



Role of Nutraceuticals and Plant based foods in Canine Health

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Dogs can obtain energy from both animal-based (meat, dairy) and plant-based foods (fruits, vegetables, grains, seeds). While NRC and AAFCO set guidelines for dog food, no specific recommendations exist for the sources of nutrients (AAFCO, 2019). Plant-based diets are popular among vegan owners and those with dogs with allergies, but meat-based diets are favored by some, despite concerns over plant-based foods being inferior (Dodd et al., 2019). Meat-heavy diets have been found nutritionally incomplete, lacking essential nutrients like calcium and vitamins A and D. More research is needed on the nutritional benefits of plant-based compounds, excluding toxic plants and fibers, which have been reviewed separately (Wernimont et al., 2020).

Phytonutrients in the Canine Diet: Phytonutrients, naturally occurring compounds in plants, are not essential for dogs but may offer health benefits (Rahal et al., 2014). Their intake depends on diet, treats, and supplements. Commercial dog foods typically follow AAFCO guidelines and include phytonutrient-rich ingredients like fruits, vegetables, grains, legumes, and seeds (AAFCO, 2019). For example, soybean-based foods contain phytonutrients like isoflavones.

Dietary Fibers: Dietary fibers are carbohydrates that dogs cannot digest due to the lack of necessary enzymes. Although not covered in this review, fibers are known to influence body condition, gastrointestinal health, and immune function in dogs (Wernimont et al., 2020).

Carotenoids: Carotenoids are fat-soluble pigments found in yellow, orange, red fruits, vegetables, and leafy greens, with the most common types being α -carotene, β -carotene, cryptoxanthin, lycopene, lutein, and zeaxanthin. These can also be found in dog food supplements, including astaxanthin. Some carotenoids, like β -carotene, act as provitamin A and can be converted into vitamin A.

Polyphenols: Polyphenols are a diverse group of compounds, including phenolic acids, flavonoids, lignans, stilbenes, and phytosterols, which are found in various plant sources. These compounds are broadly classified into different categories:

- **Phenolic acids** include caffeic and ferulic acids.
- **Flavonoids** include subclasses like anthocyanidins, flavanols, flavanones, and flavones, with common sources being fruits, tea, and herbs.
- **Lignans** are found in flax and sesame seeds, and have been linked to treatments for atypical Cushing's disease in dogs, though evidence is limited.
- **Stilbenes**, such as resveratrol, are found in grapes, though grapes are toxic to dogs, resveratrol is considered safe at certain doses.

Phytosterols: Such as β -sitosterol, are found in plant oils, fruits, and vegetables.

Bioavailability of Phytonutrients in Dogs: Research on phytonutrient bioavailability in dogs is limited but emerging. Studies show that dogs can absorb, store, and metabolize carotenoids such as β -carotene, lutein, and astaxanthin (Park et al., 2010). Quercetin, a

flavonol, was detected in the plasma of Beagles after oral administration. Additionally, resveratrol was found in the plasma of Beagles after administration, and epigallocatechin gallate (EGCG), a phenolic compound from green tea, was detected in various tissues after consumption. While some polyphenols are absorbed directly in the small intestine, most are modified by intestinal microbiota in the large intestine before absorption (Kawabata et al., 2019).

Roles of Plant-Based Foods in Meeting Canine Nutrient Requirements: Essential nutrient minima for adult dogs, as established by the AAFCO (2019) and based on NRC guidelines, can be met through a combination of plant- and animal-based foods. While digestibility varies between food sources, both types of ingredients can contribute to meeting dietary needs.

Vitamin A: The recommended daily allowance for vitamin A in adult dogs is 1263 IU/1000 kcal ME (NRC) and a minimum of 1250 IU/1000 kcal ME (AAFCO). Dogs can obtain vitamin A from preformed sources in animal products or from provitamin A carotenoids, like β -carotene, in plant foods. Although conversion efficiency of carotenoids to vitamin A varies, dogs can use plant-based sources to meet their vitamin A needs.

