

REVIEW ARTICLE

Geographical Distribution of the Giardia Lamblia in Male Patients of Mazandaran Province from 1992 to 2013

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Abstract: **Introduction:** Intestinal parasites of humans are important health problems of most communities, especially those situated in tropical and subtropical areas. This review study was done on the population of Mazandaran Province, northern Iran, during 1991-2013, to gain a better understanding of the distribution of intestinal protozoan parasite, Giardia Lambelia, in this province by providing a geographic map. **Methods:** This review was performed by collecting the data through international search engines such PubMed, ScienceDirect, Google Scholar, SID, Magiran and postdoctoral theses. Data were classified and analysed by SPSS software. Then Data applied to the map by ArcGIS software. **Results:** According to our study, the maximum level of infection with Giardia Lambelia between male patients was seen in Tonekabon in 1982 and the Prevalence of this intestinal parasite in the western regions of the province was more than other regions. The prevalence of Giardia decreased After 23 years. **Conclusion:** The prevalence of intestinal protozoan parasite, Giardia Lambelia, among people of Mazandaran Province is still very high which necessitates performing special control measures.

Keywords: Geographic Information System; Giardia Lambelia; Intestinal parasite; Iran; Mazandaran; Men

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1. Introduction

Intestinal protozoan parasitic diseases, especially amoebiasis and giardiasis, are among the most common infectious diseases, especially in developing countries, which cause disability and death of millions of people every year by endangering human health (1-3). In Mazandaran province, Iran, intestinal parasitic diseases are of special importance in terms of the impact on the health of the residents of these areas and the health of the region due to the special conditions

for the transmission of these diseases, especially in rural areas among low-income groups and suburban residents. According to research conducted during the past years, common intestinal protozoan parasitic diseases in Mazandaran province include giardiasis, cryptosporidium, amoebiasis. However, non-pathogenic intestinal protozoa such as Entamoeba coli and Iodamoeba butchlii have also been reported. In recent studies in Mazandaran province, different prevalence of protozoan and intestinal worm parasites in humans has been reported in different geographical areas in this province, especially Giardia, at different times (4, 5). With the advancement of science and technology, human tools for studying health problems, including diseases, are changing. The geographical information system (GIS) can be considered as one of the new technologies for studying the

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spread and status of diseases, especially infectious diseases (1). Due to the wide relationship between the GIS and different sciences, various applications and definitions have been provided by researchers. According to the purpose of this article, this system can be used to process and present spatial information, which includes data collection, data conversion into geographically structured information, data storage, information retrieval, spatial analysis of information, and the production of maps and other outputs in the form of files or on paper (5), (6-9).

Therefore, due to the special climatic conditions of Mazandaran province and the presence of suitable conditions for the transmission and spread of parasitic infections, especially intestinal ones, we aimed to investigate the geographical spread of giardiasis in Mazandaran province during the last two decades using Arcgis software, version 9.2. This study, which was conducted for the first time in Mazandaran province, is important for two reasons: first, by determining the prevalence of parasitic infections, these studies can help find the causes of diseases and second, the geographical distribution of diseases can be an indicator of how they individuals and age, sex and occupation groups interact with the environment. Because many factors that affect the spatial distribution of diseases are simple or complex and affect alone or together (10). In fact, paying enough attention to the geographical spread of infections, in addition to allowing the clinician to monitor all aspects of the disease related to these infections with a broader and more complete view, also leads to correct diagnosis and timely treatment of the disease (6-9). Therefore, the aim of the present study was to investigate the geographical distribution of *Giardia* intestinal protozoan infections in Mazandaran province from 1991 to 2013 using Arc GIS software. In the first stage, information related to intestinal protozoan infections were collected from different provinces and then using Arc GIS software by preparing a map of the causes of the prevalence of each common infection in different places were compared with each other and by examining the causes and factors conclusions were made for providing solution for preventing that disease.

2. Materials and Methods

The present study is a review that was conducted in Mazandaran province. Data from articles were obtained by the researchers due to lack of access to raw data despite correspondence with researchers.

