

NUTRITIONAL CONSIDERATIONS FOR THE BITCH DURING REPRODUCTION

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Introduction

Nutrition is one of the most critical components related to a competitive animal's performance. The same is true for the reproducing bitch. In fact, outside an animal's genetics, nutrition is probably the single most important component to a successful breeding. Unfortunately, there is a tremendous lack of knowledge regarding the nutritional requirements of the bitch during pregnancy and lactation. This is a surprising fact, since there are some 450,000 litters registered with the American Kennel Club (AKC) per year.

Much as an umbrella protects us during a rainstorm, optimal nutrition will help protect the bitch and her progeny from the various metabolic and environmental stresses that occur during the pregnancy and lactation periods. During the reproductive process, a bitch's diet must support 3 areas: 1) her body maintenance, 2) the growth of her reproductive tissues, and 3) the growth and development of her offspring. However, the requirement and nutrient priority is not equal between the areas. Once the bitch has undergone maternal recognition of pregnancy, the developing offspring will have the highest nutrient priority followed by her reproductive tissues, with her body's maintenance having the lowest priority. A key component to remember is that unlike the bitch, the developing offspring have 2 sources of nutrients, the bitch's diet and the bitch's body. Should the bitch's diet fail to meet the required nutrient levels, the bitch will respond by sacrificing her body's maintenance and mobilize nutrients from her body's fat, muscle and skeletal tissue for the developing offspring and reproductive tissues. In extreme cases, her only solution may be to reduce the demand by decreasing the number of offspring or abort the pregnancy all together. To what extent the bitch is able to offset nutrient shortfalls remains unclear. However, since deficiencies in maternal nutrition in other species have now been associated with adult disorders in the progeny¹, it is critical breeder make all attempts to supply optimal maternal nutrition. This concept will be discussed in further detailed later in this article, "Maternal Nutrient Depletion".

Campbell and Phillips² and Ontko and Phillips³ provided some of the earliest insight into the specialized nutritional requirements for the reproducing bitch. In both studies, diets known to be sufficient for canine growth and maintenance were found to be inadequate for reproduction. However, these studies were conducted almost 50 years ago and it is doubtful that any modern growth formula would not be sufficient for reproduction. While this thought is comforting, sufficiency should not be the target. Sufficiency does not equate to optimal nutrition. Sufficiency simply means the bitch is able to complete the reproductive process. Collins⁴ concluded that the stress associated with reproduction would manifest even the smallest of nutrient inadequacies in diets assumed to be complete. These dietary inadequacies may not be severe enough to inhibit the bitch from reproducing, however they most likely will prevent her from performing at her genetic potential.

Dietary nutrient supply is routinely described relative to gross composition, X% protein, Y% fat, and so forth. However, just as the old saying of "All things are not created equal" is true, the

same can be said of dietary nutrients during pregnancy and lactation. In a broad sense, dietary nutrients are defined as essential and non-essential. Essential nutrients cannot be adequately produced by an animal's body to meet the animal's requirement, thus must be obtained through the diet. Essential nutrients would include the essential amino acids, essential fatty acids, as well as various minerals and vitamins. Conversely, non-essential nutrients can be supplied via the diet or produced by the body should dietary sources fail to supply sufficient quantities. However, this concept does not hold true for the developing offspring. Puppies (embryonic, fetal or nursing) are dependent upon the bitch to supply them with all nutrients and because many of the metabolic pathways to produce non-essential nutrients are not functional until late neonatal life. Thus for the young puppy all nutrients are in a sense "essential". However, this is not to imply that one should simply switch to a diet that contains the highest available nutrient (protein or energy or both) content or use various dietary supplements to enhance a food. Excess-nutrition can be as detrimental as nutrient deficiencies. Excess dietary energy often contributes to increase pup morbidity and excessive maternal weight gain, which dramatically increases the chance of dystocia during parturition. The use of dietary supplements can supply excessive amounts of nutrients such as minerals, thus altering the balanced dietary matrix of the diet. The key to optimal nutrition is supplying a food that has a balanced nutrient profile at levels that meets the animals need. As Mosier⁵ stated in 1977, "only by feeding well managed balanced diets can the health of an individual be maximized". Thus components within the dietary matrix that should be consider are not only the level of protein, fat, carbohydrate, vitamins and minerals, but also the type of protein and fat and the ratio of nutrients such as protein to fat.

What to feed?

