

Reference growth curves established by breed in dog from birth to two months of age

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Since birth, a close follow-up of puppies' growth allows to identify individuals with abnormal growth, in human infants (1), as well as in puppies (2). Abnormal growth witnesses the presence of another trouble (nutritional deficit, infection, parasitism) and the affected animals are known to be at increased risk of morbidity or mortality (2, 3). Growth reference curves are thus a simple and easy-to-use tool for health management of young animals. Despite this huge practical interest, such curves are to date not available for puppies during the time they are raised by their breeder, i.e. from birth to the age of two months. Moreover, the huge size variability among canine breeds makes it necessary to refer to breed specific data. The objective of the present work was to establish these growth reference curves per canine breeds. Purebred puppies were weighed at home by the breeders (with various scales) and data transmitted retrospectively on a voluntary basis and entered into an Excel file. Only puppies declared alive at two months of age were included into the analysis. Breeds were classified according to the adult body weight as small (<10kg), medium (10-25kg), large (25-45kg) or giant (>45kg). Growth reference curves between birth and the age of 60 days were built for the total population (all breeds), per size and per breed. First, a box-and-whisker plot (JMP software) allowed to describe the weight at 14 different dates (birth = D0, D1, D2, D4, D7, D10, D14, D21, D28, D35, D42, D49, D56, D60). Then, the corresponding continue non-smoothed curve was drawn (Excel). On each graph, 13 parameters were represented: the median, the two quartiles, the eight remaining deciles and centiles 5 and 95. To increase readability, growth has been represented by three different graphs, one depicting early neonatal period (0-2 days), one for the whole neonatal period (0-21 days) and another covering the birth to 2 months of age. Finally, each curve was smoothed and the growth modeled by a second degree polynomial equation. **Results:** In total, 3912 puppies from 669 litters were included. They represented 17 different breeds: Cocker, Basset Hound, Australian shepherd, Golden Retriever, Labrador Retriever, Bernese mountain dog, Bichon maltese, West Highland White Terrier, Lhasa Apso, Shih Tzu, Coton de Tulear, Cavalier King Charles spaniel, Dachshund, German shepherd, Yorkshire Terrier, Rottweiler and French Bulldog. The number of puppies included were from 136 to 512 per breed (median: 204). The kennel of origin was known for 91.8% of puppies and 29 kennels are represented. The studied population included 1919 females and 1902 males (sex ratio: 1). Growth pattern observed in the total population (all breeds) differed from that observed for the various sizes. Similarly, growth curves were different between breeds of the same size for a given period. During the early neonatal period, growth curve is linear (Yorkshire Terrier) or exponential (Cocker). Over the 0-21 days and 0-2 months periods, growth patterns are also different according to the breed: linear (Lhasa Apso), exponential (Basset Hound) or logarithmic (Bichon maltese). This work describes the physiological neonatal/pediatric growth in dogs. It provides practical tools to breeders of 17 breeds for puppies follow-up, as performed in infants (1). Deviant growth is a warning for breeders, indicating which animals have to benefit from a closer examination and specific nursing.

(1) WHO, *WHO child growth standards: methods and development*. Geneva: WHO Press, 2006.

(2) H. Mila, A. Grellet, A. Feugier, et S. Chastant-Maillard. Differential impact of birth weight and early growth on neonatal mortality in puppies. *J. Anim. Sci.* 2015;93(9): 4436.

(3) D. F. Lawler. Neonatal and pediatric care of the puppy and kitten. *Theriogenology*. 2008;70(3),384-392.



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