Food for humans and pet animals: meat based, flexitarian, vegetarian or strict vegan, what to choose?

Introduction

Humans can be classified as either omnivores or facultative carnivores. What do I mean by facultative carnivore? Most humans can survive on a plant-based diet supplemented with essential macro- and micronutrients, which are not present in plants. But I may use my self as a typical example of an individual not able to survive on a plant-based diet, because I suffer from IBS (irritable bowl syndrome) and colitis, which mean I do not tolerate FODMAPS present in my diet. Most of the plants high in protein, belongs to this category. This means that I cannot fulfil requirements for protein, amino acids, and energy on a solely plant-based diet, without getting problems with my intestine, but I can do it on a flexitarian diet.

Considering the physiology of dogs and cats, which classifies them respectively as facultative and obligate carnivores, the adequacy of vegetarian/vegan diets in supplying the minimum requirement of essential nutrients is questionable. However, plant-based pet food demands have significantly increased over the last decades, especially in Western countries. The high demands for plant-based foods are not only limited to humans, as many pet owners are continuously concerned about the possible correlations between the consumption of animal products, even for their pets, and animal welfare problems, herbicides and fertilizers, degenerative health conditions, and climate changes. We need to change our attitude towards plant-based foods, but we also need to cover and solve the challenges with a plant-based diet in the future.

Challenges with a plant-based diet

Meat has long been seen as a vital part of a balanced diets since it contains many valuable nutrients, such as high biological value protein, iron, vitamin B_{12}, other B complex vitamins, zinc, selenium, and phosphorous. Fat content and fatty acid profile, a constant matter of concern when referring to meat consumption, is highly dependent on species, feeding system as well as the cut used. Pork meat can have the highest fat content, but chicken skin is not far behind.

Protein- and amino acid composition

I addition, meat is considered as an important dietary component due to its high protein content and complete amino acid profile. Twenty different amino acids, as

building blocks of protein, are used to construct proteins; eight are considered essential for humans (10 for dogs and 11 for cats), meaning they must be ingested as food as the body do not produce them. The remaining amino acids can be created in the body and are hence considered non-essential. However, it would be necessary to supply the required raw components for the body to produce the non-essential amino acids sufficiently.

Different plant protein sources, such as soybean, which contain all essential amino acids, can be used as an alternative protein source to meat. However, protein concentrate from soybean lacks important nutrients such as low levels of tryptophane, lysine, methionine, vitamin B_{12}, and vitamin D that meat provides sufficiently. I addition, there are some nutrients from soy protein concentrate that may not be well absorbed by the body and soy protein concentrate also contain anti-nutritional substances, which limits the use of soybean concentrate in pet diets.

Other plant foods, such as peas, beans, chickpeas, peanuts, quinoa, and lentils have a long history of being used as protein sources in a broad range of cultural and international cuisines. Many are excellent protein sources, but few contain all the essential amino acids at a level that is sufficient to offer a full nutritional profile required for dogs. I addition, plant-based diets are not offering taurine, which is essential for cats, and may be limiting for dog diets low in the sulphur containing amino acids methionine and cysteine, these to being the precursors for taurine. Therefore, it must be synthetically added as a supplement to plant-based food. Taurine is proven to be essential for the reproducing female cat and may also be important for both the reproducing dog female and human female, but I could not find any data on this.

Taurine deficiency symptoms

Another symptom of taurine deficiency is dilated cardiomyopathy (DCM), which has been reported from dietary histories in which dogs were eating grain free (GF) diets, but this is not yet completely clarified. It may have been caused by other intrinsic factors inherent in legumes or other environmental factors that may be impairing taurine status in dogs. It has been hypothesized that diets containing high levels of fermentable fiber could lead to gastrointestinal losses of taurine trough the bile acid metabolism (BA). One study reported that beet pulp, a moderately fermentable fiber could affect taurine status in dogs by decreasing protein digestibility and

increasing excretion of BA, but this needs to be further investigated, before clear conclusions may be done.

Polyunsaturated fatty acids and n-6/n-3 index

Plant-based diets are also low in essential omega-3 fatty acids (n-3, PUFA) like EPA and DHA. Most of the n-3 found in plants are in the form of α-linolenic acid (ALA) and this must be converted to EPA and DHA by enzymes in the body and this is insufficient in both dogs and cats. Most fatty acids found in plant foods belongs to the omega-6 group (n-6). Omega-3 and omega-6 are competitively metabolized by the same set of desaturation, elongation, and oxygenase enzymes.

The lipid mediators produced from their oxidative metabolism perform antagonistic functions in both the human body and body of dogs and cats. Except for dihomo-γ-linolenic acid (DGLA), n-6 PUFA derived lipid mediators enhance inflammation, platelet aggregation, and vasoconstriction, while those of n-3 inhibit inflammation and platelet aggregation and enhance vasodilation. Overconsumption of n-6 PUFAs with low intake of n-3 PUFA is highly associated with the pathogenesis of many modern diet-related chronic diseases for humans, but also likely to result in similar symptoms in dogs and cats.

However, cats require arachidonic acid (AA, C:20:4 n-6), due to the lack of delta-6-desaturase, the enzyme required for endogenous conversion of linoleic acid (LA) to the longer and more unsaturated fatty acid AA. Deficiency of n-6 fatty acids can cause skin and coat abnormalities, reproductive problems, and failure to develop properly.

The volume of n-6 PUFA is largely exceeding the volume of n-3 PUFAs both in modern human diets and plant-based foods for dogs and cats. Due to higher ratios of n-6/n-3 in plant-based foods, larger quantities of LA and AA derived lipid mediators are produced, becoming the main causes of the formation of thrombus and atheroma, the allergic and inflammatory disorders, and the proliferation of cells, as well as the hyperactive endocannabinoid system. Therefore, to reduce all the risks which are due to overconsumption of n-6 PUFAs, food to both humans and dogs and cats must contain both PUFAs in the highly recommended n-6/n-3 ratio which is for humans 4-5:1, but there are in 2022 no recommendations for dogs and cats according to The European Pet Food Industry (FEDIAF).

Recent studies have shown that n-3 fatty acids from phospholipids are supporting the body more efficient than n-3 fatty acids from triglycerides. Triglycerides must be converted to phospholipids before they can be taken up by the cell membranes, and therefore they are more likely to be used as energy or stored as fat. However, phospholipid n-3 fatty acids are efficiently incorporated into the body´s cells, tissues, and organs. These fatty acids support the health of several vital organs, including the heart, kidney, liver, joints, brain, eyes, skin and coat and the right level of EPA og DHA can only be achieved by the inclusion of marine sources in the food.

A recent study from 2022 (https://doi.org/10.1212/WNL.0000000000201296) found an association between blood n-3 levels and cognitive functions in middle-aged subjects. Their results showed that low red blood cell DHA levels are associated with smaller brain volumes and a ‘‘vascular’’ pattern of cognitive impairment, even in persons free of clinical dementia. This could mean that intervening early and maintaining an optimal n-3 Index could play an important role in staving off cognitive decline, as well as dementia and maybe also Alzheimer´s in the long term. It was concluded that n-3 may be most beneficial to preserve brain health from early midlife. This is not only important for humans, but also for cat and dogs.

There are more challenges with a plant-based diet and these challenges I will cover soon.