# WEIGHT CONTROL & JOINT CARE

## A SCIENTIFIC SUPPORT PAPER

**90% of dogs moved on to a healthier weight whilst being fed Peptide+ Weight Control & Joint Care diet.**

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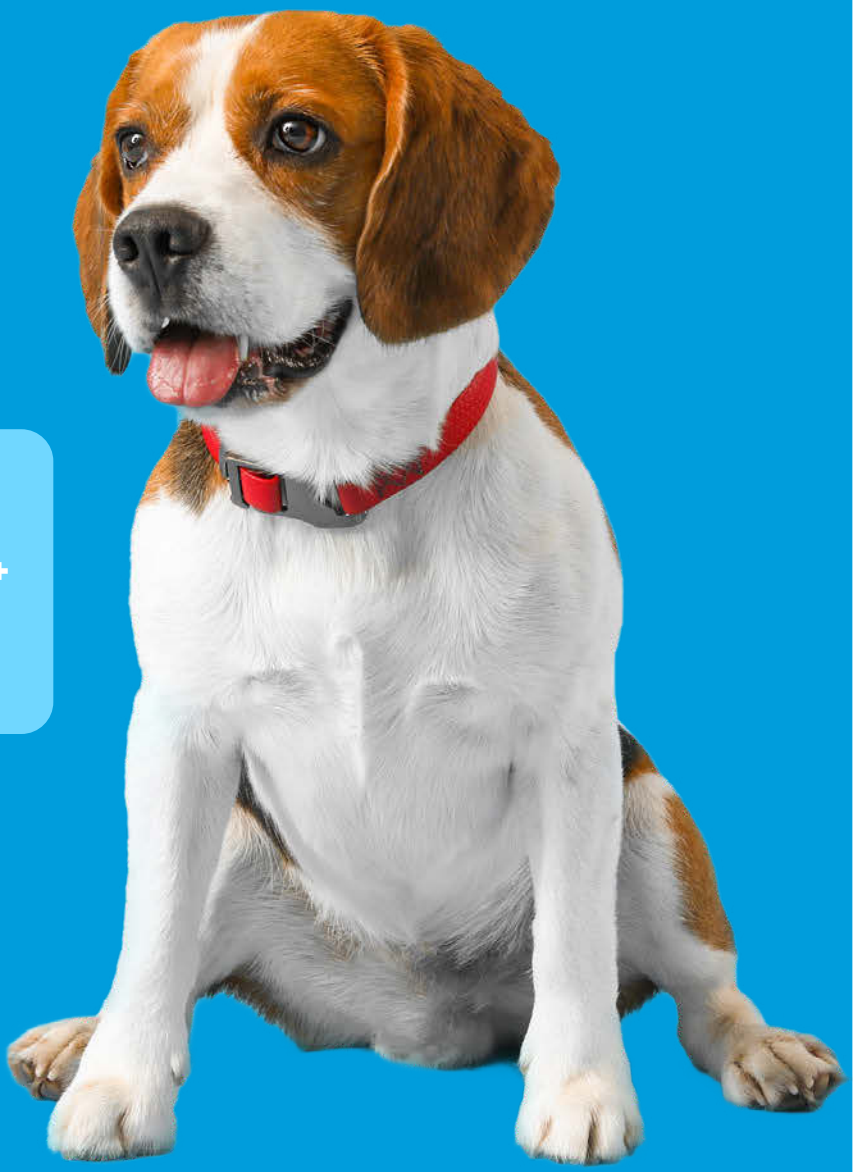

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# WHY IS HEALTHY WEIGHT SO IMPORTANT?

**A UK national survey reported that 82% of dog owners described their dog as the "ideal weight"; however, clinical studies have identified that up to 65% of dogs have obesity or are overweight and that the prevalence has been steadily increasing** **(PDSA, 2022).**

This trend is a widespread health concern as obesity is the most common nutritional disorder observed in dogs in developed nations (Robertson, 2003; Sandoe *et al.*, 2014).

