



**EVALUATION OF PYRETHROID IMPREGNATED BEDNETS
FOR CONTROL OF
ANTHROPONOTIC CUTANEOUS LEISHMANIASIS
IN BAM (ISLAMIC REPUBLIC OF IRAN)**

By

**A. Nadim, M. Motabar, B. Houshmand, K. Keyghobadi
and M.R. Aflatonian**

School of Public Health and Institute of Public Health Research, Tehran

Provincial Health Center, Kerman

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INTRODUCTION

Anthroponotic cutaneous leishmaniasis (ACL) is an important public health problem in the Middle East, especially in Iran, Syria, Turkey and Afghanistan.

In Iran, thousands of cases occur in large cities as well as in small towns. The main foci have been identified to be Mashad, Tehran, Shiraz, Kerman, Sabzevar and Neishabur. (1)

In recent years, the disease has been spreading geographically towards the southern slopes of the Zagros mountains in the south, perhaps due to an increase in the population and in the density of Ph. Sergenti. (2)

Recent reports on the effectiveness of the use of pyrethroïd-impregnated bednets in controlling malaria in several countries encouraged an evaluation of the same method to control ACL in Iran.

This is the final report of the project which received financial support from the Division of Control of Tropical Diseases, World Health Organization, Geneva.

BACKGROUND

Use of impregnated bednets for malaria control

Various forms of screening for personal protection are popular today in many parts of the world and are used by different social groups ranging from traditional communities to tourists on camping safaris in malaria endemic areas.

Bednets too have long been considered to be a useful protection against malaria and other vector borne diseases where the probability of contact with mosquitoes is high. Hence, people in such communities who do not use nets or temporarily rest outdoors, are vulnerable to infection from mosquito bites.

Tests carried out in laboratories and experimental huts of bednets impregnated with organophosphorous compounds and pyrethroïds, indicated that pyrethroïd was better suited because of its safety for humans, its rapid insecticidal effect, low volatility, long lasting persistence on netting and lack of odour. (3)

Most of the studies were based on entomological and epidemiological data collected in experimental hut studies or trials carried out at the village level.

In most areas where impregnated mosquito nets have been introduced, planning, management and operations were in the hands of specially assigned researchers and their staff. These activities are not part of a general policy to integrate vector control with impregnated bednets in the available health structure unlike certain exceptions in some provinces in China and a project in Papua New Guinea which have focused on the organizational aspects of integrating malaria control with impregnated mosquito nets in the local health services. (4)

Selection of the study area

A team visited Bam in the second half of February 1994 and examined reports of ACL cases during the previous two years, prepared a spot map of cases, identified areas with highest incidence rates on the map and selected two areas for the study: Nohsadmetri and Mahdab.

Random allocation:

At the toss of a coin, Mahdab was decided as the intervention area and Nohsadmetri as the control area.

Collection of baseline data

A plan was prepared for rapid epidemiological assessment (REA) of the two areas consisting of:

- a) preparation of the map and selection of about 250 households in each area;
- b) collection of information on the age and sex composition of the households, prevalence of sores and active lesions, sleeping places during the summer months, use of bednets and willingness to use impregnated bednets if provided free of charge. (See Annex Study Form)

The REA was carried out during the first week of March 1994.

Table 1 and Figure 1 show the results of this survey in the two selected areas. Prevalence of active sores was 2% in Nohsadmetri and 2.8% in Mahdab. Scar rates were 25% and 32% respectively. Although both were higher in Mahdab, the difference was not significant statistically.

Table 2 shows the distribution of households according to the number of inhabitants, Mahdab having more households with one or two members.

A survey of sleeping places in the households during the summer months at night showed that the absolute majority slept in the courtyard.

