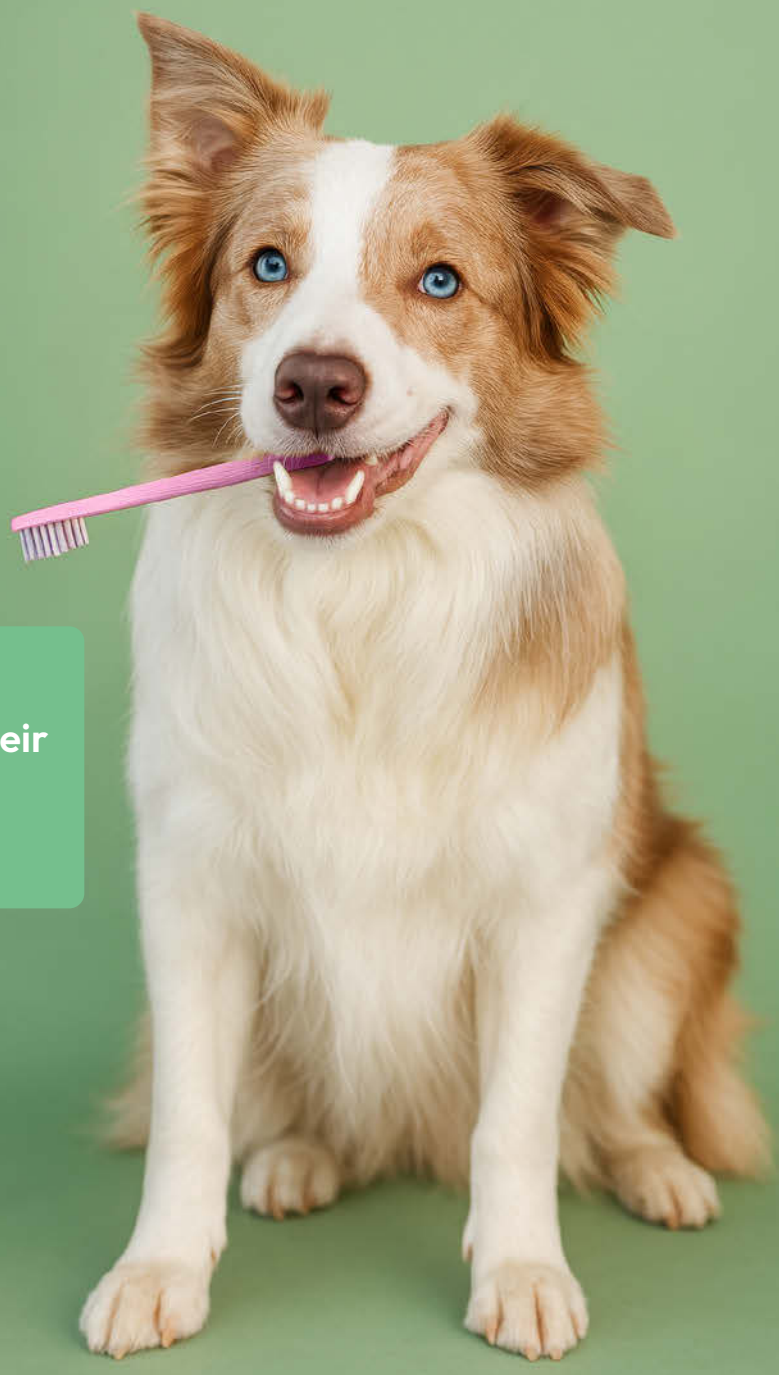
DENTAL CARE

A SCIENTIFIC SUPPORT PAPER



93% of pet owners saw a visible improvement in their dogs oral health

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WHY IS DENTAL HEALTH IMPORTANT FOR DOGS?

Dental health is essential for dogs as it directly influences their overall health, comfort, and quality of life. One of the primary concerns is the prevention of periodontal disease, which is among the most common health issues in dogs.

Studies indicate that over 80% of dogs over the age of three suffer from some form of dental disease (American Veterinary Medical Association [AVMA], 2020).

This condition begins with the build-up of plaque on the teeth, which, if left untreated, leads to gingivitis (gum inflammation). As the disease progresses, it can develop into periodontitis, where the gums recede and form pockets of infection, ultimately resulting in tooth loss (Veterinary Oral Health Council [VOHC], 2019).

Good dental hygiene in dogs is essential not only for maintaining oral health but also for preventing pain, discomfort, and long-term complications.

Dogs can suffer from various dental issues, such as abscessed teeth, infected gums, and tooth decay, all of which can be extremely painful and may interfere with everyday activities such as eating, chewing, or grooming. This pain can significantly affect a dog's overall well-being, leading to weight loss, reduced appetite, and decreased activity levels (VOHC, 2019).

In addition to managing pain, maintaining oral hygiene is crucial for preventing tooth loss. When left untreated, dental problems can lead to the destruction of the structures supporting the teeth, including the gums and jawbone. The accumulation of plaque and tartar can weaken these structures, eventually causing teeth to loosen and fall out (AVMA, 2020). Tooth loss can further hinder a dog's ability to chew properly, potentially resulting in malnutrition or feeding difficulties (Petfinder, 2021).

Dental care is also important for preventing infections. A dog's mouth contains a wide variety of bacteria, and when their teeth or gums are damaged, it provides an entry point for these harmful bacteria to invade the body (VOHC, 2019). Infections such as abscesses or gum disease can cause swelling, pain, and further complications if left untreated.

Another important aspect of maintaining a dog's dental health is preventing bad breath, also known as halitosis. Bad breath is often caused by the build-up of plaque and tartar, which harbour bacteria in the mouth (PetMD, 2021).

Regular dental care, including nutritional strategies, can help prevent the accumulation of bacteria and reduce the risk of halitosis (American Veterinary Dental College [AVDC], 2020).

