

Full Length Research Paper

A meta-analysis of *Giardia lamblia* in Iran

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***Giardia lamblia* is the frequent cause of diarrhea in humans and other mammals across the world. The present systematic review and meta-analysis aimed to estimate the epidemiology of *Giardia lamblia* in the republic Islamic of Iran. The main international sources of ISI and Pubmed as well as the major national data banks in Iran including Magiran, IranMedex, SID and IranDoc were systematically searched for the words " *Giardia lamblia*" since 1990 onward. Overall, 43 reliable and similar studies in terms of methodology were selected for a systematic review. A meta-analysis was also conducted using the random-effects model. Heterogeneity was investigated by the Cochran's Q test. STATA was used for all analysis. Given the random-effects model, the prevalence of *Giardia lamblia* in Iran was estimated to be 14.7% (95% reliability distance, 12.0%-16.6%). By age classification, the prevalence was 15.1% amongst fewer than 10 years children, 19.2% amongst adolescents and youngest of fewer than 20 years, and 6.7% amongst adults of between 20-30 years old ($p < 0.001$). Annual classification showed that the maximum and minimum prevalence rates occurred in 1994 and 2005 (37.21 and 4.91% respectively). Geographical distribution of *Giardia lamblia* also showed that the eastern parts of the country nearby Pakistan and Afghanistan borders were extremely affected (35.5%). It was 16.9% in central provinces, 14.9% in the southern provinces, 13.2% in the north of country and 12.3% in the western provinces nearby Iraq and Turkey borders. Increased prevalence of *Giardia lamblia* in Iran, in spite of preventing strategies and valuable primary health care activities has been remained as a public health concern amongst children and in the eastern parts of the country nearby Pakistan and Afghanistan borders in particular.**

Key words: *Giardia lamblia*, Iran, meta-analysis.

INTRODUCTION

Traditionally, doctors and ordinary people have been focusing on parasitic infections and it has still remained among the important public health concerns leading to mass mortalities worldwide and in developing communities in particular. Infection with *Giardia* may be associated with significant ill-health issues and while the reported incidence of infection is of concern in Iran, the true prevalence of infection and extent of morbidity due to this organism is unknown.

Giardia Lamblia is an important human pathogen with a global distribution. This flagellate mono cellular is the pathogenic parasite of the upper part of the small intestine affecting many vertebrata including human (Disney et al., 1998; Baruch e al., 1996). The importance of potable water supplies as a source of infection is not obvious, nor is the role of zoonotic spread. Even though, water sources where polluted with the mature cysts of parasite are the main source of infection (Adam, 1991).

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Parasites are even survived for some times due to the relatively resistance of *Giardia* cysts to chlorine that is existed in the water (Sayyari and Imanzadeh, 2005).

The international reports shows a prevalence rate of 73.4% in Nepal in 2004 (Easow et al., 2005), 11.6% in Filipina (Baldo et al., 2004), 4.84% in China (Yang et al., 2003), and 1.5% in South Korea (Guk et al., 2005).

Although, *Giardia lamblia* affects all age groups but children are more vulnerable, sensitive and susceptible (Baruch et al., 1996), probably due to lack of immune-system and personal health (Amar, 2000; Jahni et al., 2009). Prevention strategies include treatment of patients and disinfection of polluted drinking waters (Sayyari and Imanzadeh, 2005; Amar, 2000).

Iran is an appropriate environment for activation of various parasites due to the geographical features, the climatic conditions and the bio-cultural characteristics. Given that the recognition and controlling of risk factors of the parasitic infections, requires epidemiological investigations across the country. The present study aimed to investigate almost all studies conducted in Iran during the last decade regarding the *Giardia lamblia* infection.

MATERIALS AND METHODS

This was a systematic review and meta-analysis study on current investigations and research publications about epidemiology of *Giardia lamblia* in Iran during the last decade. The main international sources of ISI and Pubmed as well as the major national data banks in Iran including Magiran, Iran Medex, SID and Irandoc were systematically searched for the words " *Giardia lamblia*" since 1990 onward.