Most owners or handlers of competitive dogs have a general appreciation that their dog requires a higher plane of nutrition to perform. This same logic should be applied to the breeding bitch, only to a higher extent. So what diet should be recommended? A great place to start is a commercially available premium food with animal based protein sources that is recommended for gestation and lactation from a reputable company. While there are many "home based" diet recipes circulating, it is extremely difficult to achieve a complete and balanced diet using these recipes. These diets can often be deficient (or unbalanced) in vitamins, minerals, or other nutrients and are undefined with regard to amino acid and fatty acid levels. They may also vary over time due to an inconsistent ingredient supply. Commercial formulas offer distinct advantages by allowing the breeder to feed a product of known nutrient content and type proven to support the reproductive process.

Most competitive dogs will require around 125-150% the nutrition during the active season compared to non-competitive dogs. However, the nutritional requirements for the pregnant or lactating bitch are not constant. Her requirement levels are influenced by the stage of the reproductive cycle as well as her litter size and genetic ability (milk). During early and mid gestation (first 5 weeks), the energy requirements of the bitch are approximately equal to maintenance.⁶ However, this does not mean that the bitch should be fed a "Maintenance" diet. The maintenance recommendation relates only to the daily energy requirement.⁶ As mentioned earlier, the bitch must also supply the developing offspring with the nutrients they need to grow and develop. Because of this, we recommend that a bitch be switched, prior to breeding, to a

nutrient dense formula that is less dependant on carbohydrates (< than 35% of the calories) to ensure that the protein and fatty acid requirements of the puppies are met (see Table 1).

Table 1: Effect of diet matrix on daily nutrient intake.^a

	Metabolizable Energy (kcal/day)	Protein (g/day)	Fat (g/day)	Carbohydrate (g/day)	Total Intake (g/day)
Maintenance Formula	1143	78.4	48.3	108.6	279.0
High Density Formula	1143	88.3	57.2	80.1	257.8

^aBased on the average analysis of Eukanuba[®] Adult Maintenance Formula, guaranteed to contain 25% protein and 16% fat compared to Eukanuba[®] Premium Performance Formula, guaranteed to contain 30% protein and 20% fat.

Thus at approximately two weeks prior to breeding (onset of proestrus), the bitch should be transitioned (if necessary) from her maintenance diet to a diet comprised of at least 28% highly digestible animal-based protein and 18% lipids. The lipid (fat) portion of the diet should be balanced for fatty acid (FA) content to supply an omega 6 (n6) to omega 3 (n3) FA ratio in the range of 5:1 to 10:1. Findings from a recent study conducted by The Iams Company comparing 3 diets demonstrated positive benefits of feeding this dietary matrix.⁷ When fed throughout the reproductive cycle, this type of diet matrix resulted in fewer misconceptions, a reduced number of still-births and more consistent-sized litters from breeding to breeding.⁷ The exact amount of food required will vary depending on breed and metabolic rate, however the level of intake should be closely monitored to target a caloric intake similar to maintenance levels, thus avoiding over-feeding the bitch (Table 1).

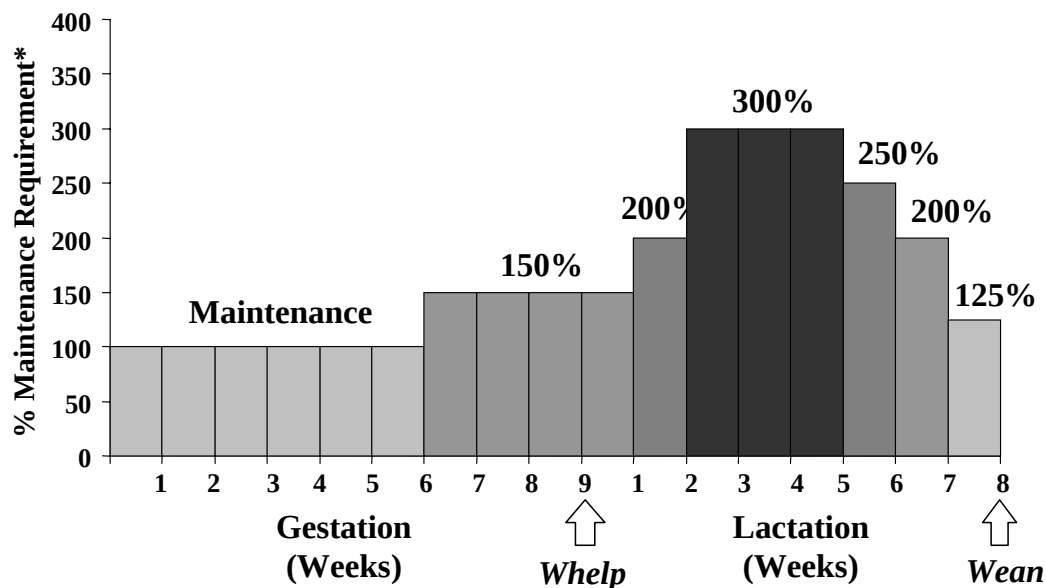
As stated earlier, during the first 5 weeks of pregnancy, the breeder should continue to feed the bitch the selected diet at maintenance levels (energy basis). It is possible that a change in the bitch's appetite may be observed at approximately 3 weeks post-breeding, first decreasing followed by a dramatic increase. This, however, may not indicate that the bitch is being overfed or underfed. This period of pregnancy parallels maternal recognition of pregnancy and embryonic implantation that may trigger these appetite changes. It is very important that the bitch be maintained on her normal routine during this period to prevent any undue stress, which could be detrimental to the pregnancy.

