

Cutaneous leishmaniasis in primary school children in the south-eastern Iranian city of Bam, 1994–95

I. Sharifi,¹ A.-R. Fekri,² M.-R. Aflatonian,³ A. Nadim,⁴ Y. Nikian,⁵ & A. Kamesipour⁶

*Between August 1994 and July 1995, 11 517 primary school children aged 6–11 years in the south-eastern Iranian city of Bam, comprising 5560 (48.3%) girls and 5957 (51.7%) boys, were examined for the presence of active lesions or scars of cutaneous leishmaniasis (CL). There was a trend towards increasing prevalence with age, the prevalence being 10.7% in 6-year-old and 20% in ≥11-year-old children. Overall, 1.3% of the children had active lesions and 14.3% had scars. There was no significant difference between the sexes in the prevalence of active lesions and/or scars. Of the children examined, 54 (0.5%) had leishmaniasis recidivans: 19 girls (35.2%) and 35 boys (64.8%). The number of active lesions or scars per child ranged from 1 to 10. The majority (82.3%) had 1 lesion, 12.4% had 2 lesions, and 5.3% had ≥3. The average number of lesions was 1.08 (1.03 in girls and 1.18 in boys). The face was the part of the body most commonly involved (63.6%), followed by the hands (20.9%), legs (12.8%) and other parts of the body (2.7%). Examination of isolates from 14 children revealed that in 13 (92.9%) the causal organism was *Leishmania tropica* and in the other (7.1%) *L. major*. The survey indicates that the geographical distribution of CL is far wider than previously thought. It also shows that Bam is a suitable area for a vaccine field trial.*

Introduction

Leishmaniasis, a complex disease caused by several pathogenic species of *Leishmania*, with a wide spectrum of clinical manifestations (1), affects over 12 million people globally (2). Cutaneous leishmaniasis (CL) is still an important public health problem in many parts of the world, especially the Middle East, and is more prevalent than was previously recognized (3–6). CL occurs in Teheran, in other large and medium-sized cities in the Islamic Republic of Iran (6), and also sometimes in villages near them. Anthroponotic cutaneous leishmaniasis

(ACL) caused by *Leishmania tropica* is endemic in Kerman Province, mainly in the cities of Bam and Kerman.

In Kerman a study of the prevalence of CL was carried out in 1981–82 (7). Of 35 000 schoolchildren examined, 0.8% had active lesions and 4.4% scars from previous infections. In a recent study in the city of Bam (8), a house-to-house survey of primary school children revealed that 2% of those aged 6–10 years had active lesions and 20% had scars. The causative agent was *L. tropica* and the vector, the sandfly *Phlebotomus sergenti*. Control of the disease is extremely difficult (9). Only in those cities and towns where the reconstruction of houses and streets has led to a considerable reduction in the sandfly population (such as parts of central Teheran) has transmission been interrupted.

A recent report on the effectiveness of killed *Leishmania* vaccine (10) encouraged us to test its effectiveness in the control of ACL (11). The disease is common in the cities of Kerman and Bam in Kerman Province (7, 8). We selected Bam for the present study because of the high prevalence of the disease there and its much smaller population.

This article presents the results of a survey of the total population of primary school children in Bam as the first step in selecting different arms of a vaccine field trial. It is one of the first studies of its kind, in that the total population of the target group was studied.

¹ Associate Professor and Vice-Chancellor, Department of Microbiology and Parasitology, Medical School, Kerman University of Medical Sciences, P.O. Box 444, Kerman, Islamic Republic of Iran. Requests for reprints should be sent to Dr Sharifi at this address.

² Assistant Professor, Department of Dermatology, Medical School, Kerman University of Medical Sciences, Kerman, Islamic Republic of Iran.

³ Head, Bam Health System, Provincial Health Centre, Kerman, Islamic Republic of Iran.

⁴ Professor, School of Public Health, Teheran University of Medical Sciences, Teheran, Islamic Republic of Iran.

