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**Research Article**

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# The relationship between nitrate in drinking water and gastric cancer in the Isfahan-Iran from the perspective of medical geography

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**ABSTRACT**

*the expression Medical Geography, more than half a century has been used in the united state including geography concepts and issues related to health and disease. Cancer is a major health problem in the world today, one of the important factors influences its prevalence is environment. Stomach cancer, the prevalence of 9/9%, is the second most common cancer in the world, the province is also the third most common cancer incidence. One of the factors affecting this type of cancer is nitrate in drinking water. In the present study using GIS and mapping software, the epicenter of the outbreak of the disease in the province include the Fereydonshahr City with Age Standardized Rate 55.84, Semirom 54.76, Fereidan 44.21. The sex ratio in gastric cancer patients over a 5-year period from 2006 to 2010 in the province 1.56 is the most common age group suffering from this disease are the age group over 70 years. Finally, to find the relationship between nitrate in drinking water and gastric cancer regression in SPSS and statistical methods were used. It showed a positive correlation coefficient R = 0.42 and P =0.05, And expressed particular attention to the reduction of nitrate in drinking water at the center of this disease and it confirmed the investigation of other factors affecting the incidence of gastric cancer .*

**Keywords:** gastric cancer, geography, medicine, drinking water nitrate, Isfahan province.

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## INTRODUCTION

Words of medical geography, more than half century, is used in the United States including the concepts, methods and issues related to the geography of health and disease, Mapping and analysis of quantitative and qualitative methods with field activities and participation, and even started interviewing techniques used and even the humanity science will be examined (1). Cancer is a major health problem and one of the most common diseases in the world (2).From the beginning it have been (3).Three factors, alone or jointly, increases a person's risk of developing cancer which include the style of living, environment, and heredity(4).Gastric cancer with the prevalance of % 9/9 in the world is the second most common cancer after lung cancer, with an incidence of % 11.8 respectively.In areas of the world with high cancer incidence, by 25% - 50% of new cancer cases is also included,However, the rate of Gastric cancer in some countries like the United States in recent 50 years has shown a 50% reduction.The disease occurs all over the world, but its prevalence varies in different regions of the world. The incidence of Gastric cancer is high in areas of the world including Japan, China, Chile, Central and Eastern Europe. the rare disease areas include Africa, India, and Southeast Asia. gastric cancer in Japan is 10 times greater than Southeast Asia and 8.5 times greater than North America. The incidence of gastric cancer in first-generation of immigrants from other

regions is similar to the country of origin, but the incidence of cancer in the next generation is similar to the host country. so the environmental factors have effects in the development of gastric cancer(5). According to Iran statistics, the incidence of Gastric cancer is one of the prevalent cancer, %15.8, after skin cancer incidence %27.6 respectively(6). Gastric cancer is the third most common cancer prevalence in Isfahan province and is rated 5 of the patients with this type of cancer which is statistically significant (7).

Environmental conditions in each region is favorable context for the incidence and prevalence some diseases, Gastric cancer is among diseases that environmental factors are considered the most important factors influencing it. The influential Environmental factors can be Nitrosamine Molybdenum, Nitrogen, Nitrate, Radiation and agricultural pesticides .However, the nitrate is one of the environmental pollution in the environment in recent years due to the excessive use of nitrate fertilizers of nitrogen sources in the environment has been increased. One way of transmitting of ,this infection to humans is contaminated water(8).Drinking water is usually local and are mainly influenced by the local geochemistry. Excessive entry of inorganic compounds into the body through drinking water is causing problems in some countries(9).Nitrate and nitrites in the environment or in the form of resuscitation the digestive tube is formed by the degradation of hemoglobin, which is toxic Metoglobin disorder creates dangers for young vertebrates. Hypotension also produce nitrites (reduced arterial pressure) the introduction of nitrozamines are carcinogenic(10). In the world, different opinions regarding the carcinogenicity of nitrate in drinking water are provided. During the last 30 years, many epidemiological studies to find the relationship between dietary nitrate and cancer of the gastrointestinal tract has been done. While some findings in the late 1970s and early 1980s confirmed the positive relationship between these, the later studies did not find any relationship (11,12). Entering Nitrate alone into human body is not important but after entering the body, nitrate is converted to nitrite in the digestive tract by microbial activity and ultimately become components of N-Nitroso (NOCs) .Finally, it is converted to carcinogenic nitrosamine of NOC(13,14).However, there is no proof which in the absence of the nitrate-containing amine required for the formation of nitrosamine , cancers have been caused . nitrate and nitrite are classified in group D in the classification of the U.S environmental organizational cancer (USEPA) so the appropriate evidence for the carcinogenicity of this substance is not approved. According to EPA guidelines, this material is insufficient information to assess the carcinogenic potential of classification(15).In the present study the spatial distribution of gastric cancer, the 5-year period from 2006 to 2010 in the province in order to introduce the epicenter of the prevalence, Breakdown by age and sex and drinking water nitrate effect on the prevalence of the disease is studied.

