

# Intelligent Nutrition for the Purebred Dog™



Meet the Needs of Your Breed  
The Chihuahua



# INTRODUCTION

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*Measuring 6-8 inches to the withers and weighing in at 2-4<sup>1/2</sup> pounds, the Chihuahua is certainly the smallest and the lightest dog in the world.*

*Far from being a modern fad, the Chihuahua is the result of a very old selection process going back to fourteenth century Mexico, where the Aztecs worshiped the breed, considering it to bring fortune.*

*The Chihuahua is a striking example of the diversity of breeds humans have been able to create through genetic selection.*

*Indeed, when it comes to size, the canine species is the most diverse in the animal world. From the Chihuahua to the St. Bernard, weight varies from around 2 pounds to more than 175 pounds. In humans and cats, for example, the largest specimens never weigh more than two to three times more than the smallest.*

*It's a real challenge for Royal Canin to meet the needs of such a wide diversity of dogs. But size and weight are not the only variables. There are anatomical, physiological and behavioral differences too, which means that a Best Balance nutritional approach really makes sense.*

- *The energy concentration of the food must be adapted to the relative volume of the digestive tract and to the metabolism. The digestive tract represents 7% of a small dog's total body weight, as opposed to only 2.7% in a large dog.*
- *The digestibility, quantity and quality of the fibers in the food are linked to the particularities of the dog's digestive transit, which varies according to breed.*
- *The nutrients in the food that combat the effects of aging (a higher quantity of antioxidants that protect the joints) are especially important for small dogs, which are more susceptible to degenerative diseases (heart, joints, eyes) due to their longer life expectancy.*

- *Lifestyle – the dog’s relationship with its owner – also influences the dog’s dietary behavior and preferences. A small dog tends to be more demanding than a large dog.*
- *The physical form of the kibble is dictated by the size of the breed’s teeth and the sensitivity of its gums.*

*All of these particularities explain why Royal Canin has chosen the path of Best Balance Nutrition. A path that, down the years, has led us to push back the frontiers of knowledge to offer increasingly precise nutritional responses based on hard science.*

*Back in 1980, Royal Canin was the first company in the world to launch a food that responds to the needs of large-breed puppies. RCCI Size, the world’s first nutritional program to take account of age, activity and physiology, of course, but most of all the size of the animal, followed in 1997.*

*Royal Canin has gone on to develop food that meets the specific requirements of diverse breeds with the launch of best balance formulas for Yorkshire Terriers, German Shepherds and Labrador Retrievers.*

*Royal Canin has now developed the optimal response to the nutritional requirements of the Chihuahua, with special attention for its well-being throughout its long life.*

*Once again, I would like to stress that it’s only by leveraging the unrivaled expertise of breeders and the foremost specialists across the world that Royal Canin’s Research and Development has been able to develop this exceptional food, which, we feel sure, is set to win hearts and minds in Asia, North America and Europe.*

*Pascal Jouannet  
Chief Executive Officer  
Royal Canin Group*

# **THE CHIHUAHUA ...**

*Key points to know*

**1 THE CHIHUAHUA - THE ULTIMATE INDOOR DOG**

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**2 PROTECTING VERY DELICATE JAWS**

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**3 MONITORING THE CARDIAC FUNCTION  
IN ADVANCED YEARS**

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**4 SENSITIVE JOINTS EXACERBATED  
BY SMALL SIZE**

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**5 OFTEN DEMANDING DIETARY BEHAVIOR**

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# Nutritional responses

## 1 Limiting unpleasant odors

- reduces the indigestible protein content
  - provides a source of highly digestible starch: rice
  - promotes intestinal flora balance
- 

## 2 Slowing down the development of dental plaque and dental tartar

- mechanical action of special kibbles on plaque and tartar
  - chemical action of chelating agents on salivary calcium
  - anti bacterial action of green tea polyphenols
- 

## 3 Supporting the cardiac function

- reinforces antioxidant defense: vitamins E and C, green tea and grape polyphenols, taurine
    - limits the sodium content in the food
  - guarantees a sufficient supply of taurine and arginine
    - supplies supplemental L-carnitine
- 

## 4 Protecting articular cartilage

- prevents excessive weight gain
  - supplies natural cartilage components:
    - glucosamine to stimulate its synthesis
    - chondroitin to slow its degradation
- 

## 5 Providing exceptional palatability

- a kibble tailored to the world's smallest dog
  - selection of the very best ingredients
- packaging specially designed to ensure freshness despite a small daily ration

# ***The history of the Chihuahua***



© Lancsai

The Chihuahua owes its name to a town in the north of Mexico where the earliest sketches have been found representing small dogs resembling those bred in the State of Chihuahua.

There are several theories on the origin of the breed.

For some, it dates back to the age of the Toltecs (ninth century), who selected the breed from the Techichi, an indigenous breed – one of the oldest known to humans – that was bred by the Native Americans. Larger than the modern Chihuahua, the Techichi had long hair and was mute. It was probably crossed with the Perro Chihuahueno, a dog from the Chihuahua mountains in the north of Mexico. There were other crosses with a dog whose ancestor came from Asia.

Other people – like the Franciscan Father Sahagun – trace its development back to the Aztec era, the civilization that supplanted the Toltecs from around the fourteenth century.

The Chihuahua has its own special place in the mystical life of this age. It was venerated and was the subject of a cult. It was sacrificed to honor the gods and eaten as sacred food. It brought good luck to the home and it was often buried along with its master (its bones have been found in burial grounds from the era).

Some dogs were introduced into Spain during the Spanish conquest.

In the United States the Chihuahua was first bred in the nineteenth century and first exhibited at a show organized by the American Kennel Club (AKC) in 1890. Called the Texas Dog and Arizona Dog in reference to the US states bordering Mexico, it was officially given the name Chihuahua in 1904, the year that Midget became the first specimen of the breed to be registered in the AKC's studbook. The Chihuahua Club of America was established 19 years later. At the time the public favored the shorthaired variety and the selection of the longhaired type didn't really begin until 1952. Today, the longhaired population is growing constantly.

The Chihuahua gradually arrived in Europe through the United Kingdom after World War II. Its small size and even-temperedness – it is fairly taciturn – are two factors that have made its name on the international stage.



© Lancelotti

# 1 **The Chihuahua: the ultimate indoor dog**

The Chihuahua is clearly a companion dog who lives much of its life indoors. Although the ideal companion in the apartment, it is recommended to take outside on a leash as often as you can.