Dental health is also critical for preventing systemic health problems. The bacteria that grow in an infected mouth can enter the bloodstream and spread to other parts of the body, leading to serious issues in organs such as the heart, kidneys, and liver. Infections that travel from the mouth to other parts of the body can result in conditions such as heart disease, kidney problems, and even liver failure (Bristol Veterinary Group, 2020).

By maintaining a dog's oral health, you reduce the risk of these harmful effects, thus promoting better overall health (American Animal Hospital Association [AAHA], 2019).

THE IMPORTANCE OF BIOAVAILABLE AND BIOACTIVE PEPTIDES FOR DENTAL HEALTH

Proteins are large molecules composed of individual 'building blocks' called amino acids.

After the consumption of food containing protein, the process of protein digestion begins as enzymes released in various parts of the gastrointestinal tract break it down into protein hydrolysates: **short chains of amino acids known as peptides, and free amino acids**.

This enables these building blocks to be absorbed into the body, where they can be recombined to synthesise new proteins.

Saliva contains a wide variety of proteins that play crucial roles in oral health, including digestion, protection, and immune function. Some of the key proteins found in saliva include amylase, proline-rich proteins (PRPs), mucins, host-defence peptides, and various immunoglobulins.

These proteins contribute to the maintenance of oral health by facilitating digestion, protecting oral tissues, and supporting the immune system.

For instance, salivary amylase initiates the breakdown of starches, PRPs assist in the formation of the acquired enamel pellicle, and mucins provide a protective barrier against microbial adhesion. Additionally, host-defence peptides, including antimicrobial peptides and immunoglobulins, play significant roles in the oral immune defence system (Valle et al., 2011).

Historically, it was believed that only free amino acids were absorbed from the gastrointestinal tract by specific amino acid transporters. However, it is now recognised that the majority of amino acids are absorbed from the intestine as di- and tri-peptides via the broad-specificity peptide transporter PepT1 (Fei et al., 1994).

Di-peptides and tri-peptides are most abundant in the molecular weight ranges of 0.2–0.25 kDa and 0.3–0.4 kDa, respectively.

Research has shown that the intake of proteins that have already been hydrolysed (peptides) results in more efficient absorption from the digestive tract than intact proteins and even individual amino acids (Maebuchi et al., 2007; Zhao et al., 1997).

COLLAGEN PEPTIDES AND PERIODONTAL HEALTH

MOLAR SHOWING PERIODONTAL DISEASE

A HEALTHY MOLAR

COLLAGEN PEPTIDES SHOWN TO IMPROVE PERIODONTAL HEALTH.

By enhancing collagen production, collagen peptides may help accelerate recovery and improve periodontal health. The results of the study showed that those who received collagen peptides exhibited a more substantial reduction in clinical signs of periodontal inflammation. (Zdzieblik et al., 2022).

Collagen peptides, derived from the hydrolysis of collagen, are the main structural proteins in connective tissues and have been the subject of extensive research regarding their impact on periodontal health.

In a randomised controlled trial, the effects of collagen peptide supplementation, specifically Verisol® B, were evaluated in patients with chronic periodontitis — a long-term inflammatory disease that damages the tissues supporting the teeth.

This study involved 39 participants who were randomly divided into two groups: one group received a daily collagen peptide supplement, while the other received a placebo. Both groups also underwent professional mechanical plaque removal (PMPR), a standard treatment for periodontal disease.

The results of the study revealed that participants who took the collagen peptide supplement showed significantly greater improvements compared to the placebo group.

Specifically, those who received collagen peptides exhibited a more substantial reduction in clinical signs of periodontal inflammation, including bleeding on probing (BoP), gingival index (GI), and periodontal inflamed surface area (PISA) (Zdzieblik et al., 2022).

These findings suggest that collagen peptides not only support the regeneration and repair of gingival tissues but may also enhance the anti-inflammatory effects of standard periodontal treatments.
In a canine model, the administration of collagen tri-peptides (CTP) demonstrated improvements in gingival microcirculation and tissue health.

Beagle dogs with dental biofilm-induced gingivitis were divided into two groups: one received CTP supplementation, while the other received a placebo.

After the supplementation period, the CTP group exhibited significant improvements in capillary loop morphology, a reduction in capillary hyperaemia, and a higher ratio of collagen fibre area to inflammation area, indicating enhanced tissue health and regeneration (Yamamoto et al., 2024).

The likely mechanism for these improvements is that collagen peptides promote tissue repair and regeneration by supporting collagen synthesis in the gums. Collagen is a critical component of the extracellular matrix in gingival tissue, and its synthesis is essential for the healing and maintenance of healthy gum tissues.

By enhancing collagen production, collagen peptides may help accelerate recovery and improve periodontal health. The study's findings provide strong evidence that collagen peptides could be a beneficial supplement for individuals with periodontal disease, particularly in improving inflammatory outcomes and supporting gum tissue repair (Zdzieblik et al., 2022).

ANTIMICROBIAL PEPTIDES IN GINGIVAL TISSUE

Antimicrobial peptides (AMPs) are naturally occurring proteins that play a **crucial role in the body's defence against microbial infections, tissue remodelling, and regulation of inflammation**, particularly in the gingival (gum) tissues.

These peptides, including LL-37, α-defensins, and β-defensins, are produced by various cells in the body, including those in the gingival epithelium and fibroblasts, and are **vital for both immune defence and tissue health**.

One important AMP found in gingival tissue is LL-37, which has been shown to stimulate gingival fibroblasts.

These cells are responsible for producing extracellular matrix proteins, including collagen.

When fibroblasts are stimulated by LL-37, they produce growth factors such as basic fibroblast growth factor (bFGF) and hepatocyte growth factor (HGF), both of which are **essential for tissue repair and regeneration**.

In fact, LL-37 is known to play a dual role: it **enhances the immune response while also supporting tissue healing**.

