Challenges of providing homemade diets for dogs and cats, with a focus on BARF and prey model modalities

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ABSTRACT

The change in the consumer profile of pet owners and the increase in concern about ingredients present in industrialized complete foods has made more and more owners choose to offer homemade diets. However, many tutors seek recommendations found on websites, offering their animals diets that mostly do not meet their nutritional needs and can pose health risks. Among the modalities of homemade diets, raw meats have been gaining more and more followers in Brazil, with emphasis on the BARF (biologically apropriate raw food) categories, which includes raw meats with and without bones, viscera and a small portion of vegetables, fruits and seeds, and prey model, which does not require the inclusion of any foods of plant origin, allowing only the inclusion of meats with and without bones and offal, in order to mimic the natural diet of wolves. This chapter addresses the benefits vs. negative points regarding the provision of homemade diets for dogs and cats, in addition to the nutritional requirements, with emphasis on calcium and phosphorus, considered the main macrominerals. In short, the objective is to alert dog and cat owners about the importance and responsibility in relation to the provision of balanced homemade diets, thus emphasizing the need for formulation by a trained professional, with technical-scientific support, in order to provide satisfactory diets for the development, well-being and longevity of dogs and cats.

Keywords: Nutritional deficiency, Raw diets, Macrominerals, Pets, Feed formulation websites.

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INTRODUCTION

In 2022, the three largest countries in canine population were the USA (69.9 million), China (27.4 million) and Russia (12.5 million), and in relation to the feline population the top four countries were the USA (74.1 million), China (53.1 million), Russia (17.8 million) and Brazil (12.5 million), according to Elad, (2024).

In recent years, several arguments have been made to support the use of natural food for dogs and cats. Increased concerns about the use of additives and preservatives in commercial *pet* foods have led to the desire of some pet owners to avoid industrially prepared foods (COUTO & CORTE REAL, 2019).

In response to the constant recall of commercial pet products, differentiated products with the appeal of "natural" began to appear on the market (COUTO & CORTE REAL, 2019).

The *Association of American Feed Control Officials* (AAFCO, 2016) defines "natural" as a food or ingredient derived exclusively from unprocessed plant, animal, or mineral sources, or has undergone physical processing, heat processing, purification, extraction, hydrolysis, enzymolysis, or fermentation, but has not been produced by a chemically synthetic process and does not contain any additives, or processing aids that are chemically synthetic, except in quantities that may inevitably occur in manufacturing practices.

The *European Pet Food Industry Federation* (FEDIAF, 2021) supports a stricter definition of "natural", proposed by Groot & Shreuder (2009):

> ... components of pet food without any additives and that have only undergone processing to make them suitable for pet *food* production and the maintenance of the content of all essential nutrients. Examples of processing include: freezing, concentration and pasteurization.

Raw diets emerged as one of the options to meet this demand from owners to feed their animals something as close as possible to their ancestors, the wolves, which they consumed or consume in the wild.

Among these diets, two of the most well-known and practiced modalities are BARF (acronym for *Biologically Appropriate Raw Food Diet*) and *prey model*. The BARF modality is an alternative raw diet designed to provide dogs with boneless meats, cuts containing bones and meats, a small portion of vegetables, fruits, and seeds. The *prey model* , on the other hand, aims to provide dogs with a diet that mimics what their ancestors consumed. In this modality, the ingredients are based on whole prey and do not include plant ingredients (PERFECTLY RAWSOME, 2023).

The Brazilian Association of the Pet Products Industry (ABINPET, 2023), recognizes that there are benefits to using homemade diets. The main one is high bioavailability, that is, a greater amount of nutrients can be absorbed and used by the animal's body and because of this greater

absorption, the volume of feces is reduced. However, people's lifestyles must be considered. Currently, feeding needs to be practical, as few tutors really have the time and attention that the natural diet requires.

