

Off to the Right Start: Nutrition for Kittens

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Growth is a complex process involving interactions between genetics, nutrition, and other environmental influences. Nutrition plays a role in the health and development of growing cats and directly affects the immune system body composition, growth rate, and skeletal development. Diet is both controllable and perhaps the most important factor that influences health and disease.

The goal of a feeding plan for kittens is to create a healthy adult. The specific objectives of a good kitten feeding plan are to achieve healthy growth, optimize growth, minimize risk factors for disease, and achieve optimal health. Also, we want to optimize trainability and immune function and minimize obesity and developmental orthopedic disease. Overall, the ultimate goal of feeding kittens is to ensure they develop into healthy adults.

When looking at cats and dogs from a dietary perspective, dogs are considered omnivores and domestic cats and other members of the superfamily *Feloidea* are strict or obligate carnivores. This difference is supported by specific behavioral, anatomic, physiologic, and metabolic adaptations of cats to a strictly carnivorous diet.

Domestic cats today display some feeding behaviors that are similar to felids in the wild. Cats naturally do not display a regular daily rhythmic sleep-wake cycle, or regular cycles of activity, feeding, and drinking. Cats are known to consume 10 to 20 small meals throughout the day and night, behavior that is believed to be reflective of the evolutionary relationship of cats and their prey. Cats are known to hunt alone. Feral cats typically catch prey/mice as their source of food. On average a mouse provides approximately 30 kcal (125 kJ) of metabolizable energy (ME). This amount is about 12 to 13% of a feral cat's daily energy requirement.^{1,2} Therefore, we can see that hunting throughout the day and night is required to provide sufficient food for an average cat. Hence, recommendations of meal feeding, especially once per day, conflict with the natural behavior of cats. Conversely, we have also seen that free feeding has contributed to the obesity epidemic that is seen in cats, as well as other species. The ideal time to educate owners about proper feeding for cats, is during kittenhood.

Feline nutritional metabolism

The metabolism of cats is unique when compared to other species. Nutrition for felines must be closely monitored to ensure the specific nutritional requirements of a true carnivore are met.¹⁻³ Some of these unique attributes include:

- a. A limited ability to downregulate enzymes of nitrogen catabolism and urea cycle enzymes
- b. A strict requirement for the amino acid arginine,
 - i. Lack of arginine in the diet for longer than 24 hours, may have life-threatening concerns

- c. An inability to synthesize taurine from cysteine
- d. An inability to synthesize vitamin A from beta carotenes
- e. An inability to synthesize niacin from the amino acid tryptophan

Neonates

The neonatal period of a cat's life is considered to be the first two weeks of their life, with the first week considered the most critical for its survival.⁴ Newborn kittens are physiologically immature, with low percentages of body fat; 1–2% as compared to 12–35% in adult cats. This immaturity is termed altricial, which means that they are born immature and are therefore completely dependent on their mother for survival.^{4,5} If they are orphaned, that care will depend on their foster parents until they are mature enough to start caring for themselves.

The first nutritional concern for newborns is that they receive colostrum immediately after birth. Colostrum is milk produced by the mother during the first 24–72 hours after parturition. Colostrum provides nutrients, water, growth factors, digestive enzymes, and maternal antibodies.⁶ Most of the antibodies and other factors transmitted through the colostrum are in the form of large proteins. These are absorbed across the intestinal barrier, conferring passive immunity to the neonate.⁴ The neonate's ability to absorb these large proteins across the intestinal barrier remains only for the first 24–72 hours of life. Continuation of colostrum after this period provides no additional immunity to the neonate. Additionally, it is important to remember the neonate can only receive protection from diseases for which the queen has been vaccinated or has contracted and developed natural immunity. This passive immunity will help to protect the neonate until into the weaning period and is considered gone by ~16 weeks of age.^{4,6}

All components of colostrum are vital to the survival of the newborn. The key difference between colostrum and milk is in the water content and nutrient composition.⁴ The water content of colostrum is lower than that of milk. Thus, it is sticky and has a concentrated appearance as compared with milk. The water content found in the milk will gradually increase from day 1 to day 3.^{4,6} Additionally, lactose concentrations in colostrum are lower than those in milk with protein and fat levels being higher.

Energy content found in milk also increases throughout lactation.^{4,6} Neonates do not develop ample glycogen reserves until after the first few days of nursing. This lack of glycogen reserves results in the neonate needing to be nursed or fed frequently, sometimes as often as every 2 hours for the first week or so of life.

