

# EVALUATION OF A BAIT DELIVERY SYSTEM FOR ORAL VACCINATION OF DOGS AGAINST RABIES IN TURKEY

*Ad VOS\**

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## TÜRKİYE'DE KÖPEKLERİN KUDUZA KARŞI ORAL AŞILAMASINDA BAİT DAĞITIM SİSTEMİNİN DEĞERLENDİRİLMESİ

### ÖZET

İstanbul'da köpeklerin kuduzla karşı oral yolla aşılmasının uygulanabilirliğinin test edilmesi için yapılan bir çalışmada aşı muhafazası içeren bait'ler seçilen bölgelerde bait kayboluşunu tesbit etmek için önceden seçilen yerlere konuldu. Köpekler için kullanılan bait'ler ham kıyma ve ekmeğin kırıntısı karışımından ibaret yerli imalat ve çok çekici olan köfte bait'i idi. Bu bait'in kayboluş oranı kırsal alanlarda çok yüksek olup Kavacık mahallesinde bait'lerin ortalama % 50'si 270 dakika içinde alınmıştı. Direkt gözlemler yoluyla bazen köpeklerin birden fazla bait'i aldığı görülmüştür. Gece boyunca bait'lerin alınma oranı gündüze oranla belirgin derecede çok daha yüksekti. Yine bait'lerin gece yerleştirilmesiyle serbest gezen sahipli köpeklerdeki intraspesifik bait kapma oranı gündüze oranla daha düşük idi. Bu da hedef alt populasyonu olan sahipsiz köpeklerin bait'e ulaşma şansını artırmaktaydı. Bait'lerin gece boyunca yerleştirilmesinin amacı da kargalar tarafından eşelenmesinin elemine edilmesi idi. Gündüz bait'ler tamamen gizlense bile %30.1'i kargalar tarafından bulunmakta idi. Gece için diğer bir dezavantaj kediler olup, bait'lerin %27.3'ü bu hayvanlar tarafından alınmaktaydı.

### SUMMARY

During a field study to test the feasibility of oral vaccination of dogs against rabies in İstanbul, Turkey, baits containing a placebo vaccine container were placed at marked selected sites to determine bait disappearance and - competition. The bait used was the very attractive local-made Köfte-bait; minced meat mixed with bread crumbs. The bait-disappearance rate was very high in urban areas; in the neighbourhood of Kavacık on average 50% of the baits distributed were gone after 270

minutes. By direct observations it was shown that sometimes a dog located and consumed more than one bait. During the night the proportion of baits taken by dogs was significantly higher than during day-time. A further advantage of placing baits during the night was the elimination of possible crow depredation of the baits. During day-time these birds located 30.1% of the baits, even baits completely hidden from view were taken. During the night cats were the major bait-competitors; 27.3% of the baits were taken by these animals.

## **INTRODUCTION**

Mass dog vaccination campaigns have been shown effective in decreasing the number of rabies cases drastically (Belotto, 1988; Chomel et al., 1988). However, vaccination campaigns can only succeed if a sufficient proportion of the dog population can be reached. Hence, campaigns have only limited success in areas with a high number of dogs inaccessible for parenteral vaccination. Therefore, attention has been focused on the development of oral rabies vaccines for dogs to increase the vaccination coverage. An important component of oral vaccination of dogs against rabies is the development of effective baits for vaccine delivery. During field-studies carried out in urban areas of İstanbul, Turkey, it has been shown that the so-called Köfte-bait (minced meat mixed with bread crumbs) is an effective oral vaccine bait-candidate (Müller et al., 1998; Schuster et al., 1998).

The next requirement is a bait delivery system that assures mass immunization of the target population, while minimizing the availability to non-target species, esp. humans. One of the bait delivery systems suggested, offering baits indirectly to dogs by placing them at selected sites, is directed at free-roaming owned and ownerless dogs (Linhart, 1993). In this case, it is important to gather information on bait uptake of the target - and nontarget species. Does this bait delivery system reach specifically those subpopulations to which it is aimed? Furthermore, the distributed baits should be accepted by the target population in a certain limited amount of time, otherwise loss of integrity and attractiveness of the bait could occur. The primary experimental objectives of the field trials presented in this paper were to determine the bait disappearance rate, bait-uptake of the target species and to identify possible bait-competitors (nontarget species) when baits were distributed at selected sites in urban areas.