Despite recognizing the best bioavailability, ABINPET (2023) takes a stand against the practice of feeding pets with homemade food. If it is not correctly handled and does not contain an adequate nutritional balance, it harms the mental and physical development of pets and can cause various diseases. This is because homemade food may not be precisely balanced to contain essential nutrients in the minimum recommended amounts for pets.

Given the growing interest in raw homemade dog food, it is important to investigate the potential risks associated with providing this type of food. Currently, there are no studies available in the literature that provide information on the levels of minerals, especially calcium and phosphorus, as well as the relationship between these minerals, in raw homemade diets containing bones.

In view of the above, the urgency of a more detailed composition of raw homemade diets with bones, both those prepared domestically and those produced commercially, becomes evident. This approach aims to expand the understanding of this type of food, improving not only the nutritional approach, but also the knowledge of tutors in relation to this food modality for pets.

A complete and balanced diet is essential for the health and well-being of dogs and cats. The right diets for each stage of life of these animals provide the necessary nutrients for reproduction, growth and for a long, healthy and active adult life. These also prevent eating-related disorders, which can occur due to nutritional deficiencies or excesses (FEDIAF, 2021).

There are three important bodies internationally recognized for researching and publishing the nutritional profiles of foods designated for growth, reproduction and maintenance of dogs and cats (MANUAL PET FOOD BRASIL, 2019):

- *The National Research Council* (NRC), of the American National Academy of Sciences, is the leading provider of nutritional recommendations for dogs and cats;
- *The Association of American Feed Control Officials* (AAFCO) is a trade body that aims to regulate the quality and safety of feed ingredients and foods in the United States;
- *The European Pet Food Industry Federation* (FEDIAF), represents the national associations of the pet food industry in Europe.

FEDIAF (2021) reports that balanced nutrition, which ensures adequate consumption of energy, proteins, minerals, and vitamins, is essential to ensure the health and longevity of dogs and cats. In 2011, the *World Small Animal Veterinary Association* (WSAVA) published global nutrition guidelines, in which it considered nutritional assessment as the 5th vital parameter, followed by temperature, pulse, respiration and pain assessment. Together with the *Global Nutrition Committee*, they have developed tools that increase the efficiency of nutritional assessment and

recommendations, such as dietary history sheets, feeding guides for hospitalized patients, body condition classification sheets, and caloric intake recommendations for dogs and cats (WSAVA, 2023).

The nutritional needs of dogs and cats are the subject of ongoing research. Estimates of nutritional levels should be decided based on technical knowledge of the concepts and methodologies that govern the area of nutrition. It is very important to consider that incorrect definitions of nutritional requirements can cause serious harm to pets, especially to their health, well-being, and longevity (COUTO & CORTE REAL, 2019).

INDUSTRIALIZED FOODS VS. HOMEMADE DIETS: CHANGES IN THE PROFILE OF DOG AND CAT OWNERS

In 2007, a *recall* that occurred in the United States with products manufactured by the Canadian company *Menu Foods*, may have been the great precursor for the interest of tutors in new food alternatives for dogs and cats. Between March and April of the same year, the company announced the withdrawal from the market of 60 million canned goods intended for pet consumption. At the time, deaths of 16 animals with kidney and liver failure were confirmed, according to the *Food & Drug Administration* (FDA, 2023).

Wheat gluten imported from China, contaminated with melamine (C3H6N6), was identified as the causative agent. This organic compound is produced from urea, being used in the plastic industry, as well as a by-product of various pesticides (SAAD & FRANÇA, 2010).

This incident took on great proportions, which aroused the interest of dog and cat owners about the ingredients present in industrialized products (SAAD & FRANÇA, 2010).

Thus, many products with natural appeals are emerging on the market (PHILLIPS, 2007):

- Chilled fresh food;
- Raw foods;
- Organic food;
- Grain-free foods;
- Natural foods;
- Ingredients with human quality standards;
- Exotic ingredients;
- Superpremium;
- Ultrapremium;
- Home-cooked meals enriched with supplements;
- Meat-centric dietas;
- Diets based on protein (*protein focused*).

