





Original Article

## Characteristics of the population of dogs and cats in Brazil

Características da população de cães e gatos domiciliados do Brasil

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### ABSTRACT

The precise estimation of the domestic animal population is important for effective health planning. The objective was to verify the applicability in Brazil of the method proposed by the World Health Organization (WHO), to estimate the animal population of developing countries, comparing it with data published by the Brazilian Institute of Geography and Statistics (IBGE). From the questionnaire prepared by IBGE, specific questions were selected to be submitted for statistical evaluation. The results indicate a population larger than that estimated by the WHO, there is still a low vaccination coverage, and campaigns should be intensified in cats and in rural areas. Rural areas have larger numbers of cats and dogs per household, and the concentration of animals in the cities is higher in neighborhoods consisting of houses than apartments. The dog is the companion animal of choice of Brazilians.

### RESUMO

A estimativa precisa da população animal é de significativa importância para o efetivo planejamento em saúde. Objetivou-se verificar a aplicabilidade no Brasil do método proposto pela Organização Mundial da Saúde (OMS) para estimar a população animal dos países em desenvolvimento, comparando-a aos dados publicados pelo Instituto Brasileiro de Geografia e Estatística (IBGE). A partir do questionário realizado por este órgão foram selecionadas perguntas específicas para serem submetidas à avaliação estatística. Os resultados indicam uma população maior que o estimado pela OMS e que ainda existe baixa cobertura vacinal, e as campanhas devem ser intensificadas em gatos e nas áreas rurais. As áreas rurais apresentam maiores quantidades de gatos e cães por domicílio, assim como a concentração de animais nas cidades é maior em bairros de casas do que de apartamentos. O cão é o animal de companhia de eleição do brasileiro.

### INTRODUCTION

The relationship of human beings with dogs and cats is very close and intense, and this relationship has an impact on the health of people and animals (VIEIRA et al., 2006). The inadequate breeding of animals and lack of knowledge about responsible ownership, associated with a low level of education, and lack of legislation, alters the population growth patterns of dogs and cats, which directly affects the well-being of all people

concerned, and favors the transmission of diseases (LIMA; LUNA, 2012).

Although contact with animals carries risks, the frequency of most zoonotic diseases can be reduced or even eliminated, through population management practices and public policies aimed at veterinary care, restriction of movement, selective breeding, responsible legislation, and education of owners, making animal care a positive experience (CANATTO et al., 2012).

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For planning these actions, it is of fundamental importance to know the size of the canine and feline population, and how it is geographically distributed (BELO; SILVA, 2015). In addition, population management programs should include, among other measures, a situation diagnosis, such as population estimates, population dynamics, and human attitudes and behaviors towards animals (GARCIA; CALDERÓN; FERREIRA, 2012). The analysis of these populations and their characteristics will be beneficial for the health and welfare of humans and non-humans in the Brazilian society (BIONDO et al., 2015).

According to Reichmann et al., (2000) several methods are proposed for estimating the canine and feline populations, such as animal census, sampling, questionnaires, and records from various sources. Given the impracticability of performing an animal census in several localities, the adoption of a methodology based on human population indicators has been shown to be more feasible. With these indicators, it is possible to evaluate programs of population control of dogs and cats, anti-rabies vaccination campaigns, and implementation of the necessary strategies in each region, according to their particularities (DIAS et al., 2004).

The WHO estimates that in emerging countries, the average proportion of dogs varies from 1:10 to 1:6, or about 10.0 to 16.7% of the human population (REICHMANN; PINTO; NUNES, 1999). In Brazil, monitoring of the animal population is still based only on estimates of the human population, or on sample surveys.

Consequently, the objective of this study was to verify the applicability in Brazil of the method proposed by the World Health Organization (WHO), to estimate animal population of developing countries, comparing it with data published by the Brazilian Institute of Geography and Statistics (IBGE) in the National Health Survey (PNS).

## MATERIAL AND METHODS

The PNS was produced by the IBGE nationwide in 2013, on the health situation and lifestyles of the Brazilian population, and for the first time in the history of Brazil the health survey questionnaire contained questions about companion animals. From this questionnaire,

specific questions were selected to be submitted for statistical evaluation, to obtain the vaccine coverage, and the means of animal:person, animal:household, and dog:cat. The analysis of the microdata was conducted using the SAS 9.3 software, after access to the database obtained from the survey conducted by IBGE. According to the type of table, comparison between means, analysis of variance or independence tests were applied to verify the significance.

To determine the results of ratio cat and dog per person, the absolute number of animals per state and by type of census situation (urban or rural area) was found. The population quantification was obtained through a table produced in the IBGE Automatic Recovery System (SIDRA), based on the National Household Sample Survey (PNAD), and population projection for the year 2013, the year that PNS was conducted.

