Study on The scenario of nutrition in pregnancy and Bangladesh

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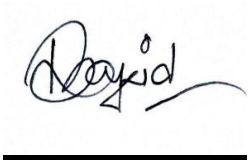
Study on The scenario of nutrition in pregnancy and neonatal mortality in breeding cats in Dhaka City, Bangladesh



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Abbreviations and symbols	Elaboration
CVASU	Chittagong Veterinary & Animal Sciences University
TTPHRC	Teaching and training pet hospital and research center
NTD	Neural Tube Defects
FeLV	Feline Leukemia Virus
FIV	Feline Immunodeficiency Virus
AAFCO	American association offeed control officials
USA	United States of America
e.g.	Example
et al.	And his associates
etc.	Et cetera
%	Percent
/	Per
>	Greater than

ABASTRACT

A healthy balanced diet is important at all times in life, but particularly so during pregnancy. The maternal diet must provide sufficient calorie 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. Questionnaire based 82 breeding cat's data were collected randomly and then analyzed. Among them, feeding of homemade food practiced in 53.66% (44), commercial in 13.41% (11) and both homemade and commercial feeding practiced in 32.93% (27). In 59.76% (49) cases found pet owners provide commercially available vitamins and minerals during pregnant periods, where 40.24% (33) owners avoid providing any supplements to their pets. Highest percentage (42.69%/35) of first time matted female cat found in between 7-12 months of age and lowest (9.76%/8) in more than 18 months of age. Complications during pregnancy and at the time of parturition are very common in cats and in present study, 21.95 % (18) pregnant cats were experienced dystocia. The average litter size in cats is 4.0 kittens per litter but varies among breeds. Medium litter size (3-4) found in 56.10% (46) cases, large size (>4) in 35.56% (29) cases and small size litter in 8.54% (7) cases. The study found an overall 76.83% neonatal death where 18.29% were in 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% (13) cases and malnourished kitten also found in 42.68% (35) cases. These results exhibit the need for owner awareness about the requirements of nutrient supplements during pregnancy as well as establishment of prophylaxis thus increasing life expectancy in the pet population.

Key words: Pets, diet, nutrition, pregnancy, neonatal, mortality, dystocia, congenital, malnourished

INTRODUCTION

Dietary recommendations for mom cat before and duringpregnancy are, in fact, very similar to those for otheradults, but with a few exceptions. The main recommendation is to eat a healthy, balanced diet as described inthe *Balance of Good Health* model. However, there aresome specific recommendations which apply to pregnancy, *e.g.* taking folic acid supplements to help reducethe risk of neural tube defects (NTDs). There are alsocertain recommendations with regard to food safety, *e.g.*the avoidance of certain foods to minimize the risk offood poisoning from harmful bacteria. The gestation period for cats is nine weeks. Pregnant cats, like humans, gain weight gradually throughout pregnancy. 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. 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. 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 somenewborn kitten losses, overall kitten mortality rates remain high. Kittens are most vulnerable when they are newborn; over half of all kitten deathsoccur in the first two weeks of life (Casal, 2010; Holst and Frössling, 2009; Sparkeset al., 2006). With an average litter size of four kittens, one kitten may be stillbornand or one kitten may die before reaching two weeks of age, leaving only two or threelive kittens (Fournier et al., 2017; Holst and Frössling, 2009; Sparkes et al., 2006).

There are many causes of kitten mortality. A broad categorization of causesof kitten mortality would be to divide them in to infectious versus noninfectiousetiologies. Non-infectious causes of kitten mortality include: trauma, congenitaldefects,

