

Nutrition and health of dogs and cats: evolution of petfood

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ABSTRACT

Maintaining the health of dogs and cats by feeding wholesome nutritional diets is becoming an important component of responsible pet ownership. Pet owners now seek a long and healthy life for their pet and look to nutrition, as well as to veterinary medicine, to provide such support. Quality of life, measured in terms of reduced incidence of diseases and the ability to maintain an active life, would appear to be able to be enhanced by appropriate nutrition and nutraceutical supplementation. As a consequence numerous improvements in companion animal nutrition have resulted in development of a wide array of foods that provide complete and balanced nutrition. As a result emphasis also has to be placed on product safety and quality parameters, in connection with traceability. The origin of products, including product characteristics and properties, processing conditions and further handling throughout the period chain, is becoming ever increasingly an issue for collective chain management.

Abbreviations: ALT, Alanine Aminotransferase; ALP, Alkaline Phosphatase; FOS, Fructo-Oligosaccharides; PUFA, Polyunsaturated Fatty Acids.

INTRODUCTION

The primary role of diet is to provide enough nutrients to meet metabolic requirements, while giving the consumer a feeling of well-being. Recent knowledge, however, supports the hypothesis that, beyond meeting nutritional needs, diet may modulate various functions in the body and may play detrimental or beneficial roles in some diseases. Concepts in nutrition are expanding to include an emphasis on the use of foods to promote a state of well-being and better health and to help to reduce the risk of diseases.

Pets have not been out left of these considerations: because of a continuing emphasis on health and proper nutrition, it is not surprising that maintaining the health of companion animals and seeking optimal nutritional products for dogs and cats is seen by pet owners as an important component of responsible pet ownership. Dogs and cats are living longer and are better fed than ever before (Reid and Peterson, 2000). Indeed, nowadays, pet are kept very much as part of the family and thus it is the responsibility of the owners to ensure their pets' longevity and quality of life to the best of their abilities.

In their role as qualified animal health professionals, veterinarians, especially those in small animal practice, are being asked to discuss these issues with their clients. Thus, it is important to obtain a better understanding of the relationship between nutrition and health, the role of various nutrients in the prevention of diseases, and the efficacy of nutraceuticals, dietary supplements, and functional food ingredients (Bauer, 2001).

Foods claimed to improve health must also be guaranteed for quality and safety. No single aspect of a petfood is sufficient upon which to judge quality. Further, many qualities of a product are difficult to assess by examination of the label or contents. However, some indications of suitability can be determined and used to compare the relative quality of products.

Recent outbreaks of animal diseases have created a heightened awareness of food-related safety and traceability issues. The petfood industry is not immune to these concerns and should be able to communicate that their products have the same quality standards as human food products.

NUTRITIONAL ADEQUACY

Pets, like humans, have a finite maximum life span, although there is some indication of a life extension or expectancy effect when calorie restriction is practiced throughout life (Kealy et al., 2002). Extensive calorie restriction is difficult to implement in practice and it is perhaps more important to examine other aspects of a pet's life. Quality of life, measured in terms of reduced

incidence of disease and the ability to maintain an active life, would appear to be able to be increased by appropriate nutrition and nutraceutical supplementation.

As the health of dogs and cats depends on the adequacy of their food, it is important to review the nutritional basis on which commercially prepared foods are formulated. Some progress into nutrient requirements have been made in recent years, so that a large number of the commercially prepared petfoods support excellent growth, reproduction and maintenance in healthy companion animals. However, more precise information is still required about nearly every essential nutrient for companion animals, bioavailability of nutrients, and the interactions between nutrients. Indeed, delineation of the nutrient requirements of dogs and cats is a fertile area of research, although the slow progress that has been made is probably due to the fact that this research is expensive to conduct and very little funding is available.

Many of the standards of nutritional support for pets now regarded as essential were once considered unnecessary or excessive. The new recommendations for supplemental or optimal nutrition that are becoming the norm are in the same category. For example, increased levels of primary antioxidants such as vitamins E, C, and β -carotene, taurine, creatine and the natural antioxidant plant components (bioflavonoids), as well as certain fiber sources, omega-3 fatty acids, mineral chelates, glucosamine, and chondroitin, are now considered normal in petfood recipe design.