The summary of all 80 related papers was read carefully and those with similar methodologies (n=43) were included (Mahyar 1997; Alavainaini 2000; Amar 2000; Abdolali 2001; Mahyar 2001; Mostafaei 2001; Rafiee 2001; Rohani 2001; Srasyabi 2001; Aminzadeh 2002; Farhnak 2002; Rohani 2002; Askari 2003; Davami 2003; Heidari 2003; Moghimi and Asghrshrifl 2003; Razavion 2003; Aminzadeh and Nazari 2004; Kheirandish 2004; Taheri 2004; Gholami 2005; Khalili 2005; Mohrez 2005; Sayyari and Imanzadeh 2005; Sharifi 2005; .J. 2006; Alborzi and Zerafati 2006; Atashnafas and Ghorbani 2006; Bahadori 2006; Hatmkhah 2006; Ashtiani 2008; Fallahi 2008; Ghofranipour 2008; Mahuti 2008; Mohsenimoghadam and Shahidizandi 2008; Molavi 2008; Monsef, Hashemi et al. 2008; Taherkhani 2008; Ghorbani 2009; Jahni, Rezaeian et al. 2009; Nasiri, Esmailnia et al. 2009 ; Mosallanejad, Avizeh et al. 2010; Taheri, Namakin K. et al. 2010) by a qualitative controlling method. The required information were extracted using a prepared check list. The original articles were provided and studied more in depth. Papers in which prevalence of *Giardia lamblia* in both genders were estimated regardless to the age and language of participants/patients were included. Unrelated papers and/or those with different methodologies /insufficient data were excluded from the study (n=37). Of excluded articles, 20 did not meet the inclusion criteria and 17 articles were either repetitive or much localized. Decision upon either exclusion or inclusion of papers was independently made by two experienced reviewers.

All measurements for the meta-analysis were done using STATA software and random effects model. The heterogeneity was investigated by Cochran's Q test. Figures were plotted using SPSS statistical software.

RESULTS

Meta-analysis model with random effects showed a prevalence rate of 14.7% (reliability distance of 95 - 16.6-12.8%) for *Giardia lamblia* in Iran. The following age-specific prevalence rates were observed (p< 001) as demonstrated in Table 2:

1. 19.2% in the age group of 10-20 years old (95% reliability distance of 12.7-17.8)
2. 6.4% in the age group of 20-30 years old (95% reliability distance of 9.1- 3.7)
3. 2.6 % In the age group of 30-40 years old (95% reliability distance of 2.4-4.9)

The time trend of *Giardia lamblia* infection showed a maximum prevalence of 37.22% in 1994 and the least prevalence of 4.91% in 2005 (Figures 1 and 2; Table 1).

Geographical distribution of *Giardia lamblia* also showed that the eastern parts of the country nearby Pakistan and Afghanistan borders were extremely affected (35.5%). It was 16.9% in central provinces, 14.9% in the southern provinces, 13.2% in the north of country and 12.3% in the western provinces nearby Iraq and Turkey borders (Table 3).

DISCUSSION

This is the first meta-analysis study in Iran as far as we have searched in the published literature, focusing on epidemiology of *Giardia lamblia* and its age-specific prevalence in particular. The descriptive cross sectional studies are the current ways for diseases assessments in the community. The present study found an overall prevalence rate of 14.7% for *Giardia lamblia* in Iran during the last decade starting from 1990 onward. Despite of this finding which put the *Giardia lamblia* as the most frequent intestinal parasite in Iran, but fortunately its annually trends in the whole country is decreasing.

In the current study, the maximum prevalence rate of 37.21% occurred in 1994 and amongst children and adolescents in particular by age-specific distribution analysis. The age-specific distribution analysis in the present study showed that *Giardia lamblia* was more frequent in the age lower than 20 years, while in the persons higher than 20 years, this age difference was not considerable. This could be in part related to unhealthy life style, consumption of low standard drinking water, resistance of *Giardia* cysts to chlorination and inappropriate health system due to rottenness of plumbs and flowing of sewages in some regions. Meanwhile, migrations, global warming, wars, natural disasters such as earthquake, floods, lack of health drinking water and resistance of the intestinal parasites to the treatment might be involved.

