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Study of the Population Structure of Dogs in a Political District in Mexico City

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Abstract: A study was followed in order to measure the canine population structure according to dog ownership variables and social stratum of housing in the political district of Alvaro Obregon in Mexico City. Through a stratified random sampling, the number of housing to be sampled was determined. Total 2436 questionnaires were applied in high (397), medium (1029) and low (1010) social strata. There was a significant difference ($p<0.05$) in the frequency of homes with dogs, number of dogs per housing, male: female ratio, dog: human ratio, breed, preventive treatments, ownership aspects, handling habits, cause of death and type of shelter. Life expectancy was 0-2 years for the three strata in approximately 1.8 periods. The difference in the population structure among the strata may lead to preventive actions, control and eradication of dog diseases or zoonoses. It is necessary to implement programs to limit canine population growth, as dogs may be an important etiology in human diseases.

Key words: Population structure, dogs, Mexico

INTRODUCTION

Ownership of dogs implies contact with their owners or other persons which can lead to danger due to transmission of diseases, particularly in persons whose socio-economic status is not favourable, as in this condition the lack of orientation and knowledge regarding the possession and maintenance of animals is more common. This propitiates, among other things, an increase of the population with the consequent rise of possibilities which can negatively impact public health as well as the environment.

Dogs can transmit bacteriologic, viral and parasite diseases to human beings, as well as mycosis, allergic processes and inflict traumatisms caused by bites. The possible transmission of rabies and other problems because of complications such as osteomyelitis and septicaemias stand out (Martín, 1982; Orihuela, 1995).

Total 244 cases of human rabies transmitted by dogs were registered in Mexico from 1990-2005; observing a decrement of 60 in 1990, to 2 in 2005. In the same period, the number of cases of canine rabies was 14,516. This was particularly evident in the Alvaro Obregon Political District (AOPD) in Mexico City (DF), where human rabies cases were notified. Twenty seven out of them were canine rabies, being the last one caused by transmission of a dog in 1996. Besides, from 2000-2001, 1,825 aggressions attributed to dogs were recorded; 814 out of them received an anti-rabies treatment.

Control of rabies in Mexico is considered a priority including actions as follows: promoting health, vaccination, modification of the legal and technical framework as well as controlling canine population programs, among others (Secretaria de Salud, 1993, 2000).

It is also necessary to consider the environmental impact produced by discharges generated by canines (Feldman, 1974) represented by a high percentage of dog urine and faeces in public areas.

Studies of population structure is the tool that allows us to define more accurately appraisers, objectives and goals within prevention and control of disease programs in dogs; this is more importantly and particularly against rabies. It is also important to lead an efficient system of epidemiologic surveillance of the control of rabies (Feldman, 1974; Faulkner, 1975; Rubi, 1990).

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The objective of this research was to find out the structure of the canine population according to the degree of marginality in the AOPD considering the number of dogs per house, breed, sex, vaccination status, purpose of the ownership, habit management, causes of death and type of safety and moreover, to study dogs: human ratio global and marginality grade and to determine life expectancy.

Variable establishment and minimal permanent estimators can lead to a basic model towards action and to more realistic knowledge of the endemic situation in a specific area. Dog population characteristics, as well as other factors like density and distribution, are determining towards stray dog control plan programs and rabies and furthermore, in order to facilitate epidemiologic prognosis.

MATERIALS AND METHODS

Temporal and spatial location: This research was carried out in the AOPD, located in the southeast of the DF at 2317 msL, with an area of 94.5 km^2 from which 70 km^2 correspond to the urban area with an estimated human population of 687.020 inhabitants (INEGI, 2005).

Sampling design: The sampling frame included information of the Statistical Geographical Areas Base (SGAB) of the AOPD, number of blocks per SGAB and number of houses in the AOPD. These were identified in maps and classified per stratum according to high marginality, (HMS); medium (MMS) and low grades (LMS).

Design of the questionnaire: A questionnaire (WHO, 1990) was designed to determine the frequency of dogs per house, breed, sex, vaccination status, purpose of ownership, management habits, cause of death and type of safety. Other factors considered were dog: human ratio global marginality grade and life expectancy.

The test was carried out through 25 previous interviews in the zone of study. This allowed choosing the best day and time for the application of the questionnaire.

Sample size determination: To determine an estimate of the percentage of houses with dogs, a survey sampling each stratum was carried out through a random selection of 2 blocks per stratus; all houses were inquired in the abovementioned area.

