SHORT COMMUNICATION

Litter size variation in Polish selected small dog breeds

Małgorzata Goleman, Mirosław Karpinski, Piotr Czyżowski, Leszek Drozd
Department of Companion and Wildlife Animals, University of Life Sciences, Lublin, Poland

Abstract

In breeders’ general opinion small breed females produce less numerous litters. The aim of the study was to analyse the litter size and the frequency of the gender ratio in selected small dog breeds in view of their popularity in Poland. The data set comprised information on 639 litters (in total 2578 puppies) of eight breeds, which were born between January 2003 and December 2014. The results were statistically analysed using statistical program SPSS 20.0. Medium-size litters were observed in the analysed small dog breeds (4.03±0.1). Comparison of the selected breeds of the Fédération Cynologique Internationale (FCI) Groups showed that the mean litter size in Group IX was higher (4.36±0.08) than that in Group III (3.87±0.14) and the differences were statistically significant. The study has confirmed the hypothesis that larger females produce more numerous litters, but there are large intra-individual variations in the number of pups born in individual breeds. Additionally, the gender ratio in the puppies born in the analysed breeds was equal, despite the fluctuations in the individual breeds.

Materials and methods

The study material contained data on reproduction of small dog breeds derived from the breeding documentation of the Lublin Branch of the Polish Kennel Club and observations made in chosen breeding farms. Breeds in which adult body weight reaches up to 10 kg and the height at the withers up to 35 cm were classified as small breeds. These measures are exactly defined by breed standards. Breeds from two FCI Groups (Fédération Cynologique Internationale, www.fcigr.be) were taken into account. From Group III: Terriers, we chose: Cairn Terrier (body weight according to the FCI standard: 6–7.5 kg, the height at the withers: 28-31 cm), Jack Russell Terrier (5-6 kg; 25-30 cm), West Highland White Terrier (6-8 kg; about 28 cm), and Yorkshire Terrier (up to 3.2 kg; 22-24 cm) were chosen. From Group IX: Companion and Toy Dogs we chose: French Bulldog (8-14 kg; 25-35 cm), Cavalier King Charles Spaniel (5-8 kg; 25-32 cm), Havanese (3.5-6 kg; 23-27 cm), and Shi Tzu (4.5-8 kg; to 27 cm) (Fci.be) were selected. The criteria for the choice of the breeds was their popularity and delivery of at least 12 litters during the investigation period. Hence, the French Bulldog was included in the research group. French Bulldogs are classified as small dogs due to their low height, despite the fact that the maximum body weight of males can reach up to 14 kg. The selected breeds are the most numerous in the Lublin Branch of the Polish Kennel Club. The data for the Havanese and Jack Russell Terrier breeds were combined with observations carried out in the chosen breeding farms, registered in other Branches of the Polish Kennel Club. The data set comprised information on 639 litters (in total 2578 puppies) of eight breeds that were born between January 2003 and the end of December 2014. In the study, the number of puppies born live and reared up to 7 weeks of age was regarded as a litter size due to incomplete data available about stillborn puppies and mortality rates from birth to the litter audit, during which the breeder has to present puppies between 6 and 12 weeks of age (Regulamin Hodowli Psów Rasowych, 2014).

The results were statistically analysed using statistical program SPSS 20.0. The frequency of the gender ratio in the born puppies was analysed. The significance of differences between average litter sizes in individual breeds was calculated using one-way analysis of variance (ANOVA) and Tukey’s post-hoc HSD test. In order to compare the average litter size, the differences were statistically significant. The study has confirmed the hypothesis that larger females produce more numerous litters, but there are large intra-individual variations in the number of pups born in individual breeds. Additionally, the gender ratio in the puppies born in the analysed breeds was equal, despite the fluctuations in the individual breeds.

Keywords: Canine; Reproduction; Litter size; Prolificacy; Small dog breeds.

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Corresponding author: Dr Małgorzata Goleman, Department of Companion and Wildlife Animals, University of Life Sciences, Akademicka 13, 20-950 Lublin, Poland. Tel. +48.81.4456889. E-mail: malgorzata.goleman@up.lublin.pl

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ter size in two FCI Groups (III and IX), Student's t-test was used. Levene's test was used to validate the hypothesis of the homogeneity of variance.