## **MATERIAL AND METHOD**

### **Test 1 Uptake rates of Köfte-baits.**

Köfte-baits containing a (placebo) vaccine container were placed at marked sites in the urban neighbourhood of Kavacık, İstanbul. This

neighbourhood (1.24 km<sup>2</sup>), situated in the Anatolian part of İstanbul, is characterized by low structures and many open areas. Approximately 50 baits per km<sup>2</sup> were distributed along roads. All baits were inspected several times at irregular intervals to count the baits that had been removed. On these occasions, baits that were missing were not replaced. All baits were hidden from view; to protect them from possible human disturbance and direct sunlight. This test was repeated six times in the same area between 23 January and 2 February 1995 (Table 1). Baits were not always placed at exactly the same site for each of the six replicates. Also in other urban and rural areas of İstanbul Köfte-baits were placed along roads (linear distribution) to estimate bait-uptake. The numerator used for calculating the final bait uptake was the number of baits that had disappeared, including those taken whose discarded vaccine-containers were retrieved at, or near (Ø - 5m), the site of placement.

**Table 1.** Details of the bait-disappearance trials in Kavacık, İstanbul.

	<b>Date</b>	<b>Observation period from</b>	<b>Observation period till</b>	<b>Number of baits</b>
<b>1</b>	23.01.95	19:16	00:25	40
<b>2</b>	24.01.95	12:12	15:53	35
<b>3</b>	25.01.95	13:00	16:20	35
<b>4</b>	26.01.95	19:03	00:25	35
<b>5</b>	31.01.95	11:34	21:53	40
<b>6</b>	02.02.95	12:05	20:44	40

### **Test 2 Identification of bait-competitors .**

To determine possible bait competition of non-target species, Köfte-baits were placed at selected sites and the fate of the bait was controlled by direct observation from a car. Hence, individual identification of the animal species that located and consumed the bait was possible. During each of the observation periods between 8 and 15 baits (on average 11 baits) were placed at selected sites. Between 7 February and 28 March 1995, 28 observation periods during day-time and 7 during the evening were carried out. The duration of these observation periods was on average 119 minutes (s.d. = 29 min.). As in Test 1, baits taken during the experiments by the different animal species were not replaced during the observation periods. Each of these trials was conducted in a different urban neighbourhood of İstanbul. Of course, during the evening this method was severely hindered by the limited visibility. Therefore, baits were placed underneath lampposts or near other illuminated spots.

## RESULTS

### Test 1

The bait uptake rate was very high during all trials carried out in Kavacik (Figure 1). To estimate the 'average' bait uptake rate in this area, the obtained results were pooled in a non-linear regression model:  $d = 100(1 - e^{-0.00257t})$ ,  $d$  = bait uptake rate (%),  $t$  = time [min]. From this model it was deduced that 50% of the Köfte-baits disappeared after approximately 270 minutes. The high bait uptake rate in Kavacik was not exceptional. The results on bait uptake made during the field trials in the other urban areas of İstanbul indicated a similar high uptake rate (Table 2). Only in the forest area the bait uptake rate was much lower.

### Test 2

By using the method of direct observation, it was possible to determine the exact time of bait uptake and to differentiate between total bait uptake and baits taken only by dogs. Therefore, a distinction has been made between bait uptake by all animal species involved and bait uptake by the target population, free-roaming dogs (Table 3 & 4). Also, it was possible to identify individual dogs; sometimes a dog located and consumed more than one bait. This was probably an artefact of the high bait density (on average 1190 baits per km<sup>2</sup>, s.d. = 1067), increasing the chances that a dog encountered more than one bait. During the evening Köfte-baits were taken at a faster rate than during day-time. Also, a significant higher proportion of baits was taken by dogs during the evening than during the day ( $\alpha=0.05$  [one-sided],  $z^*=2.0$ ). The bait uptake of the different animal species estimated by means of direct observations is shown in table 5. During day-time certain bird species were the major bait competitors, especially the hooded crow (*Corvus frugilegus*) was an expert in locating the Köfte-baits. As a result of their foraging behaviour, baits completely hidden from sight were located and consumed by these birds. Goats seem not to be interested in the Köfte-bait; several times' goats were grazing around the baits without 'disturbing' them. On rare occasions' chickens picked at the baits, but did not consume them. In the evening, the major bait competitors were cats.