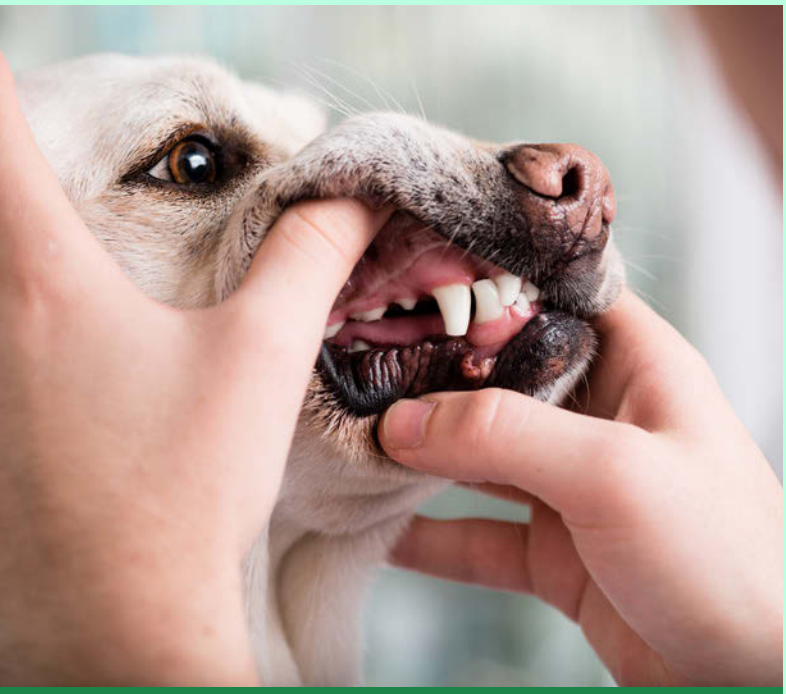
It has been observed to **promote the production of collagen** and other extracellular matrix proteins, both of which are crucial for **maintaining the integrity and strength of gingival tissues** (Fabbri and Berg, 2019).

Additionally, β-defensins, which are expressed in the gingival epithelium, contribute to the formation of a microbial barrier at the gingival margin.

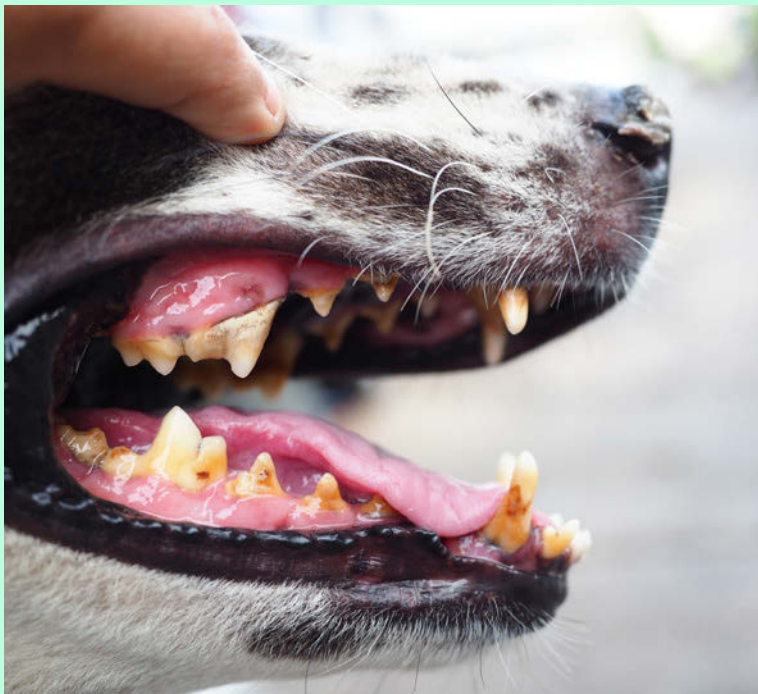
This barrier is **essential in preventing the colonisation of harmful bacteria** that could lead to infections and periodontal diseases.

By reducing microbial load and modulating local immune responses, antimicrobial **peptides help maintain gingival tissue health and prevent the onset of periodontal disease**.