In this study, information on the geographical spread of intestinal protozoan parasitic diseases from 1991 to 2013 was collected by reviewing articles published in journals, congresses and master's and doctoral dissertations. Moreover, national databases such as Iran Medex, Migiran, SID and the site of the Scientific Association of Parasitology were search

using keywords such as protozoan, parasite, *Giardia* and Mazandaran. English language databases such as Google Scholar, PubMed, Trip Database, Science Direct, Springer, Elsevier were searched with equivalent English keywords. Relevant articles were studied and after recording and collecting information and classifying them according to year and prevalence, the obtained information was entered in the tables according to place of publication, year of report, percentage of contamination, article title and researchers.

Using adjusted tables and a map of Mazandaran province using Arc GIS 9.2 software after the formation of the database, the map of the spread, chart and geographical distribution of the disease in Mazandaran province was designed based on the average prevalence over 22 years.

3. Results

Figure 1 shows the diagram for selecting and including relevant articles. Among the 215 articles found in our search, 54 were related to our topic, of which 24 were in Mazandaran province that studied the prevalence of protozoa in this province. According to the purpose of the study to investigate the prevalence and status of common intestinal protozoan parasites in Mazandaran province from 1991 to 2013 using information sources, the results were obtained according to the type of parasite, place of spread, reporting year and percentage of infection which showed that *Giardia lamblia* (the cause of giardiasis) was the most important intestinal protozoan common in Mazandaran province.

Based on the results of research conducted from 1991-2013 in Mazandaran province, the highest and lowest prevalence of *Giardia* in Mazandaran province was 28.75% in Tonekabon city and 2.7% in Babolsar city, respectively.

Based on the results extracted from studies in Mazandaran province, *Giardia lamblia* infection in primary school students in Neka city during 1998-1999, rural areas of Tonekabon in 1992 and residents of urban and rural areas of Tonekabon and Ramsar in 1992-1992 were 42.19%, 29.6%, and 27.9%, respectively, which were the highest prevalence reported in Mazandaran province.

The minimum prevalence of this protozoan was in patients referred to Taleghani Medical Center in Chalous (2.31%) and patients with gastroenteritis in Babolsar (2.7%).

By examining the rate of *Giardia* infection in Mazandaran province during the study period, the results showed different prevalence of the parasite in different regions according to age. However, in all studies, this disease has always been more prevalent in men, and therefore, in our study only men have been mentioned (table 1).

By plotting the spread chart by city and the prevalence of the parasite, the results of this study showed that the trend of changes in the prevalence of the parasite in infected men

in different cities of Mazandaran province is not the same. The highest level of infection has been reported in the west of the province (Tonekabon and Ramsar) and the east of the province (Neka and Behshahr) and the lowest level of infection has been reported from Chalous, Babolsar, and Jouybar (Figure 2 and 3).

Examining the geographical distribution map of the disease, it is clear that no research has been done on the spread of protozoa in the cities of Savadkuh, Abbasabad, Mahmoudabad, Gulogh and Surak. Therefore, there is no report on the prevalence of Giardia in these areas. Prevalence of Giardia lamblia in Chalous, Jouybar and Babolsar cities less was than 5%, 5-9% in Ghaemshahr, Noor and Nowshahr, 9-14% in Sari, Amol and Babol, and 14-19% in Behshahr and Ramsar, and more than 19% in Tonekabon and Neka (figure 3).

4. Discussion

This study was designed to determine the prevalence of Giardia lamblia protozoan infection in men in different cities of Mazandaran and also to investigate the changes in the prevalence and geographical distribution of this parasite during 1991-2013. Researchers have used GIS for nearly 30 years to study the pattern of disease spread and monitoring. Salahi and his colleagues studied fascioliasis for the first time in northern Iran in 2004 and designed a map of high-risk areas based on snail dispersion as an intermediate host (9, 11). After that, for the first time in Mazandaran province, Seyahi and his colleagues studied the 22-year pattern of geographical spread of enterobiosis in 2010 (12). According to their study, the most common parasitic infection in the north of the country after enterobiosis was giardiasis. Although Mazandaran province has a high health status, because of the high humidity and high population density, parasitic infections have a high prevalence (13, 14).