Dogs are considered overweight when they weigh 10-30% above their ideal bodyweight. Obesity is diagnosed when their weight exceeds 30% of their ideal bodyweight. Excess weight can adversely affect health and welfare by increasing the risk of diseases, causing functional impairment, shortening life spans, and reducing overall quality of life (Ludd *et al.*, 2006).

Diseases and health issues associated with excess weight and obesity in dogs include osteoarthritis and orthopaedic disorders, diabetes mellitus, cardiac dysfunction and cardiovascular disease, dyspnoea, urinary and reproductive disorders, reduced life expectancy, increased risk under general anaesthetic, decreased heat tolerance, dermatological problems, and difficulty grooming (German, 2006).

Behavioural changes are often observed as overweight dogs are likely to become disinclined to play, incapable of undertaking frequent, vigorous exercise, spend increased time resting and require help jumping or climbing (Bland *et al.*, 2009). This highlights the importance of maintaining a healthy weight to maximise long-term health and well-being.

# FACTORS AFFECTING BODY WEIGHT

**There are several factors that can influence a dog's body weight; examples include food intake and activity level.**

As excessive food intake is a main cause of weight gain, diet is essential for the maintenance of a healthy weight. It is easier to prevent weight gain through tools of weight management than it is to treat obesity and the resulting health consequences (German *et al.*, 2015).

Increased weight in dogs is a complex problem, but having an appropriately formulated diet can be part of the solution to support dog owners in managing healthy body weight for their dogs.

Furthermore, there are additional factors that may predispose weight gain in dogs. For example, in dogs, there is a clear increase in the prevalence of weight gain with increasing age.

Additionally, females are more prone to weight gain compared to males (McGreevy *et al.*, 2005; Robertson, 2003).

Neutering may predispose animals to obesity by removing hormones, such as oestrogens, that act as satiety factors in the central nervous system *(Crane, 1991)*.

Furthermore, susceptibility to obesity varies between dog breeds, which suggests the influence of genetic factors. For example, Labrador Retrievers can carry a 14 bp deletion in ***pro-opiomelanocortin*** (POMC); this gene mutation is associated with greater food motivation and increased body weight and adiposity (Raffan *et al.*, 2016).

**BREED SPECIFIC OBESITY SUSCEPTIBILITY**

Labrador Retrievers can carry a 14 bp deletion in pro-opiomelanocortin (POMC); this gene mutation is associated with greater food motivation and increased body weight and adiposity (Raffan et al., 2016).

# HOW IS A HEALTHY WEIGHT ASSESSED?

A dog's weight can be tracked by weighing them on a scale, however this can be tricky depending on the size of your dog and scales. Therefore, visual and physical observations are an ideal way to tell if a dog is underweight, overweight or an ideal weight.

A Body Condition Scoring (BCS) system can help owners easily assess whether a dog is a healthy weight. BCS can be subjective; however, the 5-point BCS system has shown good repeatability and predictability between different users based on the dog's body morphology (German *et al.*, 2006).

On a scale of 1 to 5, 1-2 represents emaciated to very thin, 3 is the optimal score for dogs and represents an ideal weight, whereas 4-5 represents obesity to severe obesity.

At an ideal body condition, the ribs are easily identifiable with slight fat covering and an apparent waist and abdomen tuck.

Behaviourally the dog should be active and not require help jumping or climbing outside of their normal capabilities. In overweight dogs and dogs with obesity, there will be a heavy layer of fat covering the rib cage, making it difficult to determine individual ribs, absence of waist and obvious broad (Dorsten & Cooper, 2004).

### 1 - EMACIATED

Ribs and bony prominences are visible and easily palpable with no fat cover - severe abdominal tuck when viewed from the side and an exaggerated hourglass shape from above.

### 2 - THIN

Ribs and bony prominences are easily palpable with minimal fat cover. A marked abdominal tuck when viewed from the side and an obvious waist when viewed from above.

### 3 - IDEAL

Ribs and bony prominences are palpable with a slight fat cover. Abdominal tuck is present when viewed from the side, and a well-proportioned waist when viewed from above.

### 4 - OVERWEIGHT

Ribs and bony prominences can be felt under a moderate fat cover. No abdominal tuck, but a moderate abdominal fat pad is visible when viewed from the side, and no waist when viewed from above.