In many cases, these walks are irregular and the Chihuahua adopts the same behavior as an indoor cat with a litter box inside the home for its daily needs. While the quantity of feces is obviously small, it's important to reduce the unpleasant odors that accompany an indoor lifestyle.

There are around 200 identified volatile compounds that produce fecal odors: ammonia, aromatic amines (cadaverine, histamine, putrescine, etc), branched amino acids (isobutyrate, isovalerate), indoles and phenols, sulfur compounds and others. As well as having an unpleasant odor, these compounds are potentially toxic and they may increase the risk of colon and rectum cancer.

Most of these molecules are products of the degeneration of undigested food by intestinal bacteria. As a rule, 500 different bacterial species live in equilibrium in the digestive tract. The bacterial populations increase from the stomach to the colon. In the large intestine, the density is between  $10^{10}$  and  $10^{11}$  bacteria/g of intestinal content.

Some of the elements that promote this fermentation process are:

- Various legume seeds (white kidney beans, green peas, lentils, cauliflower)
- Excess fermentable fibers (onions, cabbage, cauliflower to be avoided for sensitive animals)
- Slowly digestible starch (undercooked potatoes)
- Poor quality meat.

The speed of intestinal transit is also very important: if the dog is sedentary, intestinal transit is slower, thus lengthening the period favorable for bacteria to degrade food residues in the colon.

# **LIMITING UNPLEASANT ODORS**

## **Objective #1: Reduce the indigestible protein content by using proteins of excellent quality**

Low quality proteins resistant to enzymatic attack trigger the growth of microbial flora in the colon, leading to the increased production of bacterial compounds. The amount of indigestible protein provides a valuable assessment of the quality of a protein. Higher quality proteins have a low content of indigestible protein, which means there are fewer residues available for bacterial fermentation.

It is often incorrectly supposed that vegetable proteins are of a much lower quality than animal proteins. In fact, our knowledge of the technology used to transform raw ingredients now allows us to eliminate fibers and sugars that adversely affect the digestibility of proteins in vegetable sources. This means with new technology we can, in some cases, achieve a level of indigestible protein equal to or less than that of animal proteins. In addition, vegetable proteins are extracted from highly standardized raw ingredients (rice, corn, wheat) that offer an exceptional guarantee in the regularity of their composition.



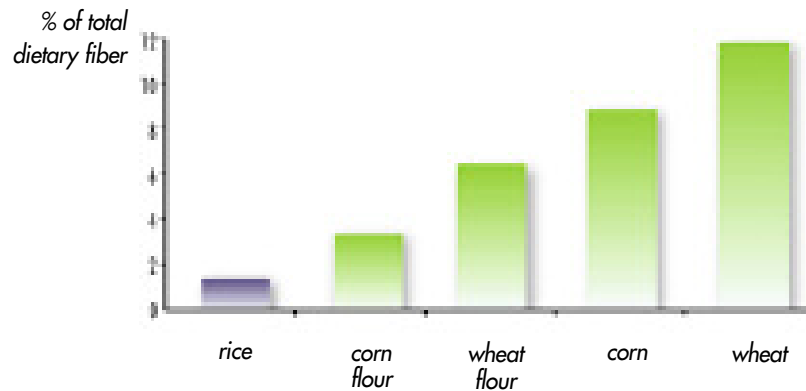
## Objective #2: Provide the most digestible starch in a limited quantity



Of the various cereals used in dog food, rice is the one best tolerated by sensitive dogs, due to the specific structure of rice starch.

Also, rice limits fecal excretion because the fiber content is much lower compared to other cereals. Finally, rice promotes the reabsorption of water and electrolytes in the intestine, thus limiting the humidity of stools (*Belay & al, 1997*).

**Comparison of fiber content in cereals**



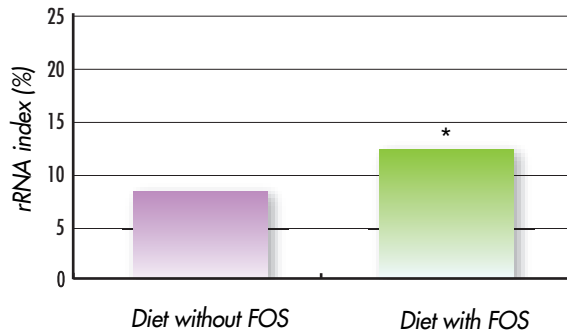
*Rice has a very low level of total dietary fiber, even lower than corn and wheat flours, which have had the cell envelope (bran) removed. The low total dietary fiber content of rice partially explains the very high digestibility of the starch contained in rice.*

### Objective #3: Promote the equilibrium of the colon's bacterial population through the intake of prebiotic fibers

Prebiotics – substances that induce the development of a beneficial bacteria population – potentially have an important role in promoting proper gastro-intestinal health.

#### **Influence of fructooligosaccharides (FOS) on the growth of fecal lactic flora in the dog (n = 9)**

(unpublished trial; sources: Royal Canin, Beghin Say)



(\* After 14 days of FOS administration (representing 1% of the total food ration) a significant increase in lactic flora was observed in the stools ( $p=0.02$ ). The result represents the percentage of the total microbe population represented by the average lactic flora (*Lactobacillus* + *Streptococcus* + *Enterococcus*). It is measured by molecular biology.

It is also well known that fructooligosaccharides\* (FOS) inhibit the growth of pathogenic bacteria in the colon (Sparkes & al, 1998).

This effect is obtained directly through the production of toxic substances for the pathogenic bacteria, and indirectly through acidification due to the production of the short chain fatty acids acetate (C2), propionate (C3) and butyrate (C4).

The FOS tend to drive down the quantities of ammonia and phenols in the feces (Swanson & al, 2002). With 0.5% FOS in the food, a reduction of fecal odors was observed in the dog (Hussein & al, 2000).

