

Spatial distribution and the impact of geographical factors on brucellosis in Chaharmahal and Bakhtiari Province, Iran

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ABSTRACT

Background and aims: Brucellosis is one of the most important common diseases among man and livestock which are considered as the major problem in the health of the humans and livestock. The Importance of this disease isn't limited to its physical problems and consequences, but it is considered as a major challenge of economic development in most countries. The aim of this study was to evaluate the effect of some regional parameters on the prevalence of this disease because of its high prevalence in Chaharmahal and Bakhtiari.

Methods: This study was a descriptive- analytical and the registered statistics about those affected by Brucellosis in Chaharmahal and Bakhtiari from 2008-2011 abstracted from Center of Public Health of the province. Based on it, spatial distribution maps of Brucellosis were provided by Geographic Information System (GIS). Then, the relationship between this parameter and some regional parameters was studied by using software SPSS.

Results: Extent of Brucellosis prevalence wasn't consistent in Chaharmahal and Bakhtiari and Koohrang had the more prevalence and Lordegan, Farsan and Kiar regions had less risky. There is a meaningful relationship between increase in Brucellosis and temperature in the year 2008, 2010 and 2011 ($P<0.05$) ($P<0.01$), rainfall 2008 and 2010 ($P<0.05$) and moisture 2008, 2010 and 2011 ($P<0.01$).

Conclusion: Environmental factors influence disease prevalence.

Keywords: Chaharmahal and Bakhtiari province, Brucellosis, Climate, Spatial variability, GIS and SPSS software.

INTRODUCTION

Climate effects of the environment in medical field especially in the recent century have become so significant. Among them, medical geography is an

emerging field in Iran which studies the diversity of various diseases accompanied by environmental possibilities and condition. Factors studied in medical

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geography related to disease include: Latitude, rainy and snowfall climate, moisture, temperature, pressure, etc. One of the problems of underdeveloped country is severing prevalence of contagious diseases so that their high frequency results in increasing the mortality, population growth rate reduction and lowering the lifetime and life expectancy. Among contagious diseases, common disease, common disease among human and livestock (Zoonoses) can be noticed. Brucellosis is one of these diseases. Brucellosis is an infectious common disease in human and livestock and is one of the hygiene problems in most areas of the world especially Mediterranean, middle west including Iran. It is common in most counties of the world and just 17 countries have been formally announced as free Brucellosis.¹ Brucellosis is a common disease between man and lives tocks which is transmitted from contaminated animals to man. The causative agent of brucellosis is from Brucellosis genre with small rod-like, Gram-negative, non-mobile, non-sporulated KV basel. 4 species can affect man: *B. melitensis*, *B.abortus*, *B. Suis* and *B.canis*. *B.canis* is the most invasive and has more virulence. It usually affects goat and sometimes sheep, it is mostly considered as cow disease. *B. suis* mostly affects pig. *B. canis* results in disease in dogs. Major affection resources include livestock (cow), sheep, goat, pig, buffalo, horse and dog. The main symbol of this disease is abortion and bears pre-mature off spring, but in human, Brucellosis isn't mostly symbolic and special and divided into various clinical types. Traditionally, three types have been described: acute, sub- acute and chronic. Acute form is when the disease is terminated in 3 months. Continuity of the disease from one month to one year is called subacute and more than a year may

be acute or gradually. In addition, to fever and sweat in appetite, fatigue, headache and backache, such signs as depression Lymphadenopathy and hepatosplenomegaly may also be occurred.² Its expression is seasonal and is increased in spring and summer when livestock are pregnant and bear.³ In Iran, about 50000 Brucellosis are reported each year. The highest prevalence is in Khorasan, Hamedan, Lorestan, West Azarbaijan, Kurdistan, Fars and East Azerbaijan.⁴ This disease can create local lymph infection in liver, spleen, bone and other organs.⁵ Its outbreak is 98-130 per 100000 and most affected persons are in 10-19 age range, 79% in rural regions and 21% in urban areas, in different references it has been mentioned that males are affected more than females.⁶ There aren't many studies on Brucellosis and its relationship with climate factors and elements, but about its epidemiology in various regions, many studies are done. Maki et al, in an article entitled, epidemiology and risk factor of Brucellosis in Alexandria, Egypt, have described the trend and diagnosis of risk factor in Brucellosis in this region. Their results show that contact with animals and eating ice cream bought from badger sellers are significant in 5% level through multi-variable analysis tests with Brucellosis. Moreover, they mention that Contact with contaminated animals and their products is the most important reason of Brucellosis disease.⁷ Makita et al, epidemiologically- spatially have studied the diagnosed cases of Brucellosis in Kampala, Uganda and concluded that affection in females is more than males. Significant diversity is seen to be 6.8 km radius from hospital. In various urban regions, the most affection cases are seen in suburb areas.⁸ Bahonar et al, in their study entitled study the effective factor on Brucellosis affection in Chaharmahal and

