Research Article

# Scenario of Nutrition in Pregnancy and Neonatal Mortality in Breeding Cat in Dhaka City, Bangladesh

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**Abstract** | A healthy balanced diet is important at all times in life, but particularly during pregnancy. The maternal diet must provide sufficient calories and nutrients to meet the mother's usual requirements, as well as the needs of the growing fetus, and enable the mother to lay down stores of nutrients required for fetal development as well as for lactation. Consequently, deficiency causes neonatal abnormalities and mortality. A questionnaire-based 82 breeding cats' data were collected randomly and then analyzed. Among them, feeding of homemade food was practiced in 53.66%, commercial in 13.41% and both homemade and commercial feeding practiced in 32.93%. In 59.76% cases, pet owners provide commercially available vitamins and minerals during pregnancy periods, whereas 40.24% owners avoid providing any supplements to their pets. The highest percentage (42.69%) of first-time matted female cats were found between 7-12 months of age and the lowest (9.76%) at more than 18 months of age. Complications during pregnancy and at the time of parturition are very common in cats and in the present study, 21.95 % pregnant cats experienced dystocia. The average litter size in cats is 4.0 kittens per litter but varies among breeds. Medium litter size (3-4) was found in 56.10% cases, large size (>4) in 35.56% cases and small size litter in 8.54% cases. The study found an overall 76.83% neonatal death where 18.29% were in-vivo death, 34.15% in in-vitro death and 24.39% in both cases. Congenital anomalies occur when kittens do not develop properly in utero and congenital anomalies were seen in 15.85% cases and malnourished kittens were also found in 42.68% cases. These results exhibit the need for owner awareness about the requirements of nutrient supplements during pregnancy as well as the establishment of prophylaxis thus increasing life expectancy in the pet population.

**Keywords** | Pets, Diet, Nutrition, Pregnancy, Neonatal, Mortality

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## INTRODUCTION

Dietary recommendations for mom cats before and during pregnancy are, in fact, very similar to those for other adults, but with a few exceptions (Williamson, 2006). The main recommendation is to eat a healthy, balanced diet as described in the Balance of Good Health model. However, there are some specific recommendations

that apply to pregnancy, e.g. taking folic acid supplements to help reduce the risk of neural tube defects (NTDs) (Li and Wu, 2023). There are also certain recommendations about food safety, e.g. the avoidance of certain foods to minimize the risk of food poisoning from harmful bacteria (Lawley *et al*., 2012).

The gestation period for cats is nine weeks. Pregnant cats, like humans, gain weight gradually throughout pregnancy (Junior *et al*., 2016). The energy requirements of pregnant cats are reflected by their weight gain. The energy needs of a pregnant cat should gradually increase so that, by the end of pregnancy, the cat is consuming 25% to 50% more than her normal amount of calories (Center *et al*., 2000). Pregnant cats lose weight after giving birth. However, their nutritional needs increase dramatically. Energy needs can be two to three times normal, depending on litter size, in order to produce the milk supply that will support the offspring. Water intake is also important for milk volume (Wichert *et al*., 2009). To ensure a nursing cat is getting enough nutrition, give her a nutrient-dense diet, such as kitten food. Without increasing the amount of food at each meal, increase the number of meals in the day. Free-choice feed her, offering unlimited access to dry food.

Although breeding management and veterinary intervention can prevent some new born kitten losses, overall kitten mortality rates remain high. Kittens are most vulnerable when they are newborn; over half of all kitten deaths occur in the first two weeks of life (Sparkes *et al*., 2006). With an average litter size of four kittens, one kitten may be still born and or one kitten may die before reaching two weeks of age, leaving only two or three live kittens (Sparkes *et al*., 2006; Holst and Frössling, 2009; Fournier *et al*., 2017).

