

# Effect of rodents' management plan on controlling cutaneous leishmaniasis in endemic centers of Qom province in 2012

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## Original Article

### Abstract

**Introduction:** Cutaneous Leishmaniasis (CL) is considered as a public health condition in many tropical and sub-tropical areas like Iran. Qom Province is considered as a center for CL in Iran. This study aimed at determining the effect of rodents' management control in controlling the disease incidence in the endemic centers of Qom Province in 2012.

**Methods:** The first part of the study is a descriptive and cross-sectional study deals with rodents found in the villages of the central part of Qom Province. The second part of the study deals with the rodents' management operation which was carried out as a quasi-experimental study through four phases in all mentioned villages including 12 villages with 11061 people. SPSS, Chi-Squared and Mann-Whitney tests were used for analyzing data.

**Results:** Out of 46 hunted small mammals, 31 (67.4%) rodents were *Meriones libycus*, 8 (17.4%) rodents were *Allactaga elater*, 4 (8.7%) rodents were *Mus musculus*, 2 (4.35) rodents were *Nesokia indica*, and 1 (2.7%) rodent was *Hemiechinus auritus*. The disease incidence rate before intervention (2011) was 17.9 cases per 100,000 people which it was decreased to 11.2 cases per 100,000 people after intervention (2012). The decreased incidence of CL in the region controlled by rodents' management plan was significant ( $P < 0.001$ ). Most rodents were hunted during summer and fall seasons. There was no significant difference between year before intervention and the year after intervention in terms of gender and age ( $P > 0.05$ ).

**Conclusion:** The results showed that rodents' management plan can play a key role in controlling CL incidence rate. Thus, it is recommended that people, who live in the areas where the plan is implemented, are invited to participate in the relevant training courses.

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### Introduction:

Leishmaniasis as a zoonose is found in most parts of the world in the form of cutaneous lesions (Aleppo boil), visceral leishmaniasis (kala-azar) and

mucosal and cutaneous disorders. CL is found usually in two forms: rural or wet type and urban or dry type (1). World Health Organization (WHO)

introduces leishmaniasis one of ten important parasitic diseases in the world's tropical areas (2).

Recently, the tropical disease researches department of WHO has put this disease in the group I among other emerging and uncontrolled diseases in some parts of the world (3). Today, 88 countries in Asia, Europe, Africa and America suffer from this disease because of different causes. Its prevalence rate is 12-14 million cases and its incidence rate is 1.5-2 million people per year (2). About 90% of CL cases are reported in Afghanistan, Brazil, Iran, Peru, Saudi Arabia, Syria, Algeria and Sudan every year (4,5).

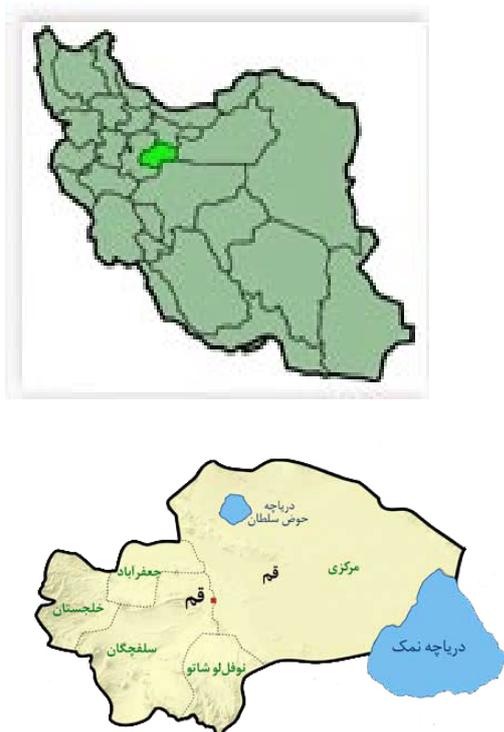
According to the reports of Center for Disease Control and Prevention more than 20000 people acquire various types of leishmaniasis each year and without doubt the real statistics 4-5 times are more than the recorded data. Rural CL is one of important health conditions in Iran. Quick expansion of cities, constructing residential units on rodents' colonies, ecological variations because of population movements, constructing dams, ceasing poison spraying programs against malaria vectors in many regions, arrival of Afghan people and finally problems caused by rapid population growth and in general socioeconomic developments have helped CL to introduce itself as a serious health condition in the country (6-8). Rodents are the main reservoir of rural leishmaniasis in Iran and four types of these rodents as the main reservoirs of the disease in Iran have been identified (10). For controlling rural leishmaniasis, all reservoirs of the disease are undermined using rodenticides and for urban leishmaniasis it is controlled through finding patients. Results of an extensive operation in Uzbekistan arranged for eradicating large rodents and their nests in a large area surrounded by mountains and rivers showed that this operation declined considerably the density of sandflies and at least four years after this plan no case of CL were not reported from there (11). Results of another study (1997) in Iran indicated that after destruction of rodents' nests and applying zinc phosphide within a radius of 500 meters of houses four times a year, the incidence rate of CL in the experimental villages in contrast to control villages decreased 12 times at the end of the first year and 5 times at the end of the second year (12).

