

Energy balance in the bitch – effect on birth weight and survival in puppies

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Obesity is major public health issue, both in human and in canine population. It predisposes to medical disorders (endocrinological, orthopedics, tumoral), but also impairs reproductive function. Infertility, miscarriage, pregnancy complications and dystocia have been described in obese women. In sows, increased serum concentration of leptin¹ - one of the hormones secreted by the adipose tissue (adipokine)-, has been found associated with a reduction of both embryo development and uterine contractions during parturition². This study aimed to evaluate the relationship between the body condition score (BCS) and serum leptin concentration in pregnant bitches and its relationship with birth weight and perinatal mortality in the canine species. The study was conducted on 41 multiparous bitches from 13 breeds within one breeding kennel (fed *ad libitum* the same diet). BCS was evaluated with a 1-9 points scale and blood was collected at the time of mating (W0), and for pregnant bitches at week 4 of gestation (W4) and 1 day after parturition (PP). According to BCS result, females were categorized into lean (L; 1-4), ideal (I; 5), overweight (Ow; 6) and obese (Ob; 7-9). Leptin was assayed on serum samples with a commercial kit (Canine Leptin ELISA kit, Millipore, St Charles, USA) and depending on the result, bitches were classified into those with low (<4 ng/ml), medium (4-8 ng/ml) or high (>8 ng/ml) leptin concentration. Birth weight and mortality in puppies from birth until 2 days of age were registered. Effect of BCS and leptin concentration at W0, W4 and PP on birth weight (% of low-birth-weight puppies, i.e.25% lowest weights) and perinatal mortality (stillbirths and mortality 0-2d) was evaluated with Chi square and Fisher exact tests. At mating, 8 out of 41 bitches were L, 13 I, 10 Ow and 10 Ob, with increase in BCS associated with higher leptin concentrations (L: mean=4.2 SD±1.7 ng/ml, I: 5.6±2.6 ng/ml, Ow: 8.7±4.0 ng/ml and Ob: 6.9±4.2 ng/ml; p=0.02). Thirty-four out of 41 bitches gave birth to 179 puppies. Leptin in pregnant bitches remained unchanged until W4 and decreased significantly after whelping (6.3±3.2 ng/ml vs 6.0±4.6 ng/ml vs 3.9±2.3 ng/ml; p=0.002). BCS increased over the whole gestation (W0-PP) in 9 bitches and decreased in 11. Data on birth weight were available for 160 puppies. Both leptin concentration and BCS were found associated with low birth weight and mortality in puppies. Proportion of low-birth-weight puppies was higher in bitches with low and high leptin concentrations at W0, W4 and PP compared with bitches having medium level (W0: low 26% (10/39) and high 37% (15/41) vs medium 14% (11/80); W4: 41% (22/54) and 41% (11/27) vs 4% (3/70); PP: 31% (28/90) and 25% (5/20) vs 6% (3/50); p<0.01 in all tests). Higher perinatal mortality was observed in Ow or Ob females at each studied period compared with bitches with lower BCS score (W0: 5% (4/81) vs 19%, p=0.004; W4: 2% (2/83) vs 22%, p<0.001; PP: 9% (10/109) vs 18% (13/70), p=0.07). Since low-birth-weight puppies are at higher risk of neonatal mortality³, this study evidenced that control of mortality in puppies should include the control of BCS in bitches, not only at whelping but also since mating.

[1] Metwally M, Li TC, Ledger WL. The impact of obesity on female reproductive function. *Obesity Reviews*. 2007. 8:515–523.

[2] Gonzalez-Añover P, Encinas T, Torres-Rovira L, et al. Ovulation rate, embryo mortality and intrauterine growth retardation in obese swine with gene polymorphisms for leptin and melanocortin receptors. *Theriogenology*. 2011. 75(1):34-41.

[3] Mila H, Grellet A, Feugier A and Chastant-Maillard S. Differential impact of birth weight and early growth on neonatal mortality in puppies. *J Anim Sci*. 2015;93:4436-4442.