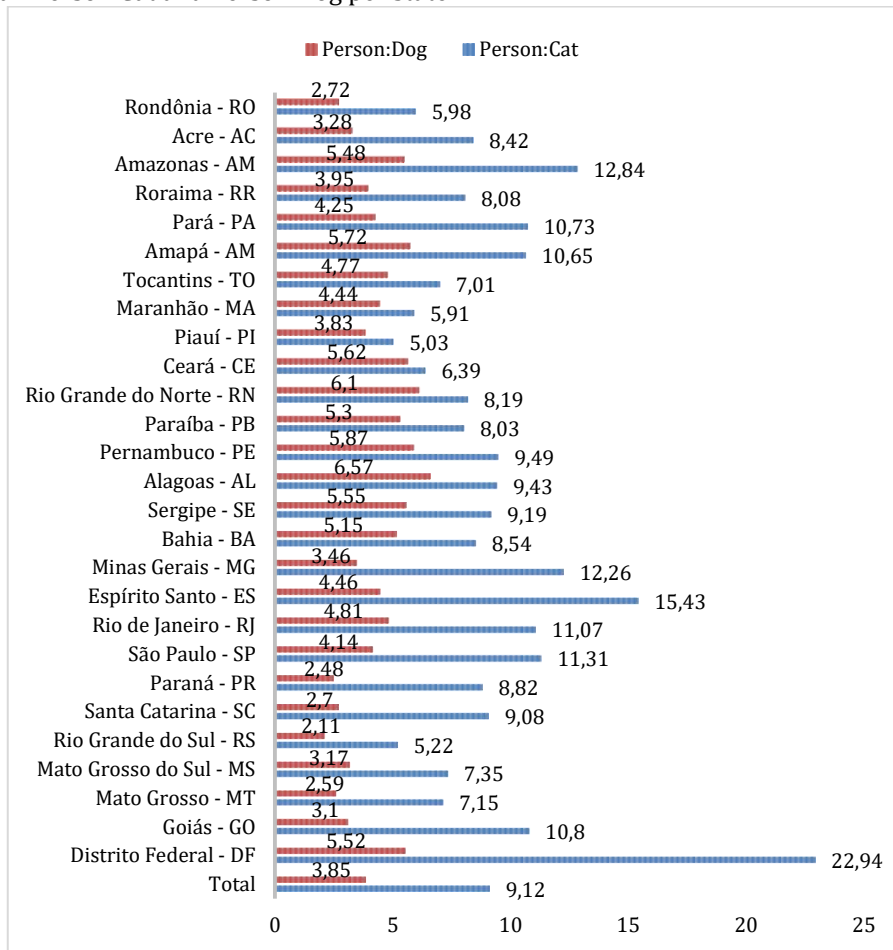
Regarding the vaccination coverage, from the absolute number of cats and dogs and the number of animals vaccinated against rabies in the last 12 months, the percentage of cats, dogs, and both vaccinated for each state was calculated, and by type of census situation. It is important to note that in the questionnaire, for the question about vaccination, the respondent was offered three types of responses: 1. Yes, all; 2. No, not all; 3. None of them. For the calculation of vaccination coverage, only the number of those who answered "Yes, all" was used, hence presenting a diagnosis that was as conservative as possible, with the minimum number of reliably vaccinated animals.

In relation to household information, the SAS shows the mean animal:household, weighted by the factor of sample expansion, the number of households with the presence and absence of animals, and the total number of households, according to the state, type of census situation, and household type (house or apartment). For the percentage that represents the "yes" within each unit, a rule of 3 was performed.

## RESULTS

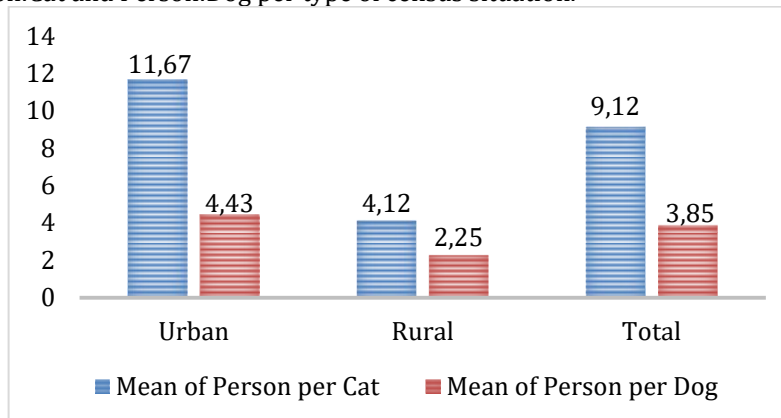
From the analysis performed, graphs and tables were elaborated, from which the following results can be extracted. Figure 1 shows the mean number of persons per cat, and per dog, considering each state, and Figure 2 shows the mean number of persons per cat and per dog in Brazil, by type of census situation. Note that the lower the mean, the greater the number of animals.

Figure 1 – Mean Person:Cat and Person:Dog per state.



Source: PNS 2013 and PNAD 2013.

Figure 2 – Mean Person:Cat and Person:Dog per type of census situation.



Source: PNS 2013 and PNAD 2013.

In relation to rabies vaccinations performed in the last 12 months by state, SP (2,845,024), MG (1,131,645), and RJ (1,060,727) presented the highest absolute number of vaccinated cats, and SP (9,274,175), MG (4,820,868), and RS (3,180,668) the highest absolute number of vaccinated dogs, while RR (25,560 and 68,110), AP (35,215 and 78,648), and AC (41,253 and 148,482) had the lowest absolute numbers of vaccinated cats and dogs, respectively. Table 1 presents the vaccine coverage for rabies in Brazil (70.43%), with the coverage of vaccinated cats (59.31%) less than that of dogs (75.13%). According to data from the IBGE, DF (86.34%),

SP (84.01%), and RJ (81.41%) were the states that had the highest vaccination coverage of household animals, the highest vaccine coverage in felines: DF (75.28%), SP (73.57%), and RJ (71.63%), and in canines: DF (89.00%), SP (87.83%), and RJ (85.66%). The Brazilian states with the lowest vaccine coverage in cats were SC (38.01%), RR (40.08%), and PR (40.92%), and the states with the lowest vaccine coverage in dogs were MA (52.70%), RR (54.85%), and SC (59.10%). RR, MA, and SC were also the states with the lowest rates of vaccinations of dogs and cats, presenting values of 50.66%, 50.97%, and 54.26%, respectively.

