.9±10.3	336±125
Hymenolepis nana	11±1.2	10.5±3.3	5.2±2.6	46.9±7.3	348.6±131
Mixed infections	10.8±0.9	7.1±1.9	4.2±2.1	46.9±13.5	331±93
Trichostrongylus	10.9±1.3	8.4±2.9	7.5±5.6	48.1±13.8	297±64
P value	0.4	0.2	0.3	0.9	0.6

Hb; hemoglobin, WBC; white blood cells, PLT; platelet, P < 0.05= significant*

Table 2: IgE level among different parasitic infections

Parasites	Diagnosis	Mean	SD	P value
E. vermicularis (n=15)	Yes	37.9	35.6	0.04*
	No	63.1	42.5	
G. lamblia (n=6)	Yes	63.3	55.2	0.7
	No	55.4	40.7	
E. histolytica (n=8)	Yes	64.7	52.1	0.5
	No	54.8	40.4	
H. nana (n=8)	Yes	49.6	23.9	0.6
	No	57.4	44.4	
Mixed infestation (n=9)	Yes	90.6	35.8	0.006*
	No	49.6	39.9	
Trichostrongylus species (n=9)	Yes	46.1	36.9	0.4
	No	58.3	42.9	

Yes=parasite in stool analysis, * P < 0.05=significant

Table 3: IgE level among different ISAAC score results

ISSAC score	Mean	SD
Asthma	79.6	67.6
Rhinitis	78.1	47.3
Mixed allergies	77.3	49.1
Eczema	61.6	40.3
No allergy	39.8	29.3
P value	0.03*	

P value < 0.05=significant.*

Table 4: Allergic conditions by ISAAC score among parasitic infections

Parasites	Not allergy (n=28)	Allergy (n=27)	P value
	No. (%)	No. (%)	
Entrobius vermicularis	8(28.6%)	7(25.9%)	0.5
Giardia lamblia	4(14.3%)	2(7.4%)	
Entameba histolytica	2(7.1%)	6(22.2%)	
Hymenolepis nana	3(10.7%)	5(18.5%)	
Mixed	5(17.9%)	4(14.8%)	
Trichostrongylus species	6(21.4%)	3(11.1%)	

P value < 0.05=significant.*

Discussion

In the present study, stool examinations of all the patients showed *Entrobius vermicularis* (15), *Trichostrongylus* species (9), *Hymenolepis nana* (8), *Entameba histolytica* (8), *Giardia lamblia* (6), and mixed infections (9).

Abo-Madyan *et al.* (2004a) in Ezbet El-Bakly (Tamyia Center) El-Fayoum Governorate among the 1019 individuals parasitologically examined, the prevalence of *S. haematobium* and *S. mansoni* were 4.2% and 2.4% respectively and the geometric mean egg count (GMEC) were 33.2 eggs/10ml urine and 113.3 eggs/gram stools. Most of the patients with haematobiasis and mansoniasis were <15years (56.4% & 53.8%), males (56.4% & 53.8%) & illiterates (46.2% & 46.2%). Abo-Madyan et al. (2004b) in Ezbet El-Bakly, Al-Fayoum Governorate found that the prevalence of fascioliasis was 1.7% and the geometric mean egg count (GMEC) was 33.2 eggs/gram stools. The most frequent symptoms were abdominal distension and flatulence (76.5%), right hypochondrial pain (17.6%) and epigastric pain (17.6%). The most prevalent signs were pallor (52.9%), tender right hypochondrium (23.5%) and tinge of jaundice (17.6%).

However, in the present study, urine samples were not included and all the present patients had neither schistosomiasis nor fascioliasis. The present children were from urban areas within Al-Fayoum City the capital of Al-Fatoum Governorate and that Abo Abo-Madyan *et al.* (2004a, b) field studies was in a small rural village. Besides Eldash *et al*. (2013) in El-Fayoum university hospitals found that giardiasis was in 47 (52.2%) patients and 30 (33.3%) controls with a significant difference. They added that the association of *Helicobacter pylori* and *G. intestinalis* was among 36 (40.0%) patients and 11 (12.2%) controls with a significant difference.