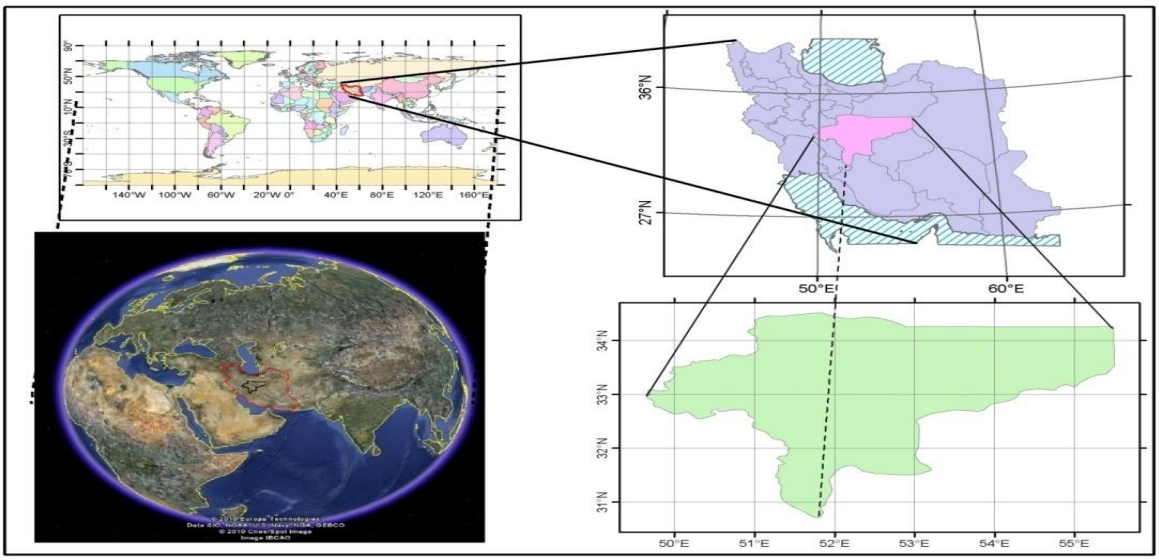


**Fig.1. The geographical location of the Isfahan - Iran**

## EXPERIMENTAL SECTION

Ecological statistics recorded in this study of patients with a diagnosis of gastric cancer in Isfahan Health Center during the 5-year period (2006-2010) using Arc GIS software as the average age standardized incidence per 100,000 population of each city to determine geographical distribution of the main focal of gastric cancer incidence were

obtained. For statistical analysis, SPSS software was used for patients based on age and gender. To find the relationship between nitrate in drinking water and gastric cancer in Isfahan province during 2012-2013 Urban Water resources data for each city were reported as mean. correlation regression models and SPSS statistical software were utilized.

**The Location of The Study Area**

Isfahan Province with an area of about 107,045 km, which is equivalent to %6.3 of the total area of Iran is located Between 30 degrees and 43 minutes and 34 degrees 27 minutes north latitude and 49 degrees 38 minutes to 55 degrees and 32 minutes east of the Greenwich meridian and its Center is 1550 meters above sea level (16).