At approximately 5 weeks post-breeding, the food intake of the bitch should be increased slightly each day to achieve a 25-50% increase in energy by the end of week 6.⁷ For example, if the bitch is consuming 1,000 calories/day for maintenance, by the end of the 6th week she should be consuming approximately 1,250 to 1,500 calories/day. One can obtain this information from the product manufacturer.

The reason for the needed increase is 2 fold. The first is to meet the increased nutrient demands of the fetal puppies as their growth rate dramatically accelerates. To put into perspective, the fetal puppy body weight will increase approximately 1200% during the last 3 weeks of pregnancy.⁸ The 2nd is to help the bitch increase her energy stores (body fat) that she will need

during lactation. It will be necessary to closely monitor the bitch for weight gain during the later portion of gestation to ensure that she is gaining sufficient weight. It is impossible to give an exact percentage of weight that a bitch should gain since the increase will vary greatly from breed to breed even within similar adult sizes. For instance, one would expect a Labrador Retriever to gain more weight (as a percentage) than an English Setter since they typically give birth to larger litters. However, a good rule of thumb would be to target a 25% weight gain in the bitch by the end of week 8 (d 56) post-breeding.

Figure 1. How Much to Feed?



* Expressed on an energy basis

Lactation:

Nutritional management through the lactation period is much more difficult than during pregnancy, however the same recommendation holds true, supply "Balanced Nutrition". The breeder must consider numerous factors when developing a management program for lactation. How many puppies is the bitch nursing? What is the bitch's normal metabolic rate? What is the nutrient density of the chosen diet? What stage of lactation is she at? These are all questions that the breeder must take into consideration.

Early Lactation: Most bitches have depressed appetites for the first few days following whelping. This is perfectly normal and should not be a concern unless the behavior continues longer than 3 days or if she is displaying other health concerns (putrid discharge, fever). Should the bitch's appetite remained depressed for more than 3 days, or if she is displaying other health concerns it is advisable to seek immediate medical attention.

First and foremost, ensure that the bitch has free access to water. Remember milk (mature) is composed of approximately 78% water, thus one of the keys to good milk production is an adequate water supply. While the bitch's body can offset the other nutrients needed for colostrum and milk production, she cannot offset a lack of water. Generally speaking, most bitches' appetites have returned to normal by day 4 or 5 post-whelping with a targeted intake around 150% of maintenance through the first week of lactation (Figure 1).⁶

Mid-Lactation: Provided the bitch is carrying a typical size litter, the breeder should try to slowly increase the amount of food they offer each day from day 8 through 30 of lactation (Figure 1).⁶ Offering numerous (4-6) meals per day often gives better results as opposed to offering 2 large meals. If this management practice is not possible, offer free choice. The general target would be to achieve approximately 200% of maintenance by the end of the 2nd week of lactation and 250-300% by the end of the 3rd week (Figure 1).⁶ The rule of thumb for 4th and 5th weeks of lactation would be 300% of maintenance, however this figure may be as high as 500% in heavy milking bitches or bitches carrying large litters. This period (weeks 4-5) is the time where the bitch will produce the greatest amount of milk (peak lactation). Some of the best bitches may utilize as much as 8,000 calories per day (estimated) during this time, thus it is practically impossible for these bitches to consume enough calories to meet these needs. This tremendous energy requirement is why it is so important for the bitch to gain the proper amount of weight during late pregnancy. The added weight (body fat) that the bitch acquires during late pregnancy will be mobilized during this timeframe to offset the energy deficient (see Maternal Nutrient Depletion below).

Late Lactation: Nutritional management during late lactation is dependent upon at what age the breeder plans on weaning the litter. The vast majority of litters are weaned between 6 and 8 weeks of age, although some breeders wean as early as 5 weeks and some extend the nursing period as long as 10 weeks, though the latter is very much the exception. There is no perfect age for weaning and each litter should be managed as an individual. The final decision should be based on how well the puppies are eating and drinking. While it is impossible to force the puppies to accept the new practice, there are management practices that the breeder can use to help promote the weaning process.