The prevention strategies could be designed to mimic the beneficial immunological effects of geo-helminth infection in the absence of actual infection (Camila *et al*, 2010)

The current study, no significant difference was between different blood indices among different parasites. However, all parasites infected showed high eosinophilic count that was higher among helminthic than protozoa infections. Hamadto *et al*. (1990) found that the mean total leucocytic and eosinophilic counts and the blastogenic response to *S. mansoni* egg antigen were significantly higher in early than in chronic schistosomal cases. Ghoshal *et al*. (2010) reported that in endemic areas, immunocompetent subjects suffered from symptomatic strongyloidiasis and associated eosinophilia was uncommon. Valerio *et al.* (2013) found that 90% of asymptomatic parasitic cases ha high eosinophil count. However, Suzuki *et al*. (2010) reported a case of giardiasis with extreme hypereosinophilia and severe systemic symptoms.

In the present study, total IgE level varied from one parasitic infection to another, with the highest level with mixed parasitic infection and the lowest with *E. vermicularis*. Mahmoud *et al*. (2004) reported that 25

symptomatic giardiasis patients with skin allergy manifested by diffuse urticaria, pruritus, wheal and erythema, and had positive serum anti-*Giardia* IgE measured as mean optical density value by ELISA and that the concept of giardiasis as an etiology of skin allergy manifested by urticaria, wheal, erythema and pruritis wass confirmed. Flohrs *et al.* (2012) reported that elevated IgE levels proved a prominent feature of allergic and parasitic diseases. Ekhlas *et al.* (2013) reported that the serum levels of IgE of parasite positive infants were significant compared with infants' parasite free.

In the present study, there was a significant difference between IgE levels among different allergic forms diagnosed by ISAAC score with highest mean of IgE with asthma, rhinitis, mixed allergic form and then the lowest was eczema. This agreed with Hussein *et al*. (2009), who reported a significant increase in total IgE levels and eosinophil count in among Egyptian atopic patients compared with the control group Also, Weidinger *et al.* (2010) in the United Europe reported that total IgE levels as a useful endophenotype for the genetics of atopic diseases

In the current study, there was no significant difference between children with allergy without allergy and parasitic infections. Bager *et al.* (2012) did not find correlation enterobiasis and reduce risk for asthma. Also, Bemnet *et al*. (2013) in Northwest Ethiopia reported no significant association between allergy children and parasitic infections

On the other hand, several factors may influence the development of asthma, including nonspecific activation of IgE and/or inflammatory mechanisms by helminth parasites (Alshishtawy *et al,* 1991). Also, in *Blastocystis*-positive Egyptian patients 60.6% suffered from urticarial (Zuel-Fakkar *et al*, 2011). Hameed *et al*. (2011) in Ain Shams University hospitals concluded that urticaria patients resistant to the ordinary regimen of urticaria treatment must be examined for *B. hominis* and first to prescribe the proper specific anti-protozoan treatment. Kevin *et al.* (2009) in Ireland reported that a convinced evidences that exposure to certain infectious agents or their products might reduce the human symptoms of allergy and asthma. They added that this might be based on of suppression of Th2-mediated allergic reactions by pathogen-induced Th1 responses, but with some limitations.

On the other hand, different allergic reactions are well documented with many ecto-parasites in Egyptian children too much to mention. Mosabah and Morsy (2012) reported tick paralysis, which clinical pictures were confused with rabies; myasthensia gravis; botulism; diphtheritic polyneuropathy encountered in rural areas. El-Bahnasawy *et al*. (2012) reported that lice are an irritating and a shaming human ecto-parasite, apart from transmission of infectious diseases. Also, ectoparasites as house dust mites allergens sensitize and induce perennial rhinitis, asthma, or atopic dermatitis in a large portion of patients with allergic disease particularly children and could be an occupational health problem (Saleh *et al*, 2013).