## RESULTS

During the years 2006-2010 the number of people diagnosed with gastric cancer in 1110 person at the center of Isfahan Provincial Health Center are registered, The figure shows the increasing trend from 2006 to 2010 so that the cases in 2006, 156 cases and 2009, 258 cases per year, respectively but the figures recorded in 1388 shows the reduction of the number of patients registered with a diagnosis of gastric cancer than 2009 (Table 1).

**Table 1- Number patients with Gastric Cancer Divided Year**

| Statistical Year | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| Number of patients with Gastric Cancer | 156 | 231 | 231 | 258 | 243 |

Sex ratio of 1.56 has been ASR(Age Standardized Rate) showed a significant increase in 5 years - so that the 19.46 in 2006 to 30.31 about per 100000 people increased in 2010.The highest Age-Standardized Rate in 2010 was seen in both sexes, This rate was consistently higher in men than women. So that the men of 26.05 in 2006 to 41.88 about 100000 people in 2010, and in women, the incidence of 12.53 about people in 2006 to 18.16 case 100000 people reached in 2010.The Age Standardized Rare of gastric cancer in men in 2006 came in to its lowest rate (26.06) and then to the maximum level (44.07) 2009(Table2).

**Table 2- Age Standardized Rare In both sexes**

| Year | Men | Women | Men & Women |
|---|---|---|---|
| 2006 | 26.05 | 12.53 | 19.46 |
| 2007 | 43.34 | 14.06 | 29.06 |
| 2008 | 38.47 | 18.67 | 28.81 |
| 2009 | 44.07 | 19.95 | 29.81 |
| 2010 | 41.88 | 18.16 | 30.31 |

Using the Age Standardized Rate gastric cancer (2006-2010), the zoning map was determined in order to obtain the focus of this cancer in high-risk disease , The basis of the city were classified into 5 groups.City of Nain, Ardestan, Natanz, Bidgol Aran, Kashan, Dehaghan, Mobarake, Chadegan and Tiran and crowns, with an average Age Standardized Rate of less than 11.6 but in relatively low prevalence And the city of Ferydonshahr City, Semirom and Fereidan standard index between 44.20–55.84, except in areas with high prevalence of gastric cancer in the province are the main focus(Fig 2).

**Table 3. Descriptive table of gastric cancer patients based on Age-Standardized Rate during the 5-year period (2006-2010)**

| Descriptive Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gastric. Cancer ASR | N | Minimum | Maximum | Mean | Std. Deviation | Skewness | |
| | Statistic | Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error |
| | 21 | .00 | 55.84 | 18.5343 | 16.53401 | 1.099 | .501 |

Table 3 shows the mean Age Standardized Rate of Gastric Cancer in the province during the period of 5 years is 18.53 , The minimum and maximum rates were related to the city of Natanz, a city with an index of zero, and f is 55.84 ,Skewness coefficient data of the number 099/1 indicates that this is expressed in most of the province mean age standardized incidence of gastric cancer is low, And only a few provinces are (Fereydonshahr, Semirom, Fereidan) with a lot of different indicators mean that the province is shown in Chart 1, which the necessity of special attention to the study of prevalence of gastric cancer is confirmed.