\* see glossary p. 30

# 2 Protecting very delicate jaws

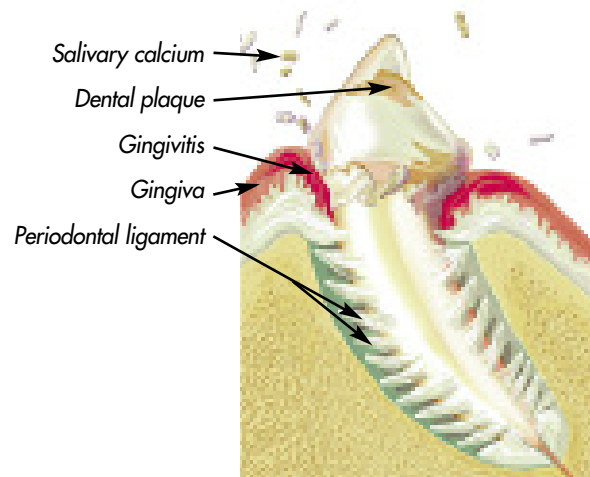
A study conducted on data recorded over a long period of time by Purdue University (West Lafayette, IN) shows that the Chihuahua has a strong predisposition to dental tartar accumulation. Between 1981 and 2001, dental pathology was the number one reason for veterinary consultation among 7,309 Chihuahuas in the age class 4-10 years (*Purdue Veterinary Medical Data Base 1981-2001*).

Small-breed dogs often suffer from periodontal disease and the Chihuahua is no exception. This disease develops in three stages.

## Stage 1: Formation of dental plaque

After the teeth are cleaned, the dental plaque starts to form in less than six hours from the bacterial biofilm\* deposited on the surface of the teeth and glycoproteins supplied by the saliva.

### Tartar and gingivitis



Tartar is the result of the mineralization of dental plaque by salivary calcium. Gingivitis is an inflammatory response to bacterial proliferation.

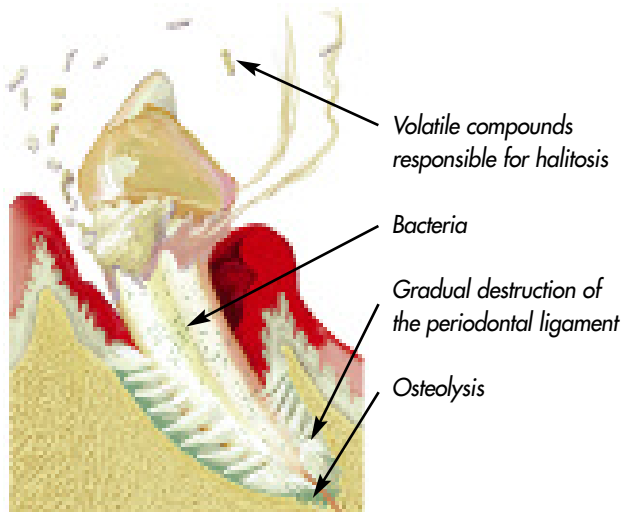
## Stage 2: Tartar and gingivitis

Tartar is formed by the mineralization of dental plaque by salivary calcium. Gingivitis is an inflammatory response to the bacterial proliferation. As the complaint develops, bacteria progressively destroy the tooth supporting tissue. This expansive process causes pain during mastication. The decomposition of dietary proteins by anaerobic bacteria leads to the release of sulfur gases, which are responsible for bad breath.

\* see glossary p. 30

## Terminal destruction of supporting tissues of the tooth

Source: Royal Canin



### Loosening of teeth

As the disease advances, the progressive destruction of the periodontal ligament by bacteria leads to the loosening of the tooth.



### Stage 3: Tooth loosening and loss

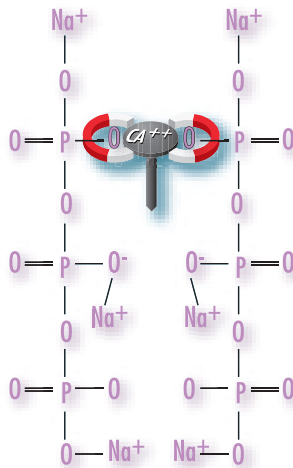
The bacteria destroy the supporting structures of the tooth down to the end of the root, thereby loosening the tooth. It is essential to stress that the Chihuahua has an exceptionally delicate jaw. There is a risk of jaw fracture when tooth extractions are necessary. In small dogs the jaw is proportionally thinner than that of large dogs. A loss of bone extending a few fractions of an inch as a consequence of periodontitis is accordingly much more serious for a Chihuahua than for a large dog (Gioso & al, 2001).

Chronic periodontitis causes a permanent state of infection in the oral cavity. Tonsils can hypertrophy and maintain a chronic inflammatory state, causing a cough and a dry throat. Periodontal disease can also allow the passage of bacteria into the blood. This can cause secondary heart, kidney or liver infections (De Bowes & al, 1996; Pavlica & al, 2003).

# SLOWING DOWN THE DEVELOPMENT OF PLAQUE AND DENTAL TARTAR

Good dental hygiene is fundamental to maintain the Chihuahua in excellent health. The main objective is to slow the development of dental plaque before it mineralizes to form tartar. Tartar can appear in less than a month (*Harvey, 1988*).

## Salivary calcium chelation mechanism generated by sodium tripolyphosphate



*The free calcium ( $Ca^{++}$ ) replaces two sodium ions. In doing so, the calcium becomes unavailable to contribute to the formation of tartar.*

Tooth brushing is the most effective form of dental care for fighting dental plaque, but it's not easy to brush your dog's teeth and many owners soon abandon this method.

There is another way to help prevent periodontal disease: regular use of an oral complement for biting and the provision of a complete food that is truly effective in the fight against plaque and tartar. This food permits the alliance of a mechanical action and the chemical action of certain active principles such as sodium polyphosphates and green tea polyphenols.

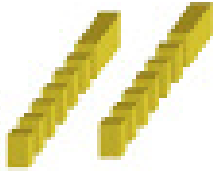
## Mechanical action on dental plaque and tartar

If specifically developed to suit a particular size of dog, the shape and the texture of the kibble can help to passively brush the teeth. The kibbles are adapted to the Chihuahua's small teeth, encouraging the dog to bite to obtain a lightly abrasive effect on the dental plaque and tartar. This mechanical action helps break down the dental plaque's tangle of bacteria and attack existing tartar deposits while keeping new tartar formation in check.

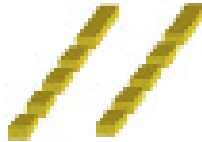
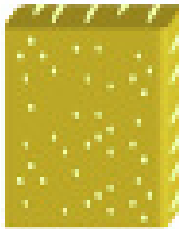
\* see glossary p. 30

## **Longitudinal extrusion promotes the kibble's mechanical action**

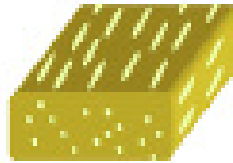
Source: Royal Canin



Classical extrusion



Longitudinal extrusion



*Longitudinal extrusion makes it possible to create a flaky structure that delays the time to break the kibble in the dog's mouth.*

*This allows the tooth to penetrate deeply into the interior of the kibble which increases the contact time and contact surface area. Hence the extrusion technique intensifies the light abrasive effect of the kibble.*

## **Chemical action of sodium tripolyphosphate**

Sodium tripolyphosphate belongs to the family of calcium chelating agents\*. Sodium tripolyphosphate temporarily traps the calcium ion ( $\text{Ca}^{++}$ ) so that it is unavailable for the formation of tartar. The calcium ion is later released in the digestive tract where it can be absorbed according to the body's needs.