Bakhtiari, Iran, stated that although contact with livestock and contaminated products is the most important factor in Brucellosis affection, climate condition and ranch type, ranch culture and food behavior of the people in each region about using livestock products and also Pathogens species in each geographical region alter the pattern of disease expression. They also showed that consumption of at least one dairy non-pasteurized milk product has a significant relationship with disease.⁹ Moradi et al, have studied epidemiologic condition of 3880 subject affected by Brucellosis in Kurdistan, Iran, and concluded that men in villages and house keeper women in the cities are considered as one of the most involved groups and Qorveh and Bijar have been known as two cities exposed to Brucellosis risk.¹⁰ In general, this disease is considered as a major problem in livestock and general hygiene in the region where livestock is the income and employment resource. Economic consequences of obliterating the livestock affected by this disease are so high, resulting in huge remedial costs for remedial organization of the country. The aim of this investigation is to study the local diversity of this disease with regarding to disease index determination in human, determine the high-risk towns in respect to this disease prevalence, effect of climate elements temperature, rainfall and moisture on development and prevalence of this disease in the towns of the mentioned province.

METHODS

The present study is in descriptive-analytical type. For doing this investigation, at first, available applied and scientific resources have been collected and studied. Data of this investigation which is related to a 2008-2011 year period includes: data related to the number of subject and livestock affected by Brucellosis which was provided from hygiene organization and general department of veterinary of Chaharmahal and Bakhtiari, Iran. As well as the statistics include average annual climatic parameters (temperature, precipitation and humidity) were calculated from the Bureau of Meteorology in the synoptic stations, the prepared. In this study, data analysis software Pearson has been done thus to calculate the relevance of the patients per year with an annual average climatic parameters that year SPSS software and the analysis of Pearson correlation examined the processing for the entire period (Table 1).

As well as spatial distribution maps of Brucellosis were provided by Geographic Information System (GIS). In this way, the incidence rate formula based on the number of event Disease in a Specified period divided the average population size of the period and Multiplication 100,000 and for each town separately calculated on the basis of the (Table 2) prepared.

Then Average index diseases gained after the index gained standard deviation and standard deviation away from the mean low and then once added that based on data obtained from low-risk and high-risk areas was drawn.

Table 1: Study the relationship between moisture, rainfall, temperature, and affection extent in 2008-2011

Brucellosis		Moisture 2008	Moisture 2009	Moisture 2010	Moisture 2011	Rainfall 2008	Rainfall 2009	Rainfall 2010	Rainfall 2011	Temperature 2008	Temperature 2009	Temperature 2010	Temperature 2011
Brucellosis 2008	Pearson correlation	-0.746**	-0.669*	-0.626*	-0.690*	-0.755**	-0.567	-0.647*	-0.445	0.806**	0.783**	0.796**	0.845**
	Sig. (2-tailed)	0.005	0.017	0.029	0.013	0.005	0.054	0.023	0.147	0.002	0.003	0.002	0.001
Brucellosis 2009	Pearson correlation	-0.601*	-0.747**	-0.775**	-0.739**	-0.570	-0.567	-0.615*	-0.264	0.785**	0.809**	0.676*	0.743**
	Sig. (2-tailed)	0.039	0.005	0.003	0.006	0.053	0.054	0.033	0.406	0.002	0.001	0.016	0.008
Brucellosis 2010	Pearson correlation	-0.360	-0.431	-0.266	-0.369	-0.235	-0.378	-0.214	-0.120	0.446	0.480	0.338	0.423
	Sig. (2-tailed)	0.251	0.162	0.403	0.238	0.463	0.226	0.505	0.710	0.146	0.114	0.283	0.171
Brucellosis 2011	Pearson correlation	-0.754**	-0.758**	-0.727**	-0.786**	-0.688*	-0.700*	-0.597*	-0.501*	0.829**	0.841**	0.760**	0.811**
	Sig. (2-tailed)	0.005	0.004	0.007	0.002	0.013	0.011	0.040	0.097	0.001	0.001	0.004	0.001
N		12	12	12	12	12	12	12	12	12	12	12	12

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed).