Even though, decreasing annual trends of *Giardia lamblia* in Iran could be related to the community health



Cases weighted by total

Figure 1. Annual trends of *Giardia lamblia* in Iran from 1990 onward.

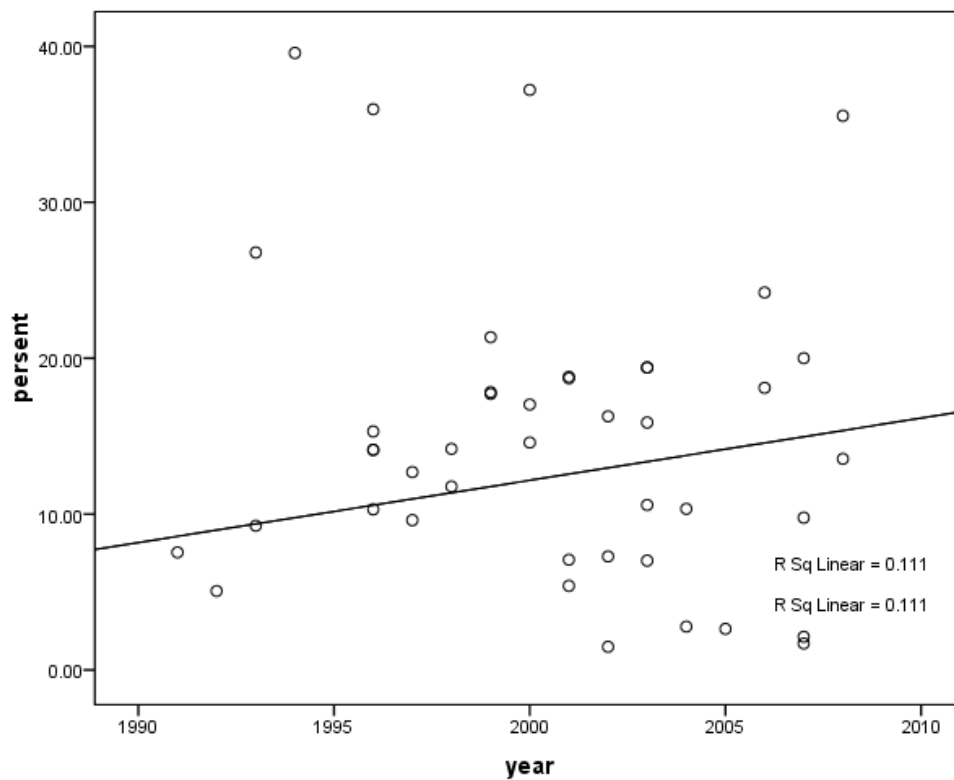


Figure 2. Regression plots of *Giardia lamblia* in Iran from 1990 onward.

Table 1. Epidemiological characteristics of included studies on *Giardia lamblia* in Iran.