In addition to niche diets such as: skin and coat health, intestinal health, oral health, urinary tract health, senile animals, athlete animals and puppy training (PHILLIPS, 2007).

Many pet owners revealed distrust of commercial foods (HEINZE, 2014). In a study carried out by Oliveira et al. (2014) it was observed that in 6.5% of the cases in which the animals received a homemade diet, the option was taken by the tutor who thought this diet was the healthiest. The role that diet and nutrition play in maintaining health and in the prevention, or treatment of diseases, is something that, in general, is within the reach of most people, even if they do not understand the nutritional science involved (MICHEL, 2006).

The inability to understand the label of pet food and the concern about the nutritional value, as well as the types and sources of the ingredients used in extruded diets are possible motivations for owners who opt for alternatives in their pet's diet. Additives, preservatives, dyes and flavorings arouse some anxiety about the impact of the long-term ingestion of these substances on the health of these animals (MICHEL, 2006; PEDRINELLI et al., 2017).

The encouragement of homemade diets is also based on the beliefs that there is greater control over ingredients and greater preservation of enzymes and phytonutrients than in extruded raw materials; homemade foods resemble the natural diet of ancestral dogs; and commercial foods may be less nutritious or have lower palatability. There is also the desire to please the pet, understand it as a member of the family, strengthen the human-animal bond and the attempt to achieve clinical advantages with diet (TEIXEIRA & SANTOS, 2016).

For Berschneider (2002), as pet owners become more aware of their own diets and the impact they have on their health, they naturally become more interested in what their animals consume and many start to explore new alternatives to commercial foods.

TYPES OF HOMEMADE DIETS, WITH EMPHASIS ON BARF AND *PREY MODEL*

Currently, tutors can choose to buy or prepare natural food for their pets. However, the formulations must be prepared by nutritionists who specialize in dog and cat nutrition. An unbalanced diet in energy and nutrients, as well as the supply of homemade mixtures or leftovers, pose great risks to the health of animals (COUTO & CORTE REAL, 2019).

The main modalities of homemade diets in Brazil, according to Couto & Corte Real (2019) are: cooked and raw homemade diets.

In cooked homemade diets, the foods used resemble the foods consumed by humans, containing carbohydrates, proteins, and various vegetables, such as legumes and leaves. These foods can be cooked in water, steamed or baked (REMILLARD & CRANE, 2010).

For raw homemade diets, two modalities are best known: BARF and *prey model*. BARF is an acronym for the English expression "*biologically aproppriate raw food*" (BILLINGHURST, 2001).

The principle of this diet is the supply of meat, bones and offal, all in their raw or "*in natura*" form, based on the similarity to the ancestral diet of dogs. In addition, in this modality, the inclusion of ingredients rich in carbohydrates, such as grains, and also vitamin-mineral supplements is avoided (COUTO & CORTE REAL, 2019).

The prey model *modality*, which in free translation means prey model, provides the opportunity for domiciled dogs and cats to consume a diet that replicates the diets of wild animals, without them having to hunt for their own food. In this modality, the proportion of ingredients is divided into 10/80/10, with 80% boneless meat, 10% edible bone-in meat, and 10% offal, 5% liver and 5% other types of viscera (PERFECTLY RAWSOME, 2023).

For Couto & Corte Real (2019), defenders of raw homemade diets report that dogs have excellent acceptability, especially because these diets offer varied formulations. Owners also believe that such diets present:

- Natural biological antioxidants;
- Greater digestibility of fats and low level of carbohydrates;
- Improved essential amino acid profile;
- Muscle improvements, which allow greater physical activity;
- Oral health, with good breath and clean teeth;
- Healthy skin and shinier hair;
- No nutritional loss, as it is not subjected to heat treatment;
- Decreased body fat, with less predisposition to obesity;
- Reduction of allergies and other diseases;
- Lower triglyceride and cholesterol levels.