The second important concern for newborn kittens is the inability to maintain body temperature. Neonatal kittens are unable to thermoregulate and must be kept in an environment that is 85–90°F during the first week of life, and 80–85°F during the second week. If unable to keep warm they may become hypothermic, which will result in them being unable to eat, and if tube fed unable to digest the food. This failure to eat may result in rejection by the queen.⁴ The best source of warmth is the mother. After 6 days the neonates are able to

shiver but are still very susceptible to becoming chilled. Keeping the environment warm and free of drafts is extremely important during the first few weeks of life.

Orphaned neonates have the same requirements as do neonates that have a mother; they still need adequate nutrition and warmth. Obviously, the best course for the young kitten would be to have a foster mother; however, this is not always possible and if a foster mother is not available, kittens can be hand-raised.

Milk from other species are poor substitutes for mothers' milk. The protein, fat, and calcium levels found in goat and cow's milk are too low for kittens.^{3,5} The ratio of casein:whey in the milk also differs among species. Casein is the solid protein found in milk, while whey is the liquid protein found in milk. The amount of casein in milk may affect protein digestion, mineral utilization, and the amino acid composition of the milk. The ratio for cats is 60:40, while dogs are 70:30.⁴ An important reminder is just as milk from a bitch would be inadequate for kittens, so too is queen's milk inadequate for puppies. This is due to inadequate lactose and calcium levels. Bitch's milk contains almost twice as much protein compared to cow's milk. It also provides branched chain amino acids and high levels of arginine and lysine

Most of the time, kittens are raised uneventfully by their mother and weaned to an appropriate growth diet. However, with orphaned kittens, other feeding approaches are required. If a nursing queen is available, it is ideal to try to foster the orphaned offspring with her. If this is not possible, the kittens will need to be hand-raised with either tube feeding in very young or debilitated neonates, or bottle feeding in older and healthier ones. Bottle feeding is safest and easiest but can be time consuming, especially if one is managing a large litter. Tube feeding can be mastered by most pet owners with a little training; this is a faster, albeit riskier, method to deliver nutrition. It is recommended that a commercial milk replacer be used, as many home-prepared formulas are not adequate to meet the needs of a growing kitten. Additionally, most of these recipes were developed through trial and error, and their actual nutrient content is unknown.⁵ Cow's and goat's milk do not contain as much fat, protein, or calories as milk from queens and bitches and therefore should be avoided.^{1,3} Recommendations for feeding vary; they typically range from 13 to 18 ml/100 g body weight (using a formula with a caloric density of approximately 1 kcal/ml) to begin with and then gradually increasing as the orphan gains weight.³ Every feeding should be followed with anogenital stimulation by using a cotton swab or warm cloth to encourage urination and defecation.

Frequent reassessment of the feeding plan should be done looking at overall health, appearance, activity level, hydration status, and weight gain of the orphans. For kittens the expected weight gain would be ~18–20 grams/day.³ Chronic whimpering or vocalization may be an indication of discomfort or hunger, and would warrant a reassessment of the feeding plan.

The American Association of Feed Control Officials (AAFCO) does not provide detailed guidelines for testing milk replacers. Therefore, it is recommended that the manufacturers' information related to nutrient composition, nutritional integrity, and feeding efficacy be obtained, as this information will be helpful in choosing the best replacement.^{4,5} It is important

to remember, even the best milk replacer cannot provide the neonate with the antibodies found in colostrum; thus extra care must be taken to maintain a clean environment and prevent transmission of disease.⁴ It is imperative that the feeding materials (e.g., bottles, nipples, tubes) be cleaned and disinfected between feedings. The milk replacer itself should be made fresh or refrigerated between feedings to decrease the incidence of bacterial contamination. Remember, only the volume of milk replacer that will be consumed within a 24-hour period should be made. Milk replacer not used at that feeding should be stored in the refrigerator.⁶