Conclusion

No doubt, parasitic infections are a public health problem particularly in developing countries. Parasitic infection might function in the prevention and pathogenesis of atopic conditions in children in developing countries. Helminths are associated with a reduced prevalence of clinically important atopic disorders, by induction of a regulatory cell population mechanism. The good epidemiologic knowledge of the immunological background of parasites and their human protective function would pave reversal of allergies using parasites and the development of new therapies.

References

Abo-Madyan, AA, Morsy, TA, Motawea, SM, 2004a: Efficacy of myrrh in the treatment of schistosomiasis (*haematobium* and *mansoni*) in Ezbet El-Bakly, Tamyia Center, El-Fayoum Governorate, Egypt. J. Egypt. Soc. Parasitol. 34,

2:423-46.
Abo-Madyan, AA, Morsy, TA, Motawea, SM, Morsy, ATA, 2004b: Clinical trial of mirazid® in treatment of human fascioliasis in Ezbet El-Bakly (Tamyia Center) Al-Fayoum Governorate. J. Egypt. Soc. Parasitol. 34, 3:807-18.
Alshishtawy, MM, Abdella, AM, Gelber, LE, Chapman, MD, 1991: Serologic analysis of total and specific IgE antibody levels and their relationship to parasitic infection. Int. Arch. Allergy Immunol. 96:348-54.
Bager, P, Vinkel, HA, Wohlfahrt, J, Melby, M, *et al*, 2012: Helminthes infection does not reduce risk for chronic inflammatory disease in a population-based cohort study. Gastroenterology 142, 1:55-62.
Bemnet, A, Jemal, A, Beyene, M, Gizachew, Y, Belyhun, Y, *et al*, 2013: Nutritional status, intestinal parasite infection and allergy among school children in Northwest Ethiopia. BMC Pediatr. 13:7-10.
Cairncross, S, Bartram, J, Cumming, O, 2010: Hygiene, sanitation and water: what needs to be done? PLOS Med. 7(11):e1000.
Camila, AF, Mauricio, LB, Laura, CR, Philip, J, *et al*, 2010: Chronic intestinal helminth infections are associated with immune hyporesponsiveness and induction of a regulatory network. Infect. Immun. 78, 7: 3160-7.
Ekhlas, HA, Usama, SB, Zakaria, M, Naoi, K, Norose, K, **2013:** Breastfeeding protects infantile diarrhea caused by intestinal protozoan infections. Korean J. Parasitol. 51, 5:519-24.
El-Bahnasawy, MM, Abdel Fadil, E, Morsy, TA, 2012: Human pediculosis: a critical health problem and what about nursing policy? J, Egypt. Soc. Parasitol. 42, 3:541-62.
Eldash, HH, Bekhit, OE, Algameel, AA, 2013: Impact of *Helicobacter pylori*-giardiasis coinfection on children with recurrent abdominal pain. J. Egypt. Soc. Parasitol. 43, 2:509-16
Feary, J, Britton, J, Leonardi, BJ, 2011: Atopy and current intestinal parasite infection: A systematic review and meta-analysis. Allergy 66, 4:569-78.
Flohrs, K, Brüske, I, Thiering, E, Rzehak, P, *et al*, 2012: Temporal changes in total serum immunoglobulin E levels in East German children and the effect of potential predictors. Int. Arch. Allergy Immunol. 158, 1:27-34.
Ghoshal, U, Khanduja, S, Chaudhury, N, Gangwar, D, Ghoshal, US, 2012: A series on intestinal strongyloidiasis in immunocompetent and immunocompromised hosts. Trop. Gastroenterol. 33, 2:135-9.
Hamadto, HA, Kamal, KA, Shaheen, H, Zakaria, MS, 1990: Total leucocytic count, eosinophilia and cellular immune response in acute and chronic schistosomiasis. J. Egypt. Soc. Parasitol. 20, 1:29-34.
Hameed, DM, Hassanin, OM, Zuel-Fakkar, N M, 2011: Association of *Blastocystis hominis* genetic subtypes with urticaria. Parasitol. Res. 108, 3:553-60.
Hussein, YM, Ahmad, AS, Ibrahem, MM, El Tarhouny, SA, Shalaby, SM, *et al*, 2009: Interferon gamma gene polymorphism as a biochemical marker in Egyptian atopic patients. J. Investig. Allergol. Clin. Immunol. 19, 4:292-8.
Jonathan, MS, Spergel, A, **2010**: From atopic dermatitis to asthma: the atopic march. Ann. Aller. Asthma Immunol. 105, 2:99-106.
Kevin, PW, Miriam, TB, Conor, MF, Boon, L, Mills, KH, 2009: Infection with a helminth parasite attenuates autoimmunity through TGF-β-mediated suppression of Th17 and Th1 responses. J. Immunol. 183, 3:1577-86.
Kim, TE, Park, SW , Cho, NY , Choi, SY, Yong, TS, *et al*, 2002: Quantitative measurement of serum allergen-specific IgE on protein chip. Exp. Mol. Med. 34, 2:152-8.
Luo, Z, Li, B, Wan, L, Peng, C, 2015: Comparative study on cluster and conventional immuno-therapy in patients with allergic rhinitis. Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 50, 2:105-9.
Mahmoud, MS, Salem, AA, Rifaat, MM, 2004: Human giardiasis as an etiology of skin allergy: The role of adhesion molecules and interleukin-6. J. Egypt. Soc. Parasitol. 34, 3:723-37.
Meike, W, Raquel, JD, Lenina, MH, Ana Maria, CM, Aniran, RE, *et al*, 2008: Association of atopy, asthma, allergic rhinoconjunctivitis, atopic dermatitis and intestinal helminth infections in Cuban children. Trop. Med. Int. Hlth. 13, 2:180-6.
Mosabah, AA, Morsy, TA, 2012: Tick paralysis: First zoonosis record in Egypt. J. Egypt. Soc. Parasitol. 42, 1:71-8.
Pols, DH, Wartna, JB, van Alphen, EI, Moed, H, Rasenberg, N, Bindels, PJ, *et al*, 2015: Interrelationships between atopic disorders in children: A meta-analysis based on the ISAAC Que-

