

# Body morphometry of newborn cats

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## ABSTRACT

This study aimed to provide the body morphometric data of neonatal cats. A total of 48 neonatal cats (35 stillbirths and 13 live births) from the delivery of 13 queens were included for analysis. In all newborns, macromorphometric data were obtained, including body weight, total body length, crown-rump length, circumference of eye, ear length, abdominal length, biparietal diameter, thoracic length, caudal length, and size of the thoracic and pelvic limbs.

*Keywords: Anatomic mensuration, feline, morphometry, neonatology.*

## 1. INTRODUCTION

The neonatal period in cats corresponds to 30 days post-partum and is characterized by a critical period of adaptation of the organismic systems to the new external environment. The first minutes of life after birth represented the most critical phase for neonatal animals (Gropetti et al. 2015). Feline neonatal mortality in the first weeks of life reaches approximately 30% (Silva et al. 2008, Mila et al. 2014), but can reach more than 50% depending on the type of delivery (Löhr, 2011). The inability to perform the correct clinical analysis and lack of technical-scientific knowledge were considered as the main causes of the high rates of neonatal mortality reported (Silva et al. 2008).

In the first 24 h, the newborn loses about 10% of its weight owing to dehydration and suffers from loss of wraps and fetal fluids (Domingos et al. 2008). Thus, it is important for the veterinarian to properly assess the parturient to select the best approach (normal delivery or cesarean section) (Domingos et al. 2008; Siena; Milani, 2021).

Morphological studies are relevant aspect of neonatology. These data are scarce for neonatal cats, but necessary, since established morphometric patterns may be used as guidance for examinations such as ultrasonography, providing an early diagnosis in morphological changes (Siena; Milani, 2021) and to assess the presence of cranial formation disorders, for example, open fontanel opening and hydrocephalus (Vannuchi; Abreu, 2017). Morphometric data of animals soon after birth are useful parameters for acquiring information that contribute to the development of kittens, identification of structural abnormalities, clinical anatomy, and external morphology, in addition to guiding the neonatologists to perform general clinical examination post-delivery (Silva et al. 2015; Siena; Milani, 2021).

The aim of this study was to collect data on the body morphometry of feline neonates, considering the scarcity of information on the topic.

## METHOD

The study was conducted with 48 neonatal cats (35 stillborn and 13 alive) from 13 pregnant cats treated in a Teaching Veterinary Hospital (TVH). All animals included in the study were mixed breed. Parturients were weighed before and after parturition.

Parametric t-student statistical tests were performed to compare the mean weights of the neonates in relation to the birth situation.

## RESULTS AND DISCUSSION

Of the 13 cats treated, all had dystocic delivery (Table 1), and 76.9% (10/13) of the owners used contraceptives at least once. Only 23.07% (03/13) did not use contraceptives. Dystocias in cats are considered rare (HOLST et al., 2017). However, in the present study this condition was frequent. This high frequency of dystocia is probably related to the use of contraceptives. These drugs are widely used in Brazil in queens. (Silveira et al., 2013).

Table 1: Dystocic parturition data of 13 cats (mixed breed) treated at a Teaching Veterinary Hospital, registered in a period of six months, and therapeutic conduct with cesarean section followed by ovariectomy.

Cats	Number of kittens at birth	Average weight of kittens (g)	Status of kittens at US* and at birth	Individual mortality (number and percentage)
1	04	92,75	US: one viable and the other non-viable fetuses	03 (75%)
2	05	70,0	US: viable fetuses	01 (20%)
3	03	99,66	US: nonviable fetuses	03 (100%)
4	02	87,5	US: one viable and one nonviable fetus	01 (50%)
5	05	95,0	US: viable fetuses, one kitten died after birth	01 (20%)
6	05	97,8	US: viable and nonviable fetuses	03 (60%)
7	04	70,0	US: viable fetuses, death after birth	04 (100%)
8	02	83	US: viable fetus, and one dead fetus insinuated into the canal	02 (100%)
9	05	76,6	US: nonviable fetuses	05 (100%)
10	01	61,4	dead fetus insinuated into the canal	01 (100%)
11	02	82	US: nonviable fetuses	02 (100%)
12	03	62	US: nonviable fetuses	03 (100%)
13	07	89,57	Nonviable and viable fetuses, two were	06 (85%)

			stillborn, four died after birth	
Average	3,7	83,88		2.69
Median	5,0			02
Total	48			35 - 72.92%

Us: ultrasonography

The female cats were weighed before and after delivery on a digital scale, with a mean weight of before birth of  $4.19 \pm 1.26$  kg (ranging from 2.9 to 6.8 kg) and a mean weight of after birth of  $3.75 \pm 1.32$  kg (ranging from 2.2 to 6.6 kg). The weight of the female cats is similar to the weight of cats registered in Brazil (Aptekmann et al. 2014).