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ABSTRACT BOOK

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NeoCare

Néonatalogie des Carnivores
Reproduction et Elevage

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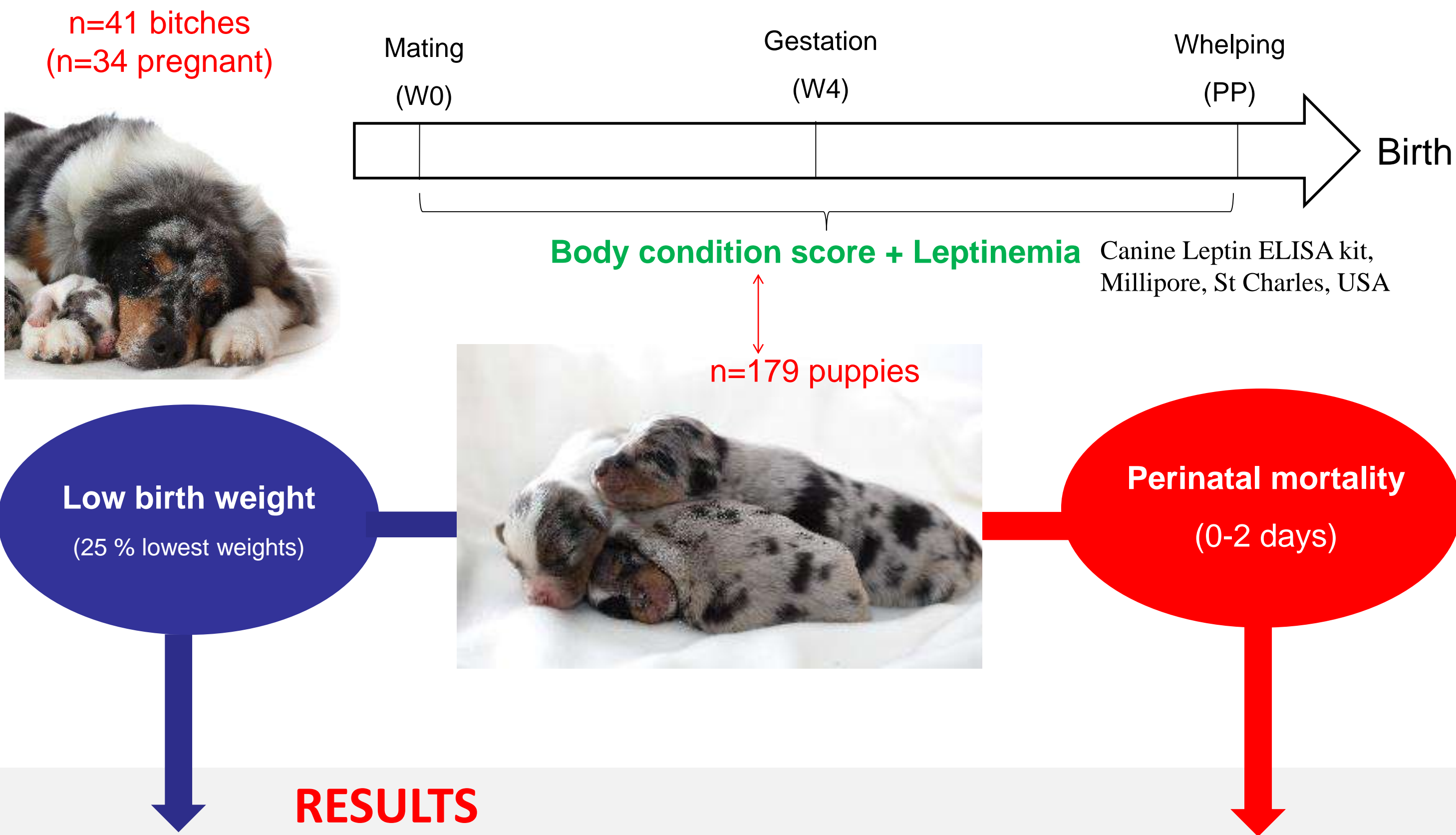
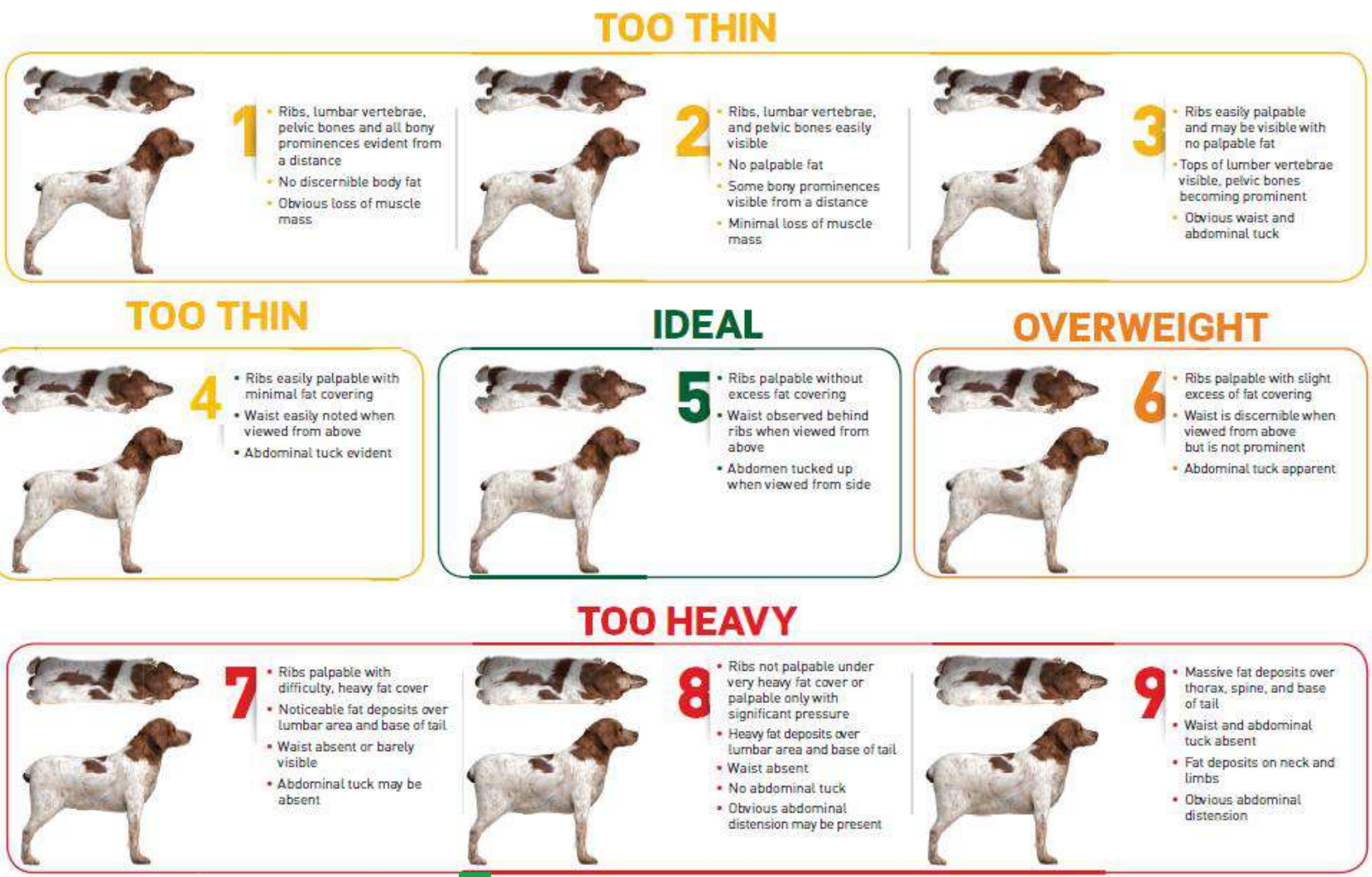
INTRODUCTION