### 5 - OBESE

Ribs and bony prominences are very difficult to feel under a thick fat cover.

Prominent pendulous ventral bulge with extensive abdominal fat deposits when viewed from the side and a markedly broadened back from above. Fat deposits around the face, neck and limbs.

# THE IMPORTANCE OF BIOAVAILABLE AND BIOACTIVE PEPTIDES TO SUPPORT WEIGHT CONTROL

**Proteins are large molecules made up of individual 'building blocks' called amino acids.**

After eating food containing protein, the process of protein digestion begins as enzymes released in different parts of the gastrointestinal tract break it down into protein hydrolysates, which are short chains of amino acids called peptides and free amino acids.

This enables these building blocks to be absorbed into the body, where they can be recombined to build new proteins (such as skin, hair, muscle, antibodies, enzymes, hormones, etc).

Historically, it was believed that only free amino acids were absorbed from the gastrointestinal tract by specific amino acid transporters, whereas it is now recognised that the majority of amino acids are absorbed from the intestine as di- and tri-peptides by the broad-specificity peptide transporter PepT1 (Fei *et al.*, 1994). Di-peptides and tri-peptides are most abundant in the molecular weight range of 0.2–0.25 kDa and 0.3–0.4 kDa, respectively.

The increased digestibility and availability of the hydrolysed protein in the Weight Control & Joint Care diet ensures an ideal supply of amino acid building blocks required for the renewal and synthesis of key peptide hormones and proteins.

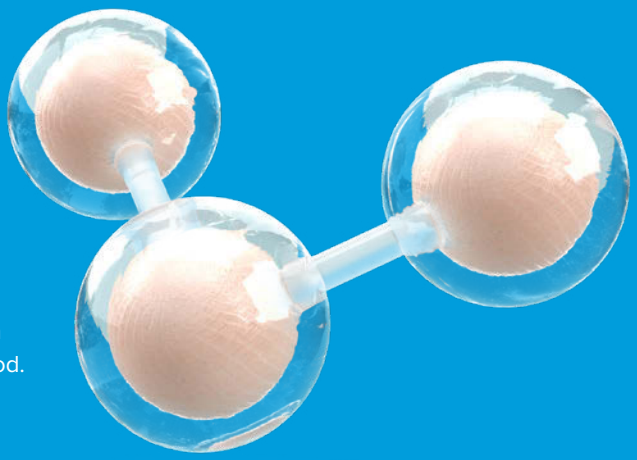
For example, cartilage oligomeric matrix protein (COMP) is an extracellular matrix glycoprotein that is critical for collagen assembly and extracellular matrix stability.

Hormones are important substances that act as chemical messengers in the body.

The majority of hormones are proteins or protein derivatives, and they facilitate a wide range of processes, including metabolism, hunger and satiety, which is the feeling of fullness. This means that they play a significant role in influencing body weight as a result of hormones role in regulating appetite (Morton et al., 2006).

The long-term regulation of body weight is controlled by several endocrine signals such as the hormones insulin and leptin. This regulation is coupled with short-term signals provided by the peptide hormone cholecystokinin (CCK) from duodenal I-cells and glucagon-like peptide-1 (GLP-1) from intestinal L cells.

Secretion is stimulated in the intestine in response to nutrient ingestion and these short-term signals help to regulate daily energy intake by maintaining an appropriate intake of food.



Peripheral GLP-1 may also interact with leptin, associating it with both acute and long-term regulation of energy balance (Morton et al., 2006).

**Fish peptides and protein hydrolysates** from crustaceans, found in the Weight Control and Joint Care diet, have been demonstrated to **highly stimulate the secretion of appetite-suppressive molecules** such as CCK in intestinal endocrine STC-1 cells *in vitro*.

In addition, **small peptides (≤1.5 kDa) exerted a greater CCK-stimulating effect than larger molecular weight peptides** (Cudennec et al., 2008).

*In vitro* effects have additionally been repeated *in vivo*. Studies have shown that fish peptides stimulate an increase in the amount of anorexigenic (appetite-suppressing) hormones, CCK and GLP-1 in the blood.