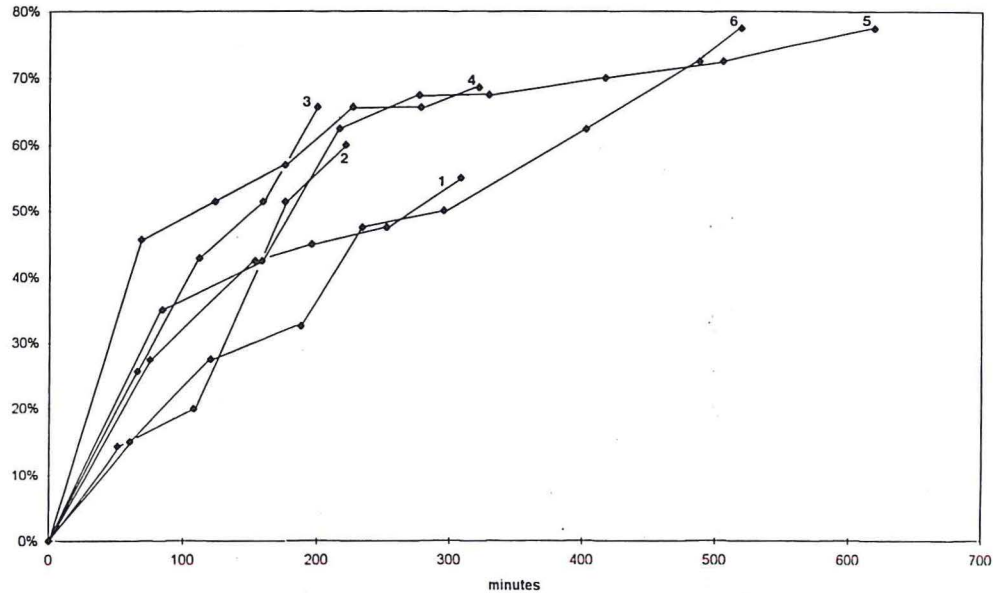
## DISCUSSION

The bait uptake rate of the Köfte-bait when placed at selected sites along roads was very high in urban areas of İstanbul; in Kavacık on average 50% of the baits disappeared after 270 minutes. Furthermore, it was shown that baits disappeared at a faster rate during the evening than during day-time. Also the proportion of baits taken by the target species, dogs, was higher during the evening than during day-time. The high bait uptake rate

**Table 2.** Köfte-bait disappearance-rate (%) when placed at selected sites in İstanbul, Turkey.

<b>Study-area</b>	<b>Ferhatpaşa</b>	<b>Sarıgazi</b>	<b>Sultanciftliği</b>	<b>Hekimbaşı</b>	<b>Inönü Mah.</b>	<b>Ferhatpaşa</b>
<b>Description</b>	forest	urban	urban	urban	urban	urban
<b>Onset of trial</b>	7 Feb. 1995 11:53	29 Jan. 1996 21:50	9 Apr. 1996 19:08	16 Apr. 1996 13:55	18 Apr. 1996 10:17	20 May 1996 20:13
<b>Duration of trial (hh:mm)</b>	22:58	14:10	15:26	22:21	24:18	15:41
<b>Number of baits</b>	48	70	70	50	45	150
<b>Bait-density (bait/km<sup>2</sup>)</b>	192	43	106	no data	no data	183
<b>Bait-uptake (%)</b>	18.8	51.4	48.6	78.0	82.2	92.7

**Figure 1.** Köfte-bait disappearance-rate in Kavacak, İstanbul. The number of the lines corresponds with the observation period as listed in table 1.