There are many causes of kitten mortality. A broad categorization of causes of kitten mortality would be to divide them in to infectious versus noninfectious etiologies. Non-infectious causes of kitten mortality include: trauma, congenital defects, nutritional imbalances, immune-mediated diseases, degenerative disorders, and poor husbandry. Infectious causes include viruses, bacteria, and parasites. Of kittens dying within the first 14 days of life, it is estimated that 50% die from infectious causes, 19% from idiopathic causes, 12% from immune-mediated causes, 9.5% from congenital causes, 4.8% from nutritional causes, and 4.8% from traumatic causes (Cave *et al*., 2002). Immune-mediated disease, husbandry-related death, congenital defects, and infectious disease will be discussed below in more detail.

Congenital defects occur when kittens do not form properly in utero. As many as 14.3% of pedigree litters may have at least one congenital defect present (Sparkes *et al*., 2006). With regard to mortality, congenital defects may cause up to 10% of neonatal kitten losses (Cave *et al*., 2002). While some congenital defects are readily visible at birth (e.g. cleft palate), others may remain unknown until the kitten dies and is submitted for necropsy (e.g. hiatal hernia). Examples of common congenital defects include eyelid coloboma, cleft palate, ocular dermoid, flat chest defect, gastroschisis, pectus excavatum, syndactyly, and umbilical hernia, (Little, 2011; Martini-Santos *et al*., 2012). Hydrocephalus and urinary dysgenesis are examples of congenital defects that can cause kitten mortality (Cave *et al*., 2002). There are many different causes of congenital defects. A congenital defect may be the result of genetic inheritance, infection in utero, exposure of the queen to ateratogen, hyperthermia of the queen, poor intrauterine environment, nutritional factors, or an interaction between environmental and genetic factors (Martini-Santos *et al*., 2012). An example of an infectious cause of a congenital defect is the panleukopenia virus, which can cause cerebellar hypoplasia in kittens. An example of a teratogen is griseofulvin, which is a drug used to treat ringworm infection. When administered to a gestating queen, griseofulvin can cause cleft palate in kittens (Moriello *et al*., 2017). A nutritional factor that can cause congenital defects is taurine deficiency, which is linked to various musculoskeletal defects (Li and Wu, 2023).

Infectious disease is a leading cause of kitten mortality, particularly during the neonatal period, with studies reporting that one-third to over half of kitten deaths are infection-related, occurring predominantly within the first 14 days of life (Cave *et al*., 2002; Omoto, 2019). Viral infections such as feline herpesvirus, feline calicivirus, feline panleukopenia virus, and feline infectious peritonitis virus are major contributors to neonatal loss, abortion, and stillbirth, while bacterial infections most commonly Escherichia coli and *Streptococcus* spp. account for a substantial proportion of respiratory, gastrointestinal, and systemic disease in kittens (Givens and Marley, 2008; Little, 2011; Johnson, 2022).

Normal pregnancy requirements and abnormalities of pregnancy are studied in domestic cats both for their value to veterinarians working with cat breeders. This manuscript is a review of normal pregnancy nutrition and physiology and reported abnormalities of pregnancy in cats.

## MATERIALS AND METHODS

### Study area and duration of study

This study has been carried out at the Teaching and Training Pet Hospital and Research Center (TTPHRC), Chattogram Veterinary and Animal Sciences University, Bangladesh. A total number of 82 cases of pregnancy and

neonatal mortality-related records from the Dhaka city area were collected during the 1-month study period (13th May-8th June 2023).

### Sampling strategy

The methodology of sampling has been applied by a simple random method. Before this study, a questionnaire was designed and followed during the sampling time. Questions were close-ended and covered issues regarding the study. At the time, 82 registered samples were conducted where owners described supplied nutrition in pregnancy, pregnancy complications and abnormalities in cats.

### Statistical analysis

All data were tabulated using commercial software (Microsoft Excel version 2016, Microsoft, USA), analyzed with a statistical program (STATA-14) and results expressed as frequencies, proportions and ratios.

## RESULTS

A summary of the information regarding pregnancy management and neonatal mortality rate statistics for breeding cats included in the study is presented in bellow tables.

In Table 1 shows the highest number of 53.66% (n=44) owners who use homemade food for their pets. Only 13.41% (n=11) of owners practice commercially available foods and the remaining 32.93% (n=27) owners provide both homemade and commercially available foods.

