in other breeds[5]. Moreover, we observed a significant difference between pregnant and non pregnant bitches from 30 days post-ovulation. It could be interesting to confirm this tendency and to determine a more precise threshold with an even larger sample of bitches.

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# 016 | Low birth weight as a risk factor for kitten mortality: determination of breed-specific thresholds

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Introduction and aim: Identification of factors involved in kitten mortality is essential to improve their chances of survival. In canine species, low birth weight has been identified as an important risk factor for neonatal mortality (1). The objectives of this study were to evaluate the impact of birth weight on kitten mortality between birth and two months of age and to determine by breed, the critical thresholds of birth weight defining kittens at higher risk of death during this period.

Materials and methods: Weight, litter size, sex of kittens and date of parturition have been recorded by breeders and retrospectively collected on a voluntary basis. Only kittens from French catteries, with known birth weight and known status at two months (dead or alive) were included. First, generalized mixed models were fitted to determine factors affecting mortality during two different periods: 0-2 days and 2 days–2 months. The fixed-effects introduced in the models were: birth weight, litter size (total number of kittens born alive), litter heterogeneity (within-litter variation of birth weight, expressed as the coefficient of variation CV, ratio of the standard deviation to the mean), season of parturition and early growth rate (calculated, using the formula [(weight at 2 days – weight at birth) ÷ weight at birth × 100]; only for the period 2 days–2 months). Cattery and queen were introduced as random effects to deal with the non-independence of kittens sharing the same cattery and the same mother. Receiver operating characteristic (ROC) curves were used to identify optimal cut-off values for birth weight regarding mortality during the first two months of life specifically for each breed included. Areas under the ROC curves were calculated to estimate the ability of birth weight to discriminate between kittens of different status, i.e. dead or alive at two months of life.

Results: A total of 4152 live-born kittens from 13 breeds, 1106 litters and 136 French catteries were included. Sex ratio was 1.2 (1795 males to 1560 females). A total of 6.8% (95% confidence interval, 95% CI: 6–7.7) of live-born kittens died during the first two months after birth with significant variations between breeds (from 0% in Ragdoll to 15% in Russian Blue). From all parameters evaluated between 0-2 days, only birth weight was associated with mortality (p < 0.001). Mortality was significantly higher in kittens with birth weight lower than the first quartile: 14.2% (95%CI: 12.3–16.6) vs. 4.4% (3.6–5.2). Mortality between 2 days and 2 months of life was influenced by birth weight and early growth rate (both p < 0.001). During this period, mortality was significantly higher in kittens with birth weight lower than the first quartile: 8% (95%CI: 6.3–10) vs. 3% (95%CI: 2.4–3.7). Kittens with low birth weight and poor early growth rate (both parameters lower than the first quartile) were at higher risk of death between 2 days and 2 months after birth compared to kittens from other categories: mortality rate at 13.3% (95%CI: 9–18.7) and 3.8% (95%CI: 3.1–4.6). Birth weight critical thresholds have been established in 7 breeds (for which AUC ≥ 0.7): Abyssinian/Somali, 95 g; British group, 103 g; Chartreux, 107 g; Egyptian Mau, 85 g; Maine Coon, 120 g; Oriental group, 77 g; Russian Blue, 95 g. Interestingly, two breeds can have a similar birth weight distribution but significantly different critical thresholds (Oriental group vs. Abyssinian/Somali for example).

Conclusions: Birth weight critical thresholds, established in 7 breeds, would allow the identification of kittens with higher risk of mortality in order to provide them with appropriate nursing and medical care.
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# 017 | Impact of neonatal and adult factors on body condition of Labrador dogs

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Introduction and aim: Overweight, affecting 20–40% of the general canine population, is a growing global health concern since it promotes the development of numerous other diseases and decreases quality of life together with life span (1). Numerous risk factors for obesity have been described in the literature including genetics, sexual status, the amount of physical activity and the diet type (2). In human, several studies highlight the importance of the early-life environment in the development of adulthood overweight (3). The aim of this study was to analyse the association between neonatal

factors and overweight at adulthood in a population of pure breed Labradors.