In this study, the highest prevalence of parasitic infections, especially Giardia was reported in Tonekabon in 1991. The methods of examining parasitic infections in different studies were different and therefore have caused differences in the results (15, 16). In a study conducted by Rouhani and colleagues in 1994 in Chalous, the prevalence of Giardia infection was 9.2%, while in a similar study conducted in 2010 by Alizadeh and co-workers, the prevalence of this infection was 2.3% (17, 18). According to the table, the available evidence indicates that in recent years, despite the development of diagnostic methods for parasitic diseases, the prevalence of Giardia lamblia in the province is declining. Therefore, this decrease in prevalence can be attributed to the increase in the cultural and health level of the people as well as their level of awareness, and on the other hand to the efforts of the health centers of the city and the province. In one study in Ontario, Canada, the seasonal and cross-sectional distribu-

tion of Giardia and its geographical distribution was studied. In that study, Giardia peaked suddenly in summer and then declined. Moreover, in some areas Giardia was seen as a cluster and more prevalent than any other area. As a result, the authors found the drawing maps to be very suitable for controlling the infection in Ontario (12).

Our study was based on the findings of other articles in different places and times, which is one of the weaknesses of this research project. Therefore, it is recommended that future studies investigate the prevalence of this parasite in a period of time and prepare its geographical maps throughout the province. On the other hand, the data obtained from articles are heterogeneous and therefore need to correspond with the authors and receive and analyze data from their studies.

Although in recent years there has been a significant improvement in the public health situation in urban and rural areas, kindergartens in urban areas and access to health facilities in the province, nevertheless, attention to the control and prevention of common parasitic infectious diseases, especially in children in cities with high levels of the parasite should be given serious attention by families, public health officials of kindergartens and schools and the health care system of the province. Moreover, unstudied areas in the province should be studied to obtain the correct model of the status of intestinal protozoa in the province, especially pathogenic types, should be given priority in research studies. In order to determine the prevalence and spread of intestinal protozoa according to geographical and social conditions, the need to compile and conduct additional studies to investigate the status of intestinal parasites in the entire province using the GIS at specific times.

5. Appendix

5.1. Acknowledgements

None.

5.2. Author contribution

All authors have the same Contribution. All authors have equally contributed in the study, data analysis and writing the manuscript.

5.3. Funding/Support

None.

5.4. Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.



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Table 1: Prevalence of *Giardia lamblia* in male patients in Mazandaran province during 1991-2013

Author(s), Publication year, Reference	Percentage of male infection	Year of report	Place of study
Rezaian et al., 1996 (16)	29.6%	1992	Rural areas of Tonekabon
Rezaian et al., 1991 (15)	27.9%	1992-1993	Urban and rural areas of Tonekabon and Ramsar
Rouhani et al., 2000 (17)	9.2%	1994-1995	Urban areas of Nowshahr and Chalous
Masoud et al., 1995 (19)	Behshahr: 14.5%, Nour: 7.8%	1995	Rural areas of Behshahr and Nour
Mobedi et al., 1997 (20)	11.2%	1997	Rural, plateau, and mountainous areas of Sari
Kalantari et al., 2000 (1)	11.5%	1998	Babol City
Soudbakhsh et al., 2002 (21)	20.3% in 1997 25.1% in 1998	1998-1999	Neka city
Mobedi et al., 1999 (22)	14.6%	1998-1999	Rural areas of Amol
Rouhani et al., 2000 (17)	17.82%	1998-1999	Rural areas of Sari
Razavian et al., 2002 (23)	16.93%	1999	Urban and rural areas of Freidounkenar
Ghahramanlou et al., 2001 (24)	21.4% 27.2%	1999	Pandemic area of east Babol
Razavian et al., 2003 (25)	7.8%	2003	Ghaemshahr city
Gholami et al., 2005 (26)	14.2%	2003	Rural areas of Babol
Gholami et al., 2005 (2, 4)	27.5%	1382(2003)	Rural areas of Mazandaran
Ranjbar Bahadori et al., 2005 (27)	18.7%	2004	Urban and rural areas of Ghaemshahr
Kia et al., 2008 (26)	10.2%	2004-2005	Rural areas of Mazandaran
Ghorbannia delavar et al., 2008 (28)	2.7%	2005-2006	Babol and Babolsar cities
Daryani et al., 2009 (29)	HIVpositive: 3.7% Control: 3.1%	2007-2008	Rural areas of Mazandaran
Sharif et al., 2010 (30)	8%	1387(2008)	Behshahr, Sari, Amol, Noshahr, Ramsar
Daryani et al., 2012 (31)	10.6%	2009-2010	Sari city
Rahimi et al., 2013 (32)	6.4%	1388-1389(2009-2010)	Central areas (rural, urban, mountainous) of Mazandaran
Vahedi et al., 2012 (33)	2.2%	2009-2010	Neha, Sari, Jouybar
Ghazanchaei et al., 2014 (34)	2.3%	2010	Chalous
Alizadeh Shargh et al., 2010-2011 (18)	2.31%	2010	Chalus

