

## Investigation of the association between Pediatric Asthma and Giardiasis; A Cross-Sectional Study on 200 asthmatic children

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ARTICLE INFO	ABSTRACT
<p><b>Article type:</b> Original Article</p>	<p><b>Introduction:</b> Asthma and parasitic infections are both common childhood diseases. Due to the high prevalence of these two diseases among Iranian children, we decided to investigate the association between giardiasis and asthma and some sociodemographic documents.</p>
<p><b>Article History:</b> Received: 09 Feb 2022 Accepted: 28 May 2022</p>	<p><b>Materials and Methods:</b> In this study, 200 asthmatic children referred to the asthma clinic of Sheikh Hospital, Mashhad University of Medical Sciences, Mashhad, Iran, and 50 healthy children, as the control group, were included. After interviewing parents, sociodemographic documents were recorded, including age, sex, duration and severity of asthma, parents' education, and occupation. Three-morning stool samples were collected from individuals daily. Examination of giardiasis based directly or formalin-ether based. Giardiasis infection was compared between healthy and asthmatic children. Besides, the relation between sociodemographic documents and giardiasis infection among asthmatic children was investigated. Records were analyzed by statistical package for social sciences (SPSS.ver.20).</p>
<p><b>Key words:</b> Asthma, Giardiasis, Children</p>	<p><b>Results:</b> We found that 12 (6%) samples from the asthma group and 5 (10%) samples from the control group were positive for giardiasis (P=0.13). There was also no significant relationship between the severity or duration of asthma and giardiasis (P=0.33, P=0.97). Besides, there was no significant relationship between sociodemographic documents and giardiasis among asthmatic children (P&gt;0.05).</p>
	<p><b>Conclusion:</b> In this study, the frequency of giardiasis was similar in both control and asthma groups. This issue might be probable that giardiasis infection has not any role in protecting, causing, or exacerbating pediatric asthma.</p>
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## Introduction

Asthma is a common and potentially severe chronic disease that causes respiratory distress and limited activity (1,2). It sometimes causes severe airway obstruction that requires immediate care. Asthma causes great harm to patients, their families, and society (3).

The most common asthma symptoms include recurrent coughing, wheezing, wheezing when exhaling, prolonged exhalation, and rapid breathing. Shortness of breath and a feeling of heaviness in the chest have been reported in older children and adults. Other manifestations of asthma can be nonspecific, including physical limitations and general fatigue due to sleep disorders (4). On the other hand, asthma prevalence is increasing globally among children (1) and is now the most common chronic disease in children (5). Meanwhile, asthma is considered one of the most common causes of visits to emergency departments among children aged between 1 to 17 years old (6,7).

Furthermore, asthma management had related difficulties among children (8), and its related morbidity remains high among children in different health services (9,1). This issue might be due to the non-adherence of parents of asthmatic patients with the guidelines at home (10). On the other hand, endoparasites, considered neglected tropical illnesses, refer to infections by both helminths and protozoa and are considered one of the health-related problems among children (11). These endoparasites could create asthma symptoms, low immune system, skin rash, and other health problems (12,13). *Giardia lamblia* is a parasite with a worldwide spread that is the only known reservoir of the human parasite, and the infection is transmitted through contaminated water and food, direct human-to-human contact, and sexual contact (14,15).

Previous studies suggested a relationship between allergic and parasitic diseases' prevalence (16,17). Due to the prevalence of allergies and asthma in developed countries and proposing the hygiene hypothesis, reducing exposure to some microorganisms is the cause of the widespread prevalence of allergic diseases like asthma (18,19). The

hygiene hypothesis by reducing the sensitivity of T cells to antigens has a protective effect and shows the role of epidemiological and experimental documents in the course of autoimmune diseases and the occurrence of helminths infections (20). Moreover, as one of the endoparasites, giardiasis infection is considered a health problem associated with high morbidity (21). However, previous research demonstrated the high IgE serum and positive skin prick test among children with atopy and positive giardiasis infection (21). Also, previous research recommended that geohelminth infections, including giardiasis intensity, are associated with a reduced risk of polysensitization (22).

However, the relationship between giardiasis with asthma and some sociodemographic documents is still unclear. Therefore, this study aimed to investigate the relationship between asthma and giardiasis in asthmatic children. Besides, we compared giardiasis infection between healthy and asthmatic individuals.

