3rd WHO consultation on oral immunization of dogs against rabies

Geneva 21. - 22. July 1992

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Accessibility of dogs to oral and parenteral vaccination against rabies in Tunisia and Turkey

During April and May 1992 a dog population study was carried out for WHO in Tekirdag, a town and province situated in the European part of Turkey near the Marmara sea. Results of this study will be presented and for comparison some data from dog population studies in Tunisia included. Special concern will be given to results which in the authors' opinion are of certain interest concerning oral and parenteral antirabies vaccination strategies for dogs.

1. Methods for oral and parenteral vaccination of dogs against rabies

Dogs are vaccinated against rabies by vaccine injection either at permanent vaccination centers, to which people can bring their dogs for vaccination whenever they want - this method is not useful for mass vaccination of dogs in developing countries -, at mobile vaccination centers which function only for short periods, or during door-to-door vaccination campaigns.

At least three bait distribution methods seem to be theoretically possible. 1. The vaccine-baits are systematically distributed in the field following a preestablished scheme (wildlife immunization model). 2. Baits are presented to a maximum number of dogs encountered during a systematic passage through the selected area (as dog poisoning is in some countries done in this way this method can be called the dog poisoning model) and 3. Distribution of baits to dogs and/or dog owners during a door-to-door vaccination campaign.

Accessibility studies can help to estimate maximum success of one or a combination of several of these methods. The main task consists of finding an optimal combination of two or even more methods in order to rise vaccination coverage as high as possible.

1.1. Dog population densities and age structure

Dog populations are in contrary to populations of wild carnivores characterized by very high densities. Several hundred dogs per sq km are not uncommon in villages of Tunisia as well as Turkey. Dog density in two Turkish villages was estimated to be 450 and 250 dogs per sq km respectively (Fig. 1). On the other hand, we were surprised to find only a very small number of dogs in a suburban area of Tekirdag. This result is based on 269 households and is probably not representative of all urban areas of Western Turkey. In fact even in Tunisian suburban areas extreme variations in dog population densities were observed.

Successful rabies immunization is probably not possible for puppies, at least for the very young ones. Yet, dogs between 0 and 3 months of age form an important part of dog populations in developing countries, between 5 and 20% in Tunisia and about 10% in a Turkish village.

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1.2. Parenteral vaccination of dogs against rabies