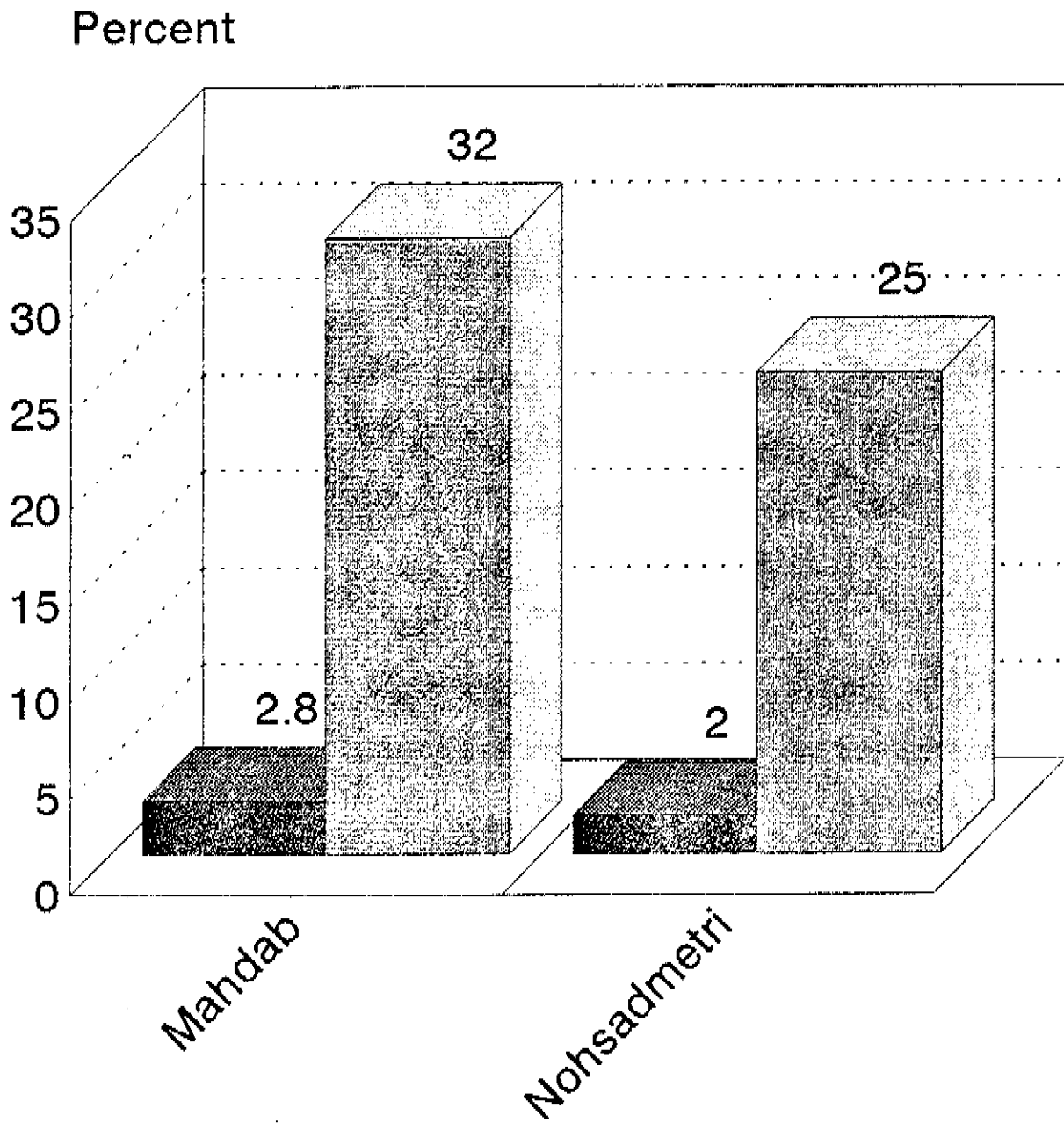
Table 1- ACL in Bam city by area, age and sex-Bam, March 1994

Area	Population Studied	Age			Sex		Scar No/ %	Active lesion No/ %
		<5year No %	5-14 No %	15 + No %	M No %	F No %		
Nohsadmetri	1293	157	332	804	657	636	319	26
		12	26	62	50.5	49.5	25	2
Mabdab	1121	110	263	248	563	558	362	31
		10	23	67	50.5	49.5	32	2.8
Total	2414	267	595	1552	1220	1194	681	57
		11	25	64	50.5	49	28	2.4

Table 2- Distribution of households in two areas surveyed for ACL in Bam city by area and number of persons in household, Bam-March 1994

No. of persons in the household	Area			
	Nohsadmetri		Mahdab	
	No.	%	No.	%
1	5	2	18	7
2	30	12	45	18
3	40	16	42	17
4	35	14	33	13
5	44	17	30	12
6	26	10	31	12
7	29	11	21	8
8	22	9	10	4
9	14	5	9	4
10	7	3	9	4
11	2	1	2	1
Total	254	100	250	100

***Fig.(1) : ACL in Bam by area.
Bam, March, 1994***



■ Active Cases ■ Scars

Figure 2 shows the frequency of the use of bednets by area. 72% of the households never used bednets and about half the households used bednets irregularly.