## **Antibacterial action of green tea polyphenols**

Green tea polyphenols slow bacterial growth in the oral cavity. Indeed, some bacteria active in periodontal disease (e.g. *Porphyromonas assacharolytica*) are highly sensitive to the action of polyphenols (Isogai & al, 1995).

\* see glossary p. 30

# 3 Monitoring the cardiac function in advanced years

A study conducted on 3,000 dogs in the UK showed that the average life expectancy of a Chihuahua is 13 years (Michell, 2000). Another study demonstrated that the Chihuahua can live longer than 15 years (Deeb & al, 1994). After age 10, small dogs are traditionally troubled by degenerative diseases: periodontal disease, sclerosis of the heart valves, chronic kidney failure and cataracts. Cardiorespiratory pathology is much more common in the Chihuahua than in other breeds (Purdue Veterinary Medical Data Base 1981-2001).

## **The importance of cardiorespiratory problems among diseases observed in Chihuahuas between 10 and 15 years (n = 1465)**

(From Purdue Veterinary Medical Data Base 2001)

<b>Clinical observations in ascending order of frequency</b>	<b>Number of observations</b>	<b>% of total observations</b>
1 - Heart murmur*	120	8.0%
2 - Mitral insufficiency	116	7.9%
3 - Periodontal disease	108	7.4%
4 - Tracheal collapse	105	7.1%
5 - Heart failure	80	5.5%

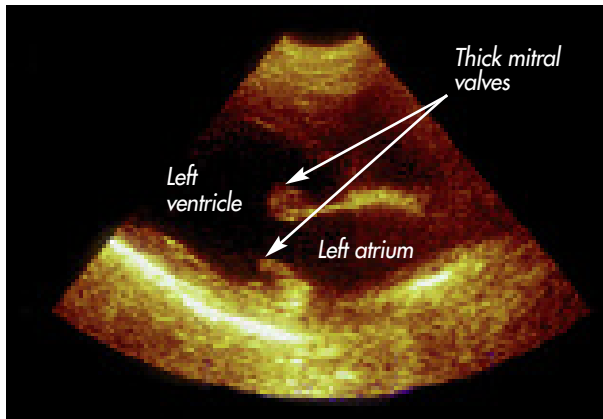
*Of the 5 most frequent clinical observations in Chihuahuas between 10 and 15 years, 4 are related to the cardiorespiratory system. Together they represent almost 30% of the total observations.*

### ● **Mitral endocardiosis**

This is a very common degeneration of the left heart valve. It affects 60% of dogs over 7 years of age and small-breed dogs are clearly more affected, especially males. The lesions lead to modification of the blood flow through the left atrium. This may be heard through the chest wall as a murmur. The complaint is asymptomatic as long as the heart can compensate for the altered blood flow. However, mitral endocardiosis typically develops into left heart failure. Several studies show that the Chihuahua is significantly predisposed to the complaint (Buchanan, 1977; Thrusfield, 1985).

\* see glossary p. 30

## Benign mitral insufficiency



An echocardiograph examination helps evaluate the condition of the cardiac valves and estimate the fraction of blood flow regurgitation circulating in the atrium towards the ventricle.

## Brachial and tracheal collapse



Tracheal collapse leads to a heavy, dry, persistent cough. The cough may be triggered by exertion, excitement, pulling on the lead, or after consumption of food or water.

### ● Tracheal collapse\*

The cartilage rings of the trachea lose their rigidity with age. This allows the trachea to collapse, which can cause breathing difficulties, coughing, and intolerance to exercise.

Analyses of collapsed tracheal rings show that the texture of the cartilage matrix is fissured. The cartilage contains fewer glycoproteins and glycosaminoglycans (GAG). It is difficult to determine whether this is due to degeneration or whether the cartilage was originally abnormal as observed in chondrodystrophic breeds (Dallman, 1985 & 1988).

The majority of dogs respond to medical or conservative treatment. Wearing a harness rather than a collar is highly recommended to limit the tractive forces applied by the lead on the throat. Exercise should be limited during warm and humid weather. Breeders advise discouraging the dog from barking so as not to worsen the irritation.

Surgery may be necessary in case of degeneration or epiglottal collapse. In many miniature-breed dogs, including the Chihuahua, the epiglottis is pressed very flat, in the shape of the ace of spades, which hampers its passage at the back of the palate.

\* see glossary p. 30

# SUPPORTING THE CARDIAC FUNCTION

Each type of antioxidant has a specific site of action in the cell. Therefore a combination of several antioxidants is desirable to maximize their potential effects.

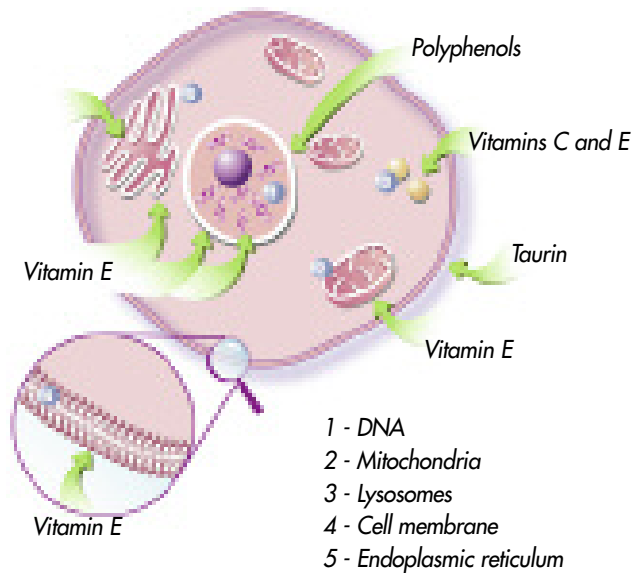
The fight against all age-related diseases hinges above all on preventing cell degeneration, which accelerates with age. Throughout the dog's life, the body is constantly fighting free radicals. Theoretically, the body is armed to defend itself against free radicals, but those defenses become less effective with age. When the balance between factors that promote and factors that prevent oxidation tip in the favor of the former the result is oxidative stress\*. The negative effects of free radicals become perceptible:

- The cell membranes undergo change, losing their fluidity;
- The free radicals attack the cell's internal protein structure (DNA): the genetic material is damaged.