Author	Year	Geographical situation*	City	Sample size	Prevalence, %
Taheri	2004	C	Birjand	10	1.48
Alborzi	2007	C	Shiraz	17	1.70
Razavian	2003	N	Mazandaran	1	2.13
Jahani	2009	C	Tehran	5	2.63
Bahadori	2006	W	Qaemshahre	183	2.77
Srasyabi	2001	S	Hormozgan	48	5.06
Davami	2003	W	Araak	89	5.39
Heidari	2003	C	Dameghan	75	7.01
Kheirandish	2004	W	Khoramabad	66	7.07
Mohrez	2005	W	Kermanshah	15	7.28
Ghorbani	2009	C	Tehran	4842	7.54
Rohani	2001	N	Noshahr	38	9.25
Mahyar	1997	W	Qazvin	39	9.61
Atashnafas and Ghorbani	2006	C	Semnan	188	9.77
Mostafaei	2001	C	Kaashan	37	10.31
Hatmkhah	2004	W	Urmia	28	10.33
Gholami	2005	N	Mazandaran	171	10.86
Mahyar	1997	W	Ghazvin	12	11.76
Farahnak	2002	W	Tabriz	33	12.69
Gharavi	2006	W	Qazvin	106	13.54
Hedayati et al.	2008	C	Tehran	163	14.11
Mohsenimoghadam and Shahidizandi	2008	E	Rafsanjan	163	14.11
Abdolali	2001	S	Yasooj	95	14.18
Nasiri	2009	C	Karaj	70	14.58
Alavinaini	2000	W	Saaveh	145	15.30
Aminzadeh and Nazari	2004	C	Varamin	40	15.87
Moghimi and Asghrshrifi	2003	S	Yasooj	75	16.27
Srasyabi	2001	S	Bandarabass	236	17.03
Molavi	2008	C	Tehran	440	17.13
Rohani	2002	N	Saari	222	17.82
Rafiee	2001	C	Tehran	76	18.10
Khalili	2005	C	Yazd	288	18.71
Sharif	2001	C	Yazd	51	18.89
Fallahi	2008	W	Delfan	97	19.40
Monsef	2008	W	Hamadan	97	19.40
Mosallanejad	2010	S	Ahvaz	64	20.00
Amar	2000	N	Babol	735	21.43
Ashtiani	2008	C	Tehran	642	24.99
Askari	2003	S	Shiraz	158	26.78
Taheri	2010	E	Khorasan J.	289	35.55
Mahuti	2008	W	Delfan	500	35.97
Mahyar	2001	W	Qazvin	96	37.21
Taherkhani	2008	W	Hamadan	188	39.58
Total				10933	14.7

N: Northern W: Western C: Central E: Eastern S: Sauterne*

Table 2. Age-specific distribution of *Giardia lamblia* in Iran.

Age group (year)	Number of studies	Prevalence,%	95 % CI, %	Weight*
1-10	22	15.1	12.4-17.8	51.75
10-20	11	19.2	14.8-23.0	24.65
20-30	8	6.4	3.7-9.1	19.4
30-40	1	2.6	0.04-4.9	2.38
40-50	1	3.96	3.52-4.4	2.18
Total	43	14.7	12.8-16.6	100.0

*Weight in meta-analysis studies is based on the sample sizes and will be accounted from 100.

Table 3. Geographical distribution of *Giardia lamblia* in Iran.

Region	Number of studies	Prevalence,%	95% CI, %	Weight*
East	1	35.5	32.3-38.8	2.29
Center	14	16.9	13.0-20.8	32.83
South	4	14.9	6.8-23.0	9.26
North	8	13.2	6.5-19.9	18.87
West	16	12.2	9.3-15.1	36.84
Total	43	14.7	12.8-16.6	100.0

promotion, more considering personal health, increased literacy levels and lack of using of the human fertilizers for reinforcement of the agricultural soils. The prevalence of the intestinal parasites was 37.2% in 2005 in Sivas region, Turkey, in which *Giardia vantrobus vermico Laris* was the most prevalent infection in the age group of 7-15 years (Celiksoz et al., 2005). In a similar study, the prevalence of *Giardia* was estimated to be 26.2% amongst children in Damghan (Heidari, 2003).

In the current study, the rate of *Giardia* infection was 35.5% in the eastern regions of the country and 16.9 % in the central areas. In tropical regions and in rural areas in particular, the prevalence of *Giardia* is expected to be high because of the climatic and health conditions as well as the socioeconomic situation. Despite valuable primary care activities in Iran, the reason behind this finding is due to poor cultural and socio-economic status of people in these regions. People might have not changed the health beliefs and life styles.

In conclusion, increased prevalence of *Giardia lamblia* in Iran, in spite of preventing strategies and valuable primary health care activities has remained a public health concern amongst children and in the eastern parts of the country nearby Pakistan and Afghanistan borders in particular.

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