Weaning

Weaning is a gradual process comprised of two phases. The first phase begins when the neonate begins to eat solid food between 3–4 weeks of age.⁶ Weaning can be encouraged by mixing a commercial food specifically made and tested for all life stages, or a thick gruel made by mixing a small amount of warm water with the mother's food which has also been made and tested for all life stages including lactation.^{4,5} It is important to remember that cow's milk should not be used to make the gruel as the lactose level is too high and may contribute to diarrhea. This gruel should be provided in a shallow dish, with the kittens allowed free access to the fresh food several times per day. To discourage bacterial growth in the food it should be removed after 20–30 minutes. A homemade weaning formula should not be fed, as the nutrient content would be unknown. This may lead to nutrient, vitamin, and mineral imbalances and an unknown caloric density. At first the intake of food will be minimal; however, by 5–6 weeks of age the deciduous teeth will have begun to erupt enabling the kittens to chew and eat dry food. As the food intake increases in the neonates, the mothers' milk production decreases. By 6 weeks of age, the second stage of weaning can begin with the kittens obtaining their full nutrition from their food and not from their mother (nutritional weaning).⁴ Some mothers may continue to nurse their young past this time, although very little milk is being produced with little nutrition being obtained by the kitten. It is believed that the psychological and emotional benefits of suckling may be as important as the nutritional benefits in animals that are older than 5 weeks of age.⁵ Because of this, complete weaning (behavioral weaning) should not be done until kittens are at least 7–8 weeks of age.

Postweaning

Kittens have high energy requirements to meet the needs of a rapid growth rate, thermoregulation, and maintenance. Kittens may grow at rates from 14 to 30 g/day during the rapid growth phase. It is imperative to remember that excessive energy intake may lead to obesity and therefore, the amount of energy provided must be carefully monitored. Remember an overweight kitten has increased chance to be an overweight adult cat. Thus, it is important that the veterinary team begin the nutrition discussion with cat owners on the very first visit.

Following neutering, it is recommended to limit food intake and/or feed a food with a lower energy density to help prevent excessive weight gain. The energy density of the food fed to rapidly growing kittens should be between 4.0 to 5.0 kcal metabolizable energy (ME)/g (16.7 to 20.9 kJ ME/g). A higher energy density allows smaller volumes of food intake to satisfy caloric needs. It is also recommended that foods with energy densities toward the lower end of this

range should be fed to neutered kittens, especially those with a body condition score (BCS) of 4/5 or greater. The prevalence of obesity increases dramatically after one year of age.

Protein requirements of kittens reflect their essential amino acid requirements and minimal nitrogen needs. Protein also provides sulfur-containing amino acids, which are required in greater amounts in kittens than in other species. Protein requirements are high at weaning then decrease gradually to adult levels as the kitten's growth slows. In kittens the recommended range of crude protein for foods for healthy kitten growth is 35 to 50% DMB.

Dietary fat serves three primary functions in growing kittens, it: 1) supplies essential fatty acids, 2) acts as a carrier for fat-soluble vitamins and 3) provides a concentrated source of energy in food. Remember too much fat and calories may predispose young kittens to obesity. Kittens and adult cats, require linoleic and arachidonic acid, and they also require omega-3 (n-3) fatty acids (docosahexaenoic acid [DHA], 20:6n-3). DHA has been shown to be necessary for normal neural, retinal and auditory development in kittens. The percentage of fat in kitten foods should be in the range of 18 to 35% fat. This will aid in enhancing palatability, meeting essential fatty acid needs and maintain the energy density of the food. DHA levels should be at least 40% of the total (DHA plus EPA), or 0.004% DMB.

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Key Nutritional Factors – Kittens (postweaning)

Recommended levels

in food (DM)

Energy Density (kcal ME/g)	4 – 5
Crude Protein (%)	35 - 50
Crude Fat (%)	18 - 35
DHA (%)	≥ 0.004
Calcium (%)	0.8 – 1.6
Phosphorous (%)	0.6 – 1.4
CA:P Ratio	1:1 – 1.5:1
Potassium (%)	0.6 – 1.2

References

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- 3 Fascetti AJ, Delaney SJ. Feeding the Healthy Dog and Cat. *Applied Veterinary Clinical Nutrition*, Fascetti AJ, Delaney SJ, eds. Wiley Blackwell. 2012. Ames, IA.
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- 6 Gross KL, Becvarova I, Debraekeleer J. Feeding Nursing and Orphaned Kittens from Birth to Weaning. *In Small Animal Clinical Nutrition, 5th ed.* Hand M, Thatcher C, Remillard R, Roudebush P, Novotny B, eds. 2010. MMI, Topeka, KS.

Resources

- AAHA 2021 Nutrition and Weight Management Guidelines = <https://www.aaha.org/aaha-guidelines/2021-aaha-nutrition-and-weight-management-guidelines/home/>
- 2021 AAHA/AAFP Feline Life Stage Guidelines = <https://www.aaha.org/aaha-guidelines/life-stage-feline-2021/feline-life-stage-home/>
- Feline Feeding Programs: Addressing Behavioral Needs to Improve Feline Health and Wellbeing = <https://catvets.com/guidelines/practice-guidelines/how-to-feed>