## Where do free radicals come from?

Free radicals are produced by physiological processes like respiration or by environmental pollutants: ozone, ionizing rays, halogenated hydrocarbons, heavy metals, cigarette smoke, asbestos, and others.

## Action sites of antioxidant nutrients



## Strengthening the oxidative defenses

The intake of antioxidants helps protect the cells from attack by free radicals.

### ● Vitamin E

Vitamin E's capacity to prevent the formation of initial atherosclerotic lesions by slowing the oxidation of certain plasma lipoproteins has been shown *in vitro* (Esterbauer & al, 1989). In the dog, where atherosclerosis is not a problem, administering vitamin E can limit oxidation in the red blood cells, enabling better resistance to physical effort. This subject is now being studied among dogs in diverse situations (Grandjean & al, 1997).

### ● Vitamin C

The presence of vitamin C intensifies the effect of vitamin E by facilitating its regeneration. This synergic effect has been tested *in vitro* on the oxidation of low density lipoproteins (LDL) (Rifici & al, 1993):

\* see glossary p. 30

LDL, or low density lipoproteins are molecules that transport cholesterol in the blood. Humans possess predominately LDL, which makes them sensitive to the development of atherosclerosis when lipids build up on the artery walls.

Dogs on the other hand, are much more resistant to atherosclerosis because they have more HDL (High Density Lipoproteins), which are much smaller than the LDL molecules.

- The intake of vitamin E alone reduces LDL oxidation by 50%.
- The intake of vitamin C alone reduces LDL oxidation by 15%.
- The intake of vitamins E and C together results in a 78% reduction in LDL oxidation.

Results obtained among humans show that this synergy also exists *in vivo* (Kanter & al, 1993).

### ● Green tea polyphenols

Some polyphenols limit plaque aggregation and contribute to slowing the formation of obstacles to good blood circulation. This action has great potential when the vessels are constricted (stenotic) in dogs (Osman & al, 1998).

### ● Limiting the dietary intake of sodium

It is no longer advised to severely reduce the sodium in the diet of a dog that is not suffering from advanced heart failure. Therefore, the sodium content in a Chihuahua's diet must accordingly be moderate – the target is below 100 mg Na/100 kcal (Freeman & al, 2003).

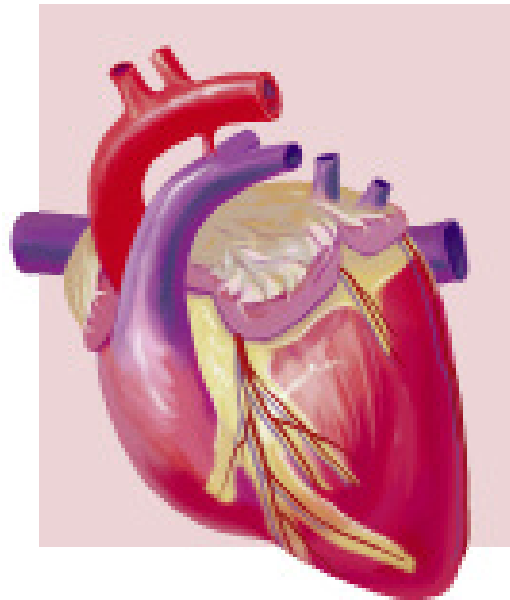
### ● Taurine intake

Taurine, an amino acid, has a positive action on cardiac contractility and a protective role as an antioxidant. Taurine improves heart contractions by facilitating the transfer of ionized calcium in the myocardium cells (Schaffer & al, 1992, 1994).

### ● Intake of L-carnitine to support the cardiac function

Several clinical observations show that some heart problems are associated with a carnitine deficiency. As a result, the supply of energy to the cells of the cardiac muscle is blocked (Dove, 2001).

### Cardiac muscle



Ninety-five percent of a dog's carnitine is concentrated in the cardiac, skeletal and smooth muscle. Carnitine is important for the production of energy for heart contractions.

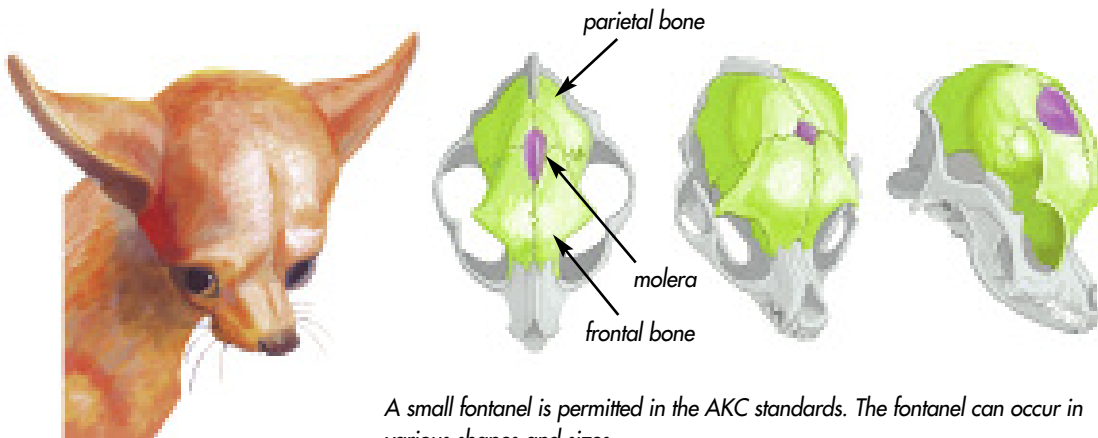
\* see glossary p. 30

# 4 Sensitive joints exacerbated by small size

The Chihuahua's very small size makes it vulnerable to trauma caused by impact or rough handling. In terms of its joints, the Chihuahua is exposed to the same conditions as other small dogs. Medial patellar luxation is one of the most frequent stifle anomalies in small-breed dogs. The patella has a tendency to extend beyond the femoral trochlea in the medial position.

The epidemiological data available shows that the Chihuahua has a strong predisposition to this complaint: the risk is 7.9 times greater than in the average dog population (*Purdue Veterinary Medical Data Base 1981-2001*). The prevalence in the female is 1.5 times higher than in the male (*Trouillet, 1996*).

