Pediatric Nutrition

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KEYWORDS

• Bitch • Puppy • Queen • Kitten • Milk replacer • Probiotics • Prebiotics

KEY POINTS

- Feeding a balanced commercial diet to lactating and growing puppies and kittens provides the necessary macronutrients (protein, fat, and so forth), vitamins, minerals, and supplements required for normal growth and development.
- The most important immune-related function of good intestinal microflora is protection against infection and colonization by harmful, and sometimes pathogenic, bacteria.
- Added benefit may arise from the use of docosahexaenoic acid–supplemented diets and from the use of prebiotic fibers, colostrum, and probiotics to promote growth and development of a healthy gastrointestinal tract, microbiota, and immune system in puppies and kittens.

INTRODUCTION

Balanced commercial dog foods designed for all life stages are the mainstay of feeding for optimal reproductive capacity in the bitch and ideal growth rates in puppies and kittens. Recent evidence suggests that certain micronutrients and macronutrients, when balanced with other nutrients in the formulation, may provide a healthier immune system, balanced gastrointestinal (GI) microbiota, and more acute hearing and vision.

PREGNANT AND LACTATING BITCHES

In general, pregnant and lactating bitches should be fed a high-energy (30% protein; 20% fat on a dry matter basis [DMB]), highly digestible commercial dog food that is balanced for vitamins and minerals. The food should be labeled adequate for all life stages. Food intake should not increase during the first 5 weeks of gestation; however, the food intake requirements increase to 1.25 to 1.5 times maintenance during the last trimester. During pregnancy in the bitch, protein requirements increase by up to 70% compare with maintenance to reach 6.3 g of protein per 419 kJ (100 kcal).[1] High-quality, animal-based proteins are preferred. Protein deficiency during pregnancy can result in low birth weights and high neonatal mortality.[2] During lactation,

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Vet Clin Small Anim 44 (2014) 265–273
http://dx.doi.org/10.1016/j.cvsm.2013.11.001 **vetsmall.theclinics.com**
0195-5616/14/$ – see front matter

protein requirements are even higher, particularly in large litters.[3] Feeding multiple times a day, with concentrated high-quality food, is essential to maintain body condition of the bitch, otherwise milk production decreases and neonatal growth is affected. In queens, certain amino acids such as taurine play an important role in maintenance of pregnancy. Fat delivers more kilojoules per gram of food (twice as many) than carbohydrates or protein, making it an essential component of an energy-rich diet for late gestation and lactation. However, lactation is extremely demanding and energy requirements may increase by 3 times compared with basal requirements by the time of weaning, particularly in large litters. Although protein and fat intake should increase in pregnant and lactating bitches, maintenance of ideal body condition is an important aspect of feeding pregnant and lactating bitches. Bitches that become overweight have a greater chance of pseudocyesis and dystocia.[4]

Before birth, some important nutritional requirements can affect the long-term health and well-being of puppies. Fats and essential fatty acids, such as linoleic and alpha-linoleic acid, are in increased demand during pregnancy and lactation in the bitch. Essential fatty acid deficiency has been associated with preterm labor, poor placental development and small litter size.[1] In particular, dams fed a diet rich in docosahexaenoic acid (DHA) deliver puppies that have improved learning ability, memory, and vision.[5–7]

Pregnant and lactating bitches do not require calcium supplementation unless to balance a homemade diet or to treat eclampsia, if present. The proper calcium/phosphorus ratio in diets for pregnant and lactating bitches is 1:0.8. Normal dietary calcium during gestation does not increase the risk for eclampsia in dogs; oversupplementation can induce parathyroid gland atrophy and associated postpartum hypocalcemia.[1] Concerns have been raised about the role of calcium in the periparturient period. Increased stillbirths have been associated with lower ionized Ca and higher parathyroid hormone levels in German shepherd bitches.[8] During lactation in the bitch, the demand for calcium increases exponentially.[9,10] In particular, small breed dogs such as Chihuahuas may be at increased risk for eclampsia, particularly if they are being fed homemade diets, such as chicken and rice, without calcium supplementation.

Prenatal folate supplementation has been promoted in human medicine to alleviate midline closure defects such as spina bifida and cleft palate. The only study in dogs showed that supplementation of folate in Boston terriers resulted in a decrease in the percentage of puppies with cleft palates.[11] However, the study was performed with dogs fed a homemade diet deficient in grains that contain large amounts of folate.[11]

Prebiotics

Sterile at birth, the GI tract is colonized within hours of birth. This well-controlled colonization involves a variety of organisms that find their own niches along the GI tract so that different groups of microorganisms colonize various locations of the intestinal tract. During the colonization process, these bacteria are organized into a state of equilibrium (a balance between beneficial and harmful bacteria) so that the health of the animal is maintained. In the stomach, because of its oxygen content and acidity, resident bacteria numbers are limited to 10^3 to 10^4 bacteria per gram of stomach contents. The primary bacteria populating the stomach are lactobacilli and enterococci. Bacteria in the small intestine are a combination of facultative anaerobes and anaerobes whose growth is limited by peristaltic activity. Populations of these microorganisms are low in the upper small intestine, but increase throughout the tract from the duodenum to the ileum. The greatest colonization of the GI tract (approximately 200 species or 400 different strains of bacteria) occurs in the colon, where decreased intestinal transit time allows bacteria to reach numbers of 10^{11} to 10^{12} organisms per