In this study, 200 children with asthma aged 1 to 14 years referred to the Asthma Clinic of Sheikh Hospital, Mashhad, Iran, were included randomly. Besides, 50 healthy children as a control group who were age-matched to the asthma group were examined. These children had no asthma or parasitic diseases. They were referred for other reasons to our clinic. After the interviewing of parents, the related satisfaction form was filled out by parents. Demographic characteristics of the participants, including age, sex, duration and severity of asthma, level of education, and parents' occupation, were recorded. *Giardia* was examined.

Inclusion criteria were children aged between 1 to 14 years old who have been diagnosed with asthma. The clinical criteria for diagnosing pediatric asthma were based on the allergist's history and physical examination. In addition, in the patient's history, disease severity was determined based on the number of daily symptoms during the week and the number of nocturnal symptoms during the month, as well as spirometry if the patient's age allowed. Patients with any of the following criteria were excluded; dissatisfaction of the

patient's parents, presence of chronic underlying disease (heart, lung, metabolic, neurological disease), age less than one year, and more than 14 years. Furthermore, patients under treatment for parasitic infections or using metronidazole and tetracycline during the last two weeks were excluded.

### **Study sample size**

According to a previous study, which reported a prevalence of giardiasis at 21% (23), we considered 200 asthmatic patients with 50 healthy children as a control group with under 95% confidence interval and 5% of study accuracy. Enrolling of participants was performed by a simple random method.

### **Study Examination**

First, we instructed the parents to collect three-morning stool samples daily. Specimen collection started in September 2010 and ended in May 2011. Then the specimens were transferred to our Parasitology Laboratory, Imam Reza Hospital, Mashhad University of Medical Sciences, Mashhad, Iran and were examined for the presence of Giardia by two direct methods formalin-ether and light microscopy.

In the formalin-ether concentration method, dissolved a stool of chickpeas in 10 ml of 10% of formalin, passed it through two layers of purification filter, and added 3 ml of ether. Then this was centrifuged for about 2 to 3 minutes at 2000 rpm. This solution was stained w Lugol's iodine drop for examination by light microscopy ( $\times 10$  and  $\times 40$  magnification).

### **Statistical Analysis**

The statistical analysis was performed under the statistical package for the social sciences version by SPSS software (SPSS Inc., version 20, Chicago, Illinois, USA). The variables with a continuous normal distribution, including age and duration of asthma, were defined in the result section by the mean  $\pm$  standard deviation. Also, the qualitative variables, including parent education, parent occupation, and severity of asthma, were defined by frequency and

percentages. The comparisons between two study groups with normal distribution have been performed under the independent Student's T-test. In addition, Chi-square and Fischer Exact tests were performed to compare the frequencies of related variables between positive and negative giardiasis groups of asthmatic children. A P value less than 0.05 was considered a statistically significant level.

### **Results**

This study investigated the relationship between asthma and giardiasis infection among 200 asthmatic children compared to healthy individuals. Table 1 presents the demographic documents of studied asthmatic patients. They were between 1 to 14 years old. Patients were under a new diagnosis of asthma till maximum 10 years of asthma infection. Eighty-five patients (42.5%) were female and 115 patients (57.5%) were male. Most of the parents of studied participants had diploma education. Also, most mothers (84%) were household, and the fathers (53.5%) were not employed. The results showed that most of the studied asthmatic patients (43%) were in grade II of asthma severity.

### **Healthy and asthmatic cases related to giardiasis**

Table 2 compares two groups of study participants. The studied samples were between 1 to 14 years old. The results showed that 85% and 84% of respectively studied asthmatic and healthy children were between 2 to 9 years old. The analysis showed no significant difference between the two study groups related to age ( $P=0.40$ ). The results showed that 12 (6%) and 5 (10%) samples in asthmatic and healthy individuals were positively related to giardiasis infection, respectively. This frequency was not significantly different between the two study groups ( $P=0.13$ ). The frequency of gender among studied participants showed that the two groups were similar ( $P=0.48$ ). Furthermore, there was no significant difference between genders with positive giardiasis among control and asthmatic samples ( $P=0.42$ ).