## Location of the anterior fontanel (or molera) in the Chihuahua



A small fontanel is permitted in the AKC standards. The fontanel can occur in various shapes and sizes.

It should be noted that the head is particularly fragile: in many cases the fontanel\* is preserved. Any impact here could lead to death.

\* see glossary p. 30

# PROTECTING ARTICULAR CARTILAGE

## Monitoring weight gain

The development of the Chihuahua's weight throughout its life should be monitored closely, because excessive weight gain can lead to joint complaints. The older the dog grows, the higher the risk. The Chihuahua is not a breed known for its vulnerability to obesity. It generally has a sedentary lifestyle and has a very close relationship with his owner, meaning that any extra food can unbalance the diet and lead to weight gain.

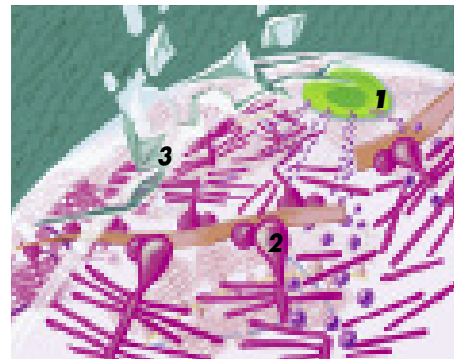
A Chihuahua's dietary intake is normally very small, on average 1½-2 ounces of kibbles a day or 12½-14½ ounces a week or 3½-4 pounds dry food a month. The smaller the dog, the more extra nibbles through the day impact their energy balance. A study conducted in the USA in 1987 shows that these extras can represent up to 50% of total ingested calories in toy dogs (*Glickman & al, 1995*).

## Protection of articular cartilage

All joints are covered in cartilage, which allows the joint surfaces to move smoothly against each other and to absorb impacts. The cartilage regenerates constantly. Age and the repetition of articular trauma (e.g. repetitive dislocation) cause its structure to change gradually, leading to a loss of resistance in the cartilage. It ultimately fissures, leaving the underlying bone unprotected. This bone is then subjected to changes that can lead to osteoarthritic lesions. Osteoarthritis is a very painful, incapacitating disease that worsens with time.

Glucosamine and chondroitin are substances that incorporate themselves into the structure of proteoglycans\* to serve as the basis for cartilage formation. The oral administration of glucosamine and chondroitin help to obtain active concentrations in the articular cartilages and synovial liquid in which the joints are bathed (*Lipiello & al, 1998*). The association of the two creates a synergic effect. Glucosamine and chondroitin are appropriate in the treatment or prevention of osteoarthritic problems in dogs (*Todhunter & al, 1994*). The earlier they are administered, the higher the probability that cartilage degeneration will be limited.

### Lesion of the articular cartilage



When the cartilage is injured, the chondrocytes<sup>1</sup> (cells that synthesize cartilage) secrete excessive quantities of enzymes. These enzymes disrupt the proteoglycans<sup>2</sup>, which are large molecules that ensure cartilage elasticity. The cartilage matrix collapses<sup>3</sup>, further weakening the joint.

\* see glossary p. 30

# 5 Often demanding dietary behavior

Being a miniature dog provides the Chihuahua with special privileges. In general, it does not appreciate the companionship of other breeds of dog very much, preferring the company of other Chihuahuas or humans.

This possessive breed is very attached to its owner and will follow him or her everywhere, involving itself very closely in the owner's day-to-day life. The Chihuahua must be firmly educated from the start to ensure that it does not take too dominant a position in the household. The tendency to impose human emotions on the dog can easily lead the owner to sympathize with the "monotony" of the animal's diet, which leads to the dog eating like its owner. The owner will offer various foods to dog, pandering to its fondness for food. If spoiled, the dog will quickly become demanding. When it comes to diet, refusing to eat its regular food is a way for the dog to demand something new from its owner.

The Chihuahua must be fed a food that takes into account actual needs. If the dog is not exposed to too diverse a diet it will rarely refuse to eat a food, provided the palatability is satisfactory. The diet for a small dog needs to have more flavor because its sense of smell is less well developed than that of a large dog. The small surface of the olfactory mucus means there are fewer olfactory receptor cells.



© Lancelau

## Comparison of olfactory receptors in humans and dogs

(from Honhon, 1967; Vadurel, 1995)

	Human	Small dog	Large dog
Surface of the olfactory mucosa	1-4 sq. inches	24 sq. inches	78 sq. inches
Number of olfactory cells	10 million	67 million	200 million

# PROVIDING EXCEPTIONAL PALATABILITY

Appetence is linked to the spontaneous consumption of a food in response to the perception of the organoleptic characteristics of the product. The appetite level of a food depends on several criteria. Contrary to what some owners believe, dry foods are now sufficiently appetizing to be appreciated even by reputedly hard-to-please dogs.

## ● Physical presentation of the food

The first condition of the good acceptance of the kibbles by the Chihuahua is that the design of the diet takes the dog's small jaws and teeth in account.

## ● Selection of raw ingredients

Before they are included in a food, every source of protein and fat must be tested to verify its impact on the overall appetite of the product.

## ● Care for coating

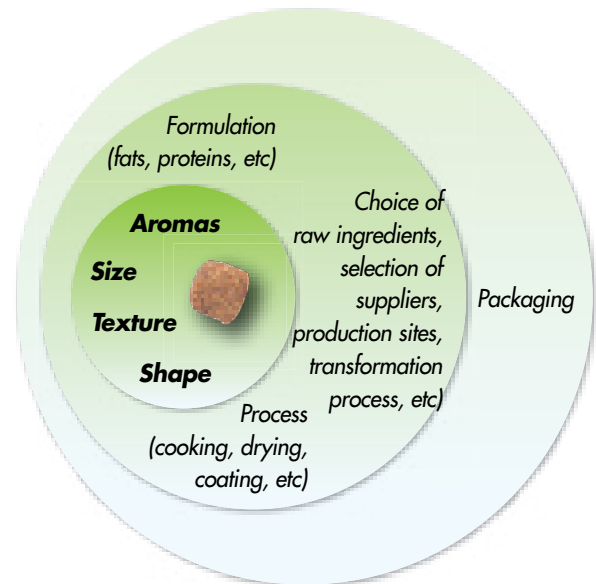
The kibble's exterior coating contains all the aromas that are attractive to the dog. These aromas are naturally volatile so they can be picked up by the dog's sense of smell. At the same time, they must be stable enough to ensure they do not lose appetite rapidly after production.