**Results and discussion**

The number of dogs registered in the Polish Pedigree Book of the Polish Kennel Club and the number of stud dogs in our country prove the popularity of a breed. These data are updated at the beginning of each year. To serve as a breeding animal, the dog must fulfill specific breeding requirements. Therefore, stud dogs in each breed represent around 40-50% of the population of registered dogs.

In female dogs, the litter size depends on the breed and dog size, with a tendency to have smaller litters by small breeds (Johnson, 2008; Scantlebury, 2000). Analysis of the average litter size in the eight examined breeds revealed the largest average number of pups per litter in the Cairn Terrier breed (6.61±0.4) and the lowest in the West Highland White Terrier (3.57±0.4) and the Yorkshire Terrier (3.57±0.1). These differences were statistically significant [F (7; 632) = 16.858; P<0.01; r² = 0.157 (Table 1)]. The largest variations were noted in the average litter size in the breeds of the same FCI Group (Terriers). Comparison of the selected breeds of the FCI Groups performed with Levene's test showed that the mean litter size in Group IX (4.36±0.08) was higher than that in Group III (3.87±0.14) and the differences were statistically significant [t (637)=2.935; P<0.05].

Due to the absence of data on mothers’ weight in each breed, it was not possible to examine the statistical correlation between the litter size and female body weight. However, taking into account the maximum body weight specified in the breed standards of the analysed breeds, dogs in FCI Group III scored an average body weight of 6.2 kg and those in Group IX - 9 kg. This confirms the hypothesis that there is a relationship between mother’s body weight and the litter size.

Analysis of the pup gender ratio in the selected breeds showed the highest frequency of males (55.5%) in Cairn Terriers; similar frequency was reported in West Highland White Terriers (53.57%), Jack Russell Terriers (52.42%), and Shi Tzu (52.26%).

**Table 1. Number of born litters and raised puppies in the selected small dog breeds in 2003-2014.**

| FCI group | Dog breed                      | n  | Male | Female | Number of litters | M       | SE  | Range |
|-----------|--------------------------------|----|------|--------|-------------------|---------|-----|-------|
| III       | Cairn Terrier                  | 218| 121  | 97     | 33                | 6.61    | 0.4 | 1-11  |
| III       | Jack Russell Terrier           | 269| 141  | 128    | 66                | 4.08*   | 0.2 | 1-7   |
| III       | West Highland White Terrier    | 56 | 30   | 26     | 16                | 3.5*    | 0.4 | 1-6   |
| III       | Yorkshire Terrier             | 1137| 547 | 590    | 318               | 3.58**  | 0.1 | 1-8   |
| IX        | French Bulldog                | 375| 191  | 184    | 90                | 4.17*   | 0.2 | 1-10  |
| IX        | Cavalier King Charles Spaniel | 97 | 41   | 56     | 25                | 3.88*   | 0.4 | 1-7   |
| IX        | Havanese                      | 72 | 34   | 38     | 13                | 5.54**  | 0.4 | 3-8   |
| IX        | Shi Tzu                       | 354| 185  | 169    | 78                | 4.54**  | 0.2 | 1-8   |
| Total     |                                | 2578| 1290| 1288   | 639               | 4.03**  | 0.1 | 1-11  |

FCI, Fédération Cynologique Internationale. **Different letters denote significant differences in pairs (Tukey's post-hoc test); groups marked with different letters differ significantly (P<0.05).**
Among born pups, the frequency of males in our study was 50.04% and this was consistent with the studies conducted by Tedor and Reif (1978) on different dog breeds, where 50.6% of born males were reported. Similarly, the gender proportions in Dogo Argentino puppies reached 50.8% of born males (Caffaratti et al., 2013) and 50.5% in the Drever breed (Bobic Gavrilovic et al., 2008).

Conclusions

The study has confirmed the hypothesis that larger females produce more numerous litters, but there are large intra-individual variations in the number of pups born in individual breeds.

Medium-size litters were observed in the analysed small dog breeds, which undermines the general opinion of the poor economic aspect of breeding thereof. Additionally, the gender ratio in puppies born in the analysed breeds was equal, despite the fluctuations in the individual breeds. The Cairn Terrier exhibited highest prolificacy. The highest average litter size and the highest maximum number of pups were reported in this breed (in 11 litters, 8 or more pups were born, including 11 pups born in two litters).

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