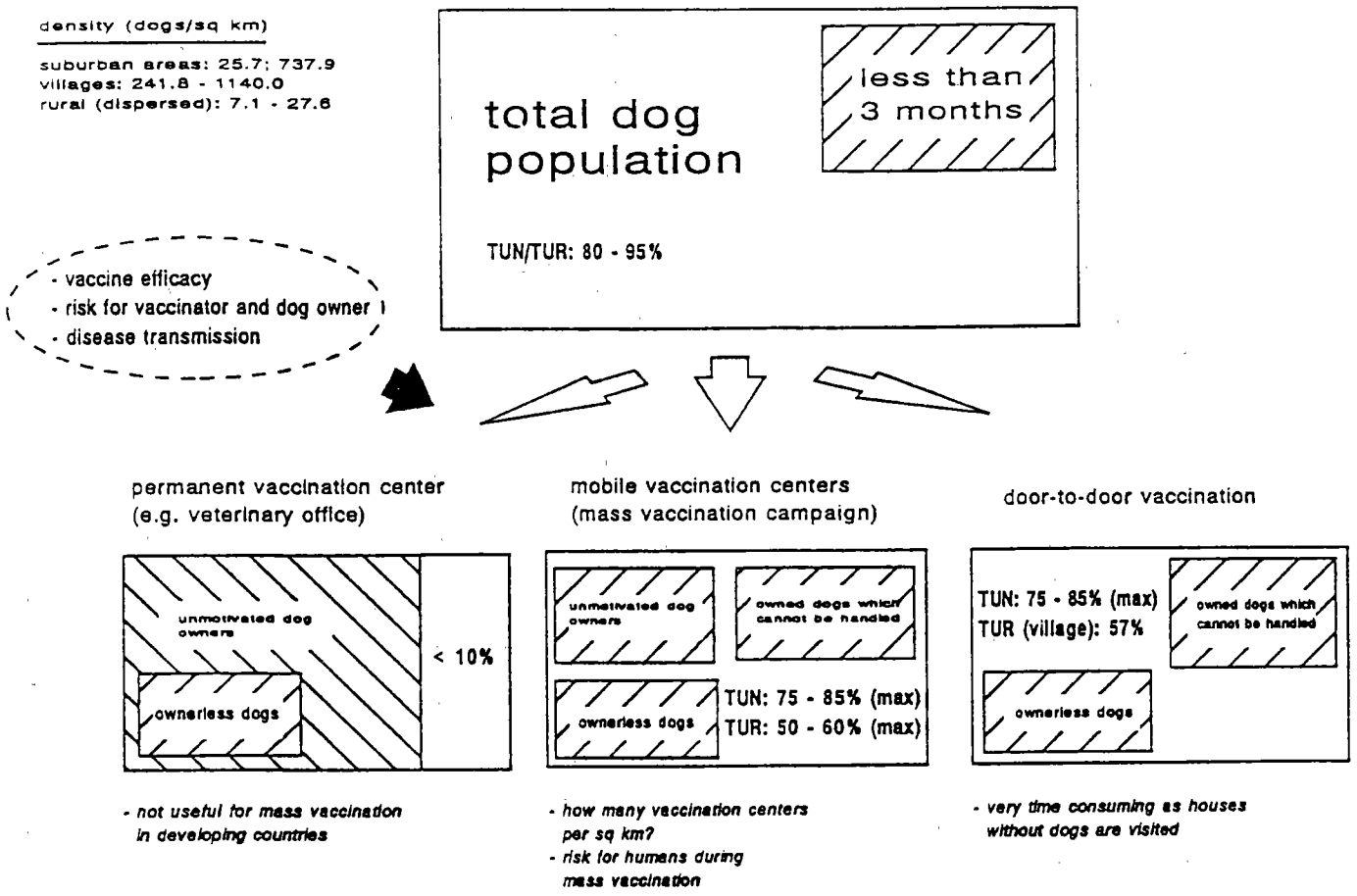

Fig. 1 Accessibility of dogs in Tunisia and Turkey to parenteral vaccination against rabies

In Tunisia as in other countries and in some areas of Turkey dogs are vaccinated by the mobile vaccination center method. 75-85% of dogs in Tunisia and 50-60% in Turkey seem to be accessible for vaccination by this method. To reach this percentage a maximum number of dog owners must be motivated to bring their dogs for vaccination and the number of vaccination centers must be sufficiently high. During vaccination in these centers many dogs are concentrated within a very restricted area. The risk for injuries or even rabies transmission between dogs but also from dogs to humans (especially to dog owners, vaccinators and to children omnipresent in high numbers on these occasions) is increased.

There are two categories of dogs which are not accessible by this method: Ownerless dogs and owned dogs that cannot be handled.

The percentage of ownerless dogs is relatively low in all the populations we studied in Tunisia and Turkey (Fig. 2).
No ownerless dogs living permanently in a suburban area of Tekirdag could be found. In general the quantity of available ressources strongly influences the number of ownerless dogs. It was interesting to note that no dumping place was in or near this study area. The inhabitants discharged their garbage in big metallic containers placed in front of every house. Garbage was collected daily by the municipality and transported to the official dumping place outside the city.