⁵ Professor, School of Public Health, Kerman University of Medical Sciences, Kerman, Islamic Republic of Iran.

⁶ Assistant Professor, Centre for Research and Training in Skin Diseases and Leprosy, Teheran University of Medical Sciences, Teheran, Islamic Republic of Iran.

Reprint No. 5861

Annual precipitation is very low (average, 58.5 mm) and the average relative humidity over the last 10 years has been 25.1%.

Materials and methods

The city of Bam, the capital of Bam District, is located in the Zagros mountain range 200 km east of the city of Kerman in the south-east of the country. The population is about 100 000. The summers are hot, with a maximum temperature of about 46°C, and the winters are mild.

The survey was carried out from August 1994 to July 1995. A total of 11 517 primary school children aged 6–11 years (mean age, 8.4 years) were examined physically. All primary schools in the city were included. The survey was conducted by three teams under the supervision of a dermatologist; each team consisted of a physician, a nurse, and a health assistant. Only schoolchildren absent at the time of the survey (5.3%) were excluded.

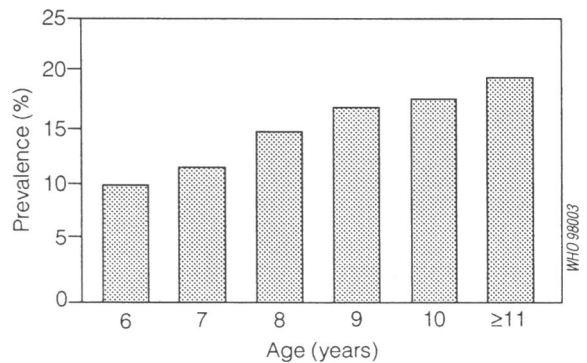
A list of all primary schools in Bam was obtained from the Department of Education. The schools were divided into three groups, and one team was allocated to each group. A questionnaire was completed for each child, indicating age, sex, place of residence, and the type, number and location of CL lesions. A whole body examination was carried out on each child for the presence of active lesions or scars.

Suspected active lesions were scraped with a sterile blade and the samples smeared on to glass slides, fixed with methanol, stained with Giemsa and examined under a light microscope for the presence of amastigotes. Simultaneously, samples from 14 children were inoculated into NNN medium (12) for further identification using the monoclonal antibodies T1, T2, T3, T11, T14, T15 and M2 (13). The data were double entered into a microcomputer and Epi Info ver. 6 software was used for the analysis. The χ^2 test was used to determine any statistically significant difference in disease prevalence between female and male schoolchildren.

Results

A total of 11 517 primary school children aged 6–11 years, comprising 5560 girls (48.3%) and 5957 boys (51.7%) were examined physically for the presence of active lesions or scars of CL (Table 1). There was a trend towards increased prevalence with age: 10.7% among 6-year-olds and 20% among those aged ≥ 11 years (Fig. 1). Overall, 1.3% of the chil-

Fig. 1. Prevalence of cutaneous leishmaniasis (active lesions or scars), by age, in primary school children in the south-eastern Iranian city of Bam, 1994–95.



dren had active lesions and 14.3% had scars (Table 2). There was no significant difference between the sexes in terms of the prevalence of active lesions or scars. Of the 11 517 schoolchildren examined, 54 (0.5%) had leishmaniasis recidivans: 19 girls (35.2%) and 35 boys (64.8%). There was no significant difference between the sexes.

The number of lesions (active or as scars) per child ranged from 1 to 10. The majority (82.3%) had

Table 1: Distribution by age and sex of 11 517 primary school children examined for cutaneous leishmaniasis in the south-eastern Iranian city of Bam, 1994–95

Age (years)	No. of females	No. of males	Total
6	579 (42.5) ^a	785 (57.5)	1 364 (100.0)
7	1 002 (48.1)	1 081 (51.9)	2 083 (100.0)
8	1 225 (52.3)	1 118 (47.7)	2 343 (100.0)
9	989 (46.7)	1 130 (53.3)	2 119 (100.0)
10	1 066 (48.3)	1 139 (51.7)	2 205 (100.0)
≥11	699 (49.8)	704 (50.2)	1 403 (100.0)
Total	5 560 (48.3)	5 957 (51.7)	11 517 (100.0)

^a Figures in parentheses are percentages.