**Materials and methods:** The data collection was conducted on dogs born within the same French breeding kennel (CESECAH, Lezoux, France). For each dog, information about neonatal period (birth weight, growth rate between birth and Day 2 and between Day 2 and Day 21) was recorded throughout a questionnaire. General information about dogs (sex, age, sterilization status, "Food motivation" score (4) ...), their life style (age of owner, walking duration per day...) was also recorded. Body condition score (BCS) was evaluated using the 9-point scale (5). After univariate analyses, only parameters with p-value lower than 0.20 or parameters with biological relevance were kept for multivariate analysis model, i.e. sterilisation (Yes/No), age of owner, "Food motivation" score, birth weight and growth rates (between birth and Day 2 and between Day 2 and Day 21). A generalized linear model was then fitted to determine factors affecting overweight (BCS > 6).

**Results:** A total of 85 Labradors (20 males and 65 females) raised under similar environmental conditions until two months of age were included in the present study. Dogs were from 6 months to 13 years of age (median: 3.8 years). The overall prevalence of overweight (BCS > 6) was 44% (95% confidence interval, 95% CI: 32–56). The main risk factor was the neutering (p = 0.009; relative risk RR: 3.5, CI: 1.8–7.1). For neutered dogs (males and females, n = 28), growth rate between 2 and 21 days was significantly associated with overweight (p < 0.001). Birth weight and "Food motivation" score tended to be significant (p = 0.079 and 0.074 respectively). Neutered dogs with a 2–21 days growth rate over 248% or a birth weight under 415 grams were at higher risk of overweight at adulthood than others (RR: 2.1, CI: 1.1–4.3 and RR: 1.7, CI: 0.8–3.8, respectively). A "Food motivation" score in the lowest values (low food-motivation) increased the risk of overweight.

**Conclusions:** These results suggest an influence of neonatal factors on the risk of overweight in addition to adult factors. Low birth weight puppies with high 2–21 days growth rate could be more susceptible to become overweight. More studies are needed to explore this relationship, to identify early-life predictive factors for canine overweight and obesity and to quantify the relative impact of early risk factors and environmental factors. These findings should help to reduce the current high prevalence of overweight and thus to improve health and welfare of companion dogs throughout an early management of puppies (from birth).

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## 018 | Kitten growth from birth to two months of age: breed-specific curves

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**Introduction and aim:** Weight-for-age charts are commonly used to evaluate pediatric development of infants (1). Deviation from a "normal" trajectory is associated with an increased risk of morbidity and mortality (2). Effective growth monitoring, a simple and easy-to-use tool for health management, requires accurate plotting on appropriate charts. Such curves are to date not available for kittens during the period they are raised by their breeder, i.e. from birth to the age of two months. The purpose of the present study was to draw reference growth curves in the feline species. Due to body-weight variability between feline breeds, data were plotted by breed.

**Materials and methods:** Purebred kittens were weighed by breeders from birth to two months of age (with various scales) and data were transmitted retrospectively on a voluntary basis and entered into an Excel file. Only kittens born in French catteries and declared alive at two months of age were included into the analysis. First, growth was described through seven parameters: weight at birth (D0), at D2, at D21 and at D60 and growth rates calculated between D0 and D2, between D2 and D21 and between D21 and D60. These seven parameters were compared between breed using the Kruskal-Wallis test and the Wilcoxon signed rank-test with Bonferroni correction. Then, breed-specific reference growth curves were drawn in two steps. First, box-and-whisker plots allowed to describe the weight at 14 different dates (D0, D1, D2, D4, D7, D10, D14, D21, D28, D35, D42, D49, D56, D60). Then, the weight values were fitted by a second-degree polynomial function, giving smoothed growth curves. On each graph, 13 parameters were represented: the median, the two quartiles, the eight remaining deciles and centiles 5 and 95.

**Results:** In total, 3639 kittens from 1010 litters were included. Twelve different breeds were represented: Abyssinian/Somali, Bengal, Birman, British group, Chartreux, Egyptian Mau, Maine Coon, Norwegian Forest, Oriental group, Persian group, Ragdoll and Siberian. The number of kittens included ranged from 101 to 640 per breed (median: 162). The number of litters per breed ranged from 27 to 199 (median: 60). The cattery of origin was known for 94% of kittens and 130 catteries were represented. The studied population included 1419 females and 1640 males (sex ratio: 1.2; 580 kittens with unknown sex). A significant breed effect was evidenced on all growth parameters (p-value < 0.001: birth weight ranged from 87 g (mean in Abyssinian/Somali) to 119 g (Maine Coon); weight at D60 ranged from 853 g (Oriental group) to 1174 g (Maine Coon); growth rate between D0 and D2 ranged from 16% (Birman) to 30% (Abyssinian/Somali); growth rate between D2 and D21

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