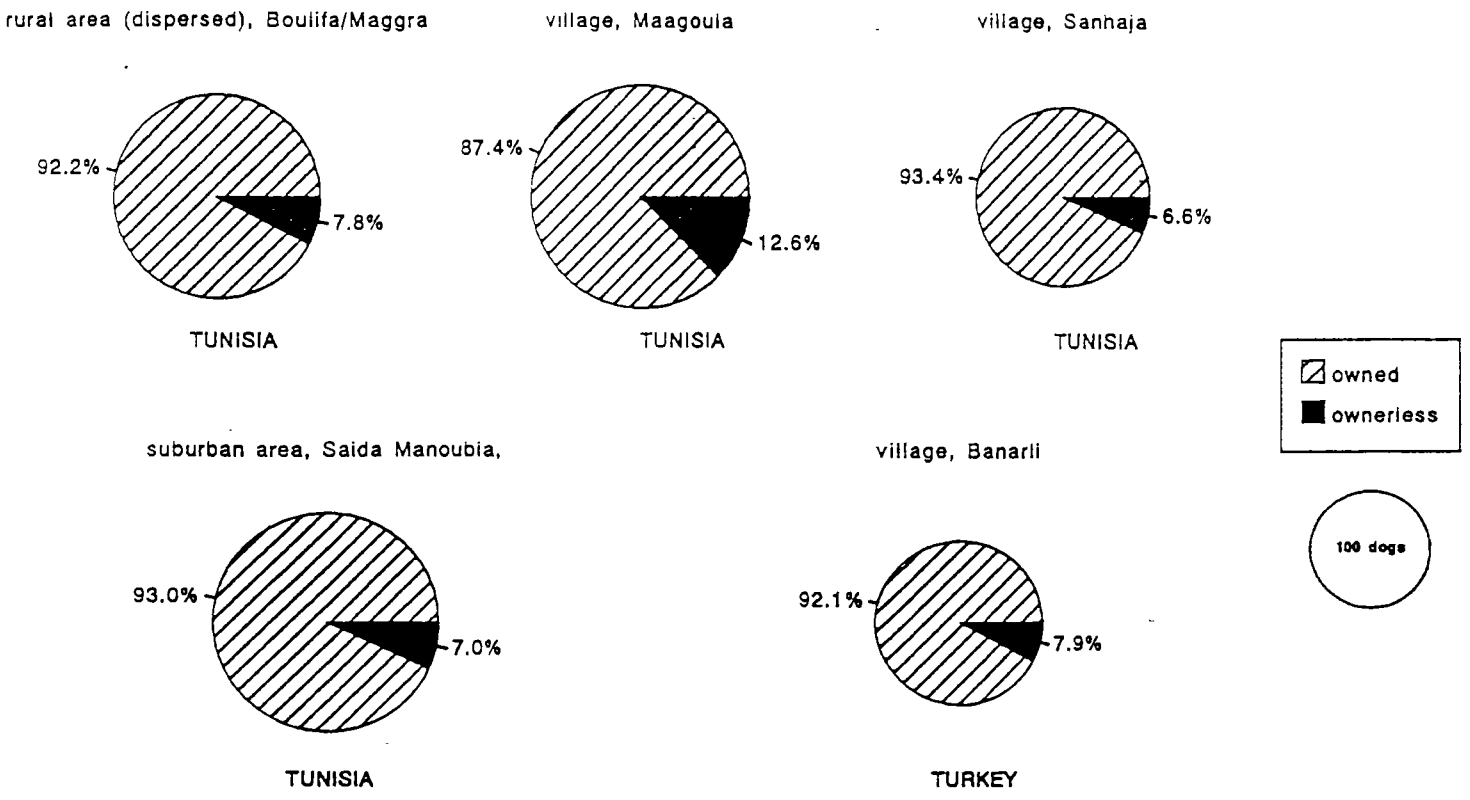

Fig. 2: Ownerless dogs in some areas of Tunisia and Turkey

We estimated the number of dogs living in or at proximity of this dumping place by the Jolly-Seber method and photographic recapture. For this purpose all owned dogs living in the few households near the dumping place were marked with a collar and could then be excluded from further recapture. The mean number of dogs living in the dumping place was estimated at 56. Several females were found pregnant or suckling. Some puppies were observed which had survived until the age of two to three months.

Tekirdag town has approximately 150.000 inhabitants. It would be interesting to investigate in other cities whether the number of dogs living in dumping places is directly correlated to the number of households discharging their garbage there.

Beside ownerless dogs, owned dogs which cannot be captured or handled are also inaccessible for parenteral vaccination (Fig.3).
The high percentage of inaccessible dogs in Turkey is striking. 48% of all free-roaming owned dogs couldn't be captured by their owners within a reasonable lapse of time. In most cases these dogs were used as sheperd dogs. They were generally in good physical condition and there was no doubt that they had an owner.
The dog population in rural areas of Turkey is less accessible to parenteral vaccination than in Tunisia because many owned dogs cannot be captured or handled. Compared to this problem the small number of ownerless dogs is less important at least within the areas we studied.

In reality, the success of vaccination campaigns is generally lower than what is theoretically expected. The percentage of vaccinated dogs is often lower in suburban than in rural areas, although we should expect the contrary when looking at accessiblity rates. During a mass vaccination campaign in 1991 about 20% of all dogs were vaccinated in two Turkish villages (Yagci, Banarli). During our stay in Tekirdag we improvised a vaccination campaign in these two areas and we marked as many owned dogs as possible for capture-mark-recapture density estimates. In Yagci we vaccinated about 50% of all dogs at three mobile centers. In the second village we vaccinated door-to-door. It is interesting to note that the door-to-door campaign didn't allow us to vaccinate more dogs in the second village of Banarli compared to Yagci. This could be an indication, that the main problem is not that dog owners

are unmotivated to bring their dogs to the vaccination centers but that they are not capable or not motivated to capture their dogs.