Table 2: Prevalence of cutaneous leishmaniasis, by sex and type of lesion, in primary school children in the south-eastern Iranian city of Bam, 1994–95

Sex	No. with active lesion	No. with scar	Total
Female	69 (1.2) ^a	828 (14.9)	897 (100.0)
Male	86 (1.4)	816 (13.7)	902 (100.0)
Total	155 (1.3)	1 644 (14.3)	1 799 (100.0)

^a Figures in parentheses are percentages.

one lesion, 12.4% had two lesions and 5.3% had at least three lesions (Fig. 2). The average number of lesions was 1.08 (1.03 in girls and 1.18 in boys).

Table 3 summarizes the distribution of CL lesions on the body in 1953 children. The face was the part of the body most commonly involved (63.6%), followed by the hands (20.9%), legs (12.8%) and other parts of the body (2.7%). Lesions were found more frequently on the face in boys than in girls ($\chi^2 = 5.24$, $P < 0.05$), whereas they were found more frequently on the legs in girls than in boys ($\chi^2 = 7.09$, $P < 0.01$).

Examination of isolates from 14 children revealed that in 13 (92.9%) the causal organism was *L. tropica* and in the remaining 7.1% of cases, *L. major*.

Discussion

Cutaneous leishmaniasis has been endemic in some parts of Kerman Province for many years (7). The only previous epidemiological study in the area was carried out in 1991 in the city of Bam (8), involving about 10% of the population of primary school children. The results showed that 2% had active lesions and 20%, scars. The prevalence of 1.3% for active

lesions and 14.3% for scars reported in the present study are based on an examination of the total population of primary school children living in Bam. Based on these data, the prevalence has slightly decreased.

The incidence of ACL depends on its epidemicity, increasing dramatically during an epidemic, followed by a sharp decrease. The disease confers immunity, thus reducing the number of infected people (14). The retrospective survey in Bam (8) showed that the incidence fell from 8% in 1989 to 3.3% in 1990 and then to 2% in 1991. Comparing these levels with the prevalence found in the present study indicates that there has been a decrease in CL incidence.

Our findings also included 54 cases of lupoid leishmaniasis recidivans. This clinical manifestation is usually caused by *L. tropica* in the Islamic Republic of Iran (15, 16). Most of the lupoid lesions were observed on the face, characterized by the development of recrudescing lupoid nodules around a healed primary lesion. Most of the lesions were on the face because the nights are fairly cool in Bam during the transmission seasons of spring and summer and the majority of children wear clothing that covers most of the body, leaving only the face, hands and legs exposed to the bites of sandflies. Also, sandflies are attracted to the carbon dioxide in exhaled breath (17). *P. sergenti* tends to take a blood meal with a single bite (7), which is probably why most children had only one lesion.

Examination of isolates from 14 children revealed that in 13 (92.9%) the causal organism was *L. tropica*; this kind of information is useful in determining optimal therapy. Around 95% of the sandflies collected by Nadim et al. (18) in various localities in Bam were *P. sergenti*, the remainder being *P. papatasi*; this correlates well with the findings of the present study. The only child who had acquired a zoonotic form of the disease was accustomed to spending some time in the countryside during the summer.

The results of the present study show that ACL is spreading south in the Islamic Republic of Iran. Bam is an example of the establishment of a new

Fig. 2. Distribution of lesions per child in primary school children in the south-east Iranian city of Bam, 1994–95.