Sample Size (SS) was determined considering the specific proportions for each stratum. A 95% of confidence and an estimated error of 2% (Farver and Thomas, 1985) applied to the following equation was used:

$$n = \frac{\sum_{i=1}^{L} \frac{N_i^2 p_i q_i}{W_i}}{N^2 B^2 + \sum_{i=1}^{L} N_i q_i p_i}$$

where:

- n = The number of houses to be sampled.
- L = The number of stratum.
- N_i = The size of the population in the iesimo stratus.
- p_i = The prevalence of houses with a dog in the iesimo stratus.
- q_i = $1-p_i$.
- N = The size of the total population.
- B = The estimated error.
- Z = The coefficient of liability.
- W_i = The specific weight of the iesimo stratus.

A percentage (10%) of absence and people not willing to be interviewed was added to the SS (rate of no answer). The distribution per stratum was done through a proportional affixal.

The number of questionnaires calculated for application per marginality grade was: HMS 362, MMS 1325 and LMS 115.

Selection of the blocks: The number of blocks to be surveyed per stratus was calculated dividing the minimal size of a housing sample by means of houses per block. And in each block, a simple sampling at random was selected.

In order to evaluate, the veracity of the answers, 10 questionnaires from each marginality grade were selected and through a new visit the obtained data was corroborated. A data base through an Epi info program, Version 8 for the data gathering and analysis of the information was used.

RESULTS

The median of inhabitants per house in the 3 strata, was four with a minimum of one and a maximum of 13.

There was a significant difference in the percentage of the houses with one dog among the three strata ($p<0.05$), being higher in the MMS (56.4%), regardless of the median of the number of dogs per house which was one for the three strata. There were differences among them ($p<0.05$) and ownership ($p<0.05$) to the increase in the frequency of houses with less than one dog, while diminishing the marginality grade. Males predominated in all the strata, being the highest for MMS with 1.98 ($p<0.05$). The dog:human ratio was of 1:4 for HMS and 1:6 for MMS and LMS ($p<0.05$) (Table 1).

Houses in the three strata with crossbred dogs predominated and the highest percentage was found in HMS (56.63%) ($p<0.05$) (Table 2).

Table 1: Frequency of houses, number of dogs, male: female and dog:human ratio by marginality strata. Alvaro obregon, political district, DF

Strata*	Houses with dogs (%)	Number of dogs per house (%)				Gender (%)		Ratio	
		1	2	3	4 or more	Male	Female	Male: Female	Dog: Human
HMS	56.40	50.89	29.46	10.71	8.93	66.50	33.49	1.98:1	1:4
MMS	42.76	57.05	27.95	9.09	5.68	60.73	39.26	1.54:1	1:6
LMS	49.31	61.24	26.31	7.23	5.22	59.27	40.72	1.45:1	1:6

*HMS: High Marginality Strata, MMS: Medium Marginality Strata, LMS: Low Marginality Strata

Table 2: Frequency of more frequent breeds for the marginality strata in the alvaro obregon, political district, DF

Strata*					
HMS n = 415		MMS n = 736		LMS n = 798	
Breed	(%)	Breed	(%)	Breed	(%)
Crossbred	56.63	Crossbred	36.41	Crossbred	39.97
German shepherd	5.54	Bullterrier	9.65	Poodle	10.15
Rottweiler	4.82	German shepherd	7.88	Cocker	06.77
Bullterrier	4.85	Poodle	7.20	Maltes	06.14

*HMS: High Marginality Strata, MMS: Medium Marginality Strata, LMS: Low Marginality Strata

Table 3: Frequency of ownership and preventive treatment in dogs per marginality strata in the alvaro obregon, political district, DF

Ownership characteristics											
	Primary use			Dogs that go out to the street (%)		Type of shelter			Preventive treatments (%)		
Strata*	Company	Guardian	Other	Yes	No	Dog house	Out of the house	Inside the house	Anti-rabies vaccination	Anti-parasite treatment	DHL**
HMS	55.42	44.34	0.24	37.59	58.31	53.73	28.43	16.39	39.76	13.25	9.64
MMS	63.04	32.74	4.21	38.04	57.20	55.98	22.96	19.43	47.42	22.83	12.50
LMS	69.80	26.57	3.64	39.97	54.64	45.24	20.93	29.82	41.60	27.69	16.79

*HMS: High Marginality Strata, MMS: Medium Marginality Strata, LMS: Low Marginality Strata, ** DHL: Distemper, Hepatitis, Leptospirosis

Table 4: Frequency of causes of death in dogs per marginality strata in the alvaro obregon, political district, DF