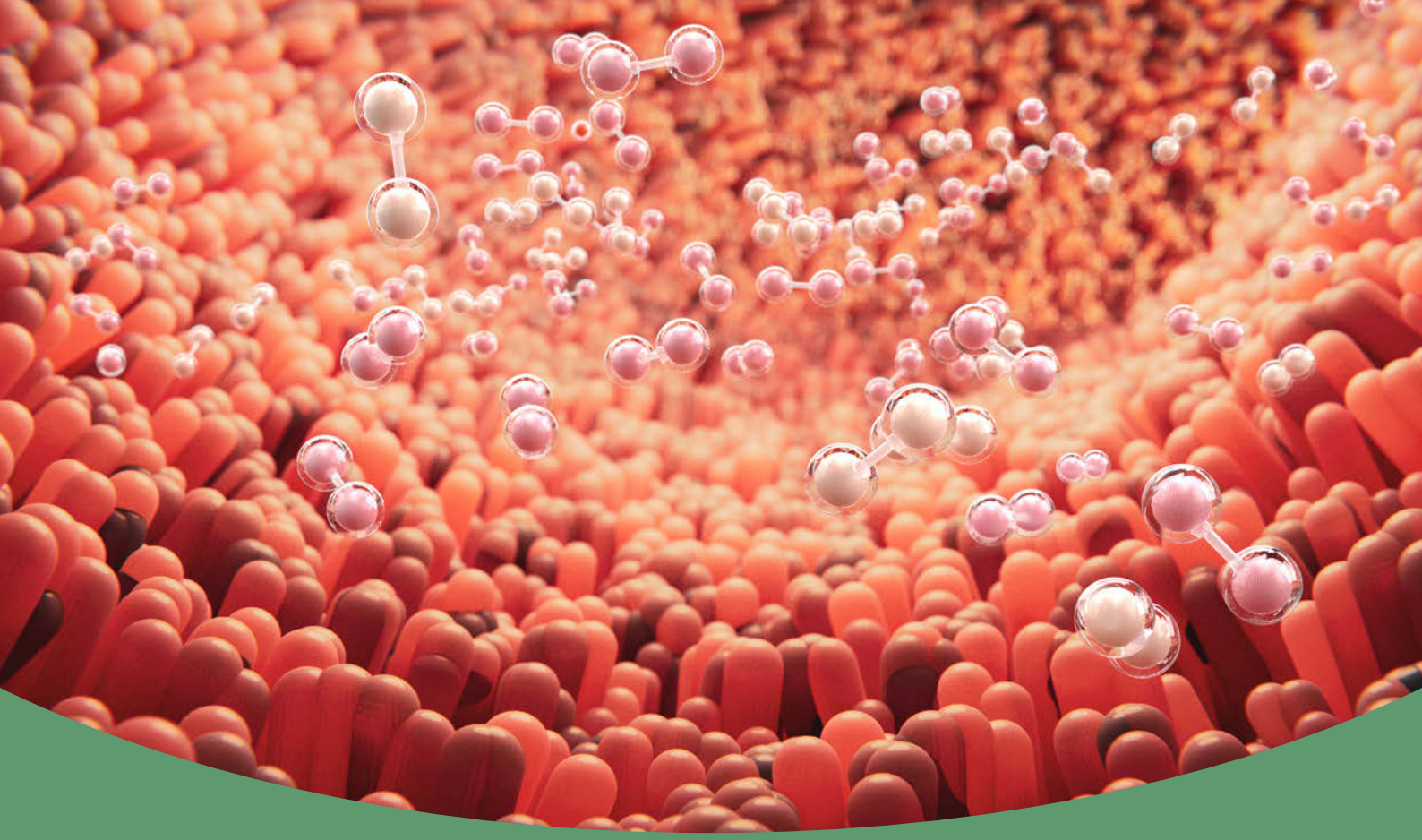
These peptides not only **support immune defence** but also assist in **maintaining the balance of the oral microbiome**, which is essential for overall gum health (Fabbri and Berg, 2019).



A DOG WITH HEALTHY GINGIVAL TISSUES AND NO SIGNS OF PERIODONTAL DISEASE



A DOG WITH INFLAMMED GINGIVAL TISSUES AND SIGNS OF PERIODONTAL DISEASE



DIETARY PROTEIN INTAKE AND PERIODONTAL HEALING

The role of dietary protein intake, specifically peptides, in periodontal healing has been well documented, particularly with regard to its impact on the **regeneration and repair of gingival tissues** following periodontal treatments.

One study investigated the influence of dietary protein on the healing process after non-surgical periodontal therapy.

The research focused on the relationship between protein intake and tissue regeneration in patients with periodontal disease.

The study found that patients who consumed at least 1 gram per kilogram of body weight per day demonstrated **significantly better healing outcomes** compared to those with lower protein intake (Gholami and Berman, 2020).

Adequate protein intake is **crucial for the synthesis of collagen** and other structural components necessary for the repair and regeneration of periodontal tissues.

Hydrolysed protein ensures that the body has an adequate supply of these amino acids, which are **essential for collagen production and tissue repair**.

The evidence from these studies highlights the significant role of dietary peptides and naturally occurring peptides in **supporting gingival health and enhancing the healing of periodontal tissues**.

This underscores the importance of nutritional support for optimised oral health.

DENTAL CARIES

Dental caries, commonly known as tooth decay or cavities, is a multifactorial microbial disease characterised by the progressive demineralisation of dental hard tissues due to organic acids produced by the bacterial fermentation of dietary carbohydrates.

Sucrose, in particular, acts as a substrate for cariogenic microorganisms, notably *Streptococcus mutans*, leading to acid production, a reduction in plaque pH, and the proliferation of acidogenic and aciduric bacterial species (Selwitz et al., 2007; Featherstone, 2000).

