

Visceral Leishmaniasis

Vector Control

Islamic Republic of Iran

A matched community intervention trial for reducing *Leishmania infantum* transmission in Islamic Republic of Iran with deltamethrin-impregnated dog collars

Islamic Republic of Iran
Meshkin-Shahr and Kalayabar, North - West Iran

Study period:
2000–2002

Small Grants Scheme
(SGS) 2000 No. 80

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Abstract

This study aimed at evaluating the impact of deltamethrin-impregnated dog collars on *Leishmania infantum* transmission in the Islamic Republic of Iran. Eighteen villages were paired and matched by pre-intervention child prevalence of *L. infantum* infection. Within pairs, villages were assigned randomly as control or intervention. All domestic dogs in intervention villages were provided with collars throughout 2 transmission seasons. Children and dogs were surveyed on three consecutive occasions at yearly intervals, i.e. pre-intervention in 2000, year 1 post-intervention in 2001, and year 2 post-intervention in 2002. The incidence of *L. infantum* infection was measured by seroconversion and leishmanin skin test (LST) conversion in children, and by seroconversion in dogs. Significant protection against seroconversion was detected in both dogs (collars causing an average reduction in incidence of 66%) and children (reduction of 53%). The impact of dog collars was also evaluated on both bloodfeeding and mortality rates of local sandfly vectors.

A survey on the knowledge and attitudes of the community regarding visceral leishmaniasis was conducted in 50 villages in the endemic region. The questionnaire also included information about the role of domestic dogs in the region, details of care delivered by the dog owners to their dogs and their attitudes towards the collars.

Results Deltamethrin-impregnated dog collars significantly reduced the risk of *L. infantum*

infection in dogs and hence its transmission to children. However, 2 years of collaring dogs failed to completely eliminate transmission in villages. This could be because transmission continues in sylvatic reservoirs that visit villages frequently (e.g. foxes and jackals). The trial described in this report only measured the impact on infection. In order to detect the impact of collars on the disease, their cost-effectiveness, and hence, to draw conclusions and recommendations about their use as a control measure for visceral leishmaniasis, a much larger population study was undertaken in a wide-scale trial that will end in 2004.

Publications

1. Gavvani et al. Domestic dog ownership in Iran is a risk factor for human infection with *Leishmania infantum*. *Am J Trop Med Hyg*, 2002, 67(5):511-515.
2. Gavvani et al. Effect of insecticide-impregnated dog collars on incidence of zoonotic visceral leishmaniasis in Iranian children: a matched-cluster randomised trial. *The Lancet*, 2002, 360:374-379.

Background

This study was a follow-up of a small grants scheme project implemented in 1999. It was recommended to continue the study for another year in order to improve the accuracy of measurements of the epidemiological effectiveness of the intervention, to carry out sandfly surveys in each village for vector identification and test the entomological effectiveness of collars in field conditions, as well as to investigate the attitudes of the local populations concerning visceral leishmaniasis and dog collars.

Materials and methods

Eighteen villages were ordered into pairs matched by pre-intervention child prevalence of *L. infantum* infection. Within pairs, villages were assigned randomly as control or intervention. All domestic dogs in intervention villages were provided with Scalibor collars (Intervet®, Intervet International of Boxmeer, The

Conclusions and implications of the study

- Deltamethrin-impregnated dog collars could clearly reduce the risk of *L. infantum* infection in dogs, and hence its transmission to children.
- There was inadequate knowledge of the population regarding the role played by the vector or reservoirs regarding disease transmission. On the other hand, there was a high acceptability for using dog collars and evidence favouring the sustainability of their use in the future.
- The main sandfly species identified in Meshkin-Shahr and Kalayabar are *Phlebotomus major* and *P. chinensis*, followed by *P. kandelaki*.

Netherlands) through 2 transmission seasons. Children and dogs were surveyed on 3 consecutive occasions at yearly intervals.

Baseline survey in the control villages, January-March 2000 A total of 1237 children were tested by DAT, and 615 by LST. Four hundred and eighty seven dogs were also tested by DAT in these villages during the period March-December 2000. A second survey was repeated in 2001 and 2002.