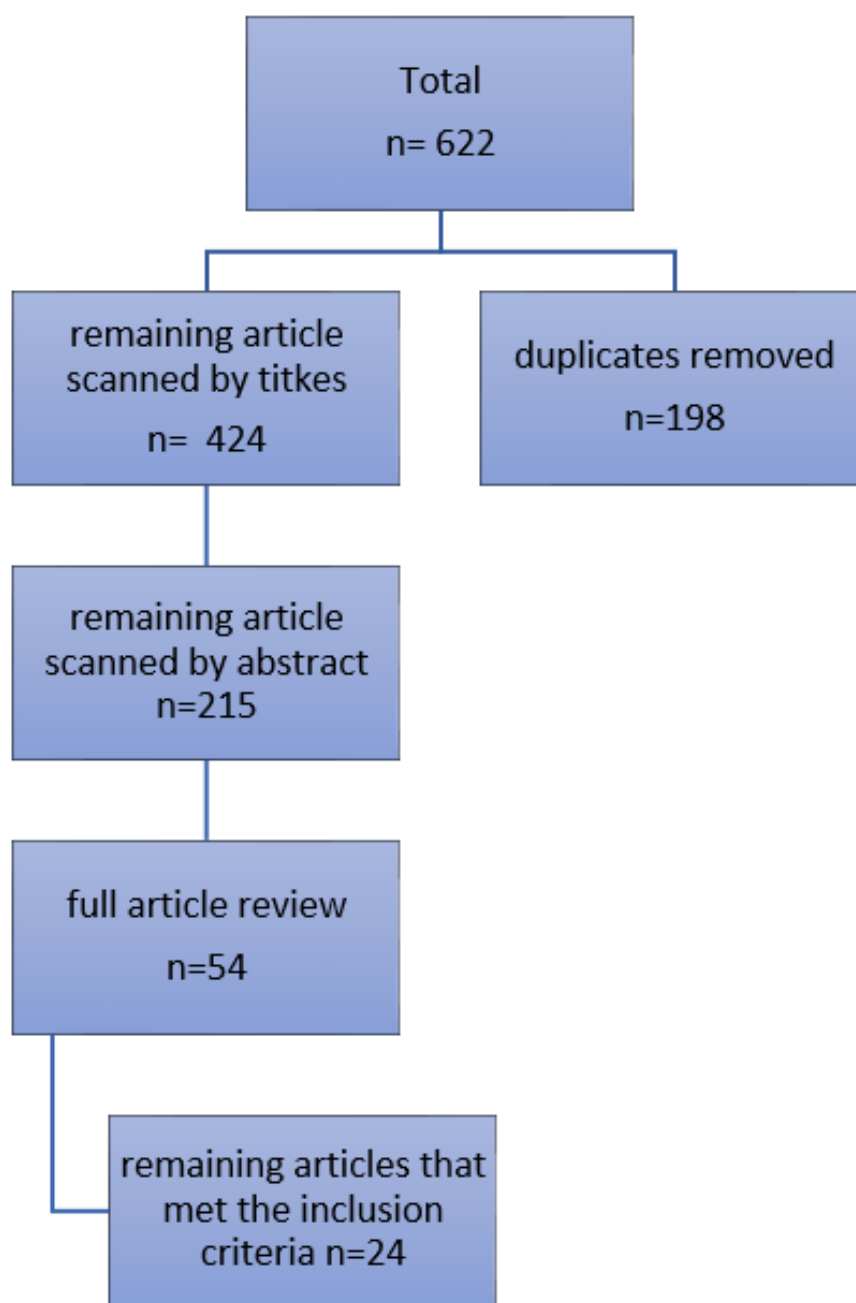


Figure 1: Algorhythm of included articles.

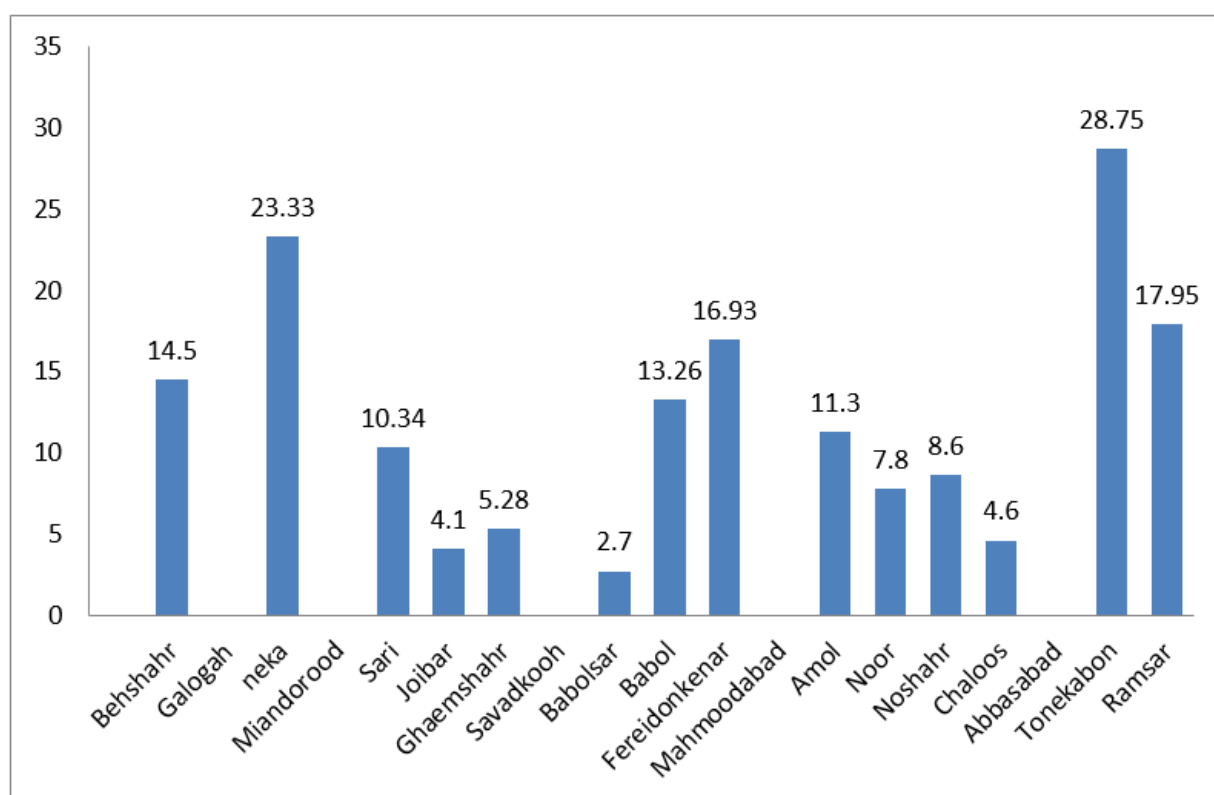


Figure 2: Prevalence of giardia in male patients of Mazandaran province (in order from East to West).

