The Rockweed Remedy

Ascophyllum nodosum possesses many potential applications in veterinary medicine.

Dental treatment is a staple of the veterinary consult and advising owners on appropriate home care is key to prophylaxis. Actively brushing the teeth is the most effective way to keep them free of plaque.[1] However, the difficulty and time required for brushing reduces owner compliance.[1,2] Passive methods, such as treats and dental kibble, have better compliance but their ability to mechanically remove plaque can be limited by product structure, palatability, and the pet's eating habits.[1]

The above dental home care can be improved by the inclusion of *Ascophyllum nodosum* in the diet or in dental products. A. *nodosum*, commonly known as rockweed, is a brown, marine seaweed that grows in cold waters.[3,4] In recent years it has emerged as an indirect method for plaque control and, as more research is done, its range of applications is becoming even broader.[4]

SUPER SEAWEED

Rockweed helps prevent calculus formation by changing the composition of saliva and gingival crevicular fluid (GCF).[5] Digestion of A. *nodosum* leads to absorption of monosaccharides, short chain fatty acids (SCFAs), and peptides. These compounds cross the capillary walls in the salivary glands and periodontal crevice, especially when hydrostatic pressure is increased as is the case with gingivitis.[6] Here the compounds can be secreted in saliva and GCF respectively and the rigid, anionic sections on the peptides compete with normal salivary acidic proteins for calcium ions.[5] Complexing the calcium reduces the ions available for precipitation as calcium carbonate and calcium phosphate, the two main components of canine calculus.[7] This can prevent the development of future calculus and allow existing plaque to break down and become easier to remove.[5]

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A. *nodosum* helps with other aspects of dental disease besides plaque. Gingivitis (often induced by pre-existing calculus) supports the colonisation of the oral microbiome by anaerobic bacteria. These bacteria produce volatile sulfur compounds, the source of halitosis from dental disease.[8] Rockweed has a high omega 3 to omega 6 ratio and contains several anti-inflammatory compounds (e.g alginic acid, fucoidan) which mitigate the gingivitis.[9] This can reduce halitosis and slow bacterial growth to decrease the risk of developing infection and periodontitis.

PREBIOTIC POWDER

A. *nodosum* is unique in that it has the highest content of polysaccharides by dry weight out of all the brown seaweeds.[10] These polysaccharides include phycocolloids such as alginates, fucoidans, laminarin, and mannitol, which cannot be digested by dogs and cats. Instead they are used as an energy source for good bacteria and thus have a pre-biotic effect.[3,4,10] Laminarins in A. *nodosum* also have positive effects on mucus structure, help maintain intestinal pH, and improve SCFA production. This helps with the regulation of intestinal metabolism and consequently decreases the ability of enteroinvasive bacteria to adhere to and cross the epithelial wall.[11] These mechanisms help prevent dysbiosis as demonstrated by the reduced E. coli shedding in cattle which receive A. *nodosum* supplementation[12].

IMMUNOLOGICAL INCLINATIONS

Another beneficial polysaccharide is ascophyllan. It enhances dendritic cell maturation which can improve an animal's response against infectious diseases and neoplasia.[13] It also stimulates the secretion of TNF-α by macrophages and increase the activity of natural killer cells against some lymphoma types.[1,13] Additionally, the polyphenols and phlorotannins found in brown seaweeds decrease cancer risk by acting as free radical scavengers and cell cycle regulators. The immunomodulatory effects of ascophyllan are also supported by fucoidan which has anti-tumour, anti-oxidant and antiviral properties[10]

A NUTRITIONAL POWERHOUSE

A. *nodosum* is also nutritionally beneficial. It has lower protein levels than red and green seaweeds but often still has more essential amino acids than commonly used grains (including soy). It has a low lipid content but still has good levels of essential fatty acids. It is a good source of vitamin C, vitamin E, and the B group vitamins (especially thiamine and riboflavin). As a result of bioaccumulation, rockweed contains high levels of minerals, including sodium, potassium, calcium, magnesium, iron, zinc, manganese, copper, and iodine. However, it is this bioaccumulation, which can contribute to heavy metals in wild seaweed. This, as well as differences between seasons and harvesting methods, can lead to variable nutritional values. Therefore, farmed options should be considered when selecting a source of rockweed.[10]

KELP FOR KELPIES?

A. *nodosum's* most obvious clinical use is as a dental treatment. It can be given as a chew, dental kibble, or powdered supplement with no apparent effects on palatability.[14] Combining rockweed with other treatments, such as dental sealants can improve their efficacy and prolong the periods between dental scale and polish procedures.[15]

In addition to reducing gingivitis, rockweed's anti-inflammatory properties can be used alongside anti-inflammatory drugs, such as prednisolone, to limit the dosage required. This can help decrease the side effects that an animal may experience when on long term treatment or when suffering from comorbities.[9]

The pre-biotic capabilities of A. *nodosum* mean that it can be used to reduce and replace antibiotic administration. This has been carried out on pig farms with improvements in the Lactobacillus to E. coli ratio and better resilience to intestinal disease.[16] Reduction can be important for mitigating the side effects of antibiotics while replacement can decrease the risk of developing antibiotic resistance. Combining A. *nodosum* with probiotics for a symbiotic approach can replace antibiotic use in cases of mild disease. This can decrease the frequency with which antibiotics are used which is important for antimicrobial stewardship and emerging antibiotic resistance.

One thing to keep in mind when feeding A. *nodosum* is the iodine content. Iodine levels in wild rockweed are particularly high which makes supplementation a potential treatment of iodine deficiency.[17] However this does also mean that dosage recommendations should not be exceeded to prevent toxicity.

The Rockweed Remedy is the prizewinning entry for the Blackmores Animal Health Veterinary Student Competition encouraging the next generation of vets utilising natural therapies as a part of their practice.

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