NeoCare
Néonatologie des Carnivores
Reproduction et Elevage

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INVITATION

Hungarian Small Animal Veterinary Association (HSAVA),

and

Federation of European Companion Animal Veterinary Associations (FECAVA)

invite you to the

40. National Congress of HSAVA és FECAVA

08-10th March, 2019
University of Veterinary Medicine, Budapest

DAM MANAGEMENT TO LIMIT NEONATAL MORTALITY (AND REPRODUCTION OPTIMISATION)

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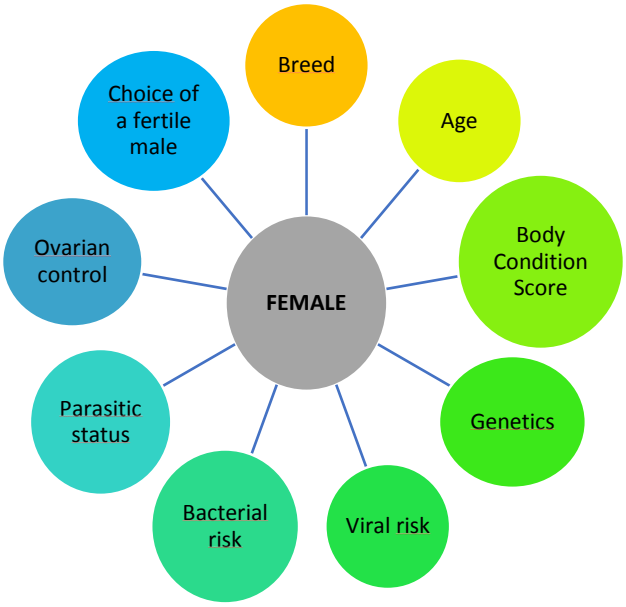
The success of a mating or an insemination is often considered as a positive pregnancy diagnosis. Nevertheless, the final goal for the breeder (or the private owner) of the dam is to obtain the highest possible number of puppies/kittens alive at weaning (or selling). Several steps are critical: obtaining estrus, fertilization, embryo and fetal survival, appropriate management of parturition to limit stillbirth and then control of neonatal and pediatric mortality. Optimization of reproductive performances thus begins as early as before estrus and deals not only with genital tract but also with immunity, genetics and nutrition.

BEFORE MATING



Age of the female: in cats, the age of the queen has no influence on reproductive performances, neither on queening rate, nor on prolificacy (nb kittens/litter). In dogs, the optimal age for breeding is 2-6 years in females (in younger and older dams, both whelping rate and prolificacy are decreased). National regulations (by laws or instructions from kennel clubs) may introduce additional restrictions on the age at breeding, the number of litters over the whole life, or the number of litters delivered by C section (2 for the Kennel Club in Great Britain) or the rhythm of whelpings (3 maximum over 2 years in France for example).

Choice of the breed (from a veterinary perspective, breed is most of the time not a choice !) (cats) Bengal, Exotic Shorthair and Persian have the lowest whelping rates whereas Birman, British Shorthair and Ragdoll show the highest ones (see Fournier et al 2017 for detailed values). In dogs, giant breeds have significantly lower whelping rates (77% vs 83.4% for medium size breeds).

Body Condition Score: overweight bitches at mating have increased proportions of low birth weight puppies and higher prevalence of neonatal mortality (18% vs 5% for bitches in lean/ideal condition; Mila et al 2016). In queens, kitten mortality is also markedly increased when the females are overweight at mating (Lawler et Monti 1984). It is thus important to control BCS during weeks preceding the scheduled mating to adapt the diet if necessary in order for the female to be in ideal BCS at the time of mating.

Genetic quality: the female should be genotyped or at least specific mutations identified in the breed should be diagnosed (PCR on buccal cytobrush sample). Genetic diversity (heterozygosity) can now be evaluated. In queens, blood group has to be determined since it has implications on the choice of the tomcat (in case of group B female, B males have to be preferred in order to avoid isoerythrolysis in the neonates).

Sanitary status:

- Viral status: Viruses with reproductive deleterious consequences (pregnancy loss or neonatal diseases) are in dogs CHV1 (herpes) and less importantly BTV (Bluetongue) or CPV1 (canine minute virus = canine parvovirus type 1); in cats FPV (panleukopenia), FCV (calicivirus), FIV and FeLV (immunodeficiency) and FeHV (herpesvirus) (Table 1).

Table 1: Viruses associated with reproductive/neonatal disturbances

QUEENS		**BITCHES**	
Panleukopenia FPV	Infertility Pregnancy loss Mummification Abnormality of Central Nervous System	**Canid Herpesvirus 1 CHV1**	Neonatal mortality Neurological signs abortion Vesicles on genital organs
Calicivirus FCV	Respiratory disease Fever in kittens	**Bluetongue virus (BTV)**	Abortion Death of the late pregnant bitch
Leucemia FeLV	Pregnancy loss Stillbirth Neonatal death Fading kittens	**Canine parvovirus type 1 CPV1 or CnMV** (Minute virus)	Neonatal mortality Embryonic resorption Abortion Stillbirth Weak pups Birth deformities
Immunodeficiency FIV	Infertility Abortion Stillbirth Low birth weight Kitten viremia		
Herpesvirus FeHV-1	Neonatal death		

Vaccination (for those agents against which a vaccine is available, such as CHV1, FPV, FCV, FeHV) is to be performed close before estrus/mating in order to reach high protection levels during pregnancy, and after parturition, high specific antibodies titers in colostrum for newborn protection. For others, quarantine and repeated serological control allow to limit the risk for contamination or spread within the kennel/cattery.