The mean weight at birth of the live kittens (13) was  $87 \pm 13.06$  g and of the stillbirths (35) was 82.73g, with close standard deviations (Table 2). The Student's t-test showed no difference between the mean weights of live and stillbirth animals (p-value = 0.37), with a 5% significance level. Some authors reported that the weight of feline neonates is around 110 g (Snook et al. 1987; Kustritz 2011), ranging from 90 to 110 g (Little 2013). Thus, the weight reported in the literature is higher than the weight recorded in this study. However, some authors reported that the weight of felines at birth can be lower (between 85 and 90 g) when there are a larger number of kittens (Snook et al. 1987; Kustritz 2011; Mugnier et al. 2022), and, in large litters, the weight of neonates is 25% below normal weight (Mila et al. 2015). Furthermore, the average birth weight of kittens varies greatly by breed (Mugnier et al. 2022). It is noteworthy that in the present study all animals were mixed breed. As the animals in Brazil are mostly mixed-breed, there is a wide variation in weight. Another factor to be considered is the weight of the mother. Although there is no record on the influence of the maternal weight on the weight of the kittens, in dogs the weight of the newborns is directly related to the weight of the mother and of the fetal membranes and fluids (Martin et al., 2005). However, in the present study there was no correlation between the weight of the mother and the weight of the kittens according to the Pearson's linear correlation. This is likely due to the small sample size.

**Table 2. Mean birth weight (g) of neonatal cats born from 13 female cats treated in a Teaching Veterinary Hospital (n=48).**

situation at birth	mean (g)	standard deviation	CI* (95%)
Dead (35)	82.73	13.32	(78.15, 87.30)
Alive (13)	87	13.06	(79.11, 87.30)

\*Confidence interval

All neonates were identified by sex and weighed on a precision digital scale (Mars/AY220) to obtain the body mass. All neonates underwent a macro-morphometric analysis using a precision digital pachymeter (Lee Tools - 150 mm). The analysis included total length (mm), which was measured from the base of the tail to the frontal bone (Figure 1A); cranial length (mm) which was measured from the occipital bone to the snout (nasal bone) (Figure 1B), crown-rump (measure from base of head to base of tail) (mm) ((Figure 1C), ocular perimeter, measured from the medial corner to the lateral corner of the eye (mm), auricular length (mm), measured from the base of the ear to the distal insertion of the ear on the head; abdominal length, measured from the final part of the xiphoid process to the pubis (mm), biparietal diameter, measured from the side of the left parietal bone to the side of the right parietal bone (mm), thoracic length, measured from the manubrium to the final portion of the xiphoid process (mm), caudal length, measured from the base of the tail to the end (mm)

and weight (g). Thoracic limbs, (mm) measured from the scapula to the digits in an extended position and pelvic limbs, measured from the wing of the ilium to the digits in an extended position, (mm) were also measured (Table 3). The data obtained were tabulated in Excel 2011. A descriptive analysis of the study variables was performed to determine means and standard deviations (Table 3).



Fig. 1 Macromorphometric data of feline neonates. A: Full length; B: Cranial length; C: Crown-rump.

Table 3. Body morphometry means and standard deviations (mm), and weight (g) of neonatal cats

VARIABLE	N	MEAN	STANDARD DEVIATION	CV (%)
Cranial length (mm)	48	38.8	15.61	40.23
Crown-Rump (mm)	48	102.95	15	14.57
Occular perimeter (mm)	48	9.74	3.7	37.99
Auricular length (mm)	48	15.95	4.19	26.27
Abdominal length (mm)	48	41.96	7.98	19.02
Biparietal diameter (mm)	48	24.43	4.43	18.13
Thoracic length (mm)	48	35.77	5.57	15.57
Thoracic limb size (mm)	48	68.64	8.16	11.89
Pelvic limb size (mm)	48	69.5	8.25	11.87
Tail length (mm)	48	63.95	14.04	21.95
Weight (g)	48	83.88	13.25	15.80

N: number of neonates; CV: coefficient of variation.

### Conclusion

Morphological studies are relevant aspect of neonatology. These data are scarce for neonatal cats, but necessary, since established morphometric patterns may be used as guidance for examinations such as ultrasonography, providing an early diagnosis in morphological changes.

## **ETHICAL APPROVAL**

The procedures performed during the experiment were approved by the Ethics Committee on Animal Experimentation at the institution where it took place (protocol 272/16).

UNDER PEER REVIEW

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