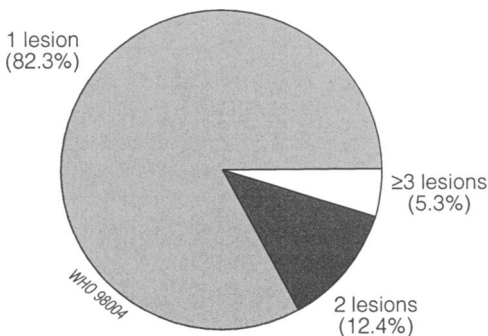


Table 3: Location of lesions on the body, by sex, in primary school children in the south-eastern Iranian city of Bam, 1994–95

Sex	No. on face	No. on hands	No. on legs	No. on other areas	Total
Female	561 (60.5) ^a	212 (22.8)	142 (15.3)	13 (1.4)	928 (100.0)
Male	681 (66.4)	196 (19.2)	108 (10.5)	40 (3.9)	1 025 (100.0)
Total	1 242 (63.6)	408 (20.9)	250 (12.8)	53 (2.7)	1 953 (100.0)

^a Figures in parentheses are percentages.

focus of ACL, probably through agricultural and unplanned urban development. In recent years, the disease has been spreading towards the southern slopes of the Zagros mountains, perhaps due to the movement of infected people and to increases in the human and sandfly populations.

On the basis of these results, we conclude that Bam is a suitable area for a field trial on the effectiveness of killed *L. major* vaccine.

Acknowledgements

We thank the Centre for Research and Training in Skin Diseases and Leprosy at Teheran University of Medical Sciences, Kerman University of Medical Sciences, and Bam Health Centre for their close collaboration. The study received financial support from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases.

Résumé

Leishmaniose cutanée chez des élèves de l'enseignement primaire en ville de Bam, sud-est de l'Iran, 1994-1995

La leishmaniose cutanée (CL) constitue encore un important problème de santé publique dans de nombreuses régions du monde, surtout dans les pays du Moyen-Orient, dont la République islamique d'Iran. De récents rapports sur l'efficacité du vaccin à base de *Leishmania* tuées nous ont encouragés à tester son efficacité dans la lutte contre la leishmaniose cutanée diffuse anthroponosique (ACL).

Entre août 1994 et juillet 1995, 11517 élèves de l'enseignement primaire de la ville de Bam, dans le sud-est de l'Iran, âgés de 6 à 11 ans et comprenant 5560 filles (48,3%) et 5957 garçons (51,7%) ont été examinés à la recherche de lésions actives ou de cicatrices de leishmaniose cutanée. Des prélèvements de zones suspectes ont été colorés au Giemsa et examinés au microscope optique afin de rechercher la présence d'amastigotes. Simultanément, des prélèvements réalisés chez 14 enfants ont été inoculés sur milieu NNN en vue d'une identification plus poussée au moyen de sept anticorps monoclonaux.

On a observé une tendance à l'augmentation de la prévalence des lésions avec l'âge, celle-ci étant de 10,7% chez les enfants de 6 ans et de 20% chez ceux de 11 ans. Globalement, 1,3% des enfants avaient des lésions actives et 14,3% avaient des cicatrices. La prévalence des lésions n'était pas significativement différente selon le sexe. Parmi les

enfants examinés, 54 (0,5%) étaient atteints de leishmaniose récidivante: 19 filles (35,2%) et 35 garçons (64,8%).

Le nombre de lésions actives et/ou de cicatrices par enfant allait de 1 à 10. La plupart des enfants étaient porteurs d'une lésion (82,3%), 12,4% de deux lésions et 5,3% d'au moins trois lésions. Le nombre moyen de lésions était de 1,08 (1,03 chez les filles et 1,18 chez les garçons); elles touchaient principalement la face (63,6%), puis les mains (20,9%) et les jambes (12,8%) et enfin les autres parties du corps (2,7%). Parmi les 14 échantillons cultivés en présence d'anticorps monoclonaux, *Leishmania tropica* a été identifiée dans 92,9% des cas (13/14) et *L. major* dans les 7,1% restants (1/14).