About 97% of the households in both areas were ready to use impregnated bednets if they were provided free of charge.

In March 1994, the disease was considered to be endemic in both areas with an average prevalence of 2.4% for active sores, and 28% for scars (Figure 1). A comparison of these rates with those of 1991 and 1992 showed that the incidence rate had stabilized with no decrease.

Intervention

1. We purchased approximately 550 bednets from a factory in Baluchistan, the size to cover between one to four persons.

The upper part of the bednets consisted of a net fabric made from a combination of cotton and nylon, while the lower 20 cms of the sides were made of plain cotton cloth. (Figure 3)

2. The insecticide used was K-Othrine with 25 mg of deltamethrin per ml. The net parts were impregnated with 25 mg (1 ml) of deltamethrin per square meter and the following steps were taken:

- the bednet was weighed
- the net parts were soaked and the extra water was squeezed out
- the bednet was weighed again to check the quantity of water absorbed
- the total surface of the net was divided to find out how much water was absorbed by one square meter of each type
- 1 ml of K-Othrine was added to the above volume of water in a large container, mixed thoroughly allowing the net part of the bednet to soak for several minutes while turning it constantly with a wooden stick
- the bednets were removed from the liquid, the remaining solution squeezed out and they were spread on special ropes in the shade for more than 24 hours to be completely dried.
- the impregnated bednets were then carefully wrapped in a nylon bags and labeled with the size (1, 2 or 3 persons) and date of impregnation. They were then kept in a cool, dry storage place until the time of distribution.

During the above-mentioned procedure, it was found that each square meter of the net absorbed about 56 ml of water. Therefore, 1 ml of K.Othrine was added to each 56ml

Fig.(2) : Relative frequency of households in two areas surveyed for ACL in Bam city by area and use of bednets in the summer, Bam, March 1994.