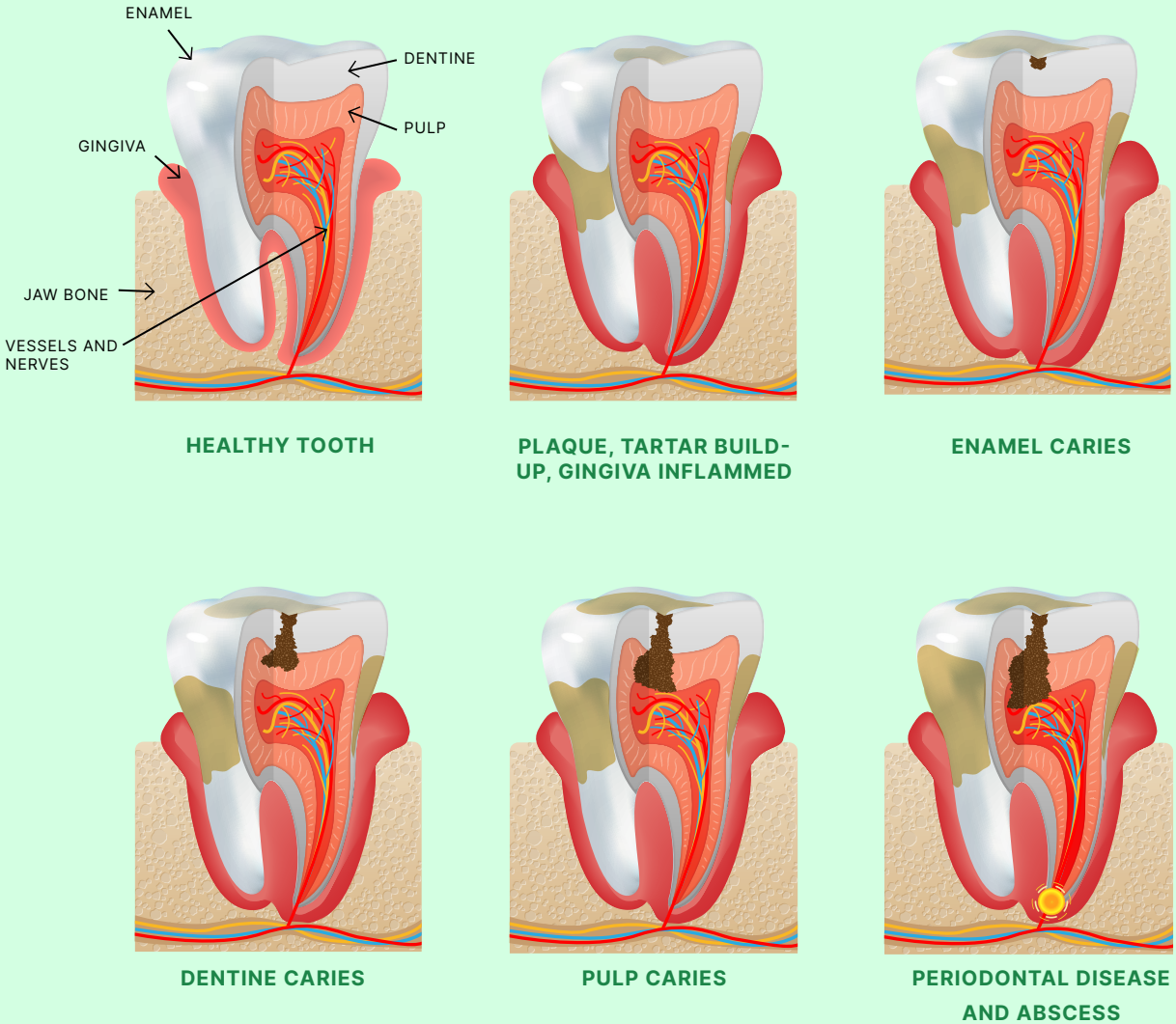
This acidic environment facilitates the dissolution of hydroxyapatite crystals in enamel, resulting in **mineral loss from the subsurface enamel** and the formation of early-stage carious lesions. If addressed promptly, these lesions are potentially **reversible through non-invasive remineralisation therapies**, e.g. nutritional management, that restore mineral content and structural integrity.

Amelogenin is the primary protein in the enamel matrix, accounting for approximately 90% of the extracellular matrix proteins produced during amelogenesis. It plays a vital role in the mineralisation of enamel. A recent study focused on the structural self-assembly properties of a novel bioactive peptide, specifically leucine-rich amelogenin peptide (LRAP). **This peptide is derived from the amelogenin protein and is engineered for therapeutic enamel remineralisation**.

The remineralisation of enamel and dentine using bioactive peptides has recently been considered as an alternative to conventional treatment protocols using fluoride and amorphous calcium phosphate-based products.

Enamel remineralisation refers to the process of replenishing minerals, such as hydroxyapatite, into the tooth enamel, which is **crucial for halting and reversing the early stages of dental decay**.

Peptides can aid in this process by facilitating the proper growth and organisation of newly formed hydroxyapatite nanostructures (Muntean et al., 2024).



WHAT MAKES THE DENTAL CARE DIET SO UNIQUE?

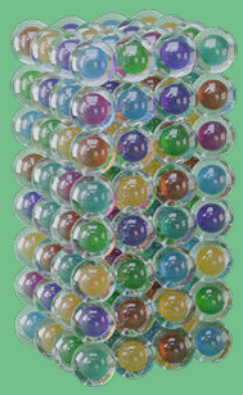
The development and formulation of the Dental Care recipe has centred around the 'Power of Peptides', using the latest Freshtrusion® HDP technology.

Freshtrusion® HDP (Highly Digestible Protein) is a unique process that involves cooking fresh meat and fish ingredients in the presence of a natural enzyme, which digests (hydrolyses) the protein into a mixture of peptides and free amino acids.

This increases the digestibility and bioavailability of the protein and improves palatability, through what is referred to as the Goldilocks Principle:

THE GOLDILOCKS PRINCIPLE

Instinctively, it might be assumed that intact protein is best for a dog to digest, as it contains all the nutritional elements together in one structure. Similarly, individual amino acids, broken down into their smallest units, might be considered easier to absorb. However, research has shown that the optimal digestibility and absorption rates occur in small-chain peptides (≤ 3 kDa). This concept is referred to as the 'Goldilocks Principle'.