After 35 days of lactation, the amount of food offered to the bitch can be reduced to around 250% of maintenance levels with additional decreases each day until the bitch is being fed around 125% of maintenance levels at the desired weaning time (Figure 1).⁶ The decrease in food intake will result in decreased milk production, thus stimulating the puppies to seek an alternative nutrient source. During this period, it is critical that the puppies be offered a wet gruel (ground kibble and water). Remember that the bitch's milk is also the puppies' source of water, so water should also be accessible by the puppies. Gruel can be prepared by mixing some of the bitch's formula (preferably a performance or growth formula) with warm water. Alternatively,

there are specially designed formulas for the weaning process. One such formula, Eukanuba® Weaning Formula, is a nutritionally balanced, caloric dense formula that has been pre-ground to allow easy mixing with warm water. Initially, the gruel should be semi-liquid (65-70% water) where the puppies can easily lap the mixture. The percentage of solids can be increased as the puppies grow more accustomed to the routine. It is also helpful to begin to add a few whole kibbles to the puppies after a week or so. This will help the puppies become familiar with the food texture and by 6 to 7 weeks of age most puppies will freely consume dry kibbles. Once the puppies have mastered the art of eating and drinking, they are ready to be weaned.

Maternal Nutrient Depletion:

Unfortunately for the breeder, the management of the bitch is not over once she has weaned her litter. Just as prior to breeding, each bitch should be carefully examined to determine her physical condition after she has weaned her litter. While not necessary, it is advisable to have your veterinarian give the bitch a physical. The desired outcome would be to have a bitch that is in identical condition after weaning as she was before she was bred. In most cases, this does not happen. The reproductive process is one of the most demanding metabolic periods of a bitch's adult life. Because of this, some bitches (most but not all) will undergo a physiological condition termed "Maternal Nutrient Depletion". Although this condition occurs naturally, it should still be a concern for the breeder. An easy way to visualize this condition is to imagine the bitch's body as a reservoir, the bitch's diet as the streams and rivers that supply water to the reservoir and the puppies as the floodgates. As long as the supply of water coming into the reservoir equals to the amount of water being released through the floodgates, then the water level remains at normal levels. However, should the amount of water leaving the reservoir exceed the amount being supplied by the streams and rivers, the water level in the reservoir will fall. This is exactly what happens to certain nutrients during reproduction. There are several examples of Maternal Nutrient Depletion. One of the most common is the loss of body fat during lactation. All breeders have observed their bitches increase the amount of body fat that they carry during the latter period of pregnancy. This increased fat will be mobilized during peak lactation to serve as an energy buffer to ensure quality milk production. Normally this type of nutrient depletion is not a big concern since the bitch has increased her body's supply of this nutrient. However, in some cases, the demand may still exceed the bitch's nutrient deposits, resulting in an animal that completes the lactation phase in poor condition. Another type of nutrient depletion that should concern breeders is related to nutrients that cannot be produced by the body (essential) or nutrients that the body can only store in limited quantities. To date, there is only limited information available on the absolute nutritional requirement levels during pregnancy and lactation. For the non-essential nutrients there is less of a risk because hopefully the bitch's body will be able to offset the shortage by increasing production of those nutrients. However, essential dietary nutrients are a different situation. As the term "essential" implies, these are nutrients that the bitch cannot produce (or cannot produce in sufficient levels) and must be supplied in the diet. When the diet fails to meet the combined requirements of the bitch and her offspring, she must resort to mobilizing her tissues (bone and muscle) to meet the demands of the puppies and her most critical systems. For this reason, it is recommended that the breeder continue to provide the same diet to the bitch for at least 3 weeks after weaning. The amount of diet required should be dictated by the physical condition of the bitch, the worse her physical condition the greater the amount of food that should be supplied. A key point to remember during this time is that the

bitch cannot fully recover if the amount of nutrients supplied only meets her maintenance requirement.

Conclusions:

Feeding the bitch does not have to be complicated. While the science associated with nutrition and reproduction may require years to understand, the actual practice of providing nutrition can be summarized fairly simply, *feed the appropriate amount of a diet that meets the animals needs*. While this practice still requires the breeder to make evaluations as to what and how much diet that will be fed, it does eliminate questions such as to what mix of products and/or supplements must be utilized. Based on our efforts in the area of canine reproduction, a good starting point for the breeder would be to identify a diet that contains at least 28% highly digestible animal-based protein and 18% lipids supplying both omega 6 and omega 3 fatty acids. The benefits of feeding a matrix of this type include increased conception rate, increased live births and more consistent maternal productivity.⁷ While nutrition is only one component of bitch management, it is one of the most (if not the most) important. Thus by providing the proper nutrition, the breeder has taken a great step forward in achieving a successful breeding program.

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