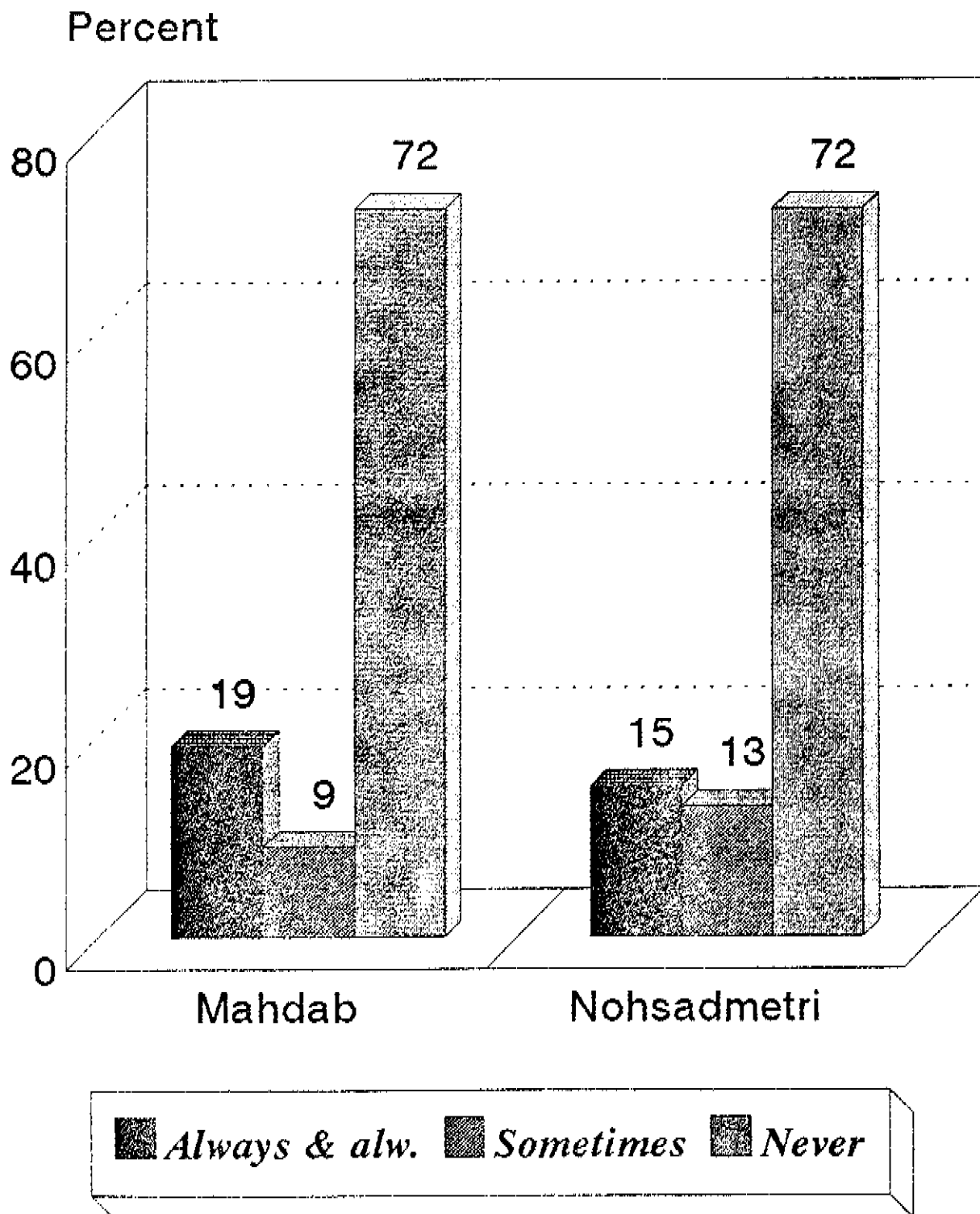


Figure 3 Type of bednets used in the study
 Bam 1994



Table 3- Distribution of bednets to households

No.households	No. bedenet to each	Total bednets
100	1	100
73	2	146
57	3	171
8	4	32
2	5	10
100	-	469

of water while preparing the insecticide solutions. As each vial contained 15 ml of insecticide, 20 vials were added to 17 liters of water.

Some of the impregnated bednets were cut into 10 x 10 cm pieces and sewn to the inner side of 100 bednets. Each month bio-assay tests are done to find out their insecticidal power.

3. The impregnated bednets were distributed to all the households according to their needs. Table 3 shows how these bednets were distributed.
4. Between 7 to 10 households were checked during the night each week (excluding weekends) by a staff member of the Bam Health Center to check the use of bednets.

Follow-up

1. During the last weeks of February, May, August, November 1994 and February 1995, house to house visits were conducted in both the intervention and control areas to investigate cases of ACL, and special forms were prepared to identify the epidemiological characteristics of ACL cases encountered during these visits. (See annexes)
2. Ten sites were selected in each area for collection of sandflies by sticky traps from rooms once every ten days.