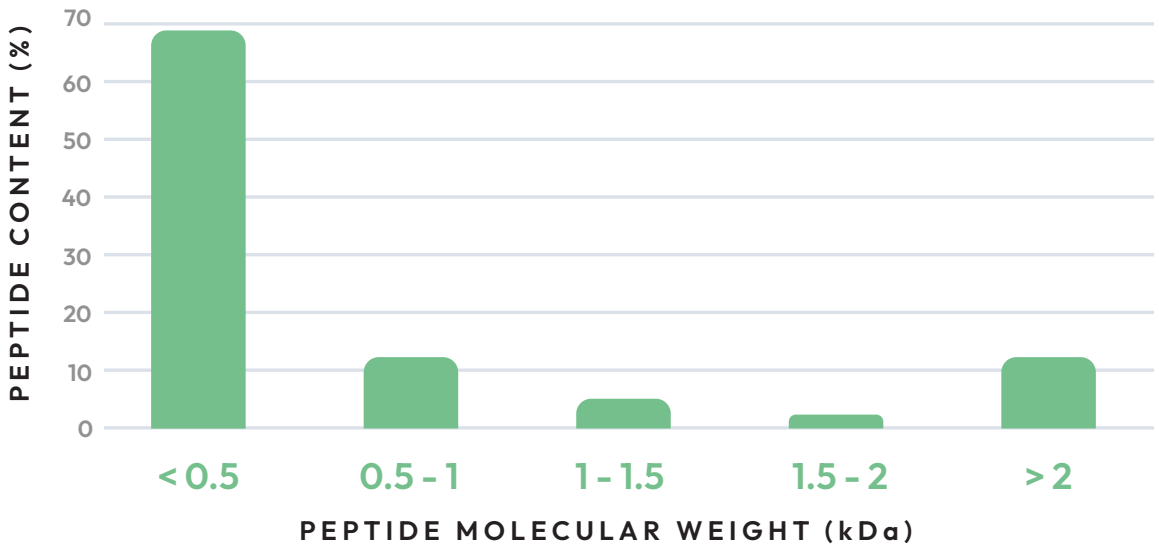
INTACT PROTEIN

DI AND TRI-PEPTIDES

SINGULAR AMINO ACIDS

TOO BIG — JUST RIGHT — TOO LITTLE

DENTAL CARE: PEPTIDE CONTENT (%)



A minimum of 69% of the peptides in this recipe are < 0.5 kDa with just 12% of the peptides > 2 kDa

These results demonstrate that the majority of peptides in the finished kibble fall into the < 0.5 kDa category. This range includes the highly digestible and nutritionally beneficial dipeptides and tripeptides, thereby achieving the Goldilocks Principle.

THE POWER OF THE PEPTIDES FOR DENTAL CARE

- ✔ Increases the digestibility and bioavailability of the protein
- ✔ Improves the palatability of the recipe
- ✔ Ensures an ideal supply of amino acid building blocks required for the renewal, maintenance, and repair of gum cells
- ✔ Ensures an ideal supply of amino acid building blocks required for the synthesis of structural proteins such as collagen
- ✔ Ensures an ideal supply of amino acid building blocks required for the production of antimicrobial peptides that support healthy gums by reinforcing the oral barrier and reducing inflammation

WHAT OTHER INGREDIENTS ARE BENEFICIAL IN MAINTAINING DENTAL HEALTH?

In addition to the inclusion of hydrolysed protein, the Dental Care diet contains a range of functional ingredients, including a unique dental blend called Plaque Defence. This is a multi-functional combination of five ingredients designed to promote optimal oral health.

It includes sodium hexametaphosphate, seaweed, cranberry, green tea extract, and peppermint.

These ingredients work synergistically to reduce plaque, inhibit bacterial growth, prevent tartar formation, and provide relief from inflammation.

Additionally, Dental Care is formulated with postbiotics to support fresher breath and a healthy oral microbiome.

Several studies suggest that each of these ingredients also contributes to improved oral health in dogs, supporting their inclusion in pet-specific oral care products.

Sodium Hexametaphosphate

Sodium hexametaphosphate is widely used in oral care products for its ability to **prevent tooth staining and calculus formation**.

In a clinical trial, products containing sodium hexametaphosphate **significantly reduced extrinsic staining** on teeth.

The mechanism involves the chelation of calcium, which prevents the formation of mineral deposits that contribute to staining and plaque (Reynolds, 2008).

In relation to dogs, one study demonstrated that sodium hexametaphosphate was **effective in reducing tartar formation when included in a veterinary toothpaste**. This finding highlights the compound's applicability in pet oral health formulations (Wysocki et al., 2005).

Seaweed

Seaweed, particularly *Chondrus crispus* (Irish moss) and other red algae, has been shown to possess antimicrobial properties that may aid in oral health by reducing plaque and supporting gum health.

Seaweed contains polysaccharides such as carrageenans and agarans, which are believed to exert a protective effect on teeth and gums by preventing microbial adhesion and reducing bacterial load (Fitzgerald et al., 2007). These compounds also exhibit anti-inflammatory properties, which may assist in reducing gingival inflammation.

In the context of pet oral health, studies have demonstrated that incorporating seaweed into dog food or treats can reduce the formation of plaque and tartar, owing to its antibacterial activity (Doherty et al., 2009).

Cranberry

Cranberry, particularly its polyphenols, is known for its ability to prevent bacterial adhesion. Cranberry proanthocyanidins inhibit the adherence of *Streptococcus mutans*, a bacterium responsible for dental caries. Studies have shown that cranberry extracts can reduce the formation of dental plaque and biofilm, which are precursors to both cavities and periodontal disease (Jeong et al., 2008).

One study investigated cranberry's role in preventing dental caries in both humans and animals. It found that cranberry polyphenols could inhibit the growth of cariogenic bacteria, suggesting their potential use in preventing plaque and gum disease in dogs as well (Bishop et al., 2013).

Green Tea Extract

Green tea extract, particularly its active compound epigallocatechin gallate (EGCG), possesses significant antimicrobial and anti-inflammatory properties. Green tea catechins have been shown to reduce oral bacteria, especially *Streptococcus mutans*, which is implicated in tooth decay.

EGCG also contributes to periodontal health by reducing collagenase activity, thereby helping to prevent the destruction of periodontal tissue (Al-Yami et al., 2013).

In the context of canine oral health, research indicates that green tea extract included in veterinary dental care products can reduce the bacterial load in the oral cavity and prevent the onset of periodontal disease.

Studies such as that by Weiss et al. (2012) support the inclusion of green tea extract in pet dental formulations for its oral health benefits.

Peppermint (Dried)

Dried peppermint contains active compounds that contribute to its recognised antimicrobial and anti-inflammatory effects.

Research into its use in oral health has shown that peppermint can reduce oral bacterial populations, alleviate gum inflammation, and promote fresh breath. Specifically, its antimicrobial properties have been shown to inhibit the growth of oral pathogens such as Streptococcus mutans, which are responsible for dental caries and periodontal disease (Rathore et al., 2016).