Short-term this induces a decrease in food intake by increasing the feeling of satiety. Moreover, it was demonstrated that the chronic administration of fish peptides leads to a decrease in body weight gain.

Therefore, in the long term, this may induce a decrease in adipose tissue as a result of hormone interactions that are capable of effectively reducing overall food intake.

This study is an example of a decrease in body weight mediated by both indirect and direct mechanisms. Against intact protein, bioactive fish peptides influenced a significant increase in the intestinal secretion of CCK and GLP-1, which decreased food intake and the total amount of calories consumed; this together will have a long-term direct impact on decreasing overall adipose tissue mass (Cudennec et al., 2012).

A dog-simulated gastrointestinal in vitro digestion model demonstrated the promising effects of fish peptides on the regulation of food intake and glucose metabolism.

In addition to the bioactive peptides stimulating CCK and GLP-1 release, the activity of the protease dipeptidyl peptidase 4 enzyme (DPP-IV) was inhibited.

Since DPP-IV targets and breaks down circulating levels of GLP-1, inhibiting its activity could lead to prolonged increases in GLP-1. This shows the positive effects of peptides as a functional ingredient in preventing or managing body weight (Theysgeur et al., 2020).

## FISH PEPTIDES FOR SATIETY TO HELP WEIGHT MANAGEMENT

Studies have show that fish peptides (included in the Weight Control & Joint Care diet) stimulate an increase in the amount of anorexigenic (appetite suppressing) hormones, CCK and GLP-1 in the blood.

Short-term this induces a **decrease in food intake by increasing the feeling of satiety,** and can lead to a **decrease in body weight gain**. Therefore in the long term this may **decrease adipose tissue** effectively reducing overall food intake.

# WHY COMBINE A WEIGHT CONTROL AND JOINT CARE RECIPE?

There is a clear link between excess weight and joint problems in humans and dogs. **Excessive weight will apply additional pressure onto joints**.

When a joint is overloaded, this can cause the **breakdown of cartilage and increases the risk of joint damage**.

Signs of joint damage include reduced joint mobility and lameness. Furthermore, as joint pain increases, this may predispose to inactivity and sedentary behaviour, leading to further weight gain and may subsequently lead to osteoarthritis (Moreau *et al.*, 2010).

**Osteoarthritis** is a progressively painful disease caused by articular cartilage degradation, in which the extracellular matrix structure is altered, resulting in the loss of important functional proteins such as proteoglycan, which provides hydration and swelling pressure to the tissue, enabling it to withstand compressional forces and collagen, which provides structural support to the extracellular space of connective tissues.

Additionally, osteoarthritis is characterised by subchondral bone sclerosis, which is a thickening and hardening of bone that happens underneath cartilage in a joint and chronic inflammation of synovial membranes (Johnson *et al.*, 2020).

**Osteoarthritis is estimated to affect approximately 20% of dogs ≥ 1 year of age and 90% of dogs > 5 years of age** (Servet *et al.*, 2006).