Table 1 – Coverage of vaccinated cats, dogs, and both per UF.

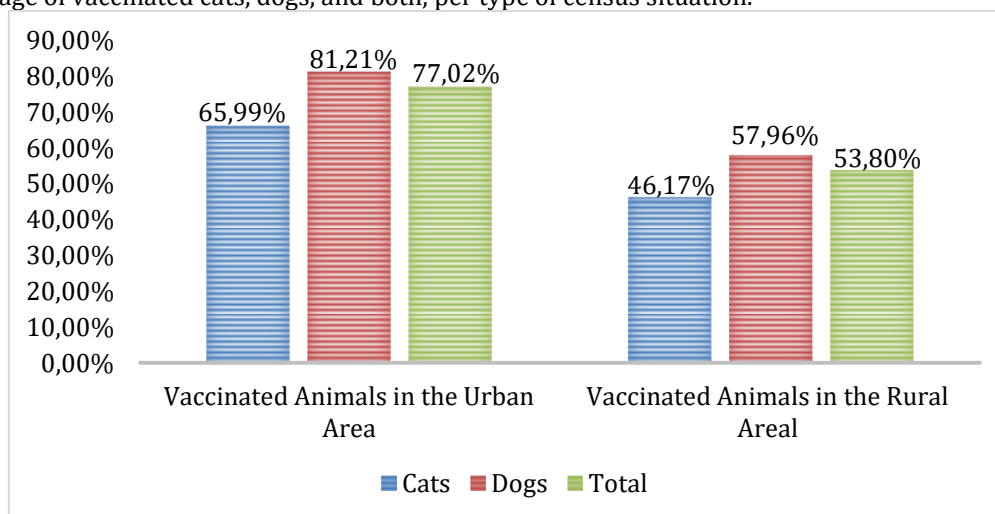
UF	Number of cats	Yes, all	Coverage %	Number of dogs	Yes, all	Coverage %	Total Animals	Total Vaccinated	Coverage %
Rondônia	289.406	195.716	67.62	634.833	510.371	71.10	924.239	706.087	76.39
Acre	92.547	41.253	44.57	237.370	148.482	62.55	329.917	189.735	57.50
Amazonas	297.589	179.447	60.30	697.494	460.954	66.08	995.083	640.401	64.35
Roraima	60.729	25.560	40.08	124.158	68.110	54.85	184.887	93.670	50.66
Pará	744.046	404.125	54.31	1.878.106	1.210.568	64.45	2.622.152	1.614.693	61.57
Amapá	69.356	35.215	50.77	128.973	78.648	60.98	198.329	113.863	57.41
Tocantins	211.486	124.018	58.64	310.391	242.205	78.03	521.877	366.223	70.17
Maranhão	1.150.092	559.939	48.68	1.530.718	806.733	52.70	2.680.810	1.366.672	50.97
Piauí	633.041	357.770	56.51	831.007	616.947	74.24	1.464.048	974.717	66.57
Ceará	1.376.283	921.784	66.97	1.564.525	1.253.574	80.12	2.940.808	2.175.358	73.97
Rio Grande	412.694	253.433	61.40	554.271	462.158	83.38	966.965	715.591	74.00
Paraíba	487.863	276.544	56.68	738.752	582.997	78.91	1.226.615	859.541	70.07
Pernambuco	971.128	497.478	51.22	1.570.930	1.094.996	69.70	2.542.058	1.592.474	62.64
Alagoas	350.281	211.989	60.51	502.600	397.950	79.17	852.881	609.939	71.51
Sergipe	239.373	139.923	58.45	396.586	325.771	82.14	635.959	465.694	73.22
Bahia	1.763.556	895.760	50.79	2.922.564	2.076.783	71.06	4.686.120	2.972.543	63.43
Minas Gerais	1.681.415	1.131.645	67.30	5.948.709	4.820.868	81.04	7.630.124	5.952.513	78.01
Espírito	249.384	154.800	62.07	862.876	679.268	78.72	1.112.260	834.068	74.98
Rio de	1.480.738	1.060.727	71.63	3.406.297	2.918.052	85.66	4.887.035	3.978.779	81.41
São Paulo	3.866.973	2.845.024	73.57	10.558.406	9.274.175	87.83	14.425.379	12.119.199	84.01
Paraná	1.249.641	511.458	40.92	4.432.583	2.760.715	62.28	5.682.224	3.272.173	57.58
Santa	732.546	278.448	38.01	2.461.542	1.454.935	59.10	3.194.088	1.733.383	54.26
Rio Grande	2.142.120	972.229	45.38	5.275.235	3.180.668	60.29	7.417.355	4.152.897	55.98
Mato Grosso	352.777	243.839	69.11	817.124	657.947	80.51	1.169.901	901.786	77.08
Mato Grosso	445.763	302.786	67.92	1.228.380	1.000.469	81.44	1.674.143	1.303.255	77.84
Goiás	597.709	377.653	63.18	2.076.724	1.685.237	81.14	2.674.433	2.062.890	77.13
Distrito	122.097	91.918	75.28	507.170	451.419	89.00	629.267	543.337	86.34
Total	22.070.633	13.090.480	59.31	52.198.324	39.221.001	75.13	74.268.957	52.311.481	70.43

Source: PNS 2013.

