

The influence of nutrition on puppy and kitten growth and development

The influence of nutrition is no more apparent in cats and dogs than during pregnancy, lactation and growth. Gillian Furniss BVMS MRCVS looks at how to achieve optimal feeding of a balanced diet.



Companion animals are what they eat or – perhaps more appropriately – what we choose to feed them!

The growth and development of any animal is a delicate and sensitive period and a host of external influences during this time will affect the wellbeing and health of the adult. Classically, the growth and development period is thought to start from conception and the influences of diet (e.g., the relationship between folic acid deficiencies and neural tube defects) on this are well documented. In this brief article we will concentrate on the nutritional influences from pregnancy through the growth period and see that in fact our companion animals too, are what they eat or – perhaps more appropriately – what we choose to feed them!

Nutrition during gestation

Pregnant dogs and cats vary considerably in their energy requirements during their nine or so weeks of pregnancy. In dogs, there is no noticeable increase in food intake during the first five weeks of gestation. At this stage, foetal growth is slow and bone mineralisation has not yet occurred. The foetuses are still small enough to

have no impact on the gastric capacity of the bitch. This situation changes six weeks into the pregnancy when there is significant development of the foetuses and a corresponding increase in the energy, protein and mineral requirement of the bitch. By the end of gestation, the energy requirement of the bitch is 1.4 x MER (maintenance energy requirement), a situation made difficult by the fact that gastric capacity is physically reduced by the presence of the foetuses and the bitch will often suffer from a corresponding decline in appetite. To maintain the energy requirement of the bitch, it is important that she is offered a highly palatable diet, which is also energy dense and highly digestible, ideally over a number of small meals throughout the day.

There are now diets available for gestation and lactation in both dogs and cats, but a complete and balanced high quality puppy growth food, preferably dry to allow a smaller volume intake, is also an appropriate choice. An appropriate diet, fed through gestation, will also be suitable for lactation, and should be the diet of choice to

prepare the maternal digestive tract for the transition between gestation to the beginning of lactation.

Cats

Contrary to the situation in dogs, it is normal for a cat's weight to increase from the beginning of pregnancy. Generally, consumption increases gradually each week and will have increased by 70% by the end of gestation. During the first third of pregnancy the queen will lay down fat reserves which will be used towards the end of gestation and during lactation. This is referred to as pregnancy anabolism. After week six the weight gain corresponds to the rate of growth of the foetuses.

Throughout pregnancy the queen should be given a high energy food, ideally gaining 30-40% bodyweight between conception and the end of gestation. Achieving a balance is crucial as weight gain may make the birth more difficult and reduce the number of live births but, conversely, under-nutrition during pregnancy will also have serious consequences for foetal growth. As with dogs, the food of choice is most often a kitten growth food; the nutrients and energy content will meet the queen's nutritional requirements and the energy density will help compensate for a reduced food intake towards the end of the pregnancy, although ultimately she will start to draw on the reserves laid down previously.

Nutrition during lactation

During lactation there are some common considerations for both dogs and cats. Both will require *ad libitum* access to high energy, high quality food and permanent access to fresh water as even slight dehydration will detrimentally affect milk production. Post-lactation both the bitch and queen can be significantly underweight, in which case the lactation diet should continue to be fed until the animals are at their optimal body condition.

Dogs

In the dog, lactation sees a significant increase in the energy requirements of the bitch, rising to between 2-4 x MER. The energy required by the bitch is related to the exceptional richness of the milk in terms of calcium, energy (1,200-1,500kcal/kg milk) and protein and, of course, the number of pups and the growth potential of the breed. The dog species has the unusual feature of having a very wide range of body weights between breeds, varying from 1kg for the Chihuahua to more than 80kg for the St Bernard. These differences in size between breeds are reflected from birth by differences in weight and litter size. For example, a Poodle bitch gives birth to between one and three puppies each weighing 150 to 200g, i.e., nearly 5% of the weight of their mother. In Newfoundlands or German mastiffs, the litter varies between eight and 12 puppies each weighing between 600 and 700g, i.e., hardly 1% of the weight of their mother. From this observation, it is therefore not surprising to find a higher frequency of dystocia (difficult birthing)

and other neonatal diseases in small breeds (eclampsia, hypoglycaemia in puppies, etc.).

Lactation itself is also influenced by breed size. In smaller dogs, for example, lactation will cover the most intense growth period for the puppies, therefore it is a more taxing event for small breed bitches.

The balanced growth of the puppies is, of course, an indirect indicator of the quality of the milk and also the mother's health. An *ad libitum* diet comprised of highly digestible ingredients, minimum 30% protein and 25% fats, with balanced vitamin and mineral levels should ensure the health of the mother and optimal development of the puppies. By ensuring the appropriate dietary selection, there should be absolutely no need to supplement, particularly as addition of any supplement has the potential to disrupt the absorption of other constituents, the most obvious example being supplementation with extra calcium leading to lactation tetany and zinc deficiency.