**Table 1:** Frequency distribution of feeding practices followed by the owner during pregnancy.

| Feeding practices | Frequency | Percentage (%) |
|---|---|---|
| Homemade | 44 | 53.66 |
| Commercial | 11 | 13.41 |
| Both | 27 | 32.93 |
| Total | 82 | 100 |

**Table 2:** Frequency distribution of nutritional supplements (vit, min, etc) during pregnancy periods.

| Providing nutritional supplements | Frequency | Percentage (%) |
|---|---|---|
| Yes | 49 | 59.76 |
| No | 33 | 40.24 |
| Total | 82 | 100 |

In Table 2, providing nutritional supplements to the pregnant cat, 59.76% (n=49) of owners give commercially available different types of vitamin and mineral supplements throughout the pregnancy period, whereas 40.24% (n=33) of cases found owners do not provide any supplements.

For the present study, the author categorized the age of female cats when 1st mated into 4 groups. Among them, a small number of female cats' first matting took place at more than 18 months of age and that was only 9.76% (n=8). Then 19.51% (n=16) of female cats start matting within 6 months of age or during the time of puberty. The maximum number of first matting recorded within 7-12 months of age, 42.69% (n=35) followed by 13-18 months of age, 28.09% (n=23), respectively in Table 3.

**Table 3:** Frequency distribution of age of female cats when matted (1st time).

| Age | Frequency | Percentage (%) |
|---|---|---|
| Up to 6 months | 16 | 19.51 |
| 7-12 months | 35 | 42.69 |
| 13-18 months | 23 | 28.09 |
| More than 18 months | 8 | 9.76 |
| Total | 82 | 100 |

There is a significant relationship between early pregnancy and dystocia. Due to lack of proper nutrition during pregnancy time may also cause birth difficulty in breeding cat. In this study of (Table 4) the author found 21.95% (n=18) pregnant cat developed dystocia during delivery and on the contrary, 78.05% (n=64) mother cats gave normal delivery.

**Table 4:** Frequency distribution of dystocia.

| Dystocia | Frequency | Percentage (%) |
|---|---|---|
| Yes | 18 | 21.95 |
| No | 64 | 78.05 |
| Total | 82 | 100 |

**Table 5:** Frequency distribution of litter size of the mother cat.

| Litter size | Frequency | Percentage (%) |
|---|---|---|
| Small (1-2) | 7 | 8.54 |
| Medium (3-4) | 46 | 56.10 |
| Large (>4) | 29 | 35.36 |
| Total | 82 | 100 |

In Table 5 litter number parts, the author also divided it into 3 categories according to the number of kittens delivered and these are small, medium and large litter sizes. Only 7 mother cats delivered a small number of kittens and represented about 8.54% of the total. A medium number of litter was encountered in n=46 numbers of pregnant cats and constituted 56.10% and 35.36% large litter size recorded from 29 mother cats.

During the defined period, n=82 cases were selected for this study in Table 6 and 34.15% (n=29) neonatal deaths

were found within a few days after delivery, followed by 18.29% (n=15) fetal deaths in intra-uterine and 24.39% (n=20) neonatal mortality counted in both intra-uterine and after delivery.

**Table 6:** Frequency distribution of neonatal mortality rate.

| Neonatal mortality | Frequency | Percentage (%) |
|---|---|---|
| In vivo | 15 | 18.29 |
| In vitro | 28 | 34.15 |
| Both | 20 | 24.39 |
| Total | 63 | 76.83 |

**Table 7:** Frequency distribution of congenital anomalies of a new born kitten.

| Congenital anomalies | Frequency | Percentage (%) |
|---|---|---|
| Yes | 13 | 15.85 |
| No | 69 | 81.15 |
| Total | 82 | 100 |

In Table 7 regarding congenital anomalies of kittens, in Table 7 out of n=82 observations, 15.85% (n=13) cases showed kittens delivered having different types of congenital anomalies whereas 81.15% (n=69) breeding cats delivered normal healthy fetuses.

Among the presented numbers, which were shown in Table 8, 42.68% (n=35) of mother cats birthed malnourished kittens, whereas 57.32% (n=47) of cases represented normal well healthy kittens.