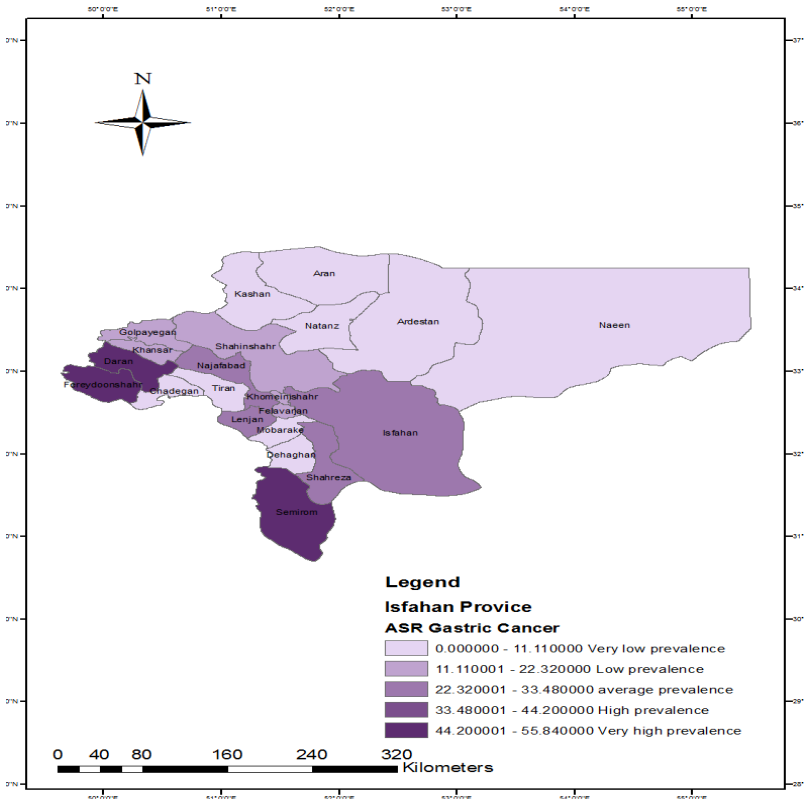


**Fig. 2. Zoning Map of gastric cancer based of Age-Standardized Rate(2006-2010)**

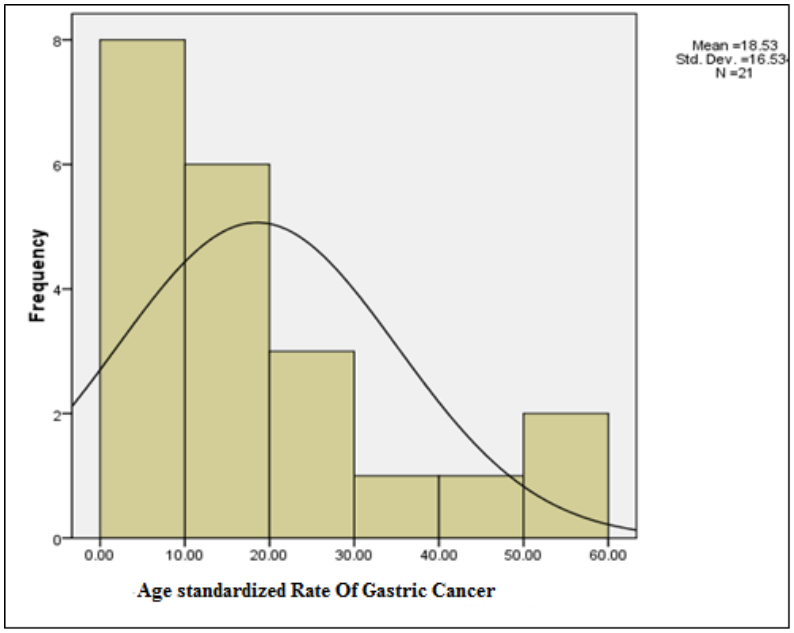


**Chart 1. Diagram skewness data based on Age standardized Rate (2006-2010)**

The analysis of trends in incidence in subgroups based on Age Standardized Rate during the period 2006-2010 has been increased with increasing age there is an increasing trend, The highest age group who are diagnosed with the disease are older than 75 years that the index is higher in men(Table 5,Chart 2).

**Table 5 .index of Age Standardized Rate According to age group**

| Year | Under 45 years | 45-60 Year | 60-75 Year | Over 75 years |
|---|---|---|---|---|
| 2006 | 4.23 | 28.68 | 60/65 | 120.02 |
| 2007 | 5.7 | 34.72 | 111.89 | 152.68 |
| 2008 | 5.15 | 40.75 | 99.34 | 175.42 |
| 2009 | 4.78 | 55.85 | 104.57 | 168.92 |
| 2010 | 5.15 | 47.55 | 95.16 | 198.16 |
| 2006-2010 | 25.04 | 207.56 | 477.9 | 786.17 |