Considering cases where all animals in the household were reported to be vaccinated, divided by type of census situation, resulted in an observed total of 13,090,480 vaccinated cats, of which 9,654,187 were in urban areas, and 3,436,293 in rural areas, and

39,221,001 vaccinated dogs, 31,316,322 in urban areas, and 7,904,680 in rural areas. Figure 3 shows the vaccination coverage of cats and dogs in urban and rural areas.

Figure 3 – Coverage of vaccinated cats, dogs, and both, per type of census situation.



Source: PNS 2013.

Table 2 shows in absolute numbers the general number of animals estimated for Brazil, according to the species (cat and dog), and state. The maximum is the highest number of animals found in a household, and the minimum the lowest number of animals. The mean is the ratio of the number of animals to the total number of households, and the standard deviation tells us how close or distant the data are to the mean. It is observed that Brazil has 22,070,633 cats and 52,198,325 dogs. The states with the highest absolute number of cats are SP (3,866,973), RS (2,142,120), and BA (1,763,556), and the lowest are RR (60,729), AP (69,365), and AC (92,547). Those with the highest number of dogs are SP

(10,558,406), MG (5,948,709), and RS (5,275,235), and the lowest are RR (124,158), AP (128,973), and AC (237,370). The maximum number of cats per household varied from 11 in SC, to 51 in RS. For dogs the maximum per household varied from 7 in RN to 80 in DF. The data indicated that the mean number of cats per household in Brazil is 0.34, and of dogs 0.80. The states with the highest mean for cats are PI (0.67), MA (0.62), and RO (0.53) and RS (0.53) tied, and the lowest are DF (0.13), ES (0.19), and MG (0.24). For dogs, the highest mean values were in RS (1.31), PR (1.22), and RO (1.17), and the lowest in AL (0.52), RN (0.54), and PE (0.55).

Table 2 – Number of cats and dogs per UF.

UF	Number of Cats					Number of Dogs				
	N	Max	Mean	SD	Min	N	Max	Mean	SD	Min
Rondônia	289.406	12	0.53	20,33	0,00	634.833	15	1.17	26,12	0,00
Acre	92.547	20	0.43	12,97	0,00	237.370	15	1.11	15,66	0,00
Amazonas	297.589	20	0.32	17,83	0,00	697.494	13	0.74	21,32	0,00
Roraima	60.729	16	0.51	10,83	0,00	124.158	16	1.05	11,53	0,00
Pará	744.046	12	0.35	24,25	0,00	1.878.106	10	0.88	37,76	0,00
Amapá	69.356	15	0.38	10,51	0,00	128.973	10	0.71	11,45	0,00
Tocantins	211.486	15	0.47	20,11	0,00	310.391	10	0.69	18,58	0,00
Maranhão	1.150.092	25	0.62	50,05	0,00	1.530.718	15	0.82	45,47	0,00
Piauí	633.041	15	0.67	30,99	0,00	831.007	30	0.88	35,39	0,00
Ceará	1.376.283	19	0.51	36,64	0,00	1.564.525	30	0.58	33,1	0,00
Rio Grande do Norte	412.694	30	0.41	31,65	0,00	554.271	7	0.54	20,93	0,00
Paraíba	487.863	20	0.39	31,35	0,00	738.752	17	0.59	27,89	0,00
Pernambuco	971.128	12	0.34	32,39	0,00	1.570.930	10	0.55	33,57	0,00
Alagoas	350.281	15	0.36	20,86	0,00	502.600	9	0.52	21,23	0,00
Sergipe	239.373	22	0.35	21,48	0,00	396.586	10	0.58	21,09	0,00
Bahia	1.763.556	13	0.37	43,45	0,00	2.922.564	13	0.61	49,3	0,00
Minas Gerais	1.681.415	20	0.24	32,03	0,00	5.948.709	22	0.85	56,94	0,00
Espírito Santo	249.384	14	0.19	19,76	0,00	862.876	15	0.67	31,72	0,00
Rio de Janeiro	1.480.738	20	0.25	37,94	0,00	3.406.297	14	0.57	41,88	0,00
São Paulo	3.866.973	20	0.27	49,56	0,00	10.558.406	24	0.73	62,2	0,00
Paraná	1.249.641	20	0.34	37,38	0,00	4.432.583	30	1.22	59,8	0,00
Santa Catarina	732.546	11	0.32	35,43	0,00	2.461.542	22	1.08	57,39	0,00
Rio Grande do Sul	2.142.120	51	0.53	58,21	0,00	5.275.235	24	1.31	64,59	0,00
Mato Grosso do Sul	352.777	15	0.42	24,5	0,00	817.124	20	0.98	27,53	0,00
Mato Grosso	445.763	20	0.41	30,15	0,00	1.228.380	12	1.14	36,28	0,00
Goiás	597.709	15	0.28	31,44	0,00	2.076.724	15	0.97	39,37	0,00
Distrito Federal	122.097	30	0.13	19,1	0,00	507.170	80	0.56	36,3	0,00
Brazil	22.070.633	51	0.34	34,25	0,00	52.198.325	80	0.8	42,51	0,00

Source: PNS 2013.