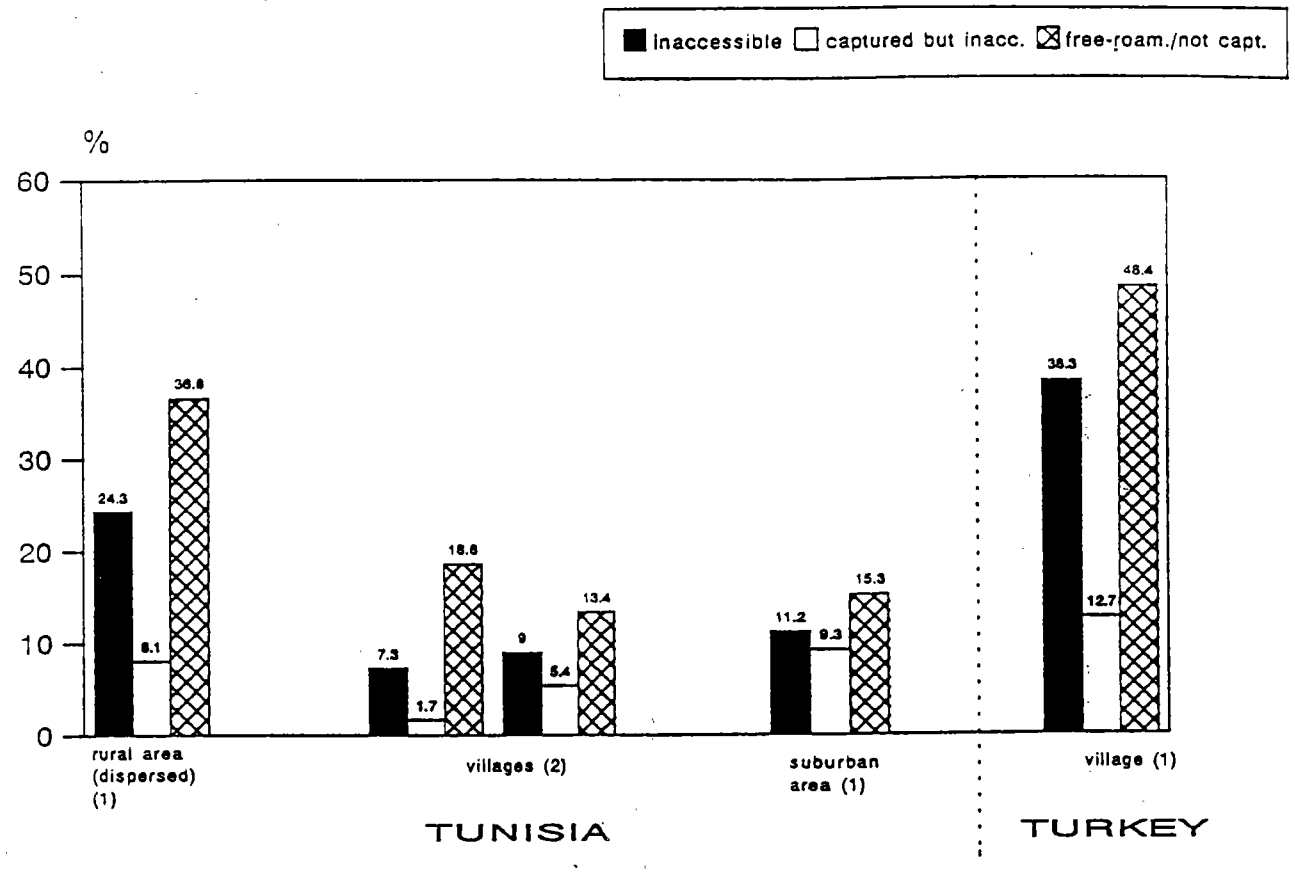

Fig 3. Accessibility of owned dogs to parenteral vaccination

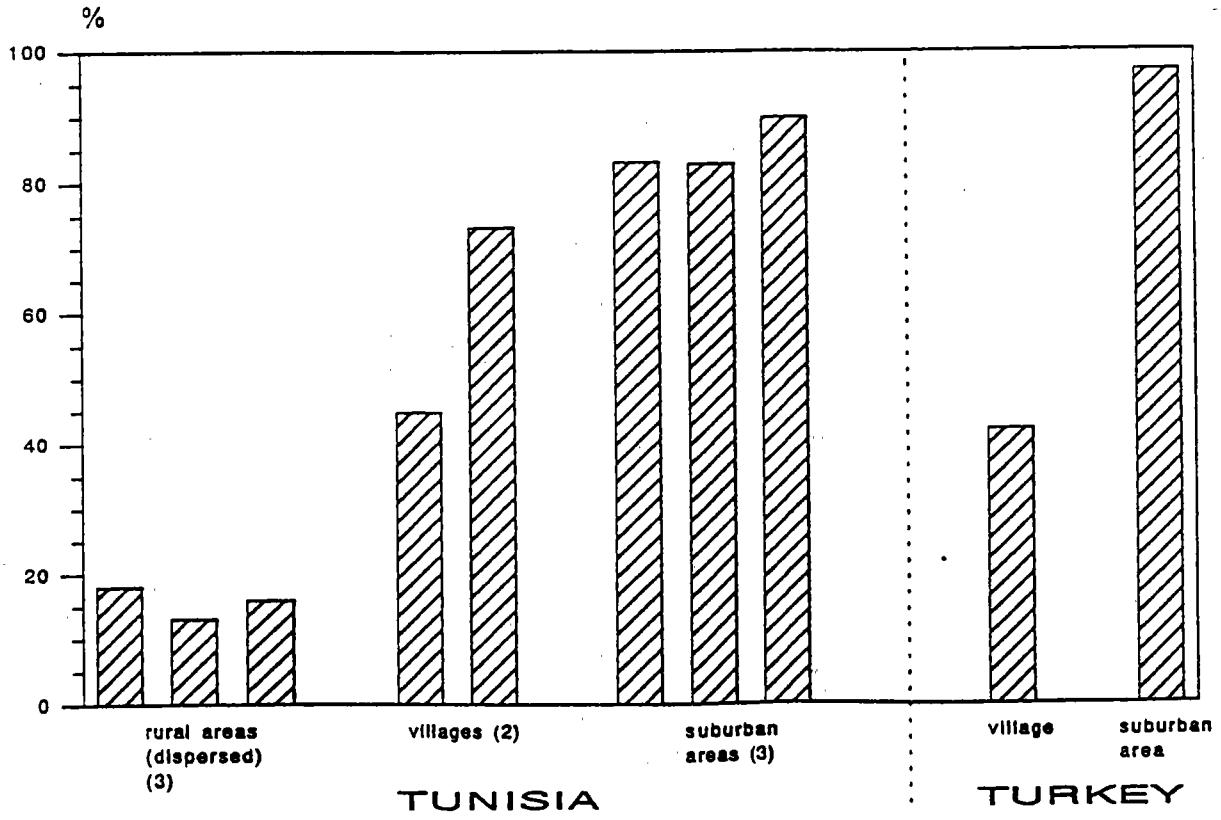

Fig 4: Households without dogs in some areas of Tunisia and Turkey

In Tunisia door-to-door vaccination gave very good results and has been recommended for the National Rabies Control Program. Unfortunately this method is very time-consuming because many households, especially those in villages and suburban areas, have no dogs and are therefore visited in vain.