However, Couto & Corte Real (2019) comment that raw homemade diets have important disadvantages, which can cause nutritional deficiencies if there is no balance of nutrients. Among these, the following stand out:

- lower digestibility of protein and amino acids;
- Risk of accidents such as choking, tooth injuries, mouth wounds and perforation of internal organs;
- Risk of bacterial infections;
- Greater dedication of tutors to food safety.

França (2009) evaluated the digestibility of six different diets: a) a dry (extruded) diet, b) a wet diet, c) a homemade diet with raw chicken, d) a homemade diet with chicken heated for three minutes in a microwave, e) a homemade diet with raw beef, and f) a homemade diet with beef heated for three minutes in a microwave. It was observed that the digestibility of crude protein in dry and wet diets was lower than in homemade diets, and fat digestibility was higher in homemade diets of

chicken and cooked beef. For the dry matter digestibility coefficient, the dry diet did not differ from the homemade raw beef-based feed, but was lower than the other feeds. However, again, the composition of the diets used was different in terms of fat and fiber contents, which may have interfered with the results of the study.

Regarding food preference, Zanatta et al. (2016) demonstrated that dogs prefer cooked meats over raw meats, but that many factors can influence this result, such as the fat content of the food.

VULNERABLE POINTS OF RAW HOMEMADE DIETS

Thousands of dogs and cats are given homemade diets. And often these diets are deficient in essential nutrients like calcium, iron, and taurine, which can lead to fractures, anemia, and heart problems. Feeding pets with raw meat-based diets has become an increasingly popular trend among pet owners, however, this practice does not exempt the pet owner from food safety risk issues. The risks of biological contamination, especially salmonellosis, toxoplasmosis and various worms, are the weak points of raw natural diets (SAAD & FRANÇA, 2010). The raw materials used for the preparation of these diets do not undergo any type of heat treatment or sterilization, and can maintain the bacteria and parasites existing at the time of consumption of the food by the animals (FINLEY et al., 2007).

Billinghurst (2001) suggested that these pathogens are harmless and, exceptionally, adapted to the canine intestinal tract. There are no reports documenting clinical salmonellosis in dogs fed the BARF diet, however, clinical pictures of *Salmonella* sp. are well described in dogs (GREEN, 1990; LEJUNE & HANCOCK, 2001).

There is little information on the duration of colonization of *Salmonella spp* in dogs, however, it has been widely cited that once infected, a dog may shed *Salmonella* organisms in its feces for six weeks or more, continuously for the first week, and then intermittently (MORSE et al., 1976; SANCHEZ et al., 2002).

Salmonella *contamination* in pets is of utmost importance, as they can be a source of potential infection for humans, particularly high-risk individuals such as children, the elderly, and immunocompromised individuals (WEESE et al., 2005).

Usually raw natural foods are kept refrigerated and frozen. In the case of refrigeration, temperatures are between 0 and 7ºC. In this case, the impacts on nutritional and sensory properties are milder, but the conservation times are shorter. For freezing to be efficient, temperatures of -18ºC or lower are required. There are microorganisms that still grow at -10ºC, which poses a danger for poorly monitored freezing. It is known, however, that at a temperature of -18ºC or less, some microorganisms are inhibited (SAAD & FRANÇA, 2010).

Major institutions such as *the American College of Veterinary Nutrition* (ACVN), *the World Small Animal Veterinary Association* (WSAVA), *the American Animal Hospital Association* (AAHA), *the Center for Disease Control and Prevention* (CDC), and *the Food & Drug Administration* (FDA) are against the practice of raw food for dogs and cats.

With regard to nutrition, according to Couto & Corte Real (2019), in several studies involving the nutritional composition of homemade natural diets for dogs and cats, it is observed that the vast majority do not meet all the recommendations for nutritional requirements based on the species' recommendation manuals. The main nutritional imbalances described were energy deficiency, excess or deficiency of protein, deficiency of calcium and phosphorus, imbalance of trace minerals and deficiency of vitamins.