Cats

After birthing, the queen will weigh around 20% more than her pre-pregnancy weight, reflecting the previously laid down fat reserves which will now be drawn on to provide for the energy demands of lactation. Throughout lactation, the queen should have *ad libitum* access to a high quality, highly digestible, high energy food. The fat content of the food will influence the quality of the milk being produced, affecting the fat content of the milk and also the body condition of the queen post-weaning.

Milk substitutes

Certain conditions such as the death of the mother, the mother not producing milk (agalactia), the mother not producing enough milk (hypogalactia), or toxicity in the milk due to mastitis, would indicate the need for a puppy or kitten to be fed a suitable milk substitute. Problems with lactation will become very quickly apparent if neonatal growth is retarded. Milk replacer should be selected based on several criteria including composition of the milk, ease of administration and, of course, the result obtained by feeding it. Ideally, a milk substitute should have a nutritional profile as close as possible to the mother's milk. Cat and dog milk are actually quite similar and much richer than cow's milk in terms of fat, protein and mineral content. The digestive system, particularly of kittens, is adapted to digesting protein, fat and lactose of animal origin and their starch digesting enzymes are not yet fully developed. The milk substitute should also contain all of the necessary vitamins, minerals and trace elements, essential amino acids and of course essential fatty acids.

Weaning and growth stages

The weaning period is a transitional period during which the capacity of the animal to digest starch develops and its ability to digest lactose wanes (explaining the diarrhoea

often seen when the suckling period is prolonged). For kittens and puppies this is a stressful time. Their maternal immunity starts to wane and their own immune response is not yet fully developed. On top of this, they are at increased risk of encountering infectious agents and, given their low gastric acidity, are more open to toxic infections from poorly processed food or from poor hygienic standards. To help support the immune function, brain development and general health of animals during weaning, a high quality, well balanced diet should include high levels of antioxidants (such as vitamins E, C and taurine) and appropriately balanced essential amino and fatty acids (such as DHA).

Dogs

In dogs, the weight at birth changes very quickly, being doubled in seven to 10 days, tripled in three weeks and quadrupled or quintupled in a month. Breed-specific variations in puppy growth patterns are well documented. Larger breeds (with a growth period of anything up to 24 months) have a longer growth period than smaller breeds (averaging eight months). In fact, the differences in body size between breeds principally relates to differences in secretion of circulating growth hormone as the puppy grows. Poor nutrition during the first four months can have dire consequences for future growth and development and during this period excesses can be as dangerous as deficiencies.

During weaning and early growth the puppy has a very sensitive digestive system (low digestive capacity), and is experiencing a critical period in terms of its immune system. Its requirements, like those of the mother, are two to three times higher than those of an adult dog. There are a number of important considerations in the selection of a diet whether it be for growth or weaning. For example, the digestibility of the food must be excellent. All ingredients should be of superlative quality and highly digestible, ensuring the puppy is able to absorb the full nutrient value of the diet. Any raw meats fed during this time will be indigestible, exacerbating puppy diarrhoea and potentially leaving the animal at risk from infection such as salmonellosis. Diet should be of a high energy density allowing a sufficient energy intake in a small volume, so as not to overload the gastrointestinal system. A weaning animal should be fed small volumes throughout the day.

Given the marked differences in growth periods, diet should be selected with the age and stage of development taken into account together with the anticipated adult size of the animal. 'Maxi' (26-44kg) and 'giant breed' (>44kg) dogs in particular should be fed a diet specific for each period of growth to ensure optimal health, growth and development. Energy should be balanced. So, for example, a puppy with an anticipated adult weight of 30-35kg should not gain more than 150g per day, nor weigh more than 65% of their adult weight at six months of age. Excessive calorie intake will increase the rate of growth resulting in

rapid maturation of the musculoskeletal system, increased joint stress and increased risk of musculoskeletal disorders such as hip dysplasia, osteochondritis and hypertrophic osteodystrophy. Diet should also contain an appropriate balance of nutrients for that age and stage in relation to anticipated adult size. Calcium and phosphorous imbalance, for example, is of course a major risk in growing dogs. Calcium and phosphorous intake must be carefully monitored particularly in maxi and giant breed puppies to prevent skeletal disease, but also in smaller breed puppies to prevent metabolic changes.

In the past it was wrongly thought that high levels of protein in puppy food was unfavourable for correct growth in dogs of large breeds. This conclusion, although very controversial, quickly became widespread and many believed in good faith that the protein contents of foods for puppies of large breeds should be limited. However, work that is more recent has confirmed the experiences of many clinicians and nutritionists. These studies have found no difference in the skeletal development in puppies raised on diets with the same energy content but containing different protein concentrations. An epidemiological study to identify the risk factors associated with some joint disorders even showed that foods richer in proteins seemed to have a protective effect. Such observations indicate that protein cannot be implicated as being a cause for osteo-articular disorders during the growth of puppies of large breeds, despite some of the more zealously held beliefs! An enhanced and balanced level of vitamins and other dietary antioxidants is recommended to prevent growth disorders but more importantly to help support a developing immune response.

Given the differences in requirement through different lengths of growing periods, all feed guides should now take into account the vast variations we have in dog sizes. Growth curves, daily weight gains, mineral content and energy requirements all vary depending on the age and size and even breed of dog, and all must be taken into account when formulating diets for puppies.