It is also well known that nutrition plays a role in the development of certain diseases in companion animals, but the present database on this topic is still less than complete (Morris and Rogers, 1994). A number of areas of nutrition impinge directly on the longevity and health of pets, such as the optimal level of phosphorus and protein for normal dogs and cats to prevent renal diseases, the optimal growth rate for giant and large breed dogs that will lead to normal skeletal developments, the relationship between energy intake in the growth phase and predisposition to obesity; the optimal levels of nutrients with antioxidant properties in food (Hand et al., 2000).

Finally, many nutrients have been implicated in either enhancement or suppression of the immune system. Early studies on the interaction of nutrition and immunity focused on the effects of protein-energy deprivation. Neither of these are typically lacking in the diets fed to companion animals today. However other nutrients may be provided at sub-optimal levels due to inaccurate estimation or imprecise knowledge of the maintenance requirement for that nutrient, poor bioavailability of the nutrient to the animal, inadequate supplementation levels or, perhaps, a uniquely high nutrient requirement for a particular lifestage or activity level (Grieshop, 2002).

NUTRACEUTICALS AND FUNCTIONAL FOODS

The development of nutraceutical and functional foods provide an opportunity to contribute improve the quality of food. Much of the interest in functional food stems from evidence that manipulation of health status by medication is no longer accepted as the only means of treatment. Notwithstanding the regulatory status of these substances, scientific studies to support safety and utility for these supplements are still lacking. To complicate matters further, most published studies are in man or animals other than pet species. Therefore, use of these supplements in companion animals should be further investigated to ascertain product quality, efficacy, tolerance, and safety (Bauer, 2001).

Antioxidants. Nutrition plays a part in increased longevity partly by protecting the body from free radical damage mediated either by antioxidants found naturally in foods or supplemented to foods. A number of studies on the effects of antioxidants in dogs and cats have consisted of administration of “cocktails” of various antioxidants. Various combinations fed to dogs and cats have been reported to improve serum vitamin status, suppress lipid peroxidation, and “normalize” the adverse effects of exercise on the immune system (Chew et al., 2000). However, because the observed effects could not be attributed to the level of any single antioxidant, few useful inferences as to the utility of any particular substance can be derived from this work.

Of the individual antioxidants, vitamin E has been studied the most. The NRC (1985) suggested that 22 mg/kg of diet would be adequate. However, in diets high in PUFA, even as much as 100 mg/kg of vitamin E may be insufficient, and a vitamin E to PUFA ratio of 0.6:1 should be considered as the minimum. A recent examination of vitamin inclusion in petfood showed a wide variation in the use of vitamin E, ranging from 14 to 400 mg/kg of diet (adjusted to 400 kcal/100 g). Jewell et al. (2000) indicated that the inclusion of over 500 mg/kg is beneficial to antioxidant capacity.

Gut health. It is generally understood that there is a strong link between the gastrointestinal tract and the overall health of the animal. Prebiotics and probiotics have been shown to have some benefits on the gut, and have been proposed as adding value to petfood preparations, while others, such as glutamine, and nucleotides have not been extensively studied for dogs and cats as for other species.

A number of studies on dogs and cats has shown beneficial effects from the administration of prebiotics, such as FOS and inulin. The main effects reported include modification of the large intestinal microflora to encourage the growth of beneficial bacteria to the exclusion of potential pathogens,

The most adverse effect of over consumption of prebiotics is gastrointestinal intolerances. While high intake of fiber can adversely affect nutrient availability, it appears to be less so for prebiotic as compared to traditional dietary fiber sources (Diez et al., 1998).

The available data are less supportive of the utility of probiotics. The reported benefits of feeding these organisms include decreased occurrence and duration of diarrhoea, immunostimulation, pathogen resistance and maintenance of mucosal integrity. How probiotics are able to exert so many positive effects is still not fully understood and may be a combination of many factors where most widely accepted mode of action is that of competitive exclusion.