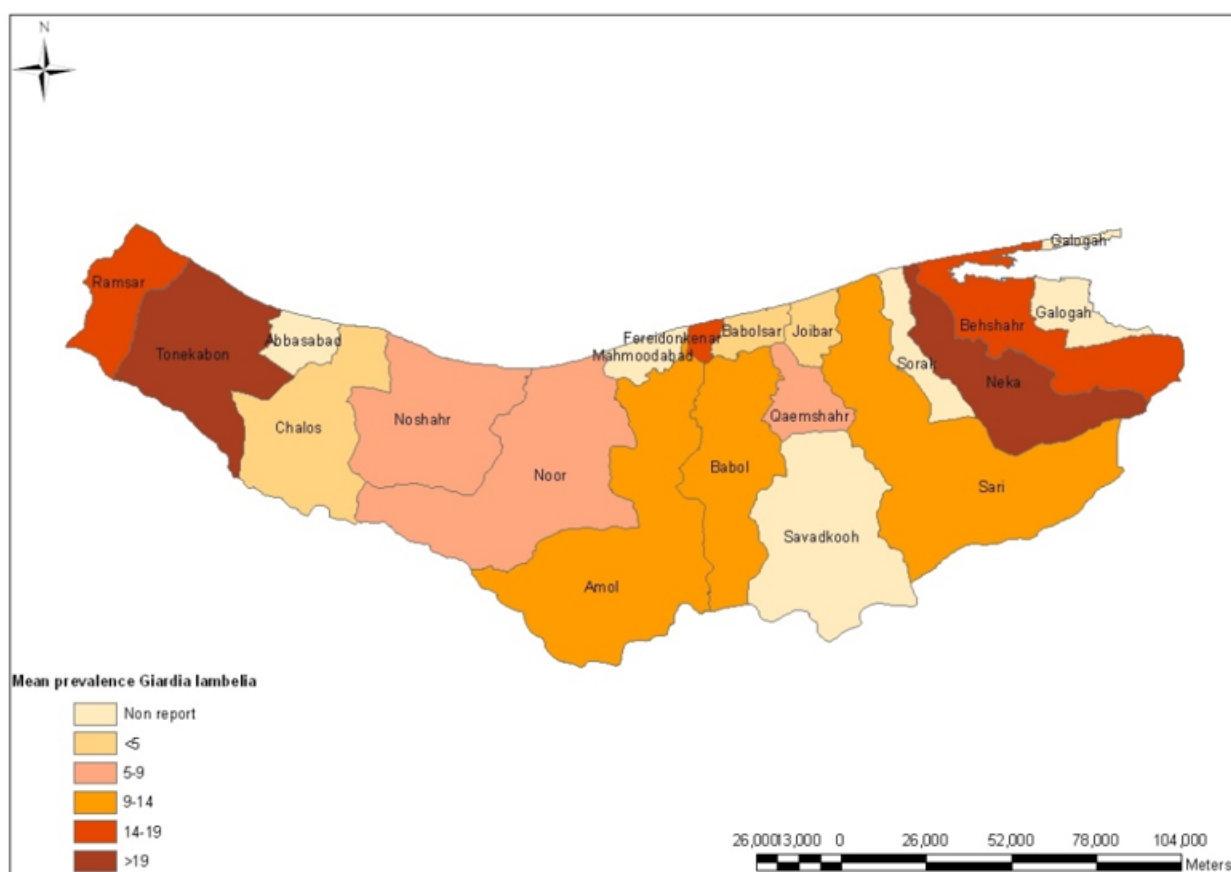


Figure 3: Geographical distribution map of mean giardia prevalence in male patients in Mazandaran provinfe during 1991-2013.