Strata*	Causes of death (%)				
	Disease	Negligence	Age	Accident	Unknown
HMS	36.36	25.45	12.73	07.27	18.18
MMS	43.84	05.48	12.33	15.07	23.29
LMS	30.10	02.91	24.27	07.77	34.95

*HMS: High Marginality Strata, MMS: Medium Marginality Strata, LMS: Low Marginality Strata

Table 5: Llife expectancy in dogs by marginality strata in the alvaro obregon political district, DF

Age group	HMS (%)	Life expectancy (Periods)	MMS (%)	Life expectancy (Periods)	LMS (%)	Life expectancy (Periods)	Global life expectancy (Periods)
0-2	41.45	1.80	41.17	1.80	40.73	1.80	1.80
2.01-4	26.02	1.60	23.10	1.90	20.80	2.10	1.90
4.01-6	13.01	1.80	13.72	1.80	13.53	2.00	1.90
6.01-8	10.12	1.20	8.29	1.80	9.15	1.80	1.70
8.01-10	4.85	1.18	6.11	1.20	5.89	1.60	1.40
10.01-12	0.96	2.75	2.85	1.10	3.51	1.30	1.30
12.01-14	0.72	2.50	1.49	0.70	1.25	1.90	1.40
14.01-16	1.45	0.50	0.41	0.50	0.75	1.80	1.00
16.01-18					0.38	2.10	2.10
18.01-20					0.63	0.50	0.50
Unknown	1.96		2.85		3.38		

*HMS: High Marginality Strata, MMS: Medium Marginality Strata, LMS: Low Marginality Strata

The frequency of houses with a company dog predominated in the three strata and increased as the marginality grade diminished ($p<0.05$). On the other hand, the frequency of houses with dogs free to go out to the street was similar ($p<0.05$) in the three strata. Houses with a shelter for dogs in the house predominated; nevertheless, it was observed that there was a tendency to the permanency of the dogs within the house. The grade of marginality decreased (Table 3).

With regard to preventive treatments, the HMS reported the highest frequency (47.42 %) with the anti-rabies vaccination ($p<0.05$) and in the MMS the highest frequency for the application of the anti-parasite treatment (27.69) and vaccination against distemper, hepatitis and leptospirosis (DHL) (16.79%). These frequencies presented a tendency ($p<0.05$) to decrease at the same time that the marginality grade increased (Table 3).

Houses in the three strata, in which the most frequent cause of elimination or lost of dogs was death ($p<0.05$) due to a disease, predominated (Table 4).

The highest life expectancy was observed in group 2.01-4 years in the MMS (1.9) and LMS (2.1). A similarity among the aged groups of 0-2 years of the three strata and from the global population, which presented a life expectancy of almost two periods of 2 years each (1.8), was observed (Table 5).

DISCUSSION

The median of four inhabitants per house observed in the three strata agrees with the information provided by the Instituto Nacional de Geografia e Informatica (INEGI) (Geography and Informatics National Institute) for the DF and the AOPD regarding the MMS and LMS which presented some extreme values of inhabitants per house (from 1-20), setting forth resulting in a similarity among strata.

Variations in the percentage of houses with a dog (42.76-56.40%) were minor to those reported in other studies in Mexico. Variations found were between 71-85% (Orihuela, 1995).This proved to be similar to other studies carried out in Chile (Martín, 1982), Argentina (Franco, 1994) and some other cities in the Unites States (Nassar and Mosier, 1986), (Patronek, 1997). Minor percentages (20 and 29%) were reported in studies done in the Unites States and Chile (Schneider, 1975; Morales, 1993). In this last one with a tendency to an increase of houses with one dog. This is the case in the population of Morelos (Orihuela, 1995), Unites States (Nassar and Mosier, 1986; Patronek, 1997; American Veterinary Medical Association, 1995) and Argentina (Franco, 1994). The abovementioned is an evidence that the dog is a domestic species of easy handling. It is common and popular in the different cultures due to its historic background as the first domesticated animal and companion per antonomasia.

The preference to males in the three strata coincides with other studies performed in Mexico and other regions in Europe, South America and Africa (Martín, 1982; Orihuela, 1995; Franco, 1994; Patronek, 1997; Schneider, 1975; Morales, 1993; Fishbein, 1992; Thrusfield, 1989; Rautenbach, 1991). Results, possibly, indicate a rejection to the female population due to reproduction control.