While the benefits of probiotics are generally accepted, there are still many questions concerning their mechanisms. This has always been a difficult topic of research because of the huge of variability of the different trials, not only concerning the subject animals and their environment, but also involving different preparations of the probiotics themselves. Commercial preparations of probiotics have often been criticized for not containing enough viable organisms required to pass the digestive processes. Weese (2002) analysed 8 veterinary and 5 human commercial probiotic preparations and reported that only two commercial probiotic labels accurately described the types and concentrations of organisms claimed to be in the product.

Nutraceutical use in restricted calorie diets. Suitable diets for weight loss should be low in fat, rich in dietary fiber with selective carbohydrate sources to subdue insulin response. It is now proposed that, in addition to this calorie restriction, there are supplemental nutrients will help in the control of glycemia and influence fat metabolism and consequently the fat mass/lean ratio. Such components include conjugated linoleic acid, biotin, and carnitine.

Plant extracts. There are many natural supplements, including herbal extracts such as *Ginger*, *Echinacea*, *Garlic*, *Ginseng*, *Aloe*, *St. John's wort*, which have been postulated to produce beneficial health effects and can be used for a variety of symptoms, although scientific evidence for their efficacy and safety is still insufficient. Due to the presence of various biologically active molecules, these herbs provide distinctive antioxidant and immunostimulant properties. *Silybum marianum* extracts have been shown to be protective antioxidant agents of hepatocytes and to support hepatocellular repair and regeneration. Bontempo *et al.* (2003) observed a decrease in ALT (324 IU/L to 180 IU/L) and ALP (352 IU/L to 191 IU/L) serum concentration in a 30 day study on dogs supplemented with *silymarin*, exhibiting its use as a support to traditional liver disease therapy.

However, while several of these natural supplements have been used with positive results, necessary precautions should be taken. Although serious adverse reactions are rare, when used outside the parameters of common sense and moderation, any plant can be toxic.

NUTRITIONAL QUALITY

The primary objective of a quality assurance program is to source and purchase ingredients of consistent nutritional quality and quantity while conforming to specific standards. Significant variation in the nutritional quality of ingredients directly affects the nutritional value of the finished product. Moreover, processing of foods can influence the availability of nutrients, either positively or negatively. The effect of different processing methods on the bioavailability of ingredients and the bioavailability and effectiveness of physiologically active components in various functional foods remains to be determined.

Fats play an important role in the nutritional quality of petfoods (Mussa e Minieri, 1997). As soon as foods are manufactured, they begin to undergo a variety of chemical and physical changes. Oxidation of lipids is one common and frequently undesirable chemical change that can impact on flavour, aroma and nutritional quality. It is necessary to predict and understand lipid oxidation to minimize objectionable flavours and aromas arising from rancidity, although selection of an optimum test is difficult due to the complexity of the chemical processes involved.

PETFOOD SAFETY

Commercially prepared petfoods may contain a wide range of ingredients from many sources (Zaghini et al., 1993). These include meat, poultry, cereal, vegetable, and fish products and by-products, as well as added nutrients. Considering the myriad of constituents in petfoods, the possibility exists that they may be contaminated by agricultural and industrial pollutants from the culture and production of their plant and animal constituents, as well during final processing of the finished petfood product.

Safety of petfood and the many ingredients that make up the food will no doubt occupy ever-increasing attention on the part of manufacturers, regulators and pet owners. It will be necessary to develop system that enable food pathogens and adulterants in specific ingredients to be traced. This will need to be coupled with development of rapid detection methods to quantify undesirable components of ingredients.

CONCLUSIONS

The petfood industry is dynamically changing with growing consumer demand for more quality products. The pet population is also increasingly being fed prepared petfood, demonstrating that the industry will need to rise to meet this demand.

With the growing demand for variety and convenience, there will be an ever greater need for research and innovation within pet nutrition. Major advances in the field of companion animal nutrition have been made over the years. However, much remains to be accomplished if we are to move beyond the point of using empirical information to formulate the many types of diets currently fed to cats and dogs. Also, as nutrition is an integrative science, more accurate information is needed in the nutritional area to effectively capitalize on the possible interactions between nutrition and other disciplines such as physiology, immunology, pathology, toxicology and genomics in order to provide accurate advice to pet owners, petfood manufacturers and pet care professionals so that they might work towards enhancing the nutritional status, health and well-being of the companion animal population.

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