ABSTRACTS

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Multivariable statistical analysis of reproductive performance in the bitch

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OBJECTIVES AND METHODS: Most studies describing the reproductive performance of canids have evaluated factors which vary at a single level (univariate analysis) (1, 2, 3). Univariate analysis does not take into account the fact that some variables influencing reproductive performance are related to each other, nor does it determine which exposure variables are the most significant predictors of reproductive performance. Given that many independent variables can contribute to reproductive performance, multivariable analyses are required to determine the relative contribution of each on the outcome of interest (4). The aim of this prospective cohort study was to determine the factors that significantly affect reproductive performance as measured by whelping rate, litter size and gestation length in the bitch. We also examined the relationship between progesterone concentrations, predicted time of ovulation, and timing of AI in relation to whelping rate and litter size.

A total of 441 individual bitches representing 84 different breeds contributed 545 oestrous cycles over the 4 year (2007-2011) study period. Bitches were inseminated with either frozen-thawed (n=252), chilled (n= 10) or fresh (n=275) semen from 387 different males. The mean age of bitches at the time of AI was 4.02 years with a range of 7.9 mo - 10 y. Frozen-thawed semen was deposited into the uterus using either a surgical approach (n=53) or endoscopic trans-cervical technique (TCI, n=443) and fresh or chilled semen into the vagina (n=30), or the uterus using TCI. All semen was evaluated immediately prior to AI for morphology and motility at 37°C using light microscopy. Timing of AI was based on oestrous behaviour, vaginal cytology, vaginoscopy and serum progesterone concentrations. Statistical analysis was performed using R Version 2.13.0 (2011, http://www.r-project.org). The independent variables included in each multivariable model were: semen type (fresh, frozen), sperm motility, type of AI (surgical, TCI, vaginal), number of AIs per cycle, bitch age, bitch breed, season and day of AI in relation to LH0.

RESULTS: The mean (SD) whelping rate was 74.4 ± 4.4% and the mean litter size was 5.7 ± 3.3 pups per litter for all bitches in the study. The results of the multivariable analysis revealed that the only significant predictors of whelping rate were a) breed of bitch, b) semen motility and c) day of AI relative to LH0. Greyhounds and Labradors demonstrated a significantly higher whelping rate (88.4%) compared with all other breeds (71.3%, P<0.01). Semen that was classified as having poor motility (<30%) resulted in a lower whelping rate (37%; P<0.01) than semen classified as good (30-65%; whelping rate = 72%) or excellent (>65%; whelping rate = 78.2%). Inseminations performed on day LH+7 resulted in a lower whelping rate (Fig 1, P<0.05) than inseminations performed on LH+2 to LH+6.

The only significant predictor of litter size was breed of the bitch (P<0.01); smaller breeds had significantly smaller litters (4.3 ± 2.2 pups) than medium (5.5 ± 3.4 pups), large (5.6 ± 3.1 pups) or giant (6.6 ± 3.9 pups) breeds.

CONCLUSIONS: Using appropriate statistical techniques we have identified the most significant predictors of reproductive performance in this population. Whelping rate was significantly affected by the breed of the bitch, semen motility and the day of AI in relation to LH0. Whilst some anecdotal evidence suggests that Greyhounds are more fertile than other breeds, we are the first to show a significant effect of breed on fertility. The findings of this study indicate that sperm motility is a useful predictor of whelping rate and that sperm motility less than 30% is associated with a lower whelping rate. The timing of AI in relation to LH0 was also a significant factor with “late” inseminations (7d after LH0) resulting in a reduced whelping rate. In agreement with previous studies we showed that the most significant factor influencing litter size was the size of the bitch. This is the first study to show that gestation length was significantly longer in Greyhound bitches. In addition, increasing bitch age significantly increased gestation length and increasing litter size reduced gestation length. The progesterone profiles of 545 oestrous cycles revealed that there was very little variation in progesterone concentrations from LH -6 to LH+5. The standard error increased after LH+5 indicating wider variation in progesterone concentrations after this time. This study provides important clinical information to optimise whelping rates, litter size and prediction of whelping in certain breeds for clinicians working in canine reproduction.

Progesterone profile relative to LH 0
(n = 545 oestrous cycles)