can partly be explained by the attractiveness of the bait in comparison with other baits tested (Schuster et al., 1998). Matter et al. (1995) found that after 36 hours only 6.3% and 27.7% of an artificial bait and chickenheads, respectively, disappeared at a waste disposal site in Tunisia. However, not only the target species locate and consume baits when placed at selected sites. To identify animals that consume a bait placed at selected sites, several methods are available. For example Matter et al. (1995) used the tracking-station method at a waste disposal site in Tunisia. However, this method has many drawbacks; when different animal species visit a tracking-station it is not possible to identify the animal species that actually took the bait. Also no distinction can be made between individuals belonging to the same species; one animal can visit several tracking-stations. Additional technical problems emerge when applying this method in urban areas; human disturbance of the tracking-station. Therefore, it was decided to abandon the tracking-station method after initial try-outs in İstanbul. Although the method of direct observations is very time-consuming, it offers the possibility of collecting very detailed information. During the evening cats and during day-time corvine species were the most important bait-competitors; 27.3% and 30.1%, respectively. Between sunset and sunrise the influence of crow depredation of baits was non-existent. Also, during several field-trials in a rural area in southern Ontario, Canada,

**Table 3.** Estimation of total bait uptake and bait uptake by dogs when Köfte-baits were placed at selected sites by means of direct observation during day-time, İstanbul, 1995.

		elapsed time (minutes)					
		15	30	45	60	75	90
<b>Baits placed</b>		327	327	327	327	291	291
<b>Baits taken</b>							
<b>total</b>	<b>n</b>	6	25	43	54	59	69
	<b>%</b>	1.8	7.6	13.1	16.5	20.3	23.7
<b>dog</b>	<b>n</b>	5	14	24	32	38	44
	<b>%</b>	1.5	4.3	7.3	9.8	13.1	15.1

**Table 4.** Estimation of total bait uptake and bait uptake by dogs when Köfte-baits were placed at selected sites by means of direct observation during the evening, İstanbul, 1995.

		elapsed time (minutes)						
		15	30	45	60	75	90	105
<b>Baits placed</b>		74	74	74	74	74	74	74
<b>Baits taken</b>								
<b>total</b>	<b>n</b>	5	10	14	17	21	24	26
	<b>%</b>	6.8	13.5	18.9	23.0	28.4	32.4	35.1
<b>dog</b>	<b>n</b>	3	6	10	13	16	19	20
	<b>%</b>	4.1	8.1	13.5	17.6	21.6	25.7	27.0

**Table 5.** Köfte-bait competition when baits were placed at selected sites in urban areas of İstanbul, Turkey. Results of the individual direct observation periods were pooled.

Time	Number of baits			Animal species					
	placed	taken	dog	cat	crow	chicken	other	unknown	
<b>day</b>	<b>n</b>	309	93	44	8	28	5	1*	7
	<b>%</b>			47.3	8.6	30.1	5.3	1.1	7.5
<b>evening</b>	<b>n</b>	78	33	22	9	-	-	-	2
	<b>%</b>			66.7	27.3				6.0

\* - one bait 'disappeared' when children kicked it around with their feet.

crows (*Corvus brachyrhynchos*) were the most important bait competitor. These birds removed 63-87% of the air-dropped sponge-baits. Nevertheless, the high bait removal by crows did not seem to influence the percentage of bait acceptance of the target population (Bachmann et al., 1990). Possible removal and consumption of baits by small mammals was not observed in Istanbul. This could be an artefact of the method used (direct observation). However, not only nontarget species compete for baits, also intraspecific competition can influence bait uptake by the target subpopulation of ownerless dogs; unrestricted owned dogs vaccinated against rabies by the parenteral route can also locate and consume baits when placed at selected sites. The proportion of unrestricted owned dogs encountered during a systematic search was significantly lower during the evening than during day-time in Kavacık (Vos, unpublished data). Hence, placing baits at selected sites during the evening decreased intraspecific bait competition by unrestricted owned dogs. Further studies should focus on the effectiveness of this bait delivery system; which immunization level in the target population of ownerless and poorly supervised owned dogs can be achieved when baits are distributed at selected sites (Gleixner et al., 1998). Also this bait delivery system should be compared to other systems, to elaborate the most cost-effective strategy and which system minimizes the possibility of direct contact of nontarget species, esp. humans, with the vaccine virus.

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