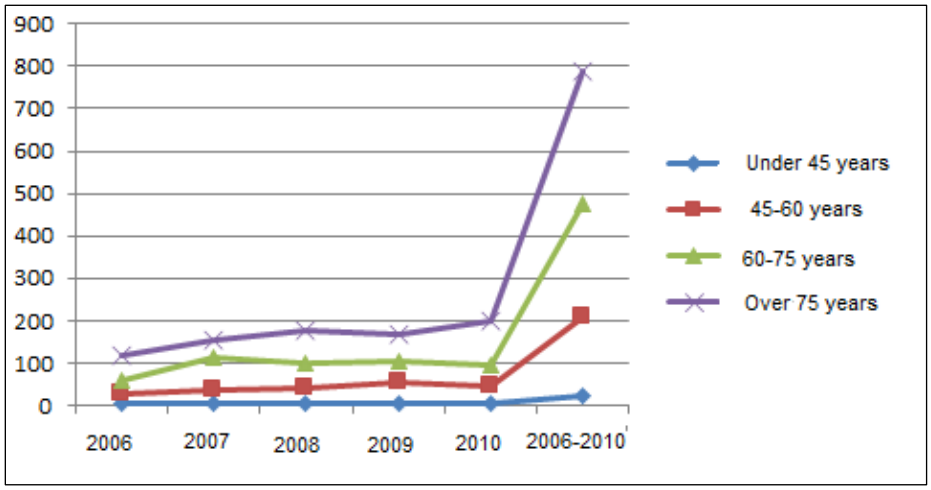


**Chart 2- Age Standardized Rate According to age group**

**Nitrate effect on gastric cancer**

In modern agriculture , nitrogen fertilizer overuse is a source of nitrate which is used with the different reasons. This system regulates food crops which makes the low phosphorus fertilizer used and thus is caused by nitrate pollution on farms. Products contaminated with nitrates and nitrites in the human and animal organism readily enter the blood and red blood cells is paralyzed. Nitrate pollutes the natural water and water reservoirs by surface water contaminated especially in the slope is also of great significance. Rotate nitrogen and nitrates in the soil system, water nitrate pollution primarily by factors such as soil texture, irrigation, crop type, soil moisture, micro-biological activity has a direct relationship with the amount of nitrogen fertilizer . Nitrates, vegetables, fruit and water entered the human organism, and approximately %80 of their daily work processes are issued , Nitrates which remain in the gastrointestinal tract have been influenced by some microorganisms and enzymes that are converted to nitrites. 80% nitrous compounds are carcinogenic. More than nitrates and nitrites are toxic to the human organism which is very dangerous (17). Recent ecological studies in Spain and Hungary show the positive relationship between gastric cancer and high amount of nitrate in drinking water(18,19).In an epidemiological study in an area with high prevalence of gastric cancer in Northeast China showed the relationship between high levels of nitrate in drinking water supplies and neoplastic changes which were found in the stomach. It has a significant relationship(20).Similar studies in Denmark showed that a positive relationship exists between nitrate in drinking water and gastric cancer(21). In general, epidemiological studies on the incidence of gastric cancer are inconsistent studies an increased incidence of gastric cancer in places with high levels of nitrates were reported, but others did not confirm this relationship(22,23).

The present study was designed to investigate the relationship between nitrate in drinking water and incidence of gastric cancer in Isfahan Province. The sampling data points were collected in Health Center of drinking water(Figure 3). To get the relationship between nitrate in drinking water and gastric cancer, the mean of every city of the province of nitrate in drinking water and Index of Age Standardized Rate in the period of 5 years (2006-2010) were obtained and the regression correlation method was used. Although the results showed that none of the city and province of nitrate in drinking water than standard WHO (50 mg/L) is higher But with increasing nitrate levels in drinking water, its prevalence increases. A positive correlation coefficient R= %42,P= 0.05 Was found(Chart 3).