Regarding the type of census situation, 14,629,322 cats were identified in urban areas, with a mean of 0.26 animals per household and a maximum of 30 animals per household in urban areas. In rural areas there are 7,441,311 cats, with a mean of 0.83 animals per household, and a maximum of 51 animals. Regarding dogs, 38,561,339 individuals were identified in urban areas, with a mean of 0.69 animals per household, and a

maximum of 80 animals, and of 13,636,986 dogs in rural areas, with a mean of 1.52 animals per household, and maximum of 30. Both the mean of dogs and of cats resulted in a significant difference between urban and rural areas in comparison test between means.

According to the household type and the number of animals present, the value of 21,361,787 cats in houses

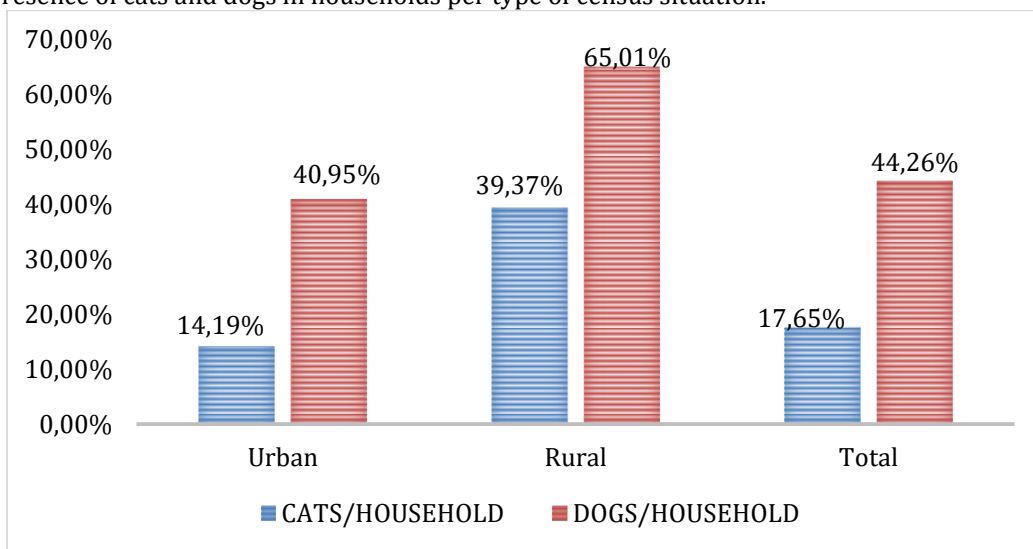
was estimated, with a mean of 0.37 animals per household and a maximum of 51, and 648,501 cats in apartments, with a mean of 0.08 and a maximum of 10. For dogs, 50,263,204 individuals were identified in houses, with a mean of 0.88 animals per household and a maximum of 80, and 1,819,865 dogs in an apartment with a mean of 0.24 and maximum of 21. Both the mean of dogs and that of cats resulted in a significant difference between houses and apartments in the analysis of variance test.

The presence of animals in households by state was evaluated, and from the data presented it can be concluded that in Brazil there are 65,195,293 households, of which 17.65% have cats and 44.26% have dogs. The states of PI (34.24), MA (31.02), and CE

(28.00), presented the highest proportions of households with cats, and DF (6.88), ES (11.07), and GO (12.53), had the smallest proportions. PR (60.08), RS (59.17), and RO (56.17), presented the highest proportions of households with dogs, whereas DF (32.30), PE (33.08), and AL (33.29), the smallest.

Figure 4 shows the presence of animals in the households, according to the type of census situation, and it is concluded that of the 56,219,947 households in urban areas, 14.19% have a cat and 40.95% have a dog, while of the 8,975,346 households in rural areas, 39.37% have a cat and 65.01% a dog. Both the presence of dogs and that of cats resulted in significant dependence between urban and rural areas in the independence test.

Figure 4 – Presence of cats and dogs in households per type of census situation.

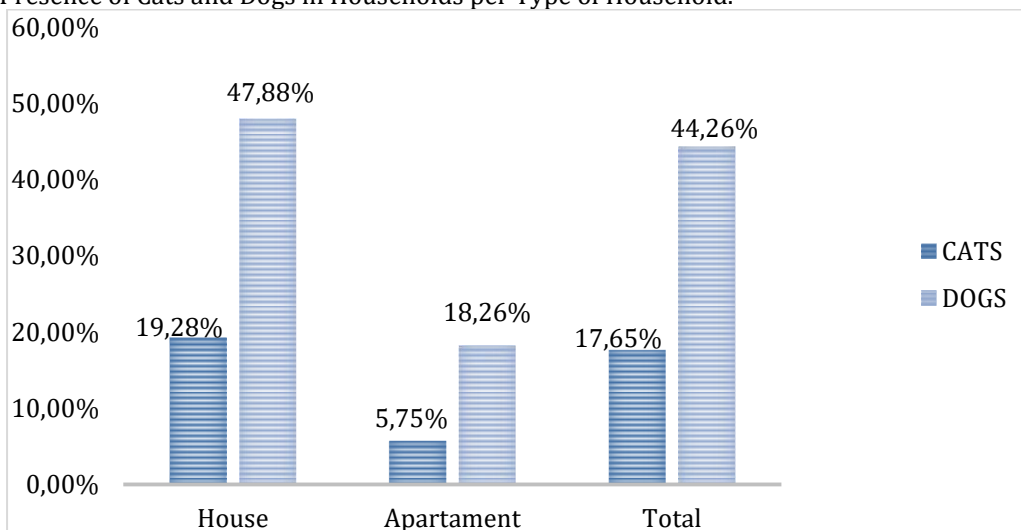


Source: PNS 2013.