Amino Acids: Both plant-based ingredients and meat provide essential amino acids (AAs), but some plant foods, like vegetables and legumes, have lower methionine, while grains and nuts are low in lysine (USDA ARS NDL, 2015). A combination of turkey meat with plant foods like spinach, peas, and brown rice can meet AA requirements, though amino acid digestibility may be lower in pulse-based diets. However, plasma levels of sulfur-containing AAs (methionine, cysteine, taurine) were not affected in dogs fed pulse-based diets short-term.

Fatty Acids: Substituting 10% kcal from turkey meat and skin with plant foods did not decrease the levels of total fats or linoleic acid below recommended minimums but did increase other essential nutrients, contributing to a broader nutritional profile. However, the impact of such dietary adjustments depends on the balance of other nutrients.

Nutrient Deficiencies in Animal-Based Diets: Many animal-based diets, whether home-prepared or commercial, fail to meet the minimum requirements for certain nutrients, such as calcium, copper, zinc, and vitamins A and D. For instance, a diet consisting solely of turkey meat and skin would fall short of the required levels for calcium, potassium, magnesium, iron, copper, manganese, zinc, and several vitamins. By incorporating plant-based foods like spinach, peas, mushrooms, and brown rice, the levels of these nutrients significantly improve. For example, mushrooms are a source of vitamin D₂ (ergocalciferol), which is thought to be as biologically active as vitamin D₃ in dogs (Parker et al., 2017).

Importance of Balanced Diets and Supplementation: While a theoretical diet with 10% kcal from a single plant food (like spinach) may result in high folate levels but insufficient calcium, a variety of ingredients and fortification are necessary for a well-balanced diet that meets the recommended nutrient allowances. Supplementation and fortification are also important to address potential nutrient imbalances (AAFCO, 2019). The digestibility of nutrients must be considered in dietary planning to ensure dogs receive the required nutrients in bioavailable forms.

Role of plant based foods and phytonutrients beyond meeting nutrient requirements

Body weight and body condition: Plant-based foods and phytonutrients may support weight management and inflammation in dogs. Fiber improves body condition soy isoflavones regulate metabolism, and green tea polyphenols offer anti-obesity effects (Rahman et al., 2020). Vitamins, carotenoids, and curcumin may improve body composition (Wang et al., 2017), and avocado mannoheptulose affects fat-to-lean ratios.

Cardiovascular outcomes: Plant foods and phytonutrients may support canine cardiovascular health. Phytosterols in beans lower cholesterol, astaxanthin reduces triglycerides (Murai et al., 2019), and unsaturated fats may improve blood pressure.

Quercetin and grape compounds offer cardioprotective effects. More research is needed to confirm their relevance in canine cardiovascular diseases.

Insulin sensitivity and glycemic control: Plant-based ingredients can affect insulin sensitivity in dogs. Soy protein reduced insulin secretion while corn oil diets prevented insulin resistance. Medicinal plants like annatto and basil improve insulin regulation. Green tea extract enhanced insulin sensitivity, while mannoheptulose had no effect (McKnight et al., 2018). These compounds show potential in managing insulin sensitivity.

GI health and gut microbiota: The canine gut microbiome is vital for health, and plant-based components like prebiotics and polyphenols can improve it. Grape proanthocyanidins and pomegranate peel extract boost SCFAs and antioxidants (Scarsella et al., 2020). Green tea polyphenols enhance microbiota diversity and reduce inflammation (Li et al., 2020). These compounds may help manage intestinal issues, but further research is needed (Candellone et al., 2020).

Immune health: Plant-based compounds support immune function in dogs. Vitamin C increased CD4+ T cells, and carotenoids enhanced immune responses. Antioxidants from Echinacea and blueberries reduced inflammation (Sgorlon et al., 2016), and vegetables lowered transitional cell carcinoma risk. For musculoskeletal health, avocado/soya bean unsaponifiables (ASU) help manage osteoarthritis by reducing cartilage breakdown.

Conclusion

In conclusion, plant-based foods and phytonutrients can support canine health by enhancing immune function, gastrointestinal health, cardiovascular outcomes, and weight management. Compounds like carotenoids, polyphenols, and phytosterols may help manage inflammation, insulin sensitivity, and obesity. While promising, more research is needed to confirm their long-term benefits. A balanced diet that includes both plant and animal-based ingredients, along with proper supplementation, is crucial for optimal canine health.

References

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