In rural areas of Tunisia 80% to 90% of households keep dogs. In suburban areas the situation is just the opposite with 80 to 90% of households without dogs. Villages take an intermediate position in levels of ownership (Fig.4).

1.3. Oral immuniziation of dogs against rabies

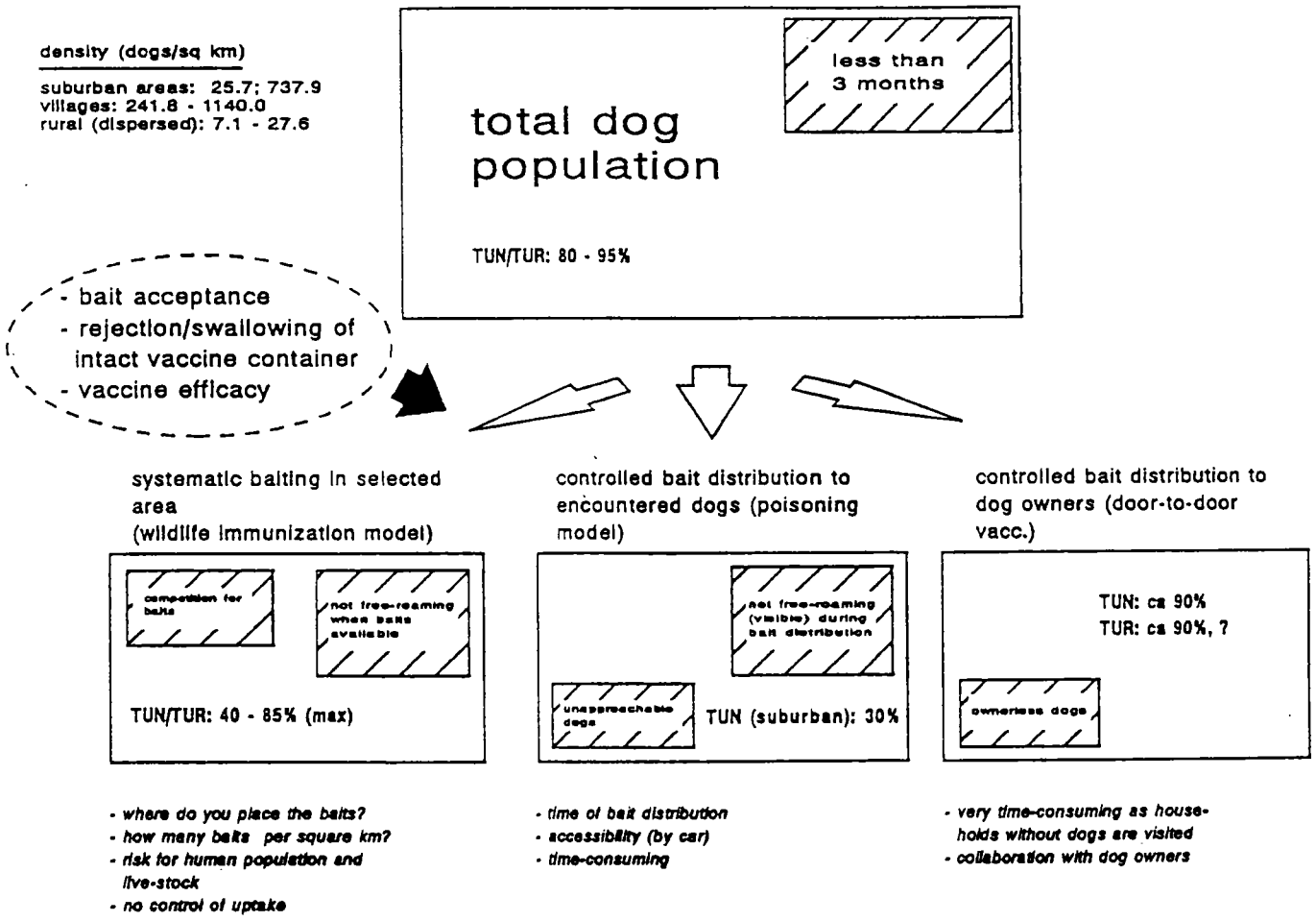

Fig. 5: Accessibility of dogs in Tunisia and Turkey to oral vaccination against rabies

To give precise data on the accessibility of dogs to oral vaccination under field conditions is rather difficult (Fig.5). An ideal bait for dogs which is easily accepted doesn't exist. The following accessibility data are maximal values which can hardly be reached in reality. When baits are distributed like they are for wild animals the main unsolved question is how many baits should be distributed and where should they be placed.