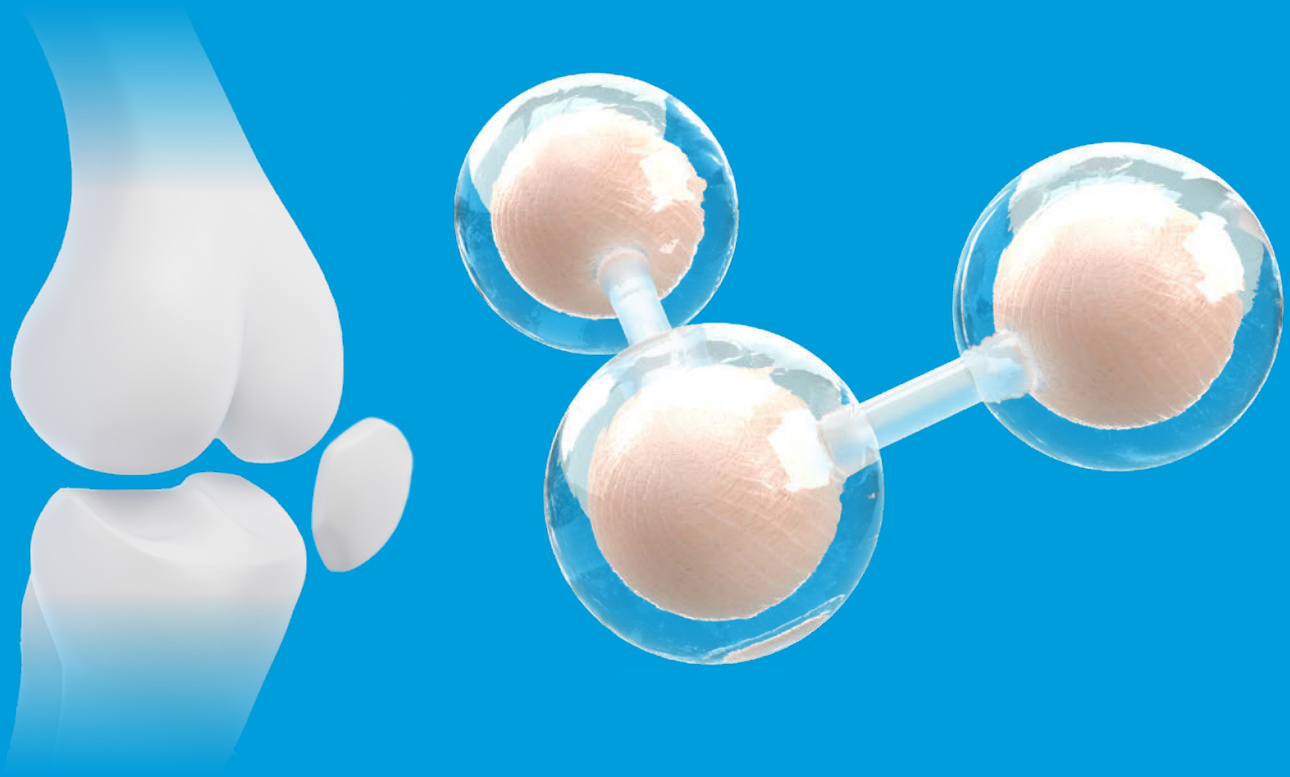
Research into the prevention of weight gain and obesity in dogs and the associated effect on osteoarthritis showed that maintaining a dog at the ideal weight and BCS may reduce the incidence of hip dysplasia, reduce the incidence and severity of osteoarthritis, delay the need for treatment of osteoarthritis and other chronic diseases and delay the need for euthanasia due to chronic disease **(osteoarthritis was a leading cause of euthanasia)** (Marshall et al., 2009).

In terms of treatment, **weight loss substantially improves mobility**, lameness and other major clinical symptoms of canine osteoarthritis.

A comparison of kinetic gait analysis at the beginning and end of weight loss showed improved hindlimb function, peak ground reaction force increased in both fore and hindlimbs, and time of the stride propulsion phase decreased.

The decrease in time of the propulsive phase of the stride suggests that the dog's gait had changed with an increased limb velocity, which may suggest improved joint comfort (Marshall et al., 2009).

# THE IMPORTANCE OF BIOAVAILABLE AND BIOACTIVE COLLAGEN PEPTIDES TO SUPPORT JOINT HEALTH



**Collagen is a protein found exclusively in animals, especially in the skin, bones and connective tissues of mammals, birds and fish.**

**Collagen proves and maintains the structural integrity of various tissues throughout the body.**

**Type I collagen** is the most abundant collagen, making up more than **90% of the protein content of bone** and is the major collagen of tendons (this type of connective tissue attaches muscles to bones) and ligaments (this type of connective tissue attaches one bone to another bone – holding joints together), providing structure and strength to these tissues.

**Type II collagen** is the predominant component of cartilage, the extremely strong, flexible and semi-rigid support tissue found at points where two bones meet, providing a smooth surface that allows joints to move easily and a 'cushion' effect to absorb the shock of impact, especially on the ends of weight-bearing bones (e.g., hip, elbow joints).