nutritional imbalances, immune-mediated diseases, degenerative disorders,and poor husbandry. Infectious causes include viruses, bacteria, and parasites. Ofkittens dying within the first 14 days of life, it is estimated that 50% die frominfectious 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 manyas 14.3% of pedigree litters may have at least one congenital defect present (Sparkeset al., 2006). With regards to mortality, congenital defects may cause up to 10% ofneonatal kitten losses (Cave et al., 2002). While some congenital defects are readilyvisible at birth (e.g. cleft palate), others may remain unknown until the kitten dies andis submitted for necropsy (e.g. hiatal hernia). Examples of common congenital defectsinclude: eyelid coloboma, cleft palate, ocular dermoids, flat chest defect,gastroschisis, pectus excavatum, syndactyly, and umbilical hernia, (Little, 2005; Little2011). Hydrocephalus and urinary dysgenesis are examples of congenital defects thatcan cause kitten mortality (Cave et al., 2002).There are many different causes of congenital defects. A congenital defectmay be the result of genetic inheritance, infection *in utero,* exposure of the queen to ateratogen, hyperthermia of the queen, poor intrauterine environment, nutritionalfactors, or an interaction between environmental and genetic factors (Little, 2005). Anexample of an infectious cause of a congenital defect is the panleukopenia virus,which can cause cerebellar hypoplasia in kittens (Little, 2005). An example of ateratogen is griseofulvin, which is a drug used to treat ringworm infection. Whenadministered to a gestating queen, griseofulvin can cause cleft palate in kittens (Little,2005). A nutritional factor that can cause congenital defects is taurine deficiency,which is linked to various musculoskeletal defects (Little, 2005).

An analysis of 274 kitten deaths identified infectious disease in over half ofthe kittens (Cave et al., 2002). This rate was consistent within the neonatal age group,with one half of all losses occurring in the first 14 days due to infectious

causes (Caveet al., 2002). Breaking this down further, of the neonatal kittens that died frominfectious causes, half died from viral infections while the other half died frombacterial infections (Cave et al., 2002). In terms of specific infectious agents, all ofthe neonatal kittens with viral disease were determined to have feline herpesvirus orfeline calicivirus via histopathological testing (Cave et al., 2002). A different analysisof 168 deaths found that one third of the kittens died from infectious causes (Mossi-Dieth et al., 1990). In that study, bacterial infections were confirmed in twice as manykittens as viral and parasitic infections combined (Mossi-Dieth et al., 2002). Specificbacterial pathogens that were isolated from these kittens included *Escherichia coli*,*Streptococcus spp.*, *Pasteurella spp.*, *Plesiomonas*, *Proteus spp.*, *Bordetella*, *andSalmonella* (Mossi-Dieth et al., 1990). Finally, a review reports that feline embryonicand fetal loss is more commonly caused by viral infection than bacterial or protozoalinfection (Daniel Givens and Marley, 2008). In particular, feline infectious peritonitisvirus can cause abortion, stillbirth, and high mortality in the first week of life; andfeline panleukopenia virus can cause abortion, stillbirth, and cerebellar hypoplasia inkittens (Daniel Givens and Marley, 2008).The most common types of bacteria isolated in cases of pneumonia, pleuritis,myocarditis/endocarditis, or meningitis/encephalitis were *Streptococcus spp*. And*Escherichia coli* (Mossi-Dieth, 1990). Other common causes of upper and lowerrespiratory tract disease in kittens include; feline herpesvirus-1, feline calicivirus,*Bordetellabronchiseptica*, *Mycoplasma spp*., and *Chlamydophila spp.* (Little, 2011).In addition, panleukopenia virus (parvovirus), coliform bacteria, *Tritrichomonasfoetus*, *Giardia spp.*, *Isopora spp*., *Ancylostoma spp*., and *Toxocara spp*. are commoncauses of gastrointestinal tract disease in kittens. As for systemic disease in kittens,feline leukemia virus (FeLV), feline immunodeficiency virus (FIV), *Toxoplasmaspp*., Gram-positive bacteria (e.g. *Streptococcus spp*., *Staphylococcus spp*.), andGram-negative bacteria (e.g. *Escherichia coli, Salmonella spp*.) are common causes(Little 2011).

Normal pregnancy requirements and abnormalities of pregnancyare studied in domestic cats both for their value toveterinarians working with cat breeders. This manuscript is a review of normal pregnancynutrition 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 teaching and training pet hospital and research center (TTPHRC), CVASU. A total of 82 cases of pregnancy and neonatal mortality related record of Dhaka city area were collected during the 1-month study period (13^{th} May – 8^{th}June 2023).

Sampling strategy:

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

Data 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.