CL is found in most provinces of Iran. It also is considered as a serious health condition in the central part of Qom Province, as several cases of CL are reported in this region every year. According to the reports released by the Healthcare Center of Qom Province, 314 people acquired CL in the central part of Qom Province in villages of Qomrud and Ghanavat in 2009. Since CL is an endemic disease in Qom Province, this study was conducted in order to determine the effect of rodents' management control plan in controlling the leishmaniasis incidence in the endemic centers of Qom Province in 2012.

### Methods:

This study has two parts. In the first of this study which was a descriptive-cross-sectional research muridae of rodents (as leishmaniasis reservoirs) were analyzed during 2011-2012 in the selected villages of Qomrud and Ghanavat regions located in the central part of Qom Province. Regarding the information released by the Healthcare Center of Qom Province about high incidence rate of CL in the central part of the province, five villages at the northeastern wing of the province with about 4000 population were selected for determining the rodents' muridae. Map 1 shows the geographical location of Qom Province and the studied region at the central part of the province. In this region, July is the warmest month of the year with the average temperature of 46° C and December is the coldest month with average temperature of -2°C. Most residents of this part of the province are active as farmers and stockbreeders.

A total of 46 small mammals during fall, winter, spring and summer of 2012 were collected using live animal traps. Each month two times and each time 30 live animal traps were placed near the active nests of rodents. In these traps cucumber, tomatoes, sausages, walnuts and carrots were used as baits. All traps usually were installed before sunshine and by the next day's noon were being collected. The hunted rodents were transferred to laboratory of Public Health Faculty of Tehran University of Medical Sciences where their species was determined (5).



**Figure 1. Geographical location of Qom Province in Iran's Map and Qom Province Subdivisions by zone**

The second part of this study is a quasi-experimental research which was carried out based on community trial. Initially, the disease incidence rate and abundance of vectors in the endemic regions of Qom Province were determined and then based on the disease incidence rate and abundance of vectors a total of 12 villages were selected for implementing the rodents' management plan. After justifying technicians and social workers in the region and holding training session for members of the Islamic Councils of the mentioned villages, programs for training how to kill rodents in villages were implemented. Since certain factors such as high abundance of vector and reservoirs of disease, people's low awareness and lack of preventive tools and equipment in villages facilitate the transmission cycle; hence necessary measures for controlling rodents were taken. Concurrent with the beginning of the warm season and increasing the activities of wild rodents, as the reservoirs of rural CL, the rodents' management plan was implemented through four phases in May, June, July and September of 2012. In this plan, initially nests of rodents by at least a radius of 500 m around the

contaminated villages were destructed and 48 hours later after the first destruction phase, the wheat dipped in P2Zn3 2.5% as baits were placed in the traps and a week after the first baiting, this process was repeated with P2Zn3 2.5%. This phases was finished by the May and again a baiting with P2Zn3 2.5% was carried out in June, one in July and another one in September. After each baiting doors of nests were coated with rocks or other things and the next baits were just placed in the nests whose doors were open (10).

In this study, prevalence of CL was analyzed at the end of 2012 through referring to the villages that were under coverage of this plan, also information of patients who have referred to both urban and rural healthcare centers were collected. After finishing analyses and filling forms, data were analyzed using SPSS and Chi-Squared and Mann-Whitney tests.

## Results:

In general during 12 months study (since May to March) totally 46 small mammals from rodents' colonies near the villages of this study were hunted and identified.

Table 1 shows that *Meriones libycus* was the most abundant (67.4%) rodent type in this study. The results of statistical tests showed that rodents' management plan has decreased the disease incidence rate, as after four rounds of this plan the CL abundance decreased from 198 cases in 2011 to 129 cases in 2012. In other words, the disease incidence rate was decreased from 17.9 cases per 100,000 people in 2011 to 11.2 cases per 100,000 people in 2012. The decrease incidence rate of CL in the area under the rodents' management plan was significant in contrast to the year before the plan ( $P < 0.001$ ).

**Table 1. Relative abundance of species of the hunted rodents in villages of the central part of Qom**

Species	No. (percent)
<i>Meriones libycus</i>	31 (67.4%)
<i>Allactaga elater</i>	8 (17.4%)
<i>Mus musculus</i>	4 (8.7%)
<i>Nesokia indica</i>	2 (4.3%)
<i>Hemiechinus auritus</i>	1 (2.7%)
<b>Total</b>	<b>46 (100%)</b>

Regarding the abundance of the hunted rodents in different seasons of the year, most rodents were hunted in summer and fall (89.13%).

Table 2 shows demographic information of patients with CL within the two years period of this study; about 60% of patients in 2012 were men. There was no significant difference between year before and year after intervention in terms of gender ( $P < 0.05$ ). Most patients in both years were

20 or older years old and there was no significant difference in terms of age before and after intervention ( $P > 0.05$ ). Likewise, other studies showed that there was a significant difference between various seasons of the study ( $P < 0.001$ ).