Collagen is essential for bone health. It provides the protein matrix ('scaffolding') on which calcification (bone mineralisation) can occur.

**Bone collagen undergoes continual breakdown, repair and renewal, so providing nourishment through dietary collagen or collagen peptides is important to help maintain lifelong, strong, healthy bones.**

In arthritic dogs supplemented with type II collagen, a significant increase in peak vertical force (N/kg body weight) and impulse area (N·s/kg body weight) was reported, indicative of a decrease in arthritis-associated pain (Gupta *et al.*, 2012).

**Supplementation with collagen peptides was proven to be beneficial in dogs with osteoarthritis** that had not previously reacted to osteoarthritic treatments. Results indicated a statistically significant reduction in lameness compared to the beginning of treatment.

Pet owners also reported an improvement in the daily routines of their dogs, including significantly decreased discomfort in standing up and a clear reduction in contact pain (Schunck *et al.*, 2017).

# WHAT MAKES THE WEIGHT CONTROL & JOINT CARE DIET SO UNIQUE?

**The development and formulation of the Weight Control & Joint Care recipe has centred around the 'Power of Peptides' using the latest Freshtrusion HDP technology.**

HDP freshtrusion HIGHLY DIGESTIBLE PROTEIN

**Freshtrusion HDP (Highly Digestible Protein)** is the unique process of 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 we like to refer it as the Goldilocks Principle:

## THE GOLDILOCKS PRINCIPLE

Instinctively, it would be assumed that intact protein would be best for a dog to digest as it contains all the nutritional elements together as one. Similarly, individual amino acids, broken down as small as possible, might be considered to be much easier to absorb. However, it has been proven in research studies that the ideal digestibility and absorption rates occur in small-chain peptides (≤ 3kDa). We like to refer to this as the 'Goldilocks principle'.

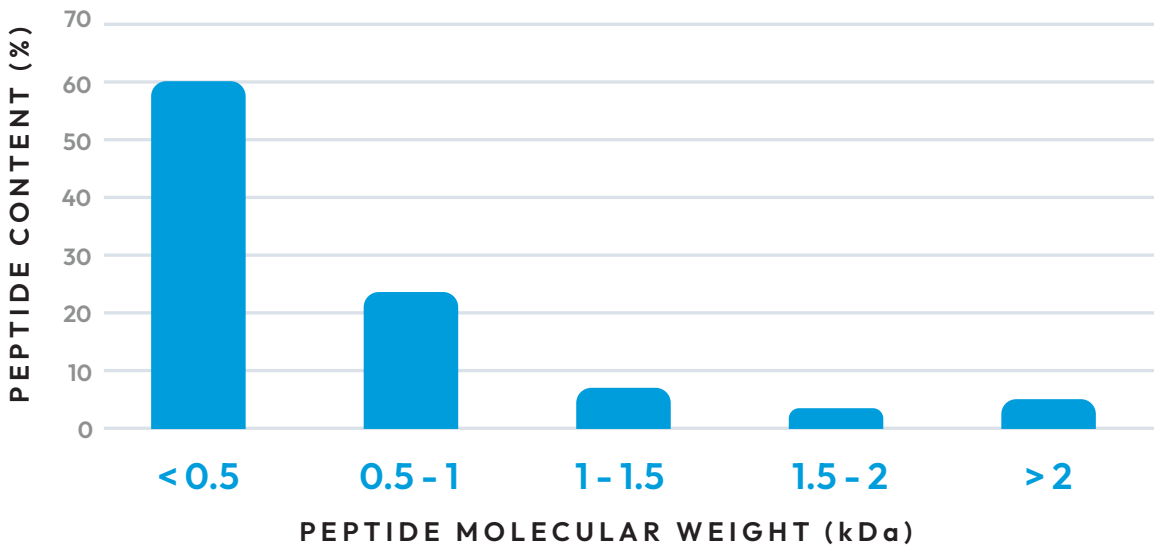
**INTACT PROTEIN**

**DI AND TRI-PEPTIDES**

**SINGULAR AMINO ACIDS**

TOO BIG — JUST RIGHT — TOO LITTLE

# WEIGHT CONTROL & JOINT CARE RECIPE: PEPTIDE CONTENT (%)




**A minimum of 60% of the peptides in this recipe are < 0.5 kDa with just 7% of the peptides > 2 kDa.**

The results show the majority of peptides in the finished kibble fall into the < 0.5 kDa category, which includes the highly digestible and nutritionally beneficial dipeptides and tripeptides - achieving the Goldilocks Principle.