**Table 8:** Frequency distribution of malnourished kittens.

| Malnourished kitten | Frequency | Percentage (%) |
|---|---|---|
| Yes | 35 | 42.68 |
| No | 47 | 57.32 |
| Total | 82 | 100 |

## DISCUSSION

A nutritious, healthy diet is essential for a pregnant cat. A good diet will support the mother's health as well as the health and development of the unborn kittens. Malnutrition, on the other hand, can lead to stillbirth, low birth weight for the kittens, developmental problems, low milk production, and other difficulties. A malnourished mother cat can suffer more complications during labor and delivery, and will not be as prepared to care for any kittens that survive. During pregnancy, dietary demand for protein increases, especially for the amino acids arginine, lysine and tryptophan (Kelley, 2003). Pregnant queens seek out higher protein diets, in preference to carbohydrate-rich diets (Kustritz, 2006). At a minimum, diets for pregnant queens should contain 32% protein and 18% fat (Kelley, 2003). By the time of parturition, queens should have gained 12–38% of their pre-pregnancy body weight (Kustritz, 2006). Dietary causes of poor reproductive performance in the cat include severe malnutrition and taurine deficiency. Cats have a limited ability to synthesize taurine; therefore, a dietary source is required. Cats on a taurine-deficient diet exhibit resorption or abortion of fetuses, an increased incidence of near-term fetal death and kittens with low birth weights (Smith, 2012). Commercial diets that are certified by the American Association of Feed Control Officials (AAFCO) contain adequate amounts of taurine. Dystocia is a reproductive emergency that is life-threatening to both dam and kittens. The incidence of dystocia among pedigree breeding cats is typically less than 10% (Sparkes *et al*., 2006; Marelli *et al*., 2020) butthere is a significant variation between breeds, pointing to a genetic component (Holst *et al*., 2017). Higher incidence rates have been described in several breeds, among them the Birman; (Holst *et al*., 2017) in a Finnish study, 15% of Birmans were diagnosed with dystocia (Sparkes *et al*., 2006), dystocia hasbeen associated with both small and large litter sizes (Strom and Frossling, 2009).

Dystocia may be due to maternal or fetal factors. The most common cause of feline dystocia is uterine inertia, which accounts for approximately two-thirds of cases (Holst, 2022). Complete primary uterine inertias are diagnosed when there are no signs of stage 2 parturition after the due date is passed, whereas partial primary uterine inertia is diagnosed when the queen reaches stage 2 parturition but uterine contractions are weak and delivery of one or more fetuses fails. Because of the varying gestation length in cats, complete primary inertia can be difficult to diagnose. To avoid fetal mortality, cesarean section is recommended 71 days after mating if there are no signs of impending parturition. The average litter size in cats is 4.0 kittens per litter (Soboleva *et al*., 2021) but varies among breeds. Number of matings is not correlated with litter size. A litter of 18 kittens was reported in one queen undergoing pregnancy termination via ovariohysterectomy (Kustritz, 2006). The cervix of queens is not patent during diestrus and pregnancy; no vulvar discharge is observed during pregnancy in normal queens (Holst, 2022). In late gestation, normocytic, normochromic anemia with reticulocytosis commonly develops. Total and differential white blood cell counts have not been demonstrated to vary with pregnancy in cats (Nemeth and Tomas, 2014). In a study, 9.7% of kittens may be stillborn and up to 16% of kittens may die before weaning (Holst and Frössling, 2009; Fournier *et al*., 2017). Other reported kitten mortality rate sare lower, with as few as 7.2% of kittens being stillborn and only 8.3% of kittens dying in the first 12 weeks of life (Sparkes *et al*., 2006; Holst and Frössling, 2009), which is similar to Table 6. Congenital defects occur when kittens do not form properly in utero. As many as 14.3% of pedigree litters

may have at least one congenital defect present (Sparkes *et al.*, 2006). With regard to mortality, congenital defects may cause up to 10% of neonatal kitten losses (Pereira *et al.*, 2022). While some congenital defects are readily visible at birth (e.g. cleft palate), others may remain unknown until the kitten dies and is submitted for necropsy (e.g. hiatal hernia). Examples of common congenital defects include: eyelid coloboma, cleft palate, ocular dermoids, flat chest defect, gastroschisis, pectus excavatum, syndactyly, and umbilical hernia, (Little, 2011; Martini-Santos *et al.*, 2012). Hydrocephalus and urinary dysgenesis are examples of congenital defects that can cause kitten mortality (Cave *et al.*, 2002).