Figure 5 refers to the presence of animals in households according to the type of household, where it was found that of the 57,200,907 houses, 19.28% have a cat and 47.88% have a dog, while of the 7,661, 161 apartments,

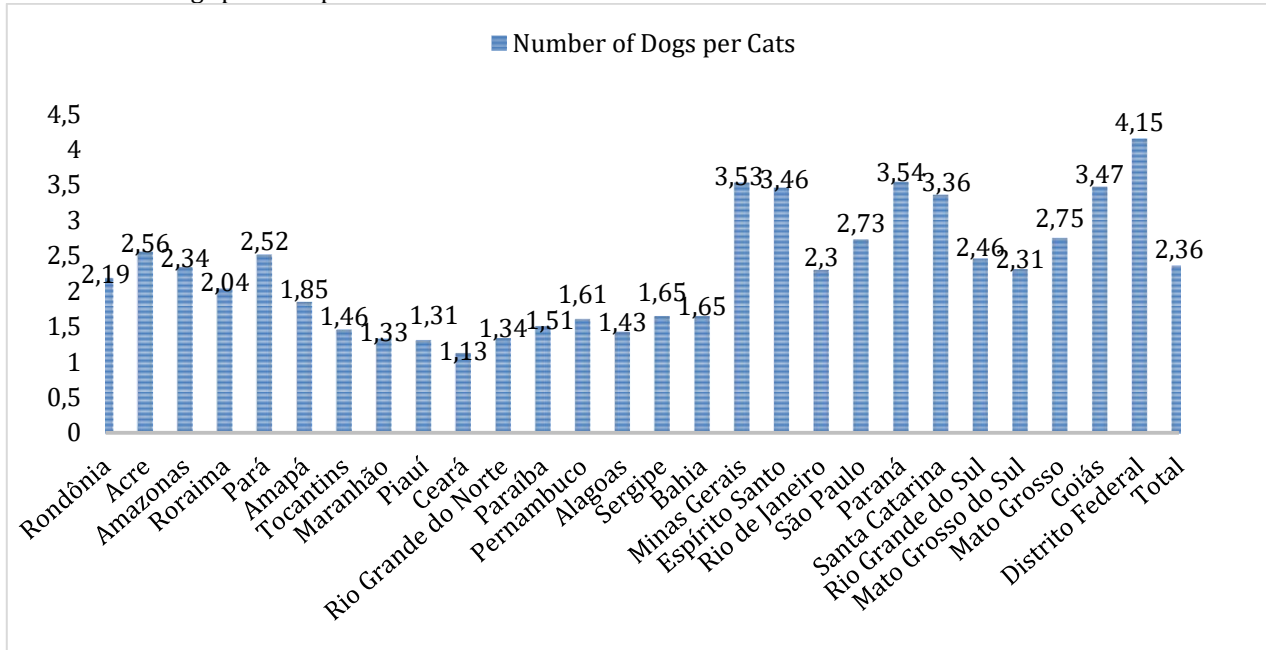
5.75% have a cat and 18.26% have a dog. Both the presence of dogs and cats resulted in significant dependence between houses and apartments in the independence test.

Figure 5 – Presence of Cats and Dogs in Households per Type of Household.



Source: PNS 2013.

Figure 6 – Mean of Dogs per Cats per UF.



Source: PNS 2013.

Considering the type of census situation, in urban areas there were 38,561,339 dogs and 14,629,322 cats, and a mean of 2.63 dogs per cat. In rural areas there were 13,198,325 dogs and 7,441,311 cats, with a mean of 1.83 dogs per cat. In the comparison test between means, the result was a significant difference between urban and rural areas. Considering the type of household, in houses there were 50,236,204 dogs, 21,361,787 cats, and a mean of 2.35 dogs per cat. In contrast, in apartments there were 1,819,865 dogs and 648,501 cats, with a mean of 2.80 dogs per cat. In the analysis of variance test the result was a significant difference between houses and apartments.

## DISCUSSION

From the microdata, there were estimated to be 22,070,633 cats and 52,198,324 dogs in Brazil, with a mean ratio of cat:person of 1:9.12, and dog:person of 1:3.85. The state of RS has the highest number of dogs per person (1:2.11) and the second largest number of cats per person (1:5.22), which justifies the actions that this state has been taking in the area of public policies for animals, such as the creation of a Special Secretariat for Animal Rights (SEDA) in the city of Porto Alegre in 2011, with the aim of reducing animal mistreatment, controlling the population growth of dogs and cats, significantly reducing the abandoned animal population, and promote responsible animal ownership (PORTO ALEGRE, 2011).