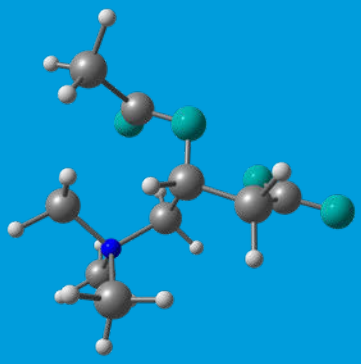
# THE POWER OF THE PEPTIDES FOR WEIGHT CONTROL & JOINT HEALTH

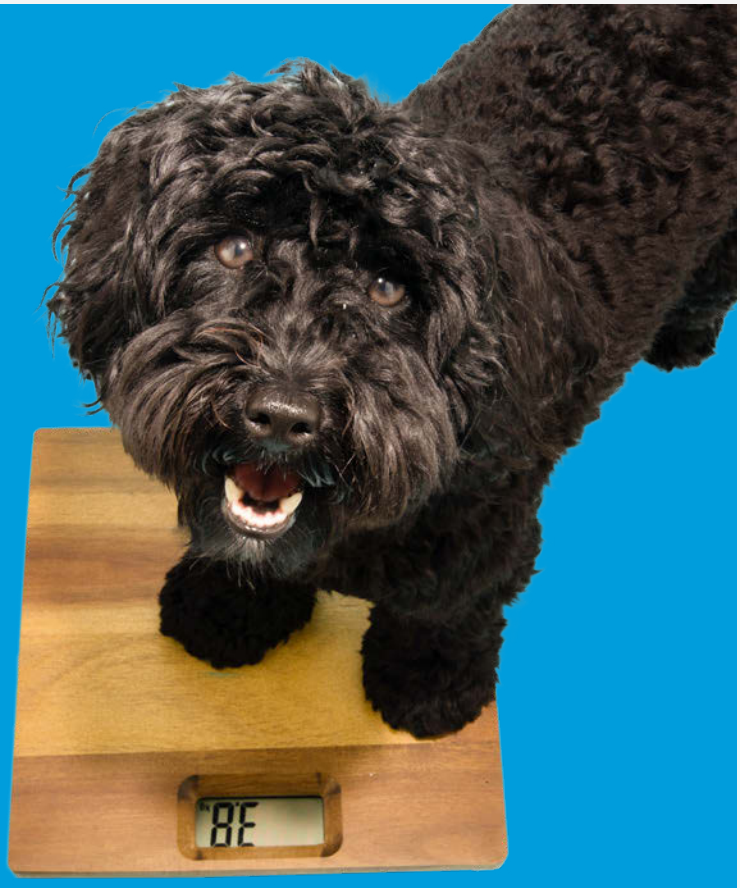
- ✔ **Increases the digestibility and bioavailability of the protein**
- ✔ **Improves the palatability of the recipe**
- ✔ **Ensures an ideal supply of amino acid building blocks required for the renewal and synthesis of key peptide hormones and proteins such as collagen**
- ✔ **Stimulates the secretion of appetite-suppressive molecules which may induce a decrease in food intake by increasing the feeling of satiety**
- ✔ **Helps to support and maintain healthy joints and regain mobility**

In addition to the inclusion of hydrolysed protein, the Weight Control & Joint Care diet includes a range of functional ingredients, including L-Carnitine and Green Lipped Mussel, that have been shown to have beneficial effects on weight control and joint health, respectively.

Furthermore, the Weight Control & Joint Care diet provides two feeding guides. One for weight loss and a second for weight maintenance, which means it is suitable for all adult dogs.