RESULT AND DISCUSSION

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

Table-1: Frequency distribution of feeding practices followed by owner during pregnancy

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

Table-1 showed highest 53.66% (44) owners use homemade food for their pets. Only 13.41% (11) owner's practices commercially available foods and remaining 32.93% (27) owners provide both homemade and commercially available foods. 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.

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**

During pregnancy, dietary demand for proteinincreases, especially for the amino acids—arginine,lysine and tryptophan (Kelley, 2003). Pregnant queens seek outhigher protein diets, in preference to carbohydrate-richdiets (Bradshaw *et. al.*, 1996). At a minimum, diets for pregnant queensshould contain 32% protein and 18% fat (Kelley, 2003). By the timeof parturition, queens should have gained 12–38% oftheir pre-pregnancy body weight (Munday and Davidson,1993). Dietary causes of poor reproductive performance inthe cat include severe malnutrition and taurinedeficiency. Cats have a limited ability to synthesizetaurine; therefore, a dietary source is required. Cats on ataurine-deficient diet exhibit resorption or abortion offetuses, an increased incidence of near-term fetal deathand kittens with low birth weights (Huxtable *et. al.,* 1979 and Sturman, 1991). Commercialdiets that are certified by the American association offeed control officials (AAFCO) contain adequateamounts of taurine.In contrast of providing nutritional supplements to the pregnant cat, 59.76% (49) owners give commercially available different types of vitamin and minerals supplements throughout the pregnancy period where 40.24% (33) cases found owners do not provide any supplements.

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**

For the present study, the author categorized the age of female cat when 1st matted into 4 groups. Among them, small number of female cats first matting take place more than 18 months of age and that was only 9.76% (8). Then 19.51% (16) female cats start matting within 6 months of age or during the time of puberty. Maximum number of first matting recorded within 7-12 months of age, 42.69% (35) followed by 13-18 months of age, 28.09% (23), respectively.

Table-4: Frequency distribution of dystocia

Dystocia	Frequency	Percentage (%)
Yes	18	21.95
No	64	78.05
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, the author found 21.95% (18) pregnant cat developed dystocia during delivery and on the contrary, 78.05% (64) mother cats gave normal delivery.

Dystocia is a reproductive emergency that islife-threatening to both dam and kittens. The
incidence of dystocia among pedigree breeding cats is typically less than 10% (Marelli *et. al.*, 2020 and Sparkes *et. al.*, 2006) butthere is a significant variation between breeds,pointing to a genetic component (Holst *et. al.*, 2017). Higherincidence rates have been described in severalbreeds, among them theBirman; (Holst et. al., 2017) in a Finnish study, 15% of Birmanswere diagnosed with dystocia (Sparkes *et. al.*, 2006), dystocia hasbeen associated with both small and largelitter sizes (Strom and Frossling, 2009).

Dystocia may be due to maternal and/orfetal factors. The most common cause of felinedystocia is uterine inertia, which accountsfor approximately two-thirds of cases (Ekstrand and Lindeforsberg, 1994).Complete primary uterine inertias are diagnosedwhen there are no signs of stage 2 parturitionafter the due date is passed, whereas partialprimary uterine inertia is diagnosed when thequeen reaches stage 2 parturition but uterinecontractions are weak and delivery of one ormore fetuses fails. Because of the varying gestation length in cats, complete primary inertia canbe difficult to diagnose.To avoid fetal mortality,caesarean section is recommended 71 days aftermating if there are no signsof impending parturition.

Table-5: Frequency distribution of litter size of 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 case of litter number parts, the author also divided into 3 categories according to number of kitten delivered and these are small, medium and large number of litter size. Only 7 number of mother cat delivered small number of kitten and represent about 8.54% of total. Medium number of litter encountered in 46 numbers of pregnant cat and constitute 56.10% and 35.36% large litter size recorded from 29 mother cats.