Results

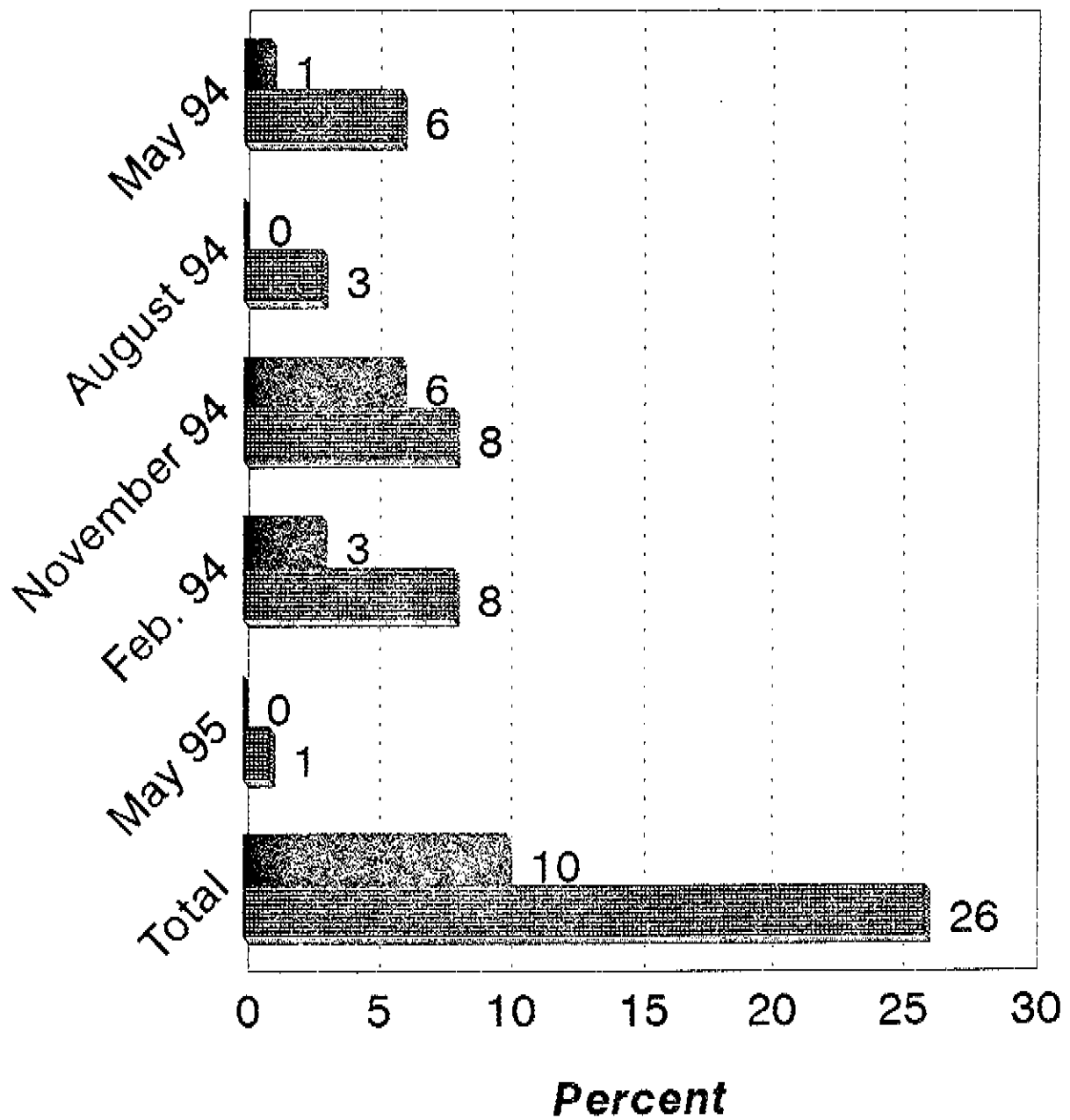
A. Follow up for ACL cases

Table 4 and Figure 4 show the number of cases seen in each area during the period of study (February 1994 through June 1995). They show that the number of cases in the control area is 2.6 times higher than those in the intervention area. If the population at risk is taken to be the number of people without sores or scars: 728 in the intervention area and 848 in the control area (visit of February 1994), this difference or decrease in incidence is statistically significant ($P = 0.05$). It should be mentioned here that about 10% of the households in both areas were lost during the whole or part of the follow-up visits, but as this phenomenon occurred in both areas it does not effect the comparative results.

Table 4 - Number of cases of ACL in house -to- house visits in
intervention and control areas, Bam 1994-1995

Date of visit	Area	
	Intervention (Mahdab)	Control (Nohsadmetri)
May. 94	1	6
Aug. 94	0	3
Nov. 94	6	8
Feb. 95	3	8
May. 95	0	1
Total	10	26

*Fig.(4) : Number of cases of ACL in house to house visits
in intervention and control areas.
Bam, 1994-1995.*



■ Mahdab ▨ Nohsadmetri

Table 5 and Figure 5 show the age distribution of cases seen during these visits in the intervention and control areas. They show that all cases in the intervention area have been in children less than 5 years old and in elderly people, while in the control area cases are seen in other age groups as well