PR comes in second place in the mean ratio of dog:person (1:2.48), a high index that possibly contributed to the Municipality of Curitiba creating the Defense and Animal Protection Network, a program that involves several public agencies, private initiatives, and

the third sector in the search for better living conditions for the city's domestic animals (SILVA, 2009).

SP is the federal unit with the largest animal population, with 3,866,973 cats and 10,558,406 dogs. This substantial quantity is accompanied by cutting-edge actions, and SP currently has the most advanced animal protection legislation in the country, with a well-established birth control policy in several municipalities. In June 2018 a Policy and a State System for the Defense of Domestic Animals were created, with the objective of promoting joint action between the state and municipalities for the protection of domestic animals (SÃO PAULO, 2018). The municipality of São Paulo also has two public veterinary hospitals, fully financed with public resources (SÃO PAULO, 2009), a pioneer initiative that other states are also trying to implement.

Regarding the type of census situation, although in absolute numbers the population of cats and dogs is higher in urban areas (14,629,322 and 38,561,339) than in rural areas (7,441,311 and 13,636,986), it is observed that proportionally the concentration of cats and dogs per person is higher in rural areas (1:4.12 and 1:2.25) than in urban areas (1:11.67 and 1:4.43). This may be because public policies for animals, information on responsible ownership and castration campaigns are scarcer in rural areas.

The WHO estimates that, in emerging countries, the mean proportion of dogs varies from 1:10 to 1:6 of the human population (REICHMANN; PINTO; NUNES, 1999). When comparing the population estimate of dogs using the WHO methodology with the results found in this research, it is observed that in total, and in all the federal states, except for AL and RN, the number of dogs was higher than that indicated by WHO, demonstrating that

the population of dogs is markedly higher than expected, a fact relevant to health planning.

Other studies with other methods and in different localities had also identified these underestimated values, as described in the municipality of Taboão da Serra - SP, with a person:cat ratio of 30.57, and a person:dog ratio of 5.14 (DIAS et al., 2004); in the interior of São Paulo, with a ratio 16.4 for cats and 4.0 for dogs (ALVES et al., 2005); in the municipality of São Paulo, with 29.49 for cats and 7.28 for dogs (MAGNABOSCO, 2006) and 19.33 for cats and 4.34 for dogs (CANATTO et al., 2012); in Curitiba - PR, with 86.38 for cats and 13.05 for dogs (SERAFINI et al., 2008); in Cacoal - RO, with 11.2 for cats and 4.5 for dogs (BELO; SILVA, 2015); and in São José dos Pinhais - PR, with 15.32 for cats and 2.47 for dogs (CATAPAN et al., 2015).

An underestimation of the animal population may jeopardize vaccination programs for rabies and control of other zoonoses, since if the canine estimate is based solely on WHO criteria, the number of animals needed to be vaccinated may be underestimated and thus vaccination coverage lower than desired (DIAS et al., 2004), leading to a misunderstanding of the campaign results. More accurate population estimates, through a continuous census of domestic animals, would allow the animal population to be safely known and its changes tracked.

The results indicate a rate of 75.13% of dog vaccination, which is a satisfactory coverage according to WHO recommendations. The WHO has established the goal of at least 75% of the estimated canine population (REICHMANN; PINTO; NUNES, 1999). However, furthering this analysis by state, it is found that RO, AC, AM, RR, PA, AP, MA, PI, PE, BA, PR, SC, and RS did not reach the minimum required index. Note that this result includes practically the entire North Region, excluding TO, and the entire South Region, which is very worrying, since the south is also among the highest rates of dogs per household in the country. The DF was the only state with vaccine coverage rates above 75% for cats (75.28%) and for dogs (89.00%).

Regarding the type of census situation, it is observed that the vaccination coverage for rabies is higher for cats (65.99%) and dogs (81.21%) in urban areas, showing that the vaccination campaigns have not reached rural areas (cats 46.17% and dogs 57.96%) with the same efficiency, leaving these regions more vulnerable. An aggravating factor for the results found, is that in rural areas, dogs may be easier targets of rabies infection, transmitted by other domestic dogs, chiropterans, or other wild animals (REICHMANN; PINTO; NUNES, 1999), so these regions need intensified actions. Among the several causes of low vaccination coverage, the logistic difficulty of vaccine distribution is a fact that may explain the low results in the North Region and in rural areas. The DF has a small territory, crossed by several routes, which certainly contributed to the good indexes.

A more detailed analysis by species showed that although the overall canine index reached the target (75.13%), the overall feline coverage was only 59.31%, and in all states the feline coverage was also smaller than that of dogs. It can be inferred that owners find it more difficult to take their cats to the vaccination posts than their dogs. In addition, there is a culture that cats need less veterinary care, or their needs are less well known, and many live with less restriction of movement, making it difficult to locate and capture them (GARCIA, 2009).

Laboratory results regarding the diagnosis of rabies in the state of SP have prompted an increase in the percentage of positive cases in felines (ALVES et al., 2005), probably because rabies control measures are predominantly directed at dogs, rather than at cats and wild animals (REICHMANN; PINTO; NUNES, 1999). A more careful evaluation of the feline population is suggested, as well as its epidemiological importance in the transmission of rabies, and the vaccination of cats is recommended and necessary.