**Table 2. Demographic and epidemiologic information of patients with CL in the central part of Qom Province, 2011-2012**

Demographic Information		Disease Cases No. (percent)		P-value
		2011	2012	
No. of under coverage village		12	12	
Population of villages	Women	5012 (45.38)	5003 (45.23)	
	Men	6031 (54.62)	6058 (54.77)	
Number of Patients with CL	Women	78 (39.40%)	50 (38.76%)	0.909
	Men	120 (60.60%)	79 (61.24%)	
Age Range	0-9	29 (14.65)	24 (18.6%)	0.221
	10-19	47 (238.8%)	21 (16.3%)	
	20 and Higher	122 (61.6%)	84 (65.1%)	
Season	Spring	1 (0.5%)	6 (4.6%)	<0.001
	Summer	31 (15.7%)	25 (19.4%)	
	Fall	147 (74.2%)	98 (76%)	
	Winter	19 (9.6%)	0 (0%)	
<b>Total</b>		<b>198 (100%)</b>	<b>129 (100%)</b>	<b>&lt;0.001</b>

## Conclusion:

The results of this study indicated that the disease incidence rate has been decreased following the implementation of rodents' management plan; in other words the disease incidence rate was decreased from 17.9 cases per 100,000 people to 11.2 cases per 100,000 people which the decreased incidence rate of CL in the studied region in contrast to the last year was significant ( $P < 0.001$ ).

Since the climate conditions did not change considerably during the two years of this study and other control measurements including sporadic training of healthcare instructions to the residents of the endemic regions by the healthcare staff were similar to the previous years, thus, the decreased rate of CL was due to implementation of rodents' management plan in the studied villages. The results of other studies in Ardakan and Damghan showed that the disease incidence rate after intervention and implementing effective control plan was decreased considerably, as in Ahmadabad City, at the center of Ardakan, the CL incidence

rate was decreased from 228.1 cases in 1999 to 107/4 cases in 2000. Likewise, in Torkabad Village, Ardakan City, it was decreased from 299.8 cases per 1000 people to 35.8 cases per 1000 people. A study in Damghan in 2004 showed that the CL incidence rate was 555 cases per 100,000 people which it was decreased to 327 cases per 100,000 people in 2005 after implementing control measurements and again was decreased to 153 cases per 100,000 people in 206 (13).

Results of a study in Badroud showed that there was a significant difference between villages conducted rodent's management plan and control villages in terms of CL incidence rate (12). For the effect of rodents' management plan on abundance of rodents, a study in Uzbekistan indicated that performing rodents' management operation with the poisonous baits decreased the rodent vectors of CL from 17.9 rodents per ha to 0.35 rodents per ha, which it in turn decreased the CL incidence rate in the residents of the region (14). Since killing rodents affects the abundance of sandflies, results of

a study in Uzbekistan showed that after implementing a rodents' management plan the abundance of sandflies has been decreased as well and it declines in turn the disease in human beings (11). Anyway, killing rodents, either through declining abundance of rodents or through decreasing abundance of sandflies, will result in controlling the disease for human beings.

Since CL in Qom Province is endemic and sandflies have a high abundance in the region's villages and have a long activity period (15) and also since the villagers residential units are located near the rodents' colonies, thus residents of such regions are susceptible to CL; as a result controlling and preventing the disease is highly important. For starting a proper measurement we need to identify the type of disease, i.e. rural type or urban type, and a strategic and special plan is needed for each type of CL. Since rodents are the CL reservoir, various species of rodents were identified. In this study, *Meriones libycus* was the dominated species among the hunted rodents which was reported as the main reservoir of CL in Badroud, Marvdasht, Arsanjan, Neyriz, Khatam, Bafq, etc. (12,16,17).

Likewise, *Meriones libycus* has been reported in other countries such as Saudi Arabia and Uzbekistan as the reservoir of rural CL.

In this study only two *N. indica* rodents were hunted in the studied villages. *N. indica* rodents can casually be involved with disease transmission cycle and acquire *L. major* (14). Contamination with this rodent has been reported in Khuzestan (7%) and Ardestan, so far (18). Another rodent hunted in this study was *Allactaga elater*. This rodent is the smallest and most ordinary jerboa found in Iran and is differentiated from other species of *Allactaga* with its relatively small ears. This small jerboa has been reported in Fars, Khuzestan, Kerman, Baluchestan, Kurdistan and Azarbaijan Provinces and in this study it was hunted and reported in the central part of Qom Province. House mouse or *Mus musculus* also was hunted in this study. This species roughly is found in all parts of Iran, except completely arid and improper for life parts such as Dasht-e Lut and Dasht-e Kavir and lives as a semi-domestic animal near human and in the form of completely wild communities. Results of a study on important rodents, as the disease reservoirs in Iran, showed that *Meriones persicus* live in Qom

province which it was not reported in this study (9). With regard to the results of this study, implementing rodent's management operation through decreasing number of rodents can be very effective in controlling rural CL.

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