Table 5 - Age distribution of ACL cases seen during the study period in intervention and control areas-Bam 1994-95

Age (years)	Area			
	Mahdab (Intervention)		Nohsadmetri (control)	
	No	%	No	%
0-4	8	80	7	27
5-9	0	0	4	15
10-14	0	0	7	27
15-19	0	0	2	7.9
20-29	0	0	2	7.9
30-39	0	0	0	0
40-49	0	0	1	3.7
50+	2	20	3	11.5
Total	10	100	26	100

Fig.(5) : Age distribution of ACL cases seen during the study period in intervention and control areas. Bam, 1994-1995.

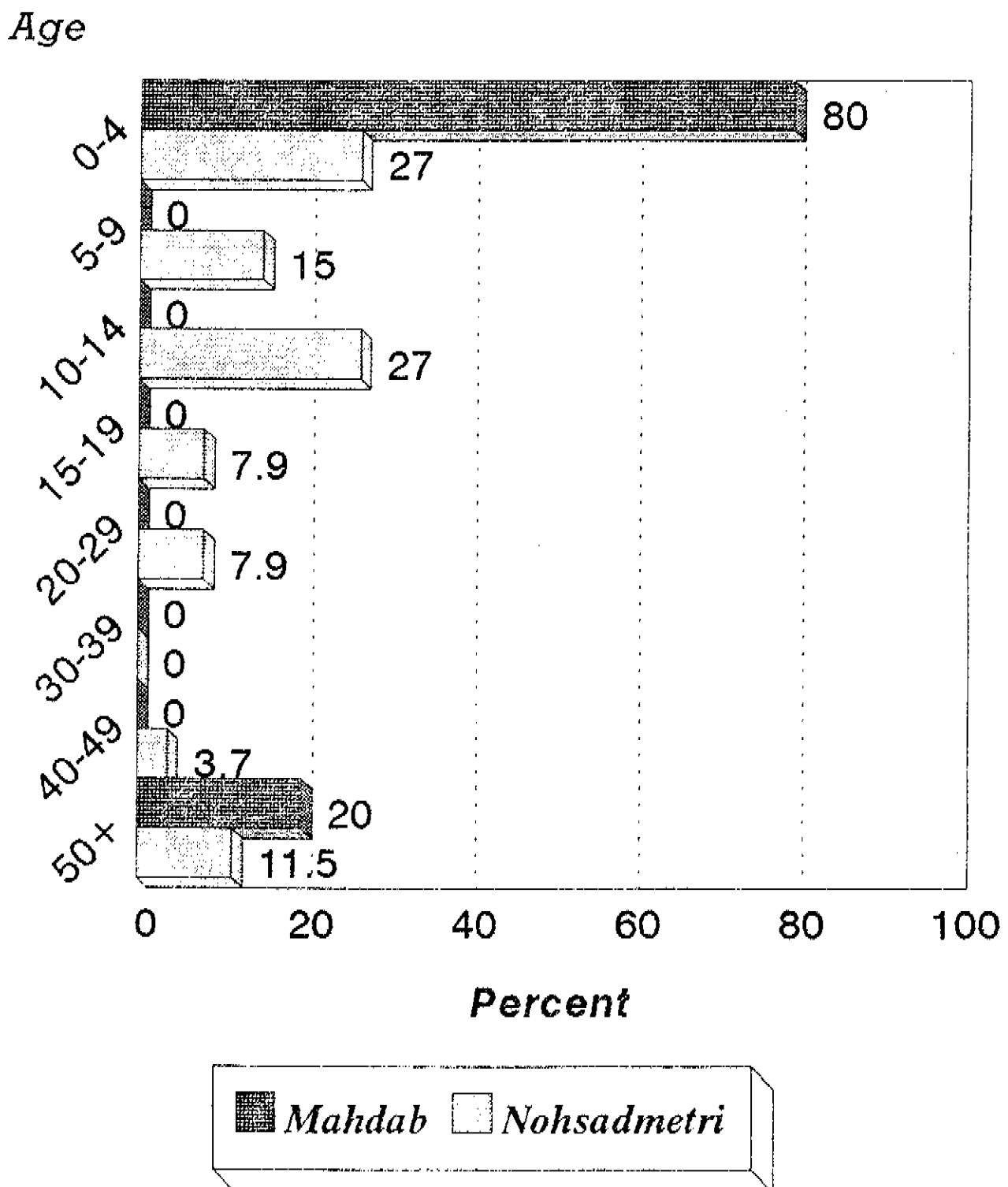


Table 6 shows the sex distribution of ACL cases seen in these two areas. In the control area, cases are significantly higher in females. In the intervention area there is no difference based on sex and the number of cases is not very high.