In the survey carried out by IBGE, there were estimated to be 65,195,293 households in Brazil, with 17.65% having a cat and 44.26% a dog. Specifically, in SP state, the results were 13.44% and 43.37%, respectively. Comparatively, other authors found similar results, such as Alves et al. (2005) in the interior of São Paulo, who evaluated 20,958 households and found that 12.6% had cats and 52.6% had dogs, similar to the results described by Canatto et al. (2012).

Of the households interviewed in the municipality of Pinhais (PR) by Martins and coworkers (2013), 90% had no cats and 62.43% had one or more dogs, while the percentages indicated by the IBGE data for Paraná were: 16.43% had cats and 60.08% dogs.

Of the seven states that have more than one dog per household, the three states from Southern Region, RS (1.31), PR (1.22), and SC (1.08), are included. In contrast, there is a tendency in the states of the Northeast Region to have a lower number of dogs per household, perhaps since the local culture of breeding animals without restriction of movement (semi-domiciled animals) is still strong, and this research is only about resident animals.

Rio Grande do Sul (RS) showed the highest concentration of dogs per household (1.31), while no state had more than one cat per household. It is generally noted that there is still a great capacity for Brazilian households to absorb animals, especially felines, a factor that encourages adoption campaigns.

On the other hand, the high number of animals found in a single household is noteworthy. Within the states, the variation is from 11 to 51 cats and from 7 to 80 dogs, with 51 cats in one house in a rural area in RS, and 80 dogs in one house in an urban area in the Federal District (DF). In apartments a maximum of 10 cats and 21 dogs were found. The promotion of well-being in conditions of high agglomeration of animals is not feasible, and the



health of the residents can also be compromised (TEIXEIRA; SILVA; SOARES, 2016). It is important that public managers be aware of and have mapped cases of animal hoarding in their region, so that these residents and animals can be adequately assisted (FILHO et al., 2013).

In the same way that the number of animals per person was higher in rural areas, the result is repeated for the mean number of animals per household, with 0.26 cats and 0.69 dogs per household in urban areas and 0.83 cats and 1.52 dogs in rural areas. The data also indicate that 39.37% of households in rural areas have a cat and 65.01% have a dog, whereas this percentage is lower for urban areas: from 14.19% (cats) and 40.95% (dogs). As already pointed out, possibly in rural areas, public policies for animals, information on responsible ownership and castration campaigns are scarcer. It is also noted that in urban areas most households have no dogs (59.05%), while in rural areas most households have dogs (65.01%). The same pattern is not observed for cats, where most households in both urban (85.81%) and rural (60.63%) have no cats. As to the type of household, the presence of animals in houses is more common, where the mean was 0.37 cats and 0.88 dogs per household, corroborating the view of Serafini et al. (2008) in a study carried out in Curitiba (PR). In apartments the mean was lower, presenting 0.08 for cats and 0.24 for dogs.

Concerning the presence of animals in apartments, only 5.75% had a cat and 18.26% a dog, but in houses, 19.28% had a cat and 47.88% a dog. The differences in the number of dogs and cats in neighborhoods with a predominance of apartments or houses, emphasizes the importance of taking into account this information for population control and vaccination programs (SERAFINI et al., 2008).

The expansion and enrichment of cities, and demographic changes are expected to rapidly increase the number of felines in many countries. In the United States, France, and Germany, the population of cats is already larger than that of dogs. This is because dogs are better adapted to conditions which are becoming scarcer, with spacious homes, large families, and time available for the care that the species demands. On the other hand, cats do their own cleaning, use sandboxes, and adapt well to apartments, as they take advantage of vertical space. This indicator of progress based on the domestic feline population is called the *Big Cat*, alluding to the Big Mac index, which measures the valuation of each country's currencies (TEIXEIRA, 2013). But, Brazil presented a proportion of dogs to cats of 2.36 and in all states the preference was still for dogs. The DF ranked first in the mean ratio of dog:cat (4.15), followed by PR (3.54), and MG (3.53). On the other hand, CE state showed the lowest preference for dogs, obtaining a result of 1.13, followed by PI (1.31), and MA (1.33).

Concerning the type of census situation, urban areas had a higher number of dogs (2.63) than the number of cats,

compared to rural areas (1.83), which can be explained by the fact that the dog is still the companion animal of choice of large urban centers. The preference for dogs was higher in apartments (2.80) than in houses (2.35), similar to that described by Biondo; Martins; Ferreira (2014) (Houses 6.82:1 and apartments 6.61:1), emphasizing that the household verticalization of urban areas in Brazil, despite the common belief and pattern of change in other countries, did not affect owners' preference for dogs compared to cats.

It is important to emphasize that the PNS was not designed to achieve the objectives of this research, and may generate some limitations, however this does not disqualify the results obtained.

## CONCLUSION

The methodology proposed by the WHO to estimate the animal population of developing countries presents smaller population numbers in comparison to the IBGE data, since it was found that the ratio between number of animals and people cannot be applied equally to all states, nor does it equate dogs and cats in this proportion. The national rabies vaccination coverage of dogs does not meet the minimum recommended by WHO, in some states and in rural areas.

Rural areas have larger numbers of cats and dogs per person and per household, just as the concentration of animals in the cities is higher in neighborhoods of houses, than in neighborhoods where apartments predominate. Even with one of the largest populations of domestic animals in the world, few states averaged more than one dog per household, and in no case was there an average of more than one cat per household, thus making it possible for households to absorb animals, a situation that favors the adoption campaigns of animals. Finally, the dog is the companion animal of choice of Brazilians.

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