## ● Quality of packaging

With a monthly consumption of less than 4½ pounds, the Chihuahua is clearly a small eater. A bag of kibble that is open too long loses its palatability, which often leads the dog to eat less. Therefore to optimize freshness, small bags are preferred. In addition, packing the diet in a controlled atmosphere\* helps conserve the full flavor of the product until consumption.

### **Main appetite factors to be considered in the design of a product**

*(From Royal Canin Focus Special Edition, 2004)*



\* see glossary p. 30

# A NUTRITIONAL PROGRAM FOR EVERY

8 - 8  
weeks months

## GROWTH PHASE

# CHIHUAHUA PUPPY 30™

For Chihuahua puppies from  
8 weeks to 8 months old



### STIMULATES FUSSY APPETITES

Chihuahua puppies tend to be picky eaters, making it difficult to ensure the right nutrition for healthy development. Chihuahua Puppy 30™ includes natural flavors and aromas guaranteed to appeal to even the most finicky puppy.



### STOOL AND ODOR REDUCTION

Young puppies are less able to digest proteins, resulting in fermentation in the intestinal tract. Chihuahua Puppy 30™ is formulated for increased digestibility, which can help to reduce stool odor and quantity.



### MINIATURE JAW

The tiny jaw of the Chihuahua puppy can be very fragile. The size, shape and density of the Chihuahua Puppy 30™ kibble makes it easy to break and chew.

# STAGE OF THE CHIHUAHUA'S LIFE

from  
8  
months

## ADULT AND MATURE PHASES

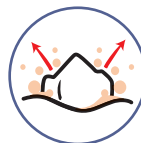
# CHIHUAHUA 28™

For Chihuahua's over 8 months old



### STIMULATES FUSSY APPETITES

Chihuahuas can be picky eaters, judging both the smell and taste of food. Chihuahua 28™ includes both natural flavors and aromas guaranteed to appeal to even the most finicky dog.



### TARTAR REDUCTION

Chihuahuas are prone to dental issues due to their delicate jaws and teeth. Chihuahua 28™'s tiny kibble creates a brushing effect that can help to reduce plaque and tartar.



### HEART HEALTH

Chihuahuas are sometimes prone to heart issues as they age. Chihuahua 28™ is formulated with antioxidants, which can help to neutralize free radicals.

# The measure of the breed

## **General Appearance**

A graceful, alert, swift-moving little dog with saucy expression, compact, and with terrier-like qualities of temperament.

## **Size, Proportion, Substance**

Weight - A well balanced little dog not to exceed 6 pounds. Proportion - The body is off-square; hence, slightly longer when measured from point of shoulder to point of buttocks, than height at the withers. Somewhat shorter bodies are preferred in males. Disqualification - Any dog over 6 pounds in weight.

## **Head**

A well rounded "apple dome" skull, with or without molera. Expression - Saucy. Eyes - Full, but not protruding, balanced, set well apart-luminous dark or luminous ruby. (Light eyes in blond or white-colored dogs permissible.) Ears - Large, erect type ears, held more upright when alert, but flaring to the sides at a 45 degree angle when in repose, giving breadth between the ears. Muzzle - Moderately short, slightly pointed. Cheeks and jaws lean. Nose - Self-colored in blond types, or black. In moles, blues, and chocolates, they are self-colored. In blond types, pink nose permissible. Bite - Level or scissors. Overshot or undershot bite, or any distortion of the bite or jaw, should be penalized as a serious fault. Disqualifications - Broken down or cropped ears.

## **Neck, Topline, Body**

Neck - Slightly arched, gracefully sloping into lean shoulders. Topline - Level. Body - Ribs rounded and well sprung (but not too much "barrel-shaped"). Tail - Moderately long, carried sickle either up or out, or in a loop over the back, with tip just touching the back. (Never tucked between legs.) Disqualifications - Cropped tail, bobtail.

## **Forequarters**

Shoulders - Lean, sloping into a slightly broadening support above straight forelegs that set well under, giving a free play at the elbows. Shoulders should be well up, giving balance and soundness, sloping into a level back. (Never down or low.) This gives a chestiness, and strength of forequarters, yet not of the "Bulldog" chest. Feet - A small, dainty foot with toes well split up but not spread, pads cushioned. (Neither the hare nor the cat foot.) Pasterns - Fine.

## **Hindquarters**

Muscular, with hocks well apart, neither out nor in, well let down, firm and sturdy. The feet are as in front.

## **Coat**

In the Smooth Coats, the coat should be of soft texture, close and glossy. (Heavier coats with undercoats permissible.) Coat placed well over body with ruff on neck preferred, and more scanty on head and ears. Hair on tail preferred

furry. In Long Coats, the coat should be of a soft texture, either flat or slightly curly, with undercoat preferred. Ears - Fringed. (Heavily fringed ears may be tipped slightly if due to the fringes and not to weak ear leather, never down.) Tail - Full and long (as a plume). Feathering on feet and legs, pants on hind legs and large ruff on the neck desired and preferred. Disqualification - In Long Coats, too thin coat that resembles bareness.

### **Color**

Any color – Solid, marked or splashed.

### **Gait**

The Chihuahua should move swiftly with a firm, sturdy action, with good reach in front equal to the drive from the rear. From the rear, the hocks remain parallel to each other, and the foot fall of the rear legs follows directly behind that of the forelegs. The legs, both front and rear, will tend to converge slightly toward a central line of gravity as speed increases. The side view shows good, strong drive in the rear and plenty of reach in the front, with head carried high. The topline should remain firm and the backline level as the dog moves.

### **Temperament**

Alert, with terrier-like qualities.

### **Disqualifications**

Any dog over 6 pounds in weight.