In the intervention area, 80% of the cases had only one sore, 10% had two sores and the other 10% had three sores. In the control area, 84% of the cases had only one sore whereas 7.5% had more than three sores.

The majority of sores in both areas were on the face, including the ears and neck, the rest were on the upper and lower limbs. The following information was collected from the intervention area:

1. All cases of ACL, except one, were in households who had put up the bednets at the time of going to sleep, i.e. 10:00 to 11:00 p.m.
2. 5% of the households had washed the bednets without reimpregnation, but none of the ACL cases were from these households.
3. 98.7% of the households were using bednets and only 1.3% did not use them.
4. 97.2% of the households using the bednets, used them regularly. Only 2.6% used them irregularly.
5. 62.5% of the households were putting up the bednets at the time of going to sleep (10:00-11:00 p.m.). Only 27.5% put them up at sunset.
6. 99% of the households used the bednets in the courtyard and only 1% in rooms.
7. 96.8% of the household claimed that children who went to sleep before the rest of the family were placed under bednets.
8. Members of all the households used the courtyards all evening from sunset to sit, eat and sleep.

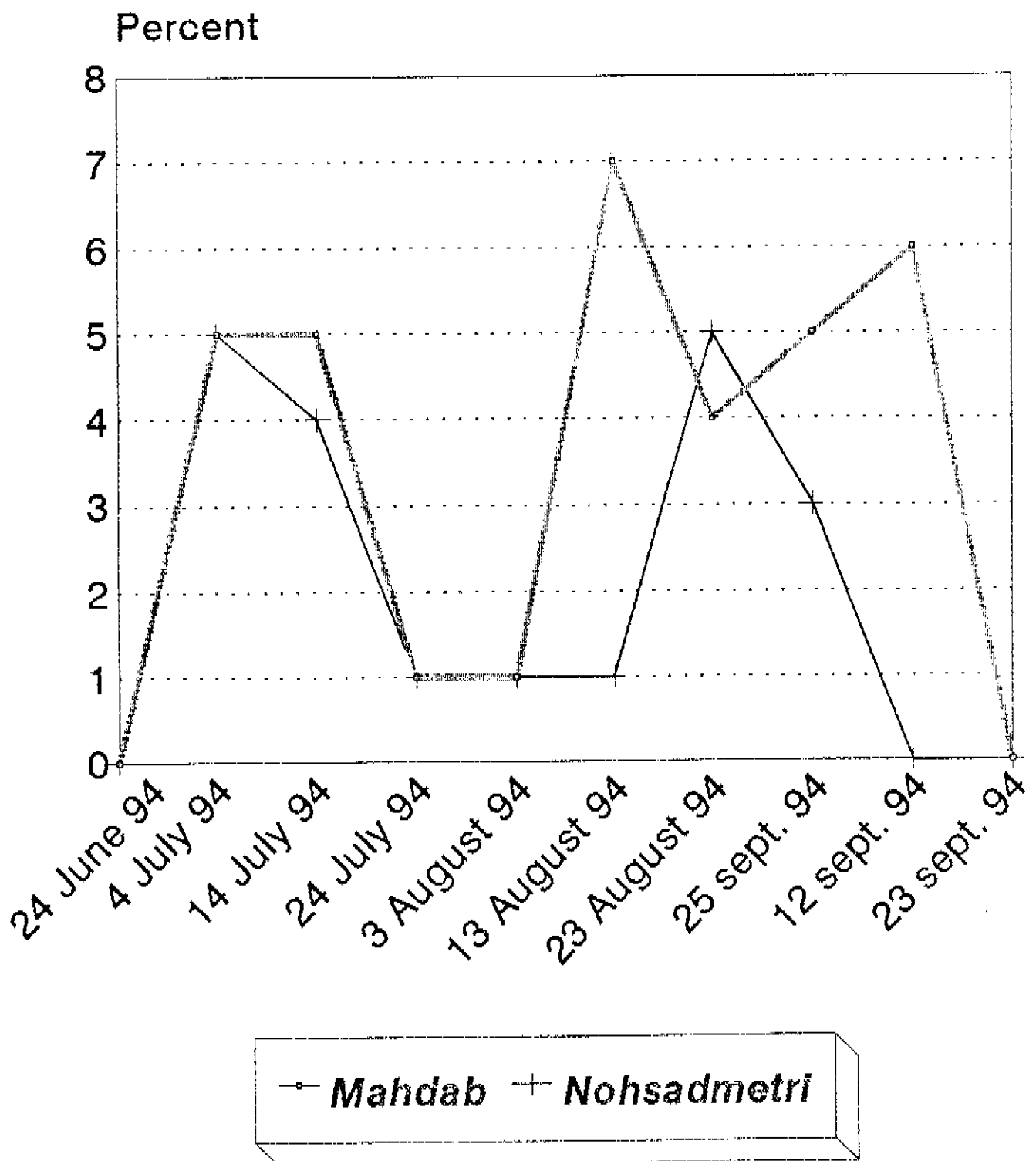
B . Density of sandflies

We were able to collect sandflies from early June to late September. Around 95% of the sandflies collected in both areas were Ph. Sergenti and only 5% were Ph. Papatasi. Figure 6 shows the seasonal activity of Ph. Sergenti in rooms. It should be pointed out that Ph. Sergenti is mainly an exophilic and exophagic sandfly. In an area where no one is in the room during the night, it is no wonder that we collected only such few sandflies by sticky traps put in the rooms. There was no sizeable difference between the density of Ph. Sergenti in the rooms of houses in the intervention and control areas.

Table 6 - Sex distribution of ACL cases seen during the study period in intervention and control areas

Sex	Area			
	Mahdab (intervention)		Nohsadmetri (control)	
	No.	%	No.	%
Male	5	50	7	27
Female	5	50	19	73
Both sexes	10	100	26	100