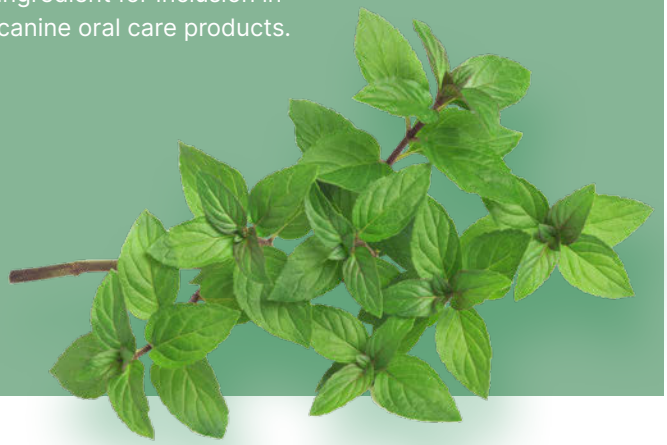
A study by Singh et al. (2018) demonstrated that dried peppermint leaf extract exhibited significant antibacterial activity against oral pathogens, suggesting it may assist in reducing microbial load, preventing plaque formation, and supporting overall oral hygiene.

In addition, dried peppermint is frequently used in natural remedies for its cooling and soothing properties, particularly for managing gingival discomfort and oral ulcers.

In veterinary applications, dried peppermint has been explored for its potential to promote oral health in pets, particularly in reducing halitosis (bad breath) and supporting gum health.

Although specific studies in dogs are limited, broader research into plant-based ingredients suggests that peppermint may provide similar benefits in pets as in humans. Pet-safe dental chews containing peppermint leaf powder have been shown to reduce the bacterial causes of bad breath and gingivitis (Barton et al., 2013).

Due to its antimicrobial and anti-inflammatory actions, dried peppermint is considered a safe and beneficial ingredient for inclusion in canine oral care products.



Dietary Prebiotics:
Mannanoligosaccharides (MOS) and Fructooligosaccharides (FOS)

Dietary prebiotics, including mannanoligosaccharides (MOS) and fructooligosaccharides (FOS), are known to influence the composition and activity of the microbiota, including that of the oral cavity. Recent scientific studies suggest that these prebiotics may have a beneficial effect on breath odour by reducing the production of volatile sulphur compounds (VSCs), which are a primary cause of halitosis.

Fructooligosaccharides, commonly found in many functional foods and supplements, serve as fermentable substrates for beneficial bacteria. A study by Campmans-Kuijpers et al. (2021) evaluated the impact of prebiotic fructans, including FOS. While this study primarily focused on aroma perception, it provided preliminary evidence that dietary fructans may influence the profile of volatile compounds in the oral cavity, suggesting a potential impact on breath odour.

Another relevant study examined the use of a 10% inulin mouth rinse, an inulin-type prebiotic closely related to FOS, and found an immediate reduction in VSC levels after rinsing (Ryder et al., 2009). This suggests that prebiotic compounds can help modulate the oral environment, leading to a decrease in malodorous compounds.

Although direct studies on MOS and halitosis in humans or animals are limited, their known immunomodulatory and microbiota-modifying effects imply similar potential. MOS has been shown to inhibit pathogenic bacterial adhesion and to support the growth of beneficial microbes in the gastrointestinal tract. These effects may plausibly extend to the oral microbiome (Spring et al., 2000).

Given that halitosis is often associated with dysbiosis and increased levels of anaerobic bacteria in the oral cavity, it is reasonable to infer that MOS could contribute to improved breath freshness by supporting a healthier microbial balance.

The mechanism by which MOS and FOS may reduce breath odour is likely linked to their ability to selectively promote the growth of non-pathogenic bacteria. These beneficial microbes can outcompete VSC-producing anaerobes such as *Porphyromonas gingivalis* and *Solobacterium moorei*.

By shifting the microbiota composition, prebiotics may reduce the microbial production of sulphur-containing gases and thereby contribute to fresher breath and a healthier oral environment.

WHAT ARE THE RESULTS?

As part of the development of the Dental Care recipe, a feeding study was conducted to evaluate the benefits of this dry dog food on 16 dogs whose owners either identified existing poor oral health or were interested in whether improvements in their pets' oral health could be made. In addition, the acceptance and palatability of this dog food were observed and evaluated.

This study was conducted independently by veterinarian Dr Des Groome, Kildare Vet Surgery. The duration of the study was 12 weeks, following a transition period onto the test diet.

Initially, the dogs' overall oral health, degree of halitosis, gum health and the build-up of plaque were assessed. Then, following the feeding, these factors were assessed periodically every 4 weeks. Additional owner feedback was provided via a questionnaire. **The results and feedback showed that the recipe caused a reduction in halitosis, plaque build-up and an improvement in oral and gum health, as 93% of pet owners saw a visible improvement in their dogs' oral health.**

"The Dental Care recipe did exactly as desired. Reduced plaque, reduced tartar, reduced gum inflammation, fresher breath and improved halitosis." - Dr Des Groome MVB, MBS

REFERENCES

Al-Yami, E.A., El-Sayed, W.S., Al-Zahrani, M.A. and Al-Bakri, S.M. (2013) 'Effects of green tea on periodontal health', Journal of Contemporary Dental Practice, 14(3), pp. 456–460.

American Animal Hospital Association (AAHA) (2019) Dental care guidelines for dogs and cats. Available at: https://www.aaha.org (Accessed: [insert date]).

American Veterinary Dental College (AVDC) (2020) Halitosis and periodontal disease in dogs. Available at: https://www.avdc.org (Accessed: June 2025).

American Veterinary Medical Association (AVMA) (2020) Periodontal disease in pets. Available at: https://www.avma.org (Accessed: June 2025).