stionnaires. PLoS One 2015 Jul 2;10(7):e01318/69

Saleh, AM, Ali, HA, Ahmed, SA, Mohammad, NM, Morsy, TA, 2013: House dust mites: a risk factor to be considered for occupational safety or source of work-related allergens. J. Egypt. Soc. Parasitol. 43, 3:669-78.

Shalaby, NM, Shalaby, NM, 2015: *Cryptosporidium parvum* infection among Egyptian school children. J. Egypt. Soc. Parasitol. 45, 1:125-31.

Suzuki, Y, Nakamura, T, Tokoro, M, Togano, T, Ohsaka, M, *et al*, 2010: A case of giardiasis expressing severe systemic symptoms and marked hypereosinophilia. Parasitol. Int. 59, 3:487-9.

Valerio, L, Roure, S, Fernández, G, Basile, L, Martínez, O, *et al*, 2013: *Strongyloides stercoralis*, the hidden worm. Epidemiological and clinical characteristics of 70 cases diagnosed in the North Metropolitan Area of Barcelona, Spain, 2003-2012. Trans. R. Soc. Trop. Med. Hyg. 107, 8:465-70.

Weidinger S, Baurecht H, Naumann A, Novak N. 2010: Genome-wide association studies on IgE regulation: are genetics of IgE also genetics of atopic disease? Curr. Opin. Allergy Clin. Immunol. 10, 5:408-17.

Wördemann, M, Polman, K, Diaz, RJ, Heredia, LT, Madurga, AMC, *et al*, 2006: The challenge of diagnosing atopic diseases: Outcomes in Cuban children depend on definition and methodology. Allergy 61, 9:1125-31.

World Medical Association Declaration of Helsinki, 2000: Ethical Principles for Medical Research Involving Human Subjects: Revised by the 52nd WMA General Assembly, Edinburgh, Scotland. http://www.wma.net/e/policy/b3.htm

Zuel-Fakkar, NM, Abdel-Hameed, DM, Hassanin, OM, 2011: Study of Blastocystis hominis isolates in urticaria: A case-control study. Clin. Exp. Dermatol. 36, 8:908-10.