Table 2: Average 4 years incidence of Brucellosis in Chaharmahal and Bakhtiari province

Row	Province	Incidence rate (per 100,000)
1	Ardal	14.5
2	Borujen	15
3	Shahrekord	12.7
4	Lordegan	5.4
5	Farsan	7.6
6	Koohrang	115.4
7	Kiar	8.1

RESULTS

By using zoning maps, we identified the disposable region to risk. Zoning map has many advantages in presenting hygiene information. Map diagrams show important points in brief method and are useful for descriptive and decision-making purposes. They display local disease or the density of the people subject to risk. These maps can be used for analytical methods and deal with the effect of exposing to possible risk resource.¹¹ For zoning and determining the prevalence foci, it should be considered that for finding the loci of disease incidence in the province, Table 3 and number of affected people can't be used and since the population of all towns isn't equal, than a logical classification according to epidemiological principals can't be done.

Table 3: General number of the affected people in the towns of province in term of year

All towns	Number of those who affected by Brucellosis							
	2011		2010		2009		2008	
	Woman	Man	Woman	Man	Woman	Man	Woman	Man
Ardal	4	12	1	3	3	3	3	5
Borujen	5	27	1	5	5	8	9	13
Shahrekord	17	51	15	29	12	16	2	31
Lordegan	5	8	4	5	6	7	2	3
Farsan	2	8	1	4	1	4	4	5
Koohrang	47	67	34	35	13	18	39	36
Kiar	0	4	2	1	2	6	-	-

For finding prevalence loci of Brucellosis in the province, its extent should be calculated for this purpose, disease incidence index. Should be obtained so that this value in all towns is based on 100000 persons and standard classification can be done among the towns in respect to incidence extent. Then we calculate average 4 years incidence, Koohrang has more than 100 per 1000

person prevalence extent which is considered as high prevalence region. As said, tribes are considered as one of the reasons of Malta fever in Iran, and based on census done in 2008, 14657 tribe families, ie 90014 persons have immigrant life in Chaharmahal and Bakhtiari, Iran, out of them about 14520 families spend their summer-quarters in the west where is considered as the country region. This can

be one of the reasons of high prevalence of this disease in this region. On the hand, animal husbandry is more traditional in this region. Provinces including Lordegan, Farsan and Kiar with less than 10 per 1000 are among the regions having low prevalence, resulting from low population

of immigrant tribes in these regions and using industrial animal husbandry methods in turn lead to less contact with pathogen microbes (Table 2 and Figure 1).

Then the effect of climate parameters on Brucellosis prevalence was studied by using SPSS software (Table 1).