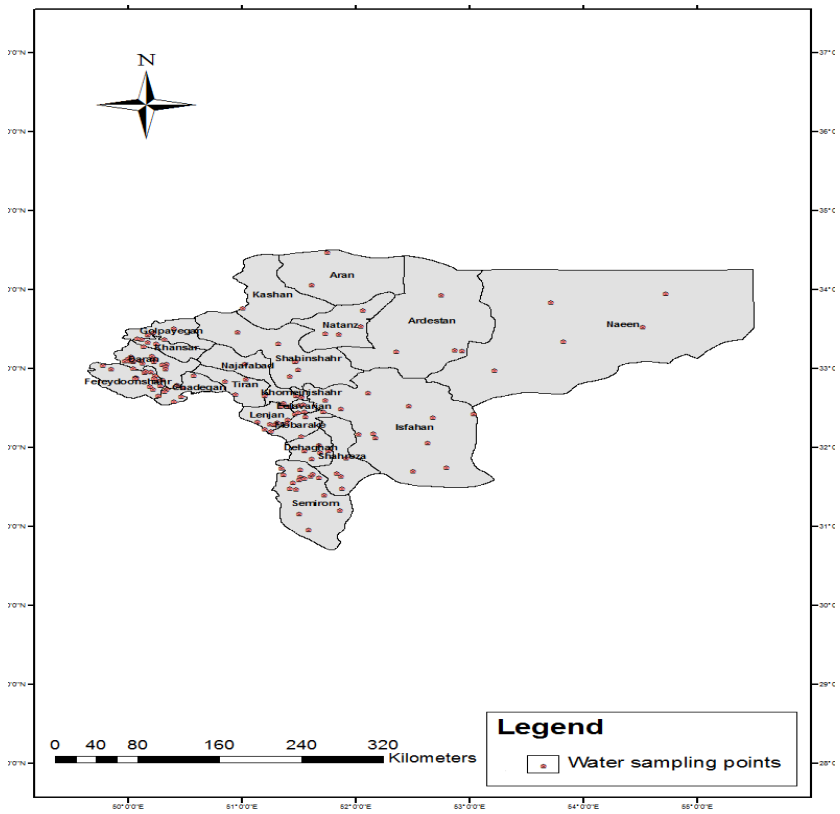


**Fig. 3 .Location of water sampling Isfahan Health Center**

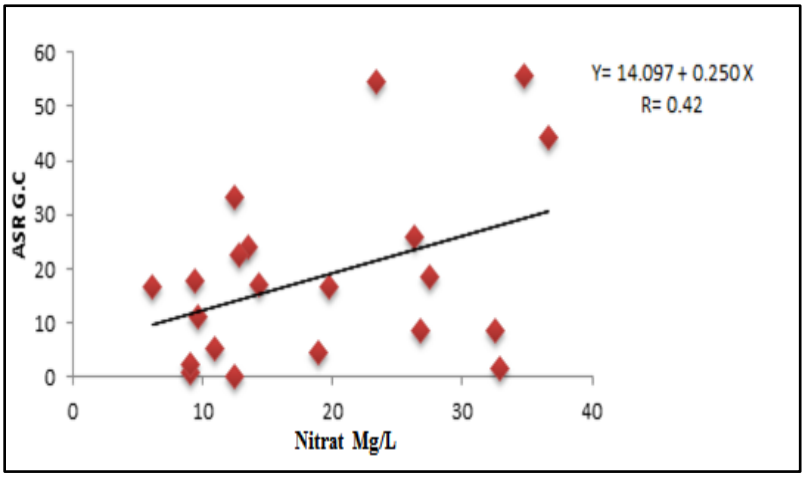


**Chart3 - Relationship between mean nitrate in drinking water and Age-Standardized Rate**

## CONCLUSION

This shows an increasing trend in the incidence of gastric cancer in the province during the 5-year period(2006-2010). this trend was seen in men more than in women. Incidence increases with age so that the disease based on Age-Standardized Rate is more common in people over 75 years. This rate is higher in men rather than in women. The main focus were Fereydonshahr city with Age Standardized Rate (55.84), Semirom (54.76) and Fereidan (44.21) in Isfahan Province, respectively. Based on the results of the regression correlation with Rate R= %42 ,P= 0/05 obtained showed that with increasing of Age Standardized Rate of nitrate in drinking water in hundreds of thousands of people also increases .This could be one of the reasons for the increased incidence of gastric cancer in

the focus of this province. Thus, it is required the officials attention to the reduction of nitrate in drinking water in the different parts of the province.

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