There are many different causes of congenital defects. A congenital defect may be the result of genetic inheritance, infection in utero, exposure of the queen to ateratogen, hyperthermia of the queen, poor intrauterine environment, nutritional factors, or an interaction between environmental and genetic factors (Martini-Santos *et al.*, 2012). An example of an infectious cause of a congenital defect is the panleukopenia virus, which can cause cerebellar hypoplasia in kittens (Sykes, 2013). An example of ateratogen is griseofulvin, which is used to treat ringworm infection. When administered to a gestating queen, griseofulvin can cause a cleft palate in kittens. A nutritional factor that can cause congenital defects is taurine deficiency, which is linked to various musculoskeletal defects (Li and Wu, 2023). Dehydration and nutritional deficiencies are a concern with kittens because their bodies are made of 80% water compared to 60% in adult cats (Little, 2011). This increased water composition, higher proportion of surface area, higher metabolic rate, and lower level of body fat causes kittens to have higher fluid requirements than an adult cat of the same size (Verbrugghe and Hesta, 2017). Further, a kitten's kidneys are not fully developed at birth, causing them to excrete a higher volume of water per unit of body weight compared to an adult cat (Johnson, 2022). Thus, a kitten can easily become dehydrated if it has diarrhea, vomiting, or reduced fluid intake (Marks, 2016). One way to quickly check a kitten's hydration status is to examine its mucous membranes and determine its capillary refill time. If the former appears pale and the latter is delayed, the kitten is at least 10% dehydrated (Howell, 2007). In addition, a dehydrated kitten's urine will be darker in color and have a specific gravity greater than 1.020 (Little, 2011). If a kitten is only slightly dehydrated and does not have any other health issues, it can be treated with warmed subcutaneous or oral fluids. However, if a kitten is severely dehydrated, it will require intravenous or intraosseous Lactated Ringer solution. Care should be taken to not overhydrate neonatal kittens because they do not have full renal excretory function (Lawler, 2008).

## CONCLUSION

This research has demonstrated the ability and desire of cat breeders to work with investigators in the interest of improving the health and welfare of pregnant cats and neonatal kittens. This research has also demonstrated the lack of current research on the causes of kitten mortality. Recent investigations appear to focus on individual diseases that can cause kitten mortality or overall kitten mortality rates. In order for kitten losses to be prevented, the causes of kitten mortality must be studied. Further, there is a need for research that compares the causes of kitten mortality between types and breeds of cats. In particular, there is a need for updated research into causes of kitten mortality that includes laboratory testing of tissue samples due to emerging feline infectious diseases.

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## NOVELTY STATEMENT

There is a lack of scientific information on pregnancy nutrition and neonatal outcomes, given the fact that cat breeding is growing in urban Bangladesh. By recording current feeding habits throughout gestation and their correlation with neonatal mortality rates in breeding cats in Dhaka City, this study closes a significant information gap.

## AUTHOR'S CONTRIBUTION

MBB conceptualized the study and developed the methodology with the assistance of MSAF. SDG, MMUH, MI, MAH and MMR prepared the first draft of the manuscript. SDG and MMUH critically reviewed and edited the manuscript. TC and AC conducted the patient follow-up and help in diagnosis. MSA-F supervised the overall research work.

### Generative AI and AI-assisted technology statement

Grammerly tools, Quilbot, and generative AI were only used for language correction and clarity improvement. Data production, processing, interpretation, and decision-making were all done without the use of AI. The material is entirely the writers' responsibility.

## Conflict of interest

The authors have declared no conflict of interest.

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