# WHAT OTHER INGREDIENTS ARE BENEFICIAL IN MAINTAINING A HEALTHY WEIGHT?





**L-carnitine supplementation has been shown to promote weight and fat loss in overweight dogs.**

**The Weight Control & Joint Care recipe has been formulated to have a high protein content to support lean muscle mass and a low fat content to limit fat intake and deposition. Additionally, the recipe contains a unique blend of fibre: Pea Fibre, Beet Pulp and Lignocellulose.**

Coupled with high protein, high inclusion of dietary fibre has been shown to be more effective at reducing voluntary food intake which suggests increased satiety.

This is important as maximising satiety is a critical factor for any weight management diet. As a result, such diets lead to **improved outcomes of weight loss in overweight dogs and dogs with obesity** (German et al., 2010).

**L-carnitine** supplementation has been shown to **promote weight and fat loss in overweight dogs**. The inclusion of L-carnitine in diets fed to dogs firstly enhances energy conversion by increasing fatty acid oxidation, which helps to reduce body fat stores (Sunvold et al., 1998).

L-carnitine may **prevent the loss of lean muscle mass** during increased activity and weight reduction, which is important for the long-term maintenance of optimum body condition and weight (Varney et al., 2017).

# WHAT OTHER INGREDIENTS ARE BENEFICIAL IN AIDING JOINT HEALTH?

**Green-lipped mussel is known to contain anti-inflammatory components and other nutrients that may benefit joint health.**

**Dietary factors can potentially modify some of the underlying processes involved in joint problems, including modulation of the inflammatory response and provision of nutrients for cartilage repair.**

Where effective, **dietary management may help to reduce or eliminate the need for conventional drugs**, some of which are associated with adverse secondary effects.

**Green-lipped mussel** is known to contain anti-inflammatory components and other chondroprotective nutrients that may benefit joint health.

Studies have found that **green-lipped mussel is effective in alleviating swelling and pain in dogs** with joint problems such as osteoarthritis (Bierer & Bui, 2002).

Green-lipped mussel contains glycosaminoglycans, for example, chondroitin sulfates. These long, unbranched carbohydrates are major components of cartilage extracellular matrix and synovial fluid; this may **help to stimulate cartilage extracellular matrix production and, therefore, repair** (Bierer & Bui, 2002).

Oral supplementation with a glycosaminoglycan preparation derived from green-lipped mussels was found to r**educe lameness and pain in arthritic dogs** (Korthauer & Torre, 1992).

Additionally, green-lipped mussel contains **omega-3 fatty acids** (eicosapentaenoic acid and docosahexaenoic acid), amino acids (glutamine), vitamins (E and C) and minerals (zinc, copper, and manganese).

Dietary supplementation of **omega-3 fatty acids resulted in an improvement in weight-bearing dogs with osteoarthritis** (Roush *et al.*, 2010).

**Glutamine** inhibits oxidative damage in cells, and glucosamine (a metabolite of glutamine) has been proposed to **alleviate inflammation in osteoarthritis patients** (Meininger *et al.*, 2000).

## WHAT ARE THE RESULTS?

As part of the development of the Weight Control & Joint Care recipe, a feeding study was conducted to evaluate the benefits of this dry dog food on overweight dogs, as well as the palatability of this dog food.

29 Dogs were initially weighed and their Body Condition Score (BSC) assessed. Over 12 weeks, the dogs were fed Weight Control & Joint Care, weighed, and their BCS assessed periodically.

**The results show 90% of dogs moved onto a healthier weight whilst being fed a Weight Control & Joint Care diet.**

On a 9-point BCS, on average, the dog's starting BCS was 7.29 – which indicates overweight, with noticeable heavy fat covering ribs, lower back area and base of the tail and absence of waist and abdominal tuck.

On average, the final BCS was 5.96 – which indicates an ideal weight as the ribs can easily be felt without excess fat, and the waist and abdominal tuck can clearly be seen.

Secondly, owners were asked to fill out a health and well-being questionnaire to assess their perception of their dog's quality of life prior to and after the feeding trial.

Results from these evaluations showed a change in owner perception after the feeding trial, as owners noted increased activity levels and improved mobility.

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