Competition for baits between dogs or other animals constitutes another problem. No data on bait competition between dogs are available. Nevertheless some sporadic observations in dumping places of Tunisia indicate that bait competition might in fact be an important factor.

For the wildlife immunization model only dogs which are free-roaming during at least a part of the period when the baits are available in the field are accessible.

Free-roaming dogs are very frequent in rural areas. In Tunisia 60 to 80% of all dogs were free-roaming during the day time. In one Turkish village about 70% of all dogs were free-roaming, significantly more than in a Tunisian village.
During a questionnaire survey in a suburban area of Tunisia 40% of all dogs were found free-roaming (Fig.6).

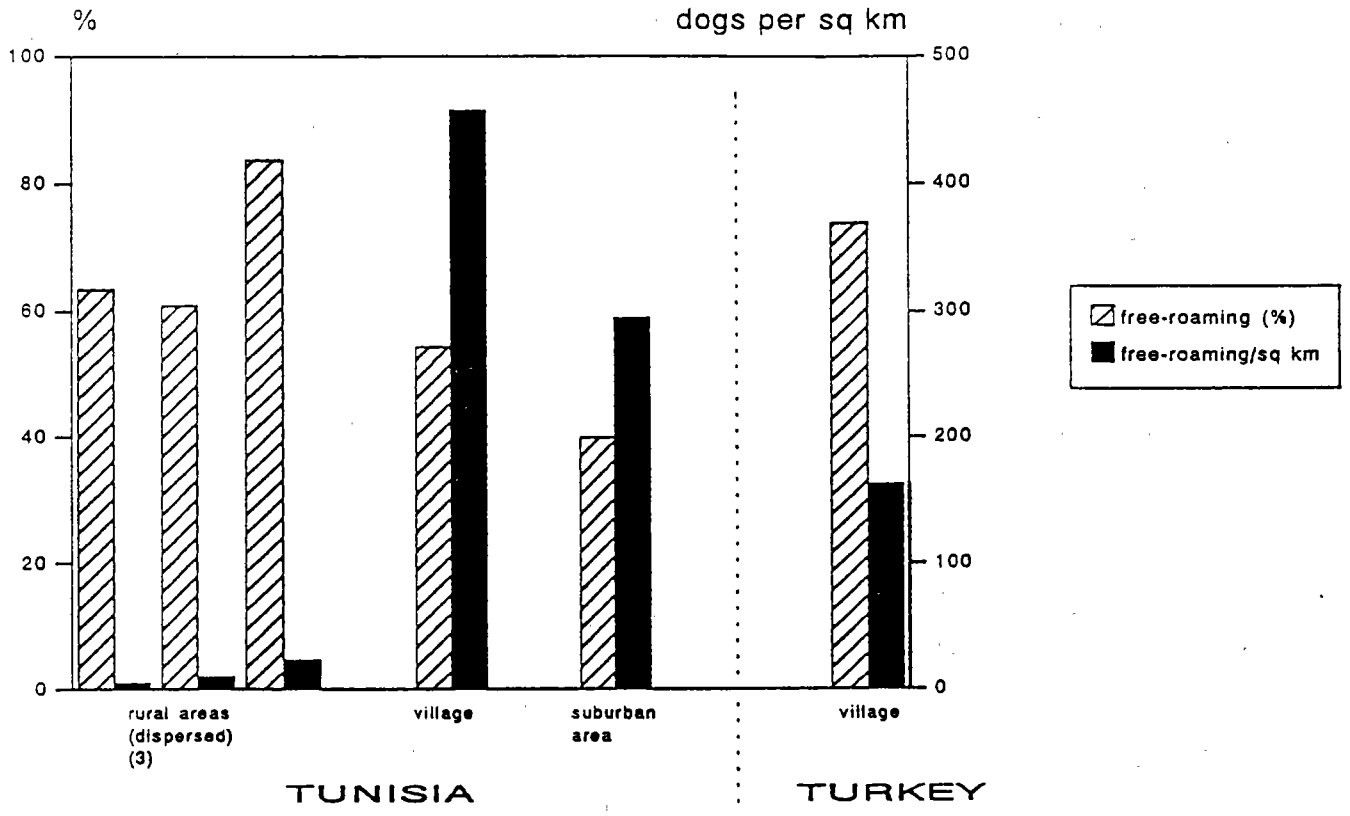

Fig. 6: Free-roaming dogs in some areas of Tunisia and Turkey

Systematic baiting doesn't seem to be a useful approach except perhaps in very restricted areas where a high percentage of dogs are free-roaming within a very limited zone as for example in dumping places.
As a further inconvenience no direct bait uptake control is possible.

The second method which is, in our opinion, more promising, especially when it is combined with a parenteral vaccination campaign, consists of giving baits as hand-outs to all dogs encountered during a systematic passage covering the total area. This is preferably done by car, as, by experience, the flight distance of dogs when approached by car is reduced. Only free-roaming dogs and confined dogs visible from the street are accessible.