Obesity is major public health issue, both in human and in canine population. It predisposes to medical disorders (endocrinological, orthopedics, tumoral), but also impairs reproductive function. Infertility, miscarriage, pregnancy complications and dystocia have been described in obese women. In sows, increased serum concentration of leptin [1] - one of the hormones secreted by the adipose tissue (adipokine), has been found associated with a reduction of both embryo development and uterine contractions during parturition [2].

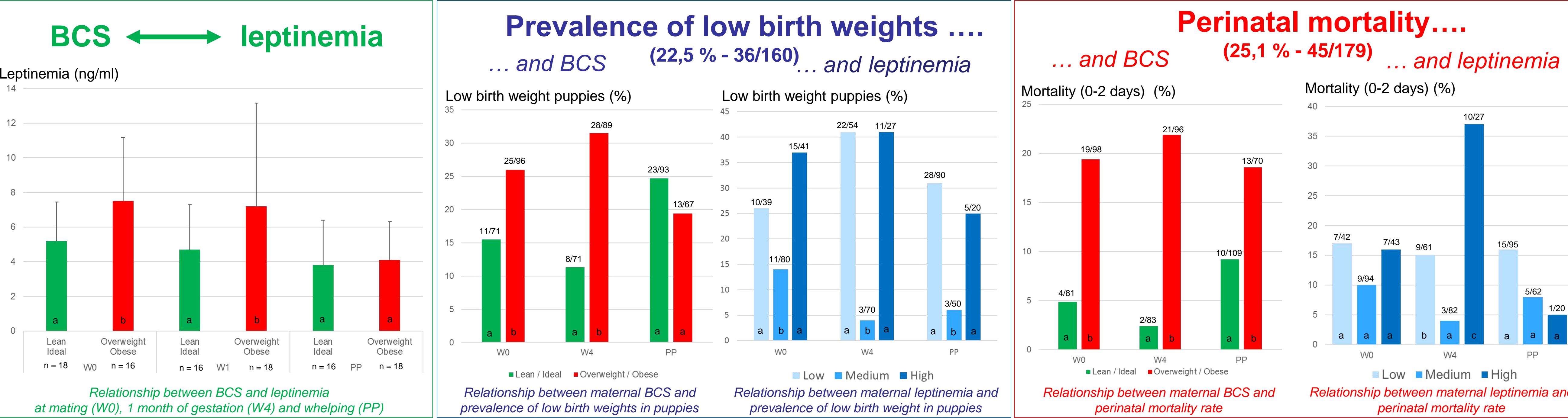
This study aimed to evaluate 1. the relationship between the BCS and serum leptin concentration in pregnant bitches
2. their effect on birth weight and perinatal mortality in the canine species.

MATERIALS AND METHODS

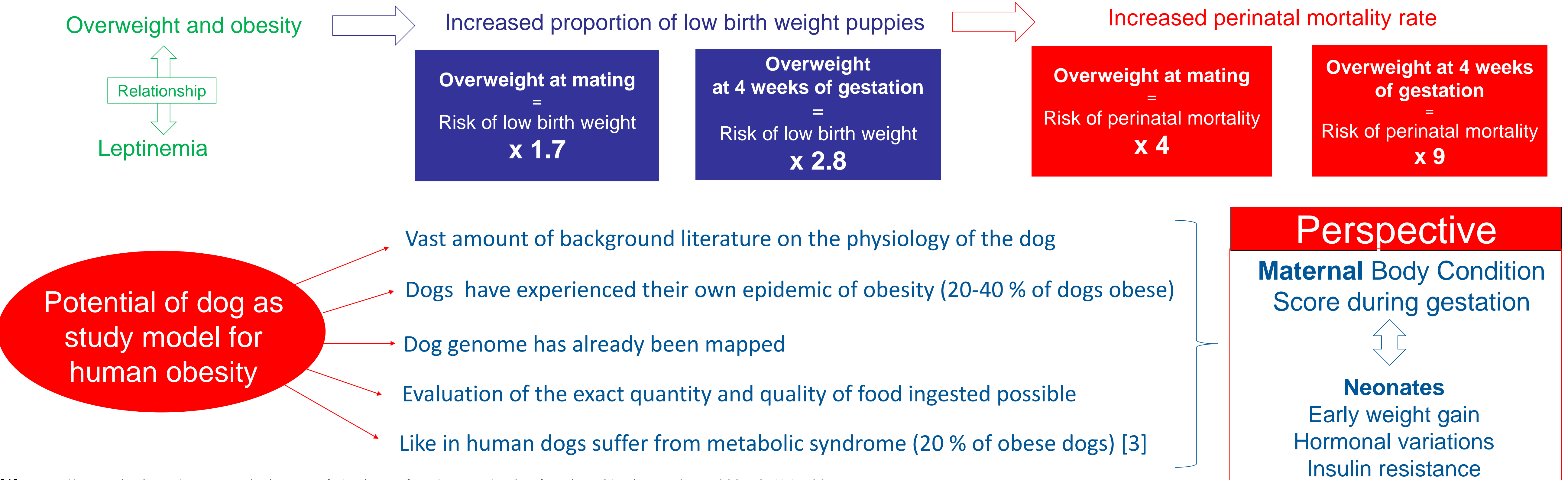
Figure 1: Scale for body condition scoring



RESULTS



DISCUSSION - CONCLUSION



[1] Metwally M, Li TC, Ledger WL. The impact of obesity on female reproductive function. Obesity Reviews. 2007. 8:515–523.
[2] Gonzalez-Añover P, Encinas T, Torres-Rovira L, et al. Ovulation rate, embryo mortality and intrauterine growth retardation in obese swine with gene polymorphisms for leptin and melanocortin receptors. Theriogenology. 2011. 75(1):34–41.
[3] Asta Tvarijonaviciute A., Ceron J., Holden S. et al. Obesity-related metabolic dysfunction in dogs: a comparison with human metabolic syndrome. BMC Veterinary Research, 2012, 8:147