Intervention: Insecticide-Impregnated Dog Collars (IIDG) Following a baseline survey (January-March 2000) of children in the intervention villages by DAT and LST and of dogs by DAT, dogs received new collars during March-April 2000, and again in May-June 2001. Each dog was treated with an anthelmintic and antibiotic and wore the IIDC for at least 2 weeks prior to the entomological experiments and for the remainder of the sandfly season. Children were re-tested by DAT and LST, and dogs were re-tested by DAT in January-March 2001, and again in April-May 2002.

Entomological study, June-August 2001 in the Kalayabar area After identifying villages with high sandfly populations, specimens were caught using sticky traps and mouth aspirators.

Experimental study to test the efficacy of IIDG Dogs were caged in 2 cages and put into 2 tents within the compounds of their owners. Sandflies were caught between 20:00 and 23:30 by hand aspirator, and placed into cups until a total of between 150 and 200 were caught. At hourly intervals, the 75-100 sandflies were released into each of the 2 tents. Seven hours later the tents were entered and the remaining flies were collected into prepared plastic cups and offered a glucose meal. They were rechecked after 20 hours for delayed mortality, then killed using smoke or permethrin and the dead sandflies were placed into Lacto phenol and stored for species identification.

■ Main study findings

Sandfly identification The main species identified in this area were *P. major* and *P. chinensis*, followed by *P. kandelaki*. However, other species were also identified: *P. keshishiani*, *P. sergenti*, *P. papatasi*, Genus *Sergentomyia*. The majority of each species were females except for *P. kandelaki*, which were mainly males.

Impact of IIDC on sandflies There was a significant difference in sandfly blood feeding rates between the collared and the control dogs. A significant rise in dead flies was reported for collared dogs at 7 hours, but not at 20 hours.

Impact of IIDG on children and dogs in the studied villages The use of impregnated dog collars halved the risk of DAT conversion in children but had less impact on the LST conversion rate (21%). Greater (66%) protection was provided to dogs.

Post-intervention data in children During the 2-year trial, a total of 115 DAT conversions was detected amongst the 4324 followed-up tests in initially DAT-negative children. There was a significant effect of collars on DAT conversion per year. A total of 66 LST conversions were detected among the 2562 followed-up tests in initially LST-negative children. A significant effect of treatment on the risk of LST conversion per year was reported.

Post-intervention data in dogs During the 2-year trial, a total of 67 DAT conversions were detected amongst the 1622 followed-up tests in initially DAT-negative dogs. There was a significant effect of treatment on the risk of DAT conversion per year. The impact in the second year (71% protection) was greater than in the first year (54% protection), suggesting a cumulative effect.

KAP study Out of 1872 villagers interviewed, 727 were dog owners (39%). The survey was conducted among these dog owners indicate that they are willing to spend considerable money for dog care, that 66% of dogs are in good health, but that only 22% were vaccinated.

Many observations favoured the potential for sustained collar use throughout the transmission season such as: the low dog population turnover rate, the low rate of collar loss, the fact that most guard dogs (71%) nearly always stay at home, the fact that most dogs have long hair (97%) which presumably helps the effectiveness of the collars, the fact that most dogs already use metal collars (70%) for protection against bites by other dogs or wolves, and that dogs are not irritated by the new Scalibor collars.

Only 55% had heard of kala-azar and 39% believed that kala-azar was related to dogs. Half the respondents believed that children got sick with kala-azar due to the bite of an insect, but only 10% mentioned sandflies specifically. Most of the dog owners were satisfied with dog collars but only 42% thought that they could prevent kala-azar. Respondents have seen stray dogs and foxes in their village, and 42% saw jackals and wolves. Almost all villagers recognized that people get sick from dogs, with the most common disease mentioned being rabies. They also reported that their dogs suffer from fleas or ticks. So the collars should be helpful for dog health irrespective of their impact on sandflies. The majority of dog owners were satisfied with dog collars. However, only 42% of respondents thought that collars could