**Table 1:** Demographic documents of studied participants in the asthmatic group

Variable		Frequency (Percentage) or Mean± Standard deviation
Age, years old		6.35±6
Duration of Asthma, years		2.29±1
Gender	Female	85 (42.5)
	Male	115 (57.5)
Mother Education	Illiterate	5 (92.5)
	Undergraduate	24 (12)
	Intermediate	34 (17)
	Diploma	93 (46.5)
	Bachelor	43 (21.5)
	Master	1 (0.5)
Father Education	Illiterate	5 (2.5)
	Undergraduate	22 (11)
	Intermediate	42 (21)
	Diploma	80 (40)
	Bachelor	47 (23.5)
	Master	4 (2)
Mother occupation	Household	168 (84)
	Employed	32 (16)
Father Occupation	Worker	22 (11)
	Not-employed	107 (53.5)
Severity of Asthma	Employed	71 (35.5)
	I	52 (26)
	II	86 (43)
	III	58 (29)
	IV	4 (2)

**Table 2:** Comparison between healthy individuals (control) and asthmatic patients

Variable		Control individuals	Asthmatic patients	P-value
Age, years old (Mean± SD)		6.36±6	6.18±6	0.40
Giardiasis infection	Positive	12 (6%)	5 (10%)	0.13
	Negative	188 (94%)	45 (90%)	
Gender	Female	85 (42.5%)	24 (48%)	0.48
	Male	115 (57.5%)	26 (52%)	
Positive giardiasis & gender	Female	6 (50%)	2 (40%)	0.42
	Male	6 (50%)	3 (60%)	

Analysis was performed under Chi-square Test and Independent T-Test. A P-value under 0.05 was considered a significant level.

### ***Asthmatic patients and giardiasis***

We investigated the comparison between asthmatic patients related to giardiasis infection in Table 3.

Asthmatic patients were divided into positive giardiasis infection (12 cases) and negative giardiasis infection (188 cases). The age of the two study groups was similar, and there was no significant difference

between the age of asthmatic children with positive and negative giardiasis infection (P=0.27).

There was no significant difference between patients with different asthma duration and giardiasis infection (P=0.97). Moreover, positive and negative giardiasis infection in asthmatic cases had the same distribution of gender frequencies (P=0.42).

Diploma education was the frequent level of education among parents of positive and negative giardiasis groups. There was no significant difference between father or mother education and giardiasis infection ( $P>0.05$ ). Besides, Statistical analysis showed that the relation between mother or father occupation and giardiasis infection

was non-significant ( $P>0.05$ ). Our analysis showed that studied patients were in grade II of asthma for both positive and negative giardiasis groups. Furthermore, patients with different severity of asthma had distributed similarly between positive and negative giardiasis groups ( $P>0.05$ ).

**Table 3:** Association between pediatric asthma and giardiasis infection among studied asthmatic children

Variable		Positive giardiasis	Negative giardiasis	P-value
Age, years old		5.42±2.53	6.37±2.97	0.27
Duration of Asthma, years		2.3±1.93	2.29±1.89	0.97
Gender	Female	6 (50)	79 (39.5)	0.42
	Male	6 (50)	109 (45.5)	
Mother Education	Illiterate	1 (8.3)	4 (2.1)	0.20
	Undergraduate	2 (16.7)	22 (11.7)	
	Intermediate	2 (16.7)	32 (12)	
	Diploma	5 (41.7)	88 (46.8)	
	Bachelor	2 (16.7)	42 (21.5)	
	Master	0	1(0.5)	
Father Education	Illiterate	1 (8.3)	4 (2.1)	0.20
	Undergraduate	0	22 (12.7)	
	Intermediate	5 (41.7)	37 (19.7)	
	Diploma	5 (41.7)	75 (39.9)	
	Bachelor	1 (8.3)	46 (24.5)	
	Master	0	4 (2.8)	
Mother occupation	Household	11 (91.7)	157 (83.5)	0.38
	Employed	1(8.3)	31 (16.4)	
Father Occupation	Worker	3 (25)	19 (10.1)	0.43
	Not-employed	8 (66.7)	99(52.8)	
	Employed	1 (8.3)	70 (37.2)	
Severity of Asthma	I	3(25)	49 (26.1)	0.33
	II	6 (50)	80 (42.6)	
	III	2 (16.7)	56 (29.8)	
	IV	1 (8.3)	3 (1.5)	