Pedrinelli et al. (2017) evaluated the nutritional profile, through the use of *software*, of 106 homemade diets (80 for dogs, 24 for cats, and 2 for dogs and cats), published in books and *websites*. Of these, none met the needs according to FEDIAF (2017). The main deficiencies found in the diets were iron (deficient in 100% of the diets for cats and 68% of the diets for dogs), vitamin E (with more than 80% of diets deficient for both species) and calcium (with 73% of diets deficient for both species). In addition, 71% of the diets did not inform the recommended amount of food intake.

Another difficulty encountered in the formulation of homemade diets is regarding the chemical composition of food ingredients, generally using food profiles for humans (COUTO & CORTE REAL, 2019). For raw homemade diets, the problem can be even greater, since important minerals such as calcium and phosphorus, present in bones, are not accounted for.

The main chemical composition tables used in the preparation of homemade diets are: Brazilian Food Composition Table (TACO), USP Food Composition Table, Food Chemical Composition Table (TABNUT, 2023) and *National Nutrient Database for Standard Reference,* which do not include the composition of cuts with bones (COUTO & CORTE REAL, 2019).

NUTRITIONAL REQUIREMENTS OF HOMEMADE DIETS FOR DOGS AND CATS

FEDIAF is a trade organisation representing the European pet food industry. Fifteen national trade associations and five companies (*Affinity Petcare, Hill's Pet Nutrition, Mars PetCare, Nestlé Purina Petcare and Wellpet*) are members of FEDIAF.

FEDIAF (2021) has compiled the manual "Nutritional Guidelines for Complete and Complementary Foods for Dogs and Cats", providing pet food manufacturers and food formulators with nutritional recommendations that ensure the production of balanced and nutritionally adequate foods.

This manual is based on published scientific studies, including the *National Research Council* (NRC, 2006), as well as published and unpublished data from experts in the field (EUROPEAN PET

FOOD, 2023), and is therefore reviewed annually and updated whenever there are new technological, scientific, or legislative advances regarding pet nutrition (FEDIAF, 2021).

The nutritional needs of dogs and cats are the subject of ongoing research. When formulating pet food, FEDIAF (2021) recommends that manufacturers do not use minimum requirements references, but rather minimum recommended amounts that ensure adequate nutrient intake, as proposed in the manual.

Providing a balanced diet with minerals is essential for the health and maintenance of pets, as they play vital roles in numerous metabolic functions, from the formation of bones and teeth to the maintenance of bodily fluids, muscle function, and other physiological processes. Among the trace minerals necessary for the diet of dogs and cats, iron, zinc, copper, iodine, manganese, selenium and molybdenum can be mentioned, and among the macrominerals, calcium, phosphorus, magnesium, potassium, sodium, chloride and sulfur. It is worth noting that calcium and phosphorus are primordial.

Calcium (Ca) is the most abundant mineral in the body, and approximately 98% is found in the composition of bones and teeth. The rest of the calcium is distributed in extracellular fluids and other tissues. Calcium is involved in blood coagulation, cell permeability, muscle contraction, transmission of nerve impulses, cardiac regulation, hormone secretion, and enzyme activation (REECE et al., 2017). Calcium intake must be balanced with phosphorus (P) intake for healthy bone growth and maintenance (GRANDJEAN & BUTTERWICK, 2009).

All nutritional guidelines state that the Ca:P ratio is as important as meeting the needs of these nutrients in diets. For dogs, the ideal ratio between these minerals is 1:1, both for the adult phase and for the growth phase, so it can reach up to 2:1 for adult dogs; 1.6:1 for early-growing dogs ($\leq$ 14 weeks) and 1.8:1 for late-growing dogs ($\geq$ 14 weeks). For cats, the ideal ratio is also 1:1 for both the adult and growth phases, and it may be safe to reach 2:1 for adult cats and 1.5:1 for growing cats (FEDIAF, 2021).

Diseases caused by Ca deficiencies were once common in small animal clinics, however, with the diffusion of industrialized and nutritionally adequate foods, these pathologies have become rare. With the great demand of tutors for homemade diets, diseases such as osteoporosis, rickets, osteomalacia and secondary nutritional hyperparathyroidism have been more frequent nowadays.