The average litter size in cats is 4.0 kittens per litter(Schmid *et. al.*, 1983, Munday and Davidson,1993 and Kelley, 2003) but varies among breeds. Number of matings isnot correlated with litter size (Prescot, 1973). A litter of 18 kittenswas reported in one queen undergoing pregnancytermination via ovariohysterectomy (Beaver, 1973). The cervix ofqueens is not patent during diestrus and pregnancy; novulvar discharge is observed during pregnancy innormal queens (Chatdarong, 2003). In late gestation, normocytic,normochromic anemia with reticulocytosis commonlydevelops (Berman, 1974). Total and differential white blood cellcounts have not been demonstrated to vary withpregnancy in cats (Berman, 1974).

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**

During the defined period, 82 cases were selected for this study and 34.15% (29) neonatal death found within few days after delivery followed by 18.29% (15) fetal death in intra-uterine and 24.39% (20) neonatal mortality counted in both intra-uterine and after delivery. In a study, 9.7% ofkittens may be stillborn and up to 16% of kittens may die before weaning (Holst andFrössling, 2009; Fournier *et al.*, 2017).

Other reported kitten mortality ratesare lower, with as few as 7.2% of kittens being stillborn and only 8.3% of kittensdying in the first 12 weeks of life (Sparkes *et al.*, 2006; Holst and Frössling, 2009).

Table-7: Frequency distribution of congenital anomalies of new born kitten

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

Regarding congenital anomalies of a kitten, out of 82 observations, 15.85% (13) cases showed kittens delivered having different types of congenital anomalies whereas 81.15% (69) breeding cats delivered normal healthy fetuses.

Congenital defects occur when kittens do not form properly *in utero.* As manyas 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% ofneonatal kitten losses (Cave *et al.*, 2002). While some congenital defects are readilyvisible at birth (e.g. cleft palate), others may remain unknown until the kitten dies andis submitted for necropsy (e.g. hiatal hernia). Examples of common congenital defectsinclude eyelid coloboma, cleft palate, ocular dermoid, flat chest defect,gastroschisis, pectus excavatum, syndactyly, and umbilical hernia, (Little, 2005; Little2011). Hydrocephalus and urinary dysgenesis are examples of congenital defects thatcan cause kitten mortality (Cave *et al.*, 2002).

There are many different causes of congenital defects. A congenital defectmay be the result of genetic inheritance, infection *in utero*, exposure of the queen to ateratogen, hyperthermia of the queen, poor intrauterine environment, nutritionalfactors, or an interaction between environmental and genetic factors (Little, 2005). Anexample of an infectious cause of a congenital defect is the panleukopenia virus,which can cause cerebellar hypoplasia in kittens (Little, 2005). An example of ateratogen is griseofulvin, which is a drug used to treat ringworm infection. Whenadministered to a gestating queen, griseofulvin can cause cleft palate in kittens (Little,2005). A

nutritional factor that can cause congenital defects is taurine deficiency,which is linked to various musculoskeletal defects (Little, 2005)

Table-8: Frequency distribution of malnourished kitten

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

Among the presented numbers, 42.68% (35) mother cats birthed malnourished kitten whereas 57.32% (47) cases represented normal well healthy kittens.

Dehydration and nutritional deficiencies are the concern with kittens because their bodies are made of80% water compared to 60% in adult cats (Little, 2011). This increased watercomposition, higher proportion of surface area, higher metabolic rate, and lower levelof body fat causes kittens to have higher fluid requirements than an adult cat of thesame size (Little, 2011). 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 comparedto an adult cat (Little, 2011). Thus, a kitten can easily become dehydrated if it hasdiarrhea, vomiting, or reduced fluid intake (Little, 2011). One way to quickly check akitten's hydration status is to examine its mucous membranes and determine itscapillary refill time. If the former appears pale and the latter is delayed, the kitten is atleast 10% dehydrated (Little, 2011). In addition, a dehydrated kitten's urine will bedarker in color and have a specific gravity greater than 1.020 (Little, 2011). If a kittenis only slightly dehydrated and does not have any other health issues, it can be treatedwith warmed subcutaneous or oral fluids. However, if a kitten is severely dehydrated,it will require intravenous or intraosseous Lactated Ringer solution (Little, 2011).Care should be taken to not overhydrate neonatal kittens because they do not have fullrenal excretory function (Little, 2011).

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 cat and neonatal kittens. This research has also demonstrated the lack of current research in 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 causes of kitten mortality between typesand 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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Biography of Author

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