*Fig.(6) : Seasonal activity of Ph. sergenti in intervention and control area . Collection from fixed stations in rooms.
Bam, 1994.*



In another study in September 1994 in various parts of the city of Bam, two students collected 148 Ph. Sergenti and 54 Ph. Papatasi.

100% of the female sandflies collected indoors were Ph. Sergenti. Only 2 of the 54 Ph. Papatasi were females and were caught outdoors.

This signifies without a doubt that the probable vector of ACL in Bam is Ph. Sergenti.

C . Bio-assay of pieces of bednets

All bio-assay tests were carried out in Bandar Abbas field station using Anopheles stephensi in the tests. Till the end of the study season, the bednet pieces produced 100% mortality on tested A. Stephensi after exposure. We did not continue this after September 1994.

DISCUSSION AND CONCLUSION

This study shows that the use of pyrethroid impregnated bednets in the conditions prevailing in Bam, i.e., very hot days during summer months but rather good weather at night does decrease the transmission significantly, but does not interrupt it. The reason is that people want to enjoy rather nice weather in the courtyard during the night. They sit there after sunset, have their supper there and sleep there.

Mosquito bites are not a nuisance, therefore most people do not ordinarily use bednets. In our study, although most people accepted to use the impregnated bednets, most of them put up the bednets only at the time of going to sleep, i.e. 10.00 to 11.00 p.m. Nadim (5) reported in 1972 that the maximum sandfly activity, especially at the end of the active season occurs in the first three hours of the night. Therefore, these people had received the infective bite before going under the bednet.

The insecticidal activity of the bednets was very high so that many insects were found dead in the morning on the top and below the bednets. Perhaps, this method or the use of impregnated curtains in endemic areas with a cooler climate in summer where people sleep in rooms at night will have better results with regard to the interruption of transmission of ACL. Further studies need to be undertaken in places like Mashad or the northern part of Tehran.

ACKNOWLEDGMENTS

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