Our estimation of the percentage of accessible dogs in a suburban area of Tunisia was based on confinement and visibility (Fig 7). We defined a dog to be free-roaming when it had free access to the outside of the owners premises. 70% of all owned dogs were confined at the time of the questionnaire survey. Only 8% of these animals were visible from the outside of the houses and could have been included into a controlled bait distribution. 90% of all free-roaming owned dogs were visible from the outside of the houses.

Theoretically all confined visible dogs would be encountered if the systematic passage covered the whole area. In contrast the encounter probability of free-roaming dogs is less than one.
During reobservation passages in our study area we encountered a mean of 75% of all owned free-roaming dogs. Assuming that the encounter probability is the same for ownerless and free-roaming,

visible, owned dogs we estimated that the percentage of free-roaming dogs which were actually encountered was about 70% This means that 25% of the total dog population had been encountered.

If all confined visible dogs are added, the percentage of accessible dogs will reach 31% (see Fig.5).

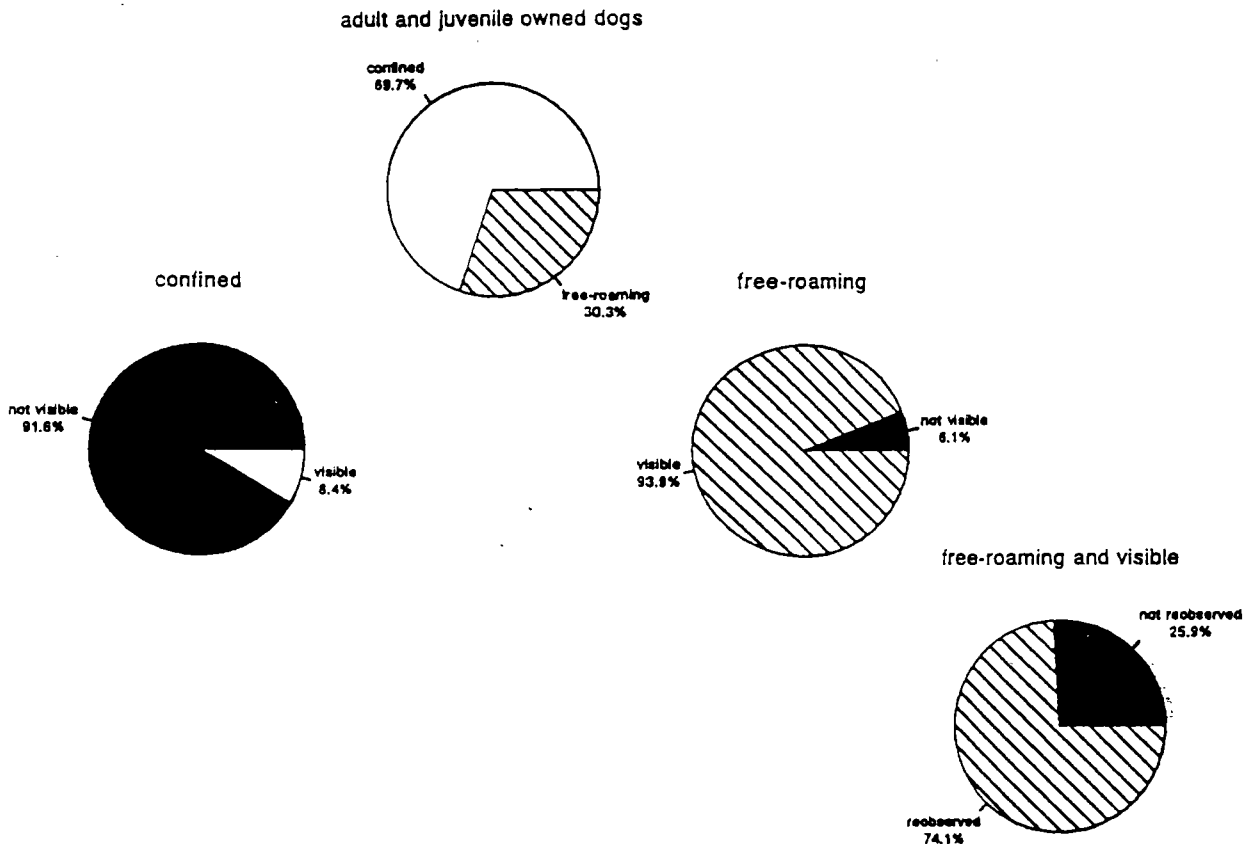

Fig.7. Accessibility of owned dogs in Saida Manoubia (Tunisia) to oral vaccination by bait distribution (poisoning model)

In October 1990 at the end of the dog population study in the suburban area of Saida Manoubia we carried out a trial of controlled bait distribution.

We used chicken head baits with Aluminium blisters, no vaccine, the blisters were filled with a Rhodamine B solution. We distributed baits by car, mainly around the inhabited zone within the study area of 0.6 sq km. A total of 102 baits were distributed.