- Bacterial risk: In bitches, *Leptospira, Listeria, Campylobacter, Salmonella, Brucella* are responsible for pregnancy loss and stillbirth. *Coxiella burnettii* is also suspected. Attention is to be paid to raw meat diets (BARF), especially to the origin of meats/bones and to the conditions of preservation. The reported frequency of contamination by *Salmonella, Campylobacter* and the parasite *Toxoplasma gondii* is high (21-48%).
- Parasitism: Are at risk for reproduction *Toxocara canis/cati, Ankylostoma infantum, Leishmania infantum* and *Neospora caninum*. In order to prevent the transplacental and lactogenic contamination of fetuses and newborns, dams are vermifugated with drugs targeting *Toxocara* at mating, and later around 42 days of pregnancy.

Ovarian activity:

- Environmental factors potentially inhibiting the ovarian cyclicity are to be avoided such as stress associated to frequent exhibitions, hunting, races, high animal density, presence of a dominant female.
- Ovarian activity can be controlled by estrus induction (mainly in bitches) and estrus postponement (in bitches and queens).
    - Estrus induction: deslorelin subcutaneous implant (4.7 mg in bitches and queens) or cabergolin per os (5 microg/kg per os until the onset of prooestrus; in bitches only)
- Estrus postponement: progestagens are contra-indicated in breeding dams. Deslorelin implants allow to postpone estrus by a mean of 14 months in bitches and 23 months in queens but with a huge non predictable interindividual variability (up to 3 years). Owners have to be informed of the risk of induced estrus within 2 weeks after insertion, of follicular cysts and pyometra (despite the incidence of these complications being low). Melatonin implants postpone estrus in queens (only) by 60-100 days (with also an important variability: 20-150 days).
- Determination of the appropriate time of mating (in bitches) is essential (up to 50% of mating/insemination failure is attributed to inappropriate time of mating): by vaginal smears associated with repeated blood progesterone assay.

AFTER MATING

Modification of the diet:

- Energy: in queens, energetic density is to be increased as early as mating (with a progressive increase of +25-50% over the duration of the pregnancy) whereas only at the 6th week of pregnancy in bitches (+50%). The difference can be explained by the origin of energy required to sustain lactation: in queens, it originates both from food and from fat deposits whereas in bitches, it relies in a large proportion on food ingested after whelping and in a lower proportion on body reserves. The distribution of food is fractionated, especially in late pregnancy (due to the abdominal bulkiness). The weight increase over pregnancy and after parturition has to be limited to prevent dystocia but sufficient to ensure sufficient lactation (table 2).

Table 2: Weight objectives for pregnant dams (variations are linked to litter size)

Weight increase compared to weight at mating	QUEENS	BITCHES
At parturition (term pregnancy)	+20-40%	+15-25%
After parturition	+15-30%	+5-10%

- Calcium: to prevent eclampsia, no calcium supplementation is provided during pregnancy (same concentration than in maintenance diet).
- Folic acid supplementation (in diet or per os): to reduce the incidence of cleft palate and spina bifida. Administration from mating to Day 35 of pregnancy (5mg/day/dam)

Control of medications: if drugs have to be administered to a (potentially) pregnant female, their safety has to be checked (see for example the list provided par Johnston et al 2001 or Lopate 2012). Especially glucocorticoids have to be avoided, because of the risk of partial abortion (2nd part of pregnancy) and the risk of cleft palate (1st part of pregnancy).

Prediction of the time of parturition: to decrease the risk of stillbirth and neonatal mortality by ensuring human assistance.

- Blood progesterone assay: ONLY in bitches. When below 2ng/ml (6 nmol/l), parturition occurs within 48 hours in 80% of bitches; Csection can be performed without risk of prematurity. Blood progesterone concentrations are not predictive for kittening.
- Rectal temperature: bitch owners can measure rectal temperature 2 or 3 times/day since Day58 of pregnancy. Decrease of more than two standard deviations predicts whelping within 48 hours in 80% of bitches (in mean, whelping occurs 22 hours after the first low temperature detected).

Control of the parasitic load:

- Vermifugation around Day 42 of pregnancy
- Shavering of perivulvar zona
- Shampoo in the last days of pregnancy or at the entry into the maternity zone) due to passive egg transfer with fur (22%-50% females with such fur contamination).

No vaccination during pregnancy, except CHV1 booster

CONCLUSION: What is a normal reproductive performance?

Reproductive efficiency is to be evaluated by pregnancy rate, whelping/kittening rate, litter size (prolificacy), stillbirth rate and neonatal-pediatric mortality rate. Mean values calculated from data obtained on large numbers of females (9 063 heats in queens, 46 393 heats in bitches; Fournier et al 2017; Chastant-Maillard et al, 2017) collected from a voluntary basis by breeders (Breeding Management System, Royal Canin) provide operational figures approaching what can be considered as "normal" in a canine or feline population (table 3).

Table 3: Reference figures for reproductive performances in dogs and cats (mean prolificacy is not indicated due to huge variations between breeds)

	Definition	Bitches	Queens
Apparent pregnancy rate	Nb of pregnant females as declared by the breeder/ nb of mated females	88%	83%
Whelping rate	Number of females delivering a litter after 55 days after mating/total number of females/number of mated females	82%	78%
Stillbirth rate	Number of stillborn newborns / total number of kittens born,	7.3%	8.5%
Neonatal and pediatric mortality	Number of newborns alive at birth but having died within the first 60 days of life / total number of newborns alive at birth	6.1%	7.9%

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