Cats

Over the past thousands of years, man has done very little to change the size and shape of cats – selecting them more for personality and appearance than for workmanship, unlike dogs. Therefore, disorders associated with rate of growth in cats are rare. Nutrition has much more of a consequence post-neutering, when the feline is faced with a number of risk factors related to gender (such as stone formation and obesity), risks which can be reduced via diet. That said, there are still some important considerations when feeding growing kittens.

In terms of monitoring growth, it is useful to weigh kittens daily, and at the same time every day. Kittens, like puppies, grow rapidly, gaining 10 to 15g per day and doubling their birth weight within 10 days. Weaning should be a gradual process but can be aided by providing a soaked,

suitable kitten food from an early age. Cats appear more sensitive than many other animals to the taste and texture of food; soaking the food in a suitable milk replacer will help make the food more appealing and the amount of liquid added can be gradually reduced over time until the kittens are fully weaned. Ideally, the diet fed to the queen will be the weaning diet of choice. Kittens are conditioned to certain flavours and even the foetus is aware of the aromas of the amniotic fluid and the neonate is sensitive to the composition of the mother's milk, both of which will be strongly influenced by diet.

As with puppies, kitten food should be energy dense, highly digestible, complete and well balanced in terms of nutrient content. Kittens will have the same issue in terms of energy needs in comparison to digestive maturation requiring an energy dense food, in small volumes throughout the day. At eight weeks of age, a kitten has an energy requirement three times more per kilogram body weight when compared to an adult cat (growing kittens require, on average, 200 to 250kcal/kg BW). Energy requirements will stay high until around 12 weeks of age when the animal then enters a slower growing period. Although nutrition-related growth disorders are rarer in kittens, as with puppies, there are still specific considerations and essential nutritional requirements must be met.

Although both the taurine and the arachidonic acid requirements of cats are well documented, the likelihood

of a commercial diet being lacking in either ingredient is exceptionally unlikely! Metabolic bone disease due to calcium deficiency is also now a very rare occurrence with most owners opting for commercial kitten diets, although it may still be seen in kittens fed some home prepared diets. Clinical abnormalities relating to excess dietary calcium are not reported although increased bone density and high plasma calcium concentrations have been shown experimentally.

Antioxidant supplements in the diet have proven effective in both kittens and puppies in terms of supporting immune performance such that the supplemented animals present a better post-vaccination immune response. Fermentable and non-fermentable dietary fibres such as fructo-oligosaccharides (FOS) and mannanoligosaccharides (MOS) have a beneficial effect on the digestive tract of kittens and puppies. FOS acts to stimulate the growth of beneficial bacteria such as *Lactobacilli* to the detriment of pathogenic bacteria such as *Salmonella*. MOS also limits the development of pathogenic strains of bacteria and, at the same time, stimulates production of intestinal antibodies.

As well as such specificities, kitten growth diets should also consider size, shape and texture of the diet to ensure the growing animal is met with a highly palatable option that it can actually pick up! Moreover, with adult teeth already erupting at around three and a half months it is never too early to contemplate the dental health benefits of a diet.

Summary

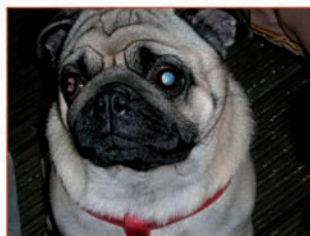
The influence of nutrition is no more apparent in cats and dogs than during pregnancy, lactation and growth. The veterinary nurse and practitioner both have a level of responsibility to ensure that clients are made aware of the requirements of a growing or pregnant or lactating animal and so ensure that optimal nutritional requirements are met. Dogs and cats, puppies and kittens, fed a diet especially formulated for their age and stage of development as well as their adult size, will have all of the nutritional requirements addressed. Optimal feeding of such a balanced diet eliminates the need for any form of dietary supplementation and ensures that an animal is given the best possible start in life. Once basic needs are met in the most optimal way, then we can start to consider the role of nutrition in helping to reduce the health risks faced by fully grown cats and dogs, but that is a whole new chapter ...!

Further reading

Please refer to www.royalcanin.co.uk and follow the links to 'Dog' and/or 'Cat Encyclopaedia'.
Growth of Puppies and Kittens. (2004). *Waltham Focus* 14: 3

Gillian Furniss is Veterinary Director with Royal Canin, UK. For more information on complete and balanced feeding of cats and dogs at any lifestage and of any size, please contact your Royal Canin VBM or the dedicated Veterinary Helpline on 0044 800 137 612.

Missing Dog



This dog, Bailey, a much loved and sadly missed family pet went missing, possibly stolen, on the 24th January 2008 from his home in the Shankill/Corbawn Lane area in South County Dublin and there is a strong possibility he may have been subsequently sold on.

He is a pure bred Pug, microchipped, four years old, blind in one eye with only 30% vision in the other eye so may require veterinary treatment.

If you think you may have seen this dog or treated him recently, please call 086 383 0899 or 01 2823381 in strictest confidence.