## Discussion

Our study found that the frequency of giardiasis infection among 200 children with asthma was six percent. Our results showed that the association between asthma and giardiasis infection was not statistically meaningful. Our study was similar to a study by Souza et al. on children between 5 to 15 years old with allergic symptoms that found the frequency of positive giardiasis was not associated with allergic symptoms in the urban area (24). They concluded that symptoms of asthma, positive skin tests for a range of environmental allergens, and positive serum markers, including high total IgE levels and positive specific IgE tests, were not associated with *G. lamblia* infections in this sample of children from urban areas (24). Also, another study on 63 children between 6 and 11 years old (47

with asthma and 16 in the control group) found that the prevalence of parasitic diseases was 21.3% among asthmatic children compared to 25% in the control group (25).

In this study, there was no significant difference in the frequency of giardiasis between asthmatic children and healthy children ( $P>0.05$ ). However, another study found that seventy percent of the infected children with giardiasis presented allergy symptoms versus forty-three percent of the non-Giardia parasitized group (26). Furthermore, they reported that this relationship between giardiasis and allergy might increase the sensitization due to the enhanced antigen penetration through damaged intestinal mucosa (26). Similarly, the previous investigation found that the presence of a parasitic infection has reduced

susceptibility to allergies and asthma. In this interventional study, due to the treatment of parasitic diseases, the clinical symptoms of asthma are exacerbated, which expresses the protective role of parasites against allergic diseases (27). However, differences between study results might be related to Giardia strain in different geographical areas and the duration of infection with the parasite, and the type of population studied.

Different investigations have examined how the innate immune system responds to giardiasis infection and affects T cell response development. Previously it was reported that there was no alteration in the expression of numerous cytokines prompted by the other intestinal pathogens (28). Another *in vivo* research resulted that there had not been determined the importance of altered cytokines during infection (29). Due to the high prevalence of giardiasis infection in our study area, there are local studies related to this parasite infection (14).

Regarding the relation between asthma and sociodemographic factors concerning the giardiasis infection, we found that there was not any significant difference between gender and giardiasis among asthmatic children. Similar to our results, a previous study on 4842 samples of positive giardiasis resulted that there was no significant difference between giardiasis and gender (30). Also, we found that the ages of asthmatic children with positive and negative giardiasis infection were not statistically different. This point was accredited in a previous study, which reported that the relation between age and giardiasis infection was not significant among children (30).

Regarding the relation between parents' education and giardiasis infection, the previous local study found that only the mother's level of education was related to the incidence of giardia. Children whose mothers had a diploma level of education, compared to the children with mothers with a lower level of education than a diploma, had more giardiasis infection (31). However, we did not find any direct relation between giardiasis infection and the level of parents' education. Besides, the relationship between parents' occupation and giardiasis among

asthmatic children was non-significant. However, previously documented that there was a relationship between these factors due to the low literacy level of mothers with the low level of knowledge compared to educated mothers and their children's daily care (31).

These differences might be due to the different study locations, study strains, and ages of the studied children, as cited reports were in rural areas with mothers with low literacy levels compared to urban areas in our study location. Also, we investigated just giardiasis infection in children between 1 to 14 years old, while they were a reported overall prevalence of parasitic infection among children from 6 to 24 months.

### **Conclusion**

In this study, we concluded that the prevalence of giardiasis in asthmatic patients was similar compared to healthy children. Therefore, giardiasis infection might be probable that did not affect protecting, causing and exacerbating asthma symptoms. Overall, most authoritative scientific sources do not consider the necessity of any treatment for asymptomatic carriers. So, a simple stool test is unnecessary for asthmatic patients' giardiasis infection.

This study, for the first, investigated the prevalence of giardiasis by evaluating sociodemographic characteristics among children with pediatric asthma. One of our study limitations was the method of detecting giardiasis by stool exam versus serological detecting.

Regarding the study limitations, it must be noted that any scientific investigations based on patients' descriptions had some errors, such as under-reporting or over-reporting of some symptoms by patients.

We resolved this problem by enrolling the asthmatic patients under consideration of pediatric asthma and allergy specialist. Also, the time limitation for sampling was another our study sampling. It was due to our inclusion criteria, and patients should not consume any drugs to treat giardiasis infections like metronidazole and tetracycline during the last two weeks at the sampling time.

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### Conflict of Interest

The authors declared that there was not any conflict of interest.

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