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Veterinary LiFE

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Dear Readers!

We've all heard the saying, "You are what you eat". But what does that mean in practice? Few of us realize the importance of this. If so, do we ask ourselves how proper nutrition affects the health of our pets?

Nutrition of animals in accordance with their natural needs is a guarantee of good health and great shape for many years.

Therefore, it is worth knowing what to pay attention to when choosing ready-made food or preparing meals yourself. Whether to choose dry or wet food, what to pay special attention to in the period from weaning or for the senior, what mistakes we most often make.

How to feed healthy and well? Hopefully, our nutrition issue will answer many of the above questions and open our eyes to things we didn't realize before.

Anna Rutkowska
Editor-in-chief

I invite you to read!

Veterinary LiFE

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Expert guidance

Practice off the shelf

Vet Pharmacy

Is the taste preference in cats due to the taste of the food?

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The cat is commonly referred to as an individualist, a loner and a taste connoisseur. A key question for cat owners related to cats' nutrition is "what nutrition to provide them with and how long will they want to eat it?" On the other hand, food concerns ask: "how to create balanced and tasty cat food?", while scientists question: "how to explain their preferences and can they really be influenced or should they be accepted?" So, what product will meet all expectations?

Keywords: cat, preferences, feline food

The cat is an increasingly popular pet. In addition to the clear advantages it possesses, it is considered a "comfortable" pet by most people. It does not need to be taken for a walk regularly, like a dog, and it can be left at home, provided with access to water, food, toilet, bedding, a window or other elements of wellbeing. For many years, it has been a challenge to ensure that the cat has access to fresh food while the owner is away. This is no longer a problem at the moment, due to the general availability of programmable feeding stations or closed bowls where wet food can be safely left.

However, it is still quite a challenge to learn about the taste preferences of domestic cats. Going back years ago, we see a wild cat, a lone hunter who was adopted by humans due to the need to protect households from rodents. Initially, having a cat was not related to the need to feed it. Of course, a human "treated" him with the products he consumed (e.g. milk, meat, etc.), but the general assumption related to having a cat was clear: the cat hunts and feeds by itself. However, the development of civilization, the advancement of science, industry, etc. and their interrelationships gave rise to commercial pet products. Regardless of whether we feed a cat with a home diet or commercial products, there is a fundamental difference in the perception of food flavors and food acceptability, not only between cats and dogs, but also in the group of cats only. A cat is a very difficult animal to feed. This is due not only to its specific nutritional requirements (high demand for protein, taurine, arginine and arachidonic acid, the inability to convert tryptophan into niacin and beta-carotenes into vitamin A