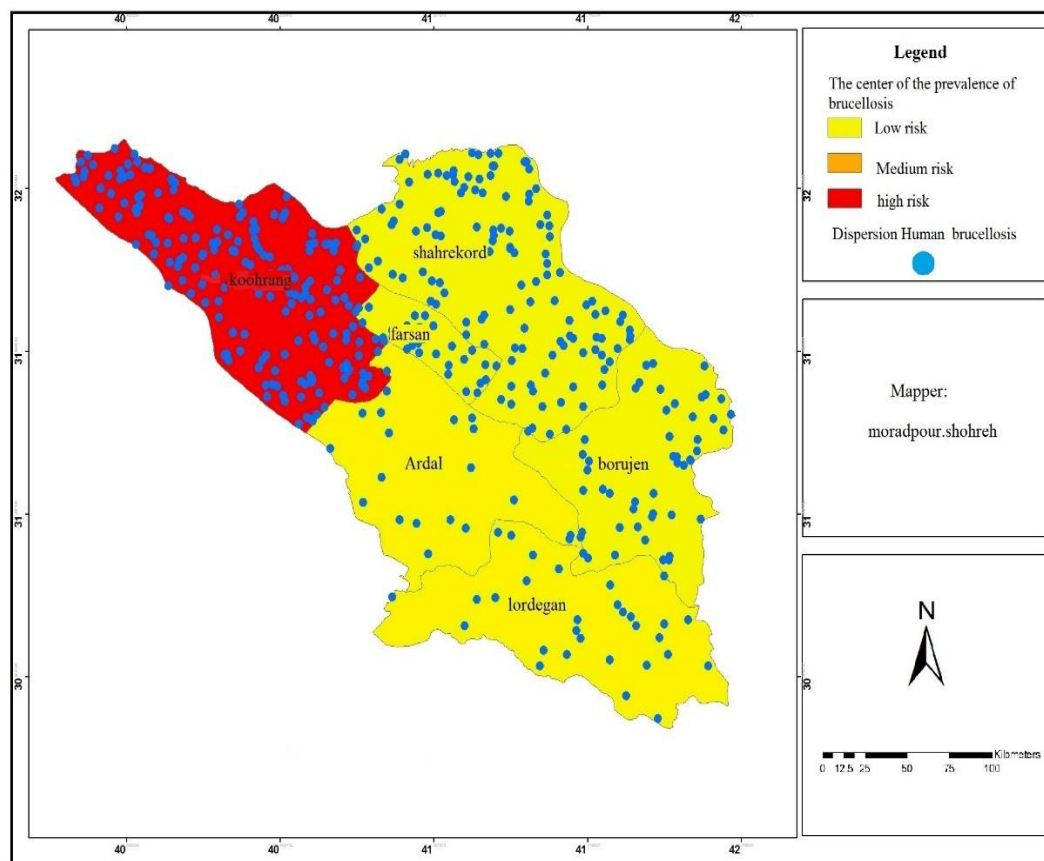


Figure 1: Prevalence loci of Brucellosis incidence in Chaharmahal and Bakhtiari in 2008-2011

Result show that there is a meaningful and positive relationship between temperature and disease affection in 2008, 2011 and ($P < 0.05$) and ($P < 0.01$), as the temperature increases, disease affection also increases. There is a negative and meaningful relationship between rainfall and disease affection in 2008 and 2009, ($P < 0.05$), showing that as the rainfall

decreases, affected person increase. There is also a negative and meaningful relationship between moisture and disease affection in 2008 and 2009, ($P < 0.01$). So that as moisture decreases, affection increases. As more affected people were the male, it can be said that this disease is related to such jobs as agriculture, butchery, agricultural engineering and work in diagnosis

laboratories. According to the studies done in this investigation, by zoning after determining human index of Brucellosis in the towns of the mentioned province in Table 3, towns were classified into three groups: high- risk and low -risk. High risk regions include Koohrang with more than 100 per 100000 affection which is considered as very high risk region. Lordegan, Farsan and Kiar with less than 10 per 100000 incidences are among low risk region zoning was done according to Table 2 which is displayed in Figure 1 according to this zoning it was known that incidence in the region where tribes are travelled.

DISCUSSION

In spring and summer where are the pregnancy and bearing seasons, as a result of contact with the residues of aborted pregnancy during animal Brucellosis Epidemic, contact of shepherds and owners of affected livestock and consumption of contaminated dairy of the livestock by the other people can result in many cases of acute Brucellosis.¹² Linear correlation between indices temperature, rainfall and Brucellosis is meaningful, as the heat increases, Brucellosis is decreased and rainfall shows a direct linear relationship between mentioned indices and Brucellosis.¹³ Study on geographical diversity of this disease show that its prevalence isn't classified as following: Very high contaminated provinces (31-41 incidence extent) East Azarbaijan, Hamadan, Lorestan, Markazi, Kermanshah and West Azarbaijan, South Khorasan; High contaminated provinces, (21-30): Khorasan Razavi, Zanjan and Kurdistan; medium contaminated provinces (11-20): Golestan, Ilam, Lorestan, Chaharmahal and Bakhtiari, Mazandaran, Semnan, Ardabil, Kerman, Fars, Yazd and Khrasan North, see.

Low contaminated provinces (0-10): Khuzestan, Mazandaran, Isfahan, Kohkilooye and Boyerahmad, Sistan and Baluchestan,

Tehran, Qom, Gilan, Bushehr, Hormozgan, and Alborz.¹⁴

With regarding to the mentioned materials, Chaharmahal and Bakhtiari is among the medium contaminated regions. Study the various factors on incidence of all Brucellosis types shows that different factor on incidence of all types of this disease. During a study done in Chaharmahal and Bakhtiari, among the effect of climate factor on this disease, temperature increases its affection extent and as rainfall and moisture decrease, affection increase, these results are consistent with those of Hatami and Mohammadi who suggest more incidence in spring and summer.^{12,15} In another study by Olfeti in Kirmanshah, it was confirmed that there is a positive and meaningful relationship between temperature increases, disease affection also increases, results of this investigation are consistent with those of Hatami, Mohammadi and Olfati.¹⁶ In the studies done by Azizi and Park, drought and high rainfall are among the favorable factors for this disease. As mentioned, in Chaharmahal and Bakhtiari the most affection is when the least rainfall is occurred.¹⁷

CONCLUSION

The investigation concluded that there is a correlation between the outbreak and some climatic parameters. Thus, in the warm months with the lowest rainfall and highest temperatures are more susceptible to disease outbreaks (Table 1). Koohrang town was also the highest dispersion disease (Figure 1) because the nomads nearby traffic that the city spend your summer days. As well as of traditional farming practices used.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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