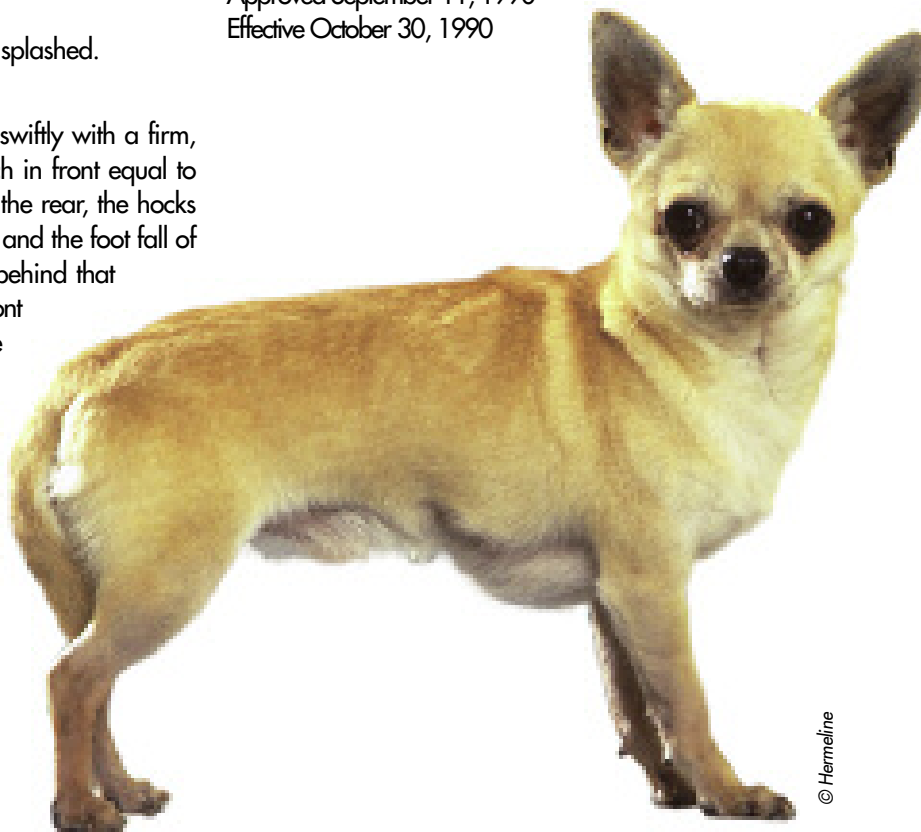
Broken down or cropped ears.

Cropped tail, bobtail.

In Long Coats, too thin coat that resembles bareness.

Approved September 11, 1990

Effective October 30, 1990



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[www.akc.org/breeds/chihuahua/](http://www.akc.org/breeds/chihuahua/)

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# Glossary

- Bacterial biofilm:** bacteria populations covering the tooth surfaces that cause dental plaque. It forms in less than six hours after cleaning.
- Calcium chelating agents:** molecules that trap the calcium to prevent it from participating in the mineralization of the dental plaque (slowing the formation of tartar).
- Controlled atmosphere:** mode of packaging in which the air is replaced by a neutral gas (nitrogen) without the presence of oxygen.
- Fontanel:** zone of intersection at the top of the cranium, at the junction of the parietal bones and the suture of the frontal bones. It normally fuses at the puppy's birth.
- Fructooligosaccharides (FOS):** fermentable fibers that promote the growth of beneficial intestinal bacterial flora (lactobacilli and bifidus).
- Green tea polyphenols:** vegetable substances whose antioxidant role is utilized to fight cardiovascular pathology and aging-related complaints.
- Heart murmur:** noise heard during the auscultation of the heart, signaling an anomaly in the blood circulation inside the heart chambers.
- Ileal digestibility:** measure of the share of digested nutrients at the end of the ileum, thus bypassing the influence of bacterial fermentation in the large intestine. It is measured in vivo or in vitro using enzyme tests.
- Indigestible protein:** the portion of proteins that arrive in the large intestine and are available for bacterial fermentation.
- Oxidative stress:** imbalance between the attack on cells by free radicals and the body's antioxidant defenses.
- Periodontal disease:** infectious disease that develops from dental plaque and can lead to the destruction of the supporting tissue (periodontal ligament) of the tooth.
- Proteoglycans:** complex molecules that guarantee the elasticity of the cartilage structure.
- Sodium tripolyphosphate:** antitartar agent that traps the salivary calcium.
- Tracheal collapse:** weakening of the tracheal rings leading to breathing difficulties.

# A history of innovation at Royal Canin

## A history of commitment to developing knowledge and respect for the needs of small, medium and large breeds.

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**1967:** Launch of ROYAL CANIN by a veterinarian

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**1980:** Launch of the first growth food for large breed puppies (AGR)

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**1988:** Launch of the veterinary ranges

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**1990:** Launch of the first diets to respond to the diversity of dog size (RCCI)

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**1997:** Launch of the Size Nutrition program based on the dog's age, activity, and size

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**1999:** Launch of:

- Starter, a unique kibble based weaning diet for dogs
- A sporting dog diet (Energy 4800™)
- A veterinary diet for the nutritional management of osteoarthritis in dogs (Mobility Support JS 21)

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**2000:** Launch of a diet for giant breed dogs (Giant Adult 28™)

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**2001:** Launch of a range of 13 veterinary diets (V Diet) including 2 hypoallergenic diets in Europe

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**2003:** Launch of:

- Foods just for small breed dogs (MINI Canine Health Nutrition™) and Yorkshire Terriers (Yorkshire Terrier 28™)
- Foods just for large breed dogs (MAXI Canine Health Nutrition™) and breed specific foods (Labrador Retriever 30™ and German Shepherd 24™)
- Eight formulas dedicated for Professional Canine Breeders (Canine PRO)

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**2004:** Launch of:

- Foods for medium breed dogs (MEDIUM Canine Health Nutrition™) including Bulldogs (Bulldog 24™)
- Small breed specific foods (Chihuahua 28™ and Poodle 30™)
- Food for very young large breed puppies (MAXI Babydog 30™)
- The first full line of therapeutic diets to help manage allergic skin disease including canine atopy (Limited Ingredient Diets, Hypoallergenic and Skin Support formulas)

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**2005:** Launch of:

- Small breed specific foods (Dachshund 28™ and Shih Tzu 24™)
- Food for Boxers (Boxer 26™)
- A specialized formula, HT42d, for the reproductive bitch
- The first veterinary diet for the nutritional management of osteoarthritis specifically for large breed dogs (Mobility Support JS 21 Large Breed)

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**2006:** Launch of small breed foods (MINI Beauty 26™, MINI Indoor Adult 21™ and MINI Dental Hygiene 24™)

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**2007:** Launch of:

- MINI Toy Indoor Adult 25™
- MINI Indoor Puppy 27™
- Miniature Schnauzer 25™
- Golden Retriever 25™

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**2008:** Launch of:

- Cocker Spaniel 25™

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**2009:** Launch of:

- Pug 25™

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**2010:** Launch of:

- Chihuahua Puppy 30™
- German Shepherd Puppy 30™
- Labrador Retriever Puppy 33™
- Yorkshire Terrier Puppy 29™

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