We encountered 85 free-roaming dogs. To confined dogs no baits were offered. 5.9% of these free-roaming dogs were not approchable either because they were too far away or in an area inaccessible by car. 13% escaped when the bait was presented, they often seemed to be frightened by the throwing movement. About 20% of the dogs encountered didn't show any interest for the baits. 60% accepted it. Contact with Rhodamine B was confirmed in 85% of these cases.

Accessibility and behaviour of owned free-roaming and ownerless dogs, which by definition are always free-roaming, differ slightly: 1. Ownerless dogs were more often frightened by the approach and bait

presentation and escaped. 2. Ownerless dogs, at least those which didn't escape, accepted the baits more easily than the free-roaming owned dogs (Fig.8).

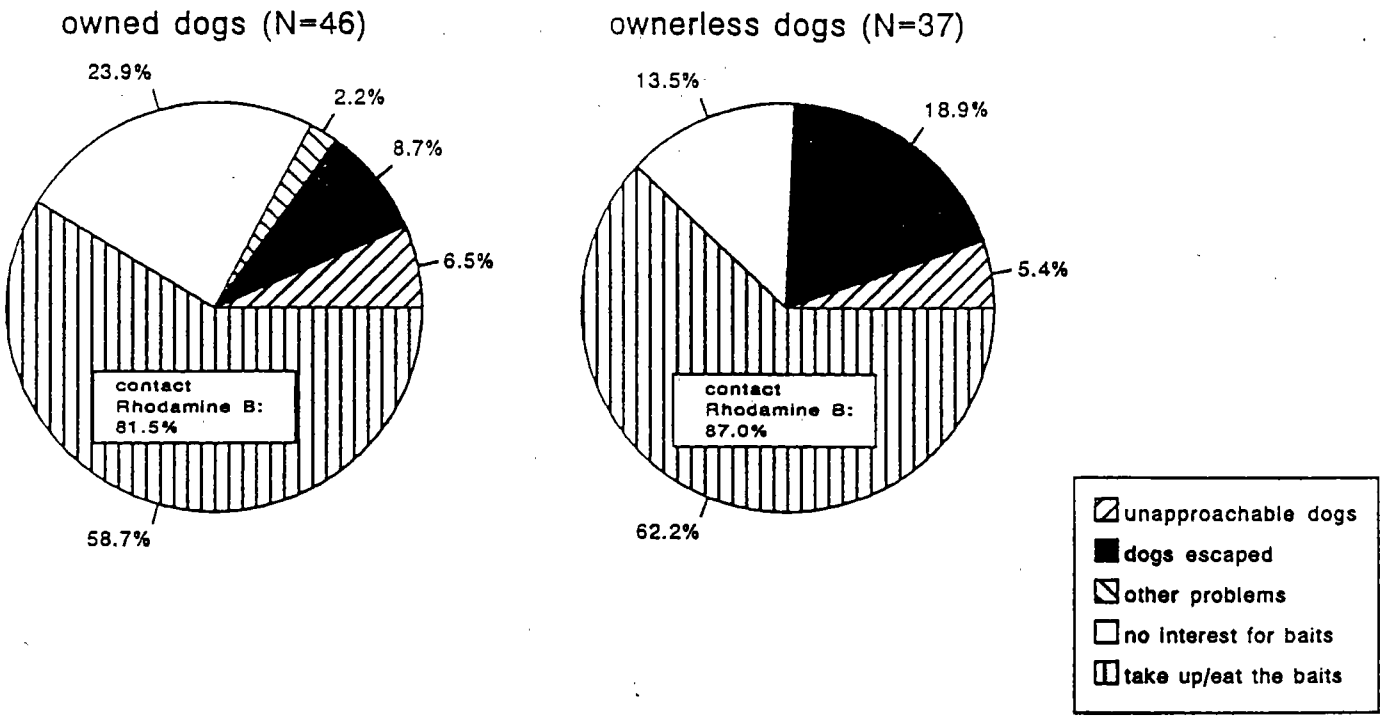

Fig. 8: Bait distribution to free-roaming dogs in Saida Manoubia (Tunisia)

The third very promising but also very time-consuming method consists of distributing baits during door-to-door campaigns to all owned dogs in the households or to dog owners if the dogs are not at home. In this case precise instructions on how to use the bait have to be given to the dog owner. The potential use and inconveniences of this method, as well as the trials we carried out in Tunisia were already discussed in the 2nd WHO consultation on oral immunization of dogs against rabies in 1990[1].

2. Conclusions

The choice of an optimal combination of these vaccination methods depends on the structure of the local dog population. For Turkey as far as the area we studied is concerned the authors would propose a combination of parenteral and oral vaccination. Parenteral vaccination could be organized by mobile vaccination centers.
On this occasion every vaccinated dog should be marked which can easily be done either with cheap nylon collars or even more quickly by the use of animal dye pens. Immediately after this vaccination campaign unmarked dogs could selectively be vaccinated by a controlled bait distribution according to the poisoning model.

[1] WHO, 1990. 2nd WHO consultation on oral immunization of dogs against rabies. Geneva, 6 July 1990. WHO/Rab.Res/91.37.