Barton, C. (2019) 'Use of activated charcoal in veterinary medicine', Veterinary Medicine Review, 6(2), pp. 101–106.

Barton, C., Turner, D. and Patel, A. (2013) 'Plant-based oral health solutions for companion animals', Companion Animal Journal, 18(4), pp. 289–294.

Bishop, C., Wilson, M. and Walker, J. (2013) 'Cranberry polyphenols and dental caries prevention', Journal of Veterinary Dentistry, 30(3), pp. 156–161.

Campmans-Kuijpers, M.J.E., Savelkoul, P.H.M., van Belkum, B. and Sikkema, J. (2021) 'Prebiotic fructans and their effect on volatile compounds in the oral cavity: a pilot study', European Journal of Nutrition, 60(4), pp. 1991–2000.

Doherty, C., Swain, J. and O'Sullivan, T. (2009) 'Effects of seaweed-derived additives on canine oral health', Journal of Applied Phycology, 21(6), pp. 687–691.

Fabbri, C. and Berg, R. (2019) 'Antimicrobial peptides in gingival health and disease', Oral Diseases, 25(2), pp. 543–552.

Featherstone, J.D.B. (2000) 'The science and practice of caries prevention', Journal of the American Dental Association, 131(7), pp. 887–899.

Fei, Y.J., Kanai, Y., Nussberger, S., Ganapathy, V., Leibach, F.H., Romero, M.F., Singh, S.K. and Hediger, M.A. (1994) 'Expression cloning of a mammalian proton-coupled oligopeptide transporter', Nature, 368, pp. 563–566.

Fitzgerald, C., Gallagher, E., Tasdemir, D. and Hayes, M. (2007) 'Heart health peptides from macroalgae and their potential use in functional foods', Journal of Agricultural and Food Chemistry, 55(22), pp. 8919–8925.

Gholami, L. and Berman, L.H. (2020) 'Influence of dietary protein intake on periodontal healing outcomes', Nutrition and Oral Health, 12(1), pp. 45–52.

Jeong, S.H., Kim, J.Y., Cho, K.H., Yun, B.H., Lee, E.H. and Park, S.N. (2008) 'Anti-adherence effect of cranberry on Streptococcus mutans biofilm formation', Archives of Oral Biology, 53(4), pp. 355–362.

Maebuchi, M., Samoto, M. and Kohno, M. (2007) 'Effect of soy protein hydrolysates on the absorption of amino acids in rats', Nutrition, 23(5), pp. 351–356.

Malkondu, O., Karaarslan, E.S. and Kazandağ, M.K. (2013) 'Evaluation of charcoal-containing dentifrices', Journal of Esthetic and Restorative Dentistry, 25(6), pp. 402–410.

Muntean, A., Rusu, L.C., Soritau, O., Picos, A.M., Simon, S. and Roman, A. (2024) 'Self-assembling bioactive peptides for enamel remineralisation', Journal of Biomaterials Applications, 38(1), pp. 89–98.

Petfinder (2021) Dental care and nutrition for dogs. Available at: https://www.petfinder.com (Accessed: June 2025).

Rathore, M., Singh, A., Pant, V.A. and Kumar, M. (2016) 'Antibacterial effect of peppermint leaf extract on oral pathogens', Indian Journal of Dental Research, 27(5), pp. 505–510.

Reynolds, E.C. (2008) 'Calcium phosphate-based remineralisation systems: scientific evidence?', Australian Dental Journal, 53(3), pp. 268–273.

Ryder, M.I., Pons, B., Greenstein, G. and Goodson, J.M. (2009) 'The use of inulin-type prebiotic rinses in modulating oral malodour', Journal of Periodontology, 80(10), pp. 1741–1748.

Selwitz, R.H., Ismail, A.I. and Pitts, N.B. (2007) 'Dental caries', The Lancet, 369(9555), pp. 51–59.

Singh, S., Yadav, M. and Aggarwal, V. (2018) 'Evaluation of peppermint extract for use in herbal oral care products', Journal of Herbal Medicine, 14(3), pp. 87–92.

Spring, P., Wenk, C., Dawson, K.A. and Newman, K.E. (2000) 'The effects of mannan oligosaccharides on cecal parameters and the microbial ecology of the gut in poultry', Poultry Science, 79(2), pp. 205–211.

Valle, M., Sivakumar, M., Monaghan, A. and Costerton, J.W. (2011) 'Roles of salivary proteins in gingival immunity', International Journal of Dentistry, 2011, Article ID 457390.

Veterinary Oral Health Council (VOHC) (2019) Understanding periodontal disease in dogs and cats. Available at: https://www.vohc.org (Accessed: June 2025).

Weiss, R., Lauten, S., Maerz, I. and Schmidt, J. (2012) 'Efficacy of green tea extract in veterinary dental chews: a pilot study', Veterinary Therapeutics, 13(1), pp. 43–50.

Wysocki, P., Graham, J., Lappin, D.F. and Clarke, D.E. (2005) 'Evaluation of sodium hexametaphosphate in canine oral health', Journal of Veterinary Dentistry, 22(3), pp. 160–164.

Yamamoto, M., Kuroda, S., Taguchi, K., Shinkai, K., Takai, Y. and Yamada, S. (2024) 'Effects of collagen tripeptides on gingival microcirculation in a canine model', Journal of Periodontal Research, 59(1), pp. 32–40.

Zdzieblik, D., Oesser, S. and Hays, J. (2022) 'Supplementation with collagen peptides improves periodontal outcomes in chronic periodontitis: a randomised controlled trial', Nutrients, 14(3), Article 611.

Zhao, X.H., Wang, J.Y. and Yang, Z.B. (1997) 'Absorption of peptides versus amino acids in the intestine', Journal of Nutritional Biochemistry, 8(9), pp. 499–504.