Cette étude montre que la leishmaniose cutanée anthroponosique s'étend davantage vers le sud de l'Iran que les études antérieures ne l'avaient montré. La ville de Bam constitue un exemple d'établissement d'un nouveau foyer d'ACL, probablement à la faveur du développement agricole et d'un développement urbain incontrôlé. Ces dernières années, la maladie a progressé vers les pentes méridionales des monts Zagros, peut-être du fait de déplacements de personnes infectées et d'une augmentation des populations humaines et de phlébotomes.

Ces résultats nous permettent de conclure que Bam est un site approprié pour un essai pratique de l'efficacité du vaccin à base de *L. major* tuées.

References

1. Dowlati Y. Cutaneous leishmaniasis: clinical aspect. *Clinics in dermatology*, 1996, **14**: 425-431.
2. Wijeyaratne P, Goodman T, Espinal C. Leishmaniasis control strategies. *Parasitology today*, 1992, **8**: 249-251.
3. Ashford RW, Kohestany KA, Karimzad MA. Cutaneous leishmaniasis in Kabul: observations on a "prolonged epidemic". *Annals of tropical medicine and parasitology*, 1992, **86**: 361-371.
4. Nadim A et al. Epidemiology of cutaneous leishmaniasis in Afghanistan. Part 1. Zoonotic cutaneous leishmaniasis. *Bulletin de la Société de pathologie exotique*, 1979, **72**: 31-35.
5. Nadim A, Seyed-Rashti MA, Ashi J. Cutaneous leishmaniasis in Saudi-Arabia: an overview. *Bulletin de la Société de pathologie exotique*, 1979, **72**: 237-244.
6. Nadim A, Faghieh M. The epidemiology of cutaneous leishmaniasis in the Isfahan province of Iran. I. The reservoir. II. The human disease. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1971, **62**: 534-542.
7. Seyed-Rashti MA et al. Urban cutaneous leishmaniasis in Kerman, southeast Iran. *Bulletin de la Société de pathologie exotique*, 1984, **77**: 312-319.

8. **Aflatonian MR.** *Cutaneous leishmaniasis in Bam.* M.P.H. thesis, Teheran University of Medical Sciences, 1992.
9. *Control of the leishmaniasis. Report of a WHO Expert Committee.* Geneva, World Health Organization, 1990: 58 (WHO Technical Report Series, No. 793).
10. **Modabber F.** Development of vaccines against leishmaniasis. *Scandinavian journal of infectious diseases*, 1990, **76**(Suppl.): 72–78.
11. **Sharifi I et al.** Field trial on ALM vaccine efficacy against anthroponotic cutaneous leishmaniasis in 6–10 year old children in Bam, Iran. Paper presented at: *Clinical Trials of Killed Leishmania major Vaccine, Amman, Jordan, 15–16 April 1996* (Symposium Proceedings, p. 40).
12. **Evans DA.** Leishmania. In: Taylor AER, Baker JR, eds. *In vitro methods for parasite cultivation.* London, Academic Press, 1987: 52–57.
13. **Jaffe CL, Idrissi NG.** *Laboratory manual: Workshop on Leishmania typing using monoclonal antibodies and excreted factors, University Hassan II, Casablanca, 13–18 March 1995.*
14. **Scott ME, Smith G.** *Parasitic and infectious diseases, epidemiology and ecology.* London, Academic Press, 1994: 398.
15. **Ardehali S et al.** Studies on chronic (lupoid) leishmaniasis. *Annals of tropical medicine and parasitology*, 1980, **74**: 440–445.
16. **Momeni AZ et al.** Chronic lupoid leishmaniasis. *Archives of dermatology*, 1996, **132**: 198–202.
17. **Mengistu G et al.** Cutaneous leishmaniasis in southwestern Ethiopia: Ocholo revisited. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1992, **86**: 149–153.
18. **Nadim A et al.** *Evaluation of pyrethroid impregnated bednets for control of anthroponotic cutaneous leishmaniasis in Bam, Iran.* Geneva, World Health Organization, 1995 (unpublished document WHO/LEISH/95.37; available on request from Division of Control of Tropical Diseases, World Health Organization, 1211 Geneva 27, Switzerland).