This is because homemade diets of all types are available on *websites* and books for free and easily accessible, and often these diets are not balanced to meet the nutritional requirements of dogs and cats, causing serious health problems (NAP et al., 2000; RICHARDSON et al., 1997).

Tutors who follow the BARF and *prey model* diets do not take into account the use of supplements or supplements to correct deficiencies and deficiencies of nutrients, including calcium

and phosphorus. This is because they believe that a raw diet, more similar to that of the ancestors of dogs, is enough to ensure nutritional balance (LONSDALE, 2001).

Calcium can be found in mammalian and bird bones. Dairy also contains significant amounts of calcium. Broccoli and cabbage are moderate sources when discounting the moisture of the food. Common mineral salts include calcium carbonate, calcium sulfate, calcium phosphate and calcium amino acid chelate (GRANDJEAN & BUTTERWICK, 2009).

Phosphorus is the mineral that has the largest number of known functions, being involved in almost all aspects of animal metabolism, including energy metabolism (part of adenosine triphosphate - ATP), muscle contraction, nervous tissue function, metabolism of carbohydrates, fats and amino acids, acid-base balance, transport of metabolites, in addition to participation in the structuring of nucleic acids and the lipoprotein membrane of cells.

In addition, 80% of phosphorus is found in bone tissue and teeth, and together with calcium, it gives them structural rigidity. Particularly in bones, together with calcium, it is mainly in the form of hydroxyapatite crystals, in an approximate ratio of two parts calcium to one part phosphorus (CARCIOFI, 2023).

Thus, the lack or excess of these important macro minerals can cause harm to pets. Complete and balanced commercial diets have relatively high concentrations of calcium and phosphorus, and reports of deficiencies in dogs are absent in the literature, when it comes to this type of food (BÖSWALD et al., 2019; NAP et al., 2000; RICHARDSON et al., 1997).

From the 90's onwards, problems related to nutritional excesses have been much more frequent, especially if a balanced growth ration is supplemented with minerals, vitamins and energy (RICHARDSON et al., 1997)

For growing animals, the nutritional imbalance of calcium and phosphorus, as well as their relationship, is even more serious. Developmental osteoarticular alterations can occur due to changes in the intake of calcium, phosphorus, vitamin D, protein, copper, zinc, manganese and vitamin A. Vitamin D is a steroid whose biological activity is closely associated with the metabolism of calcium and phosphorus, being extremely important in the homemade diets of adult and growing dogs and cats. In addition to bone deformities, phosphorus deficiency can result in slow growth and impaired appetite (LEPINE & REINHART, 1998).

Like calcium, phosphorus can also be found in bones and especially in meat and offal (GRANDJEAN & BUTTERWICK, 2009). Among the mineral salts can be included dicalcium phosphate, monobicalcium phosphate, monoammonium phosphate, among many others (ROSTAGNO, 2005).

Moura (2023) evaluated the composition of calcium and phosphorus in raw homemade diets with bones, in the BARF and *prey model modalities,* for adult and growth dogs (up to 14 weeks and

after 14 weeks) and compared them with the recommendations of FEDIAF (2021), in addition to evaluating the relationships between these two nutrients. Of the 30 formulations analyzed, none reached the minimum values of calcium, phosphorus and Ca:P ratio recommended, with calcium being the nutrient with the highest incidence of values below the recommendation. In addition, calcium and phosphorus deficiencies for growing dogs were much higher compared to adults. These results show the presence of nutritional inconsistencies in the recommendations proposed in the researched websites and reinforce the need for care when formulating a raw homemade food for pets, in different physiological phases.

In short, it is extremely important for tutors to recognize the need for the formulation of diets by a trained professional, with technical-scientific support on the essential nutrients and their adequate amounts, in order to provide balanced and satisfactory homemade diets for the correct development, well-being and longevity of dogs and cats.

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