Advances in Research

Volume 25, Issue 2, Page 93-97, 2024; Article no.AIR.111822
ISSN: 2348-0394, NLM ID: 101666096

Body Morphometry of Newborn Cats

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Authors' contributions

This work was carried out in collaboration among all authors. Author JLRC collected all the data, performed the statistical analysis, wrote the first draft of the manuscript. Author FAdNS assisted in collecting all data and statistical analysis, critically analyzed the first draft. Author NMBdMN assisted in collecting all data, critically analyzed the first draft. Author TCdS critically analyzed the draft and made changes to the text (second version). Author AD critically analyzed the draft and made changes to the text (third version). Author AMQ conceived the project, guided all stages of data collection and wrote the final version of the text. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AIR/2024/v25i21036

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/111822

Data Note

Received: 03/12/2023
Accepted: 08/02/2024
Published: 15/02/2024

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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 [1]. Feline neonatal mortality in the first weeks of life reaches approximately 30% [2,3], but can reach more than 50% depending on the type of delivery [4]. 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 [2].

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) [5,6].

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 +6] and to assess the presence of cranial formation disorders, for example, open fontanel opening and hydrocephalus [7]. 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), [6].

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

2. METHODS

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.

3. 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 [8]. 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 [9].

The female cats were weighed before and after delivery on a digital scale, with a mean weight of before birth of 4.19 ± 1.26 kg (ranging from 2.9 to 6.8 kg) and a mean weight of after birth of 3.75 ± 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 [10].

The mean weight at birth of the live kittens (13) was 87 ± 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 [11,12], ranging from 90 to 110 g [13]. 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 [11,12,14] and, in large litters, the weight of neonates is 25% below normal weight [15]. Furthermore, the average birth weight of kittens varies greatly by breed [14]. 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 [16]. 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.

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 (Fig. 1A); cranial length (mm) which was measured from the occipital bone to the snout (nasal bone) (Fig.1B), crown-rump (measure from base of head to base of tail) (mm) ((Fig. 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).

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 ovariohysterectomy

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 stillborn, four died after birth	06 (85%)
Average	3,7	83,88		2.69
Median	5,0			02
Total	48			35 - 72.92%

Us: ultrassonography

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*

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

4. 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).

ACKNOWLEDGEMENTS

To Veterinary Hospital of the Federal University of Piauí (Teresina, PI, Brazil), for the support in the approach of the clients.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/111822