There is a difference in the dog: human ratio of the HMS (1:4) with what was observed in 1979 in this same area (1:10) (Fuentes, 1979). Nevertheless, it is similar to what was informed in the Iztapalapa political district (Rubí, 1990) in the State of Mexico in both rural and urban areas (Vargas, 1992; Universidad Autonoma del Estado de México, 1996). For the MMS and LMS the dog: human ratio (1:6) coincides with the obtained in the DF and the urban area of the State of Mexico (Vargas, 1992; Gandarillas, 1995). It is important to point out that the ratio used in the AOPD is of 1:7, which is wider than the observed one. Due to this, the importance of a better knowledge of those indicators, or the actions to control diseases such as rabies could have lower coverage and impact by under-programming of resources for the specific attention and control regarding dog population with these characteristics (Fishbein, 1992; Wandeler 1988).

The highest amount of crossbred dogs observed in the three strata has been described by other authors in the DF (Fuente, 1979) and Morelos (Orihuela, 1995), as well as in Chile (Fuentes, 1979; Morales, 1993) and in the United States (Nassar and Mosier, 1980). Different results were reported in studies carried out in regions in great Britain (Thrusfield, 1989) and in the United States (Wandeler, 1988), where a special permission for the ownership of animals is required and those reported in the data by the Kennel Club.

Breeds in this study are included in the classified groups by the Federacion Canofila Mexicana (Dog Mexican Federation) with combined characteristics of guard, company, walking, personal protection and the joy of living together with children. There is a predilection for medium-or small size dogs (30-60 cms approx) in the MMS and LMS. The above mentioned is perhaps due to practical reasons like food cost and space. This can suggest that the crossbred dog is preferred because it is more available, due to its supposed rusticity and lower maintenance costs (Federacion Canofila Mexicana, 1984).

Ownership in this study coincides with other researchers in Chile where the highest percentage of interviews revealed that people have a dog for affective reasons and in the second place for protection ones (Martín, 1982; Morales, 1993). The function of a dog as a pet is difficult to be defined. It all depends on the geographical area and the type of society involved. The presence of company dogs is psychologically important and its possible work as guardians and protectors, without excluding other activities (Wandeler, 1988). This dichotomy, inexistent in reality, can influence the differences found in this study.

The fact that more than half of the dogs are not allowed to go out to the street is similar to the information given in the state of Morelos and other countries in Latin America (Martín, 1982; Orihuela, 1995; Morales, 1993). The answer to the questionnaire could be misleading as people consider that dogs should not be allowed to leave the house premises out to the street and their responses could have been mischeveous.

It is important to point out that during the application of the questionnaire it was possible to observe a number of stray dogs in several sectors of the delegation and moreover, reiterated complains because of the presence of stray dogs which had been aggressive in some cases.

Having a shelter for the dog shows the concern to protecting the animal. On the other hand, having it inside the house and the lack of preventive care represents a risk to those living in the same house. This is more evident in dogs located outside the house as they not only imply a risk regarding the transmission of zoonoses to inhabitants of the house, but also to the public (Feldman, 1974; Wandeler, 1988). In this sense stray dogs constitute contagious populations and there is a predisposition of transference and persistency of infectious diseases in areas due to the close contact between them and also due to the movement of animals (Schneider, 1975; Thrusfield, 1989).

The predominance of diseases as cause of death in HMS and MMS differs from studies in other countries where euthanasia was the principal cause of death (Orihuela, 1995; Nassar and Mosier, 1986; Patronek, 1997; Arluke, 1991). This may be due to the fact of freedom of possession in Mexico and the regulations regarding responsibility and ownership of dogs in the United States and countries in Europe (Nassar and Mosier, 1986; Patronek, 1997; American Veterinary Medical Association, 1995; Thrusfield, 1989; Arluke, 1991).

Percentages of houses with dogs aged from 0-2 years were higher than the reported one by authors in Morelos (Orihuela, 1995) and Puebla (Vargas, 1992). What was observed indicates a principally young population with a high reproductive potential (Martín, 1982; Schneider, 1975; Morales, 1993; Thrusfield, 1989). This agrees with the medium life expectancy in these groups and it can confirm the high birth rate found in this study.

The dog is a domestic animal with a very important role and the way of breeding presented different ownerships and differences in the zone of study according to the marginality strata. Acknowledgements can be helpful to lead to actions of programs and campaigns of prevention, control and when necessary in the eradication of diseases. It is necessary to plan and develop programs directed to limit the growth of canine population.

It is recommended to develop studies directed to complement aspects related to the dynamics of these populations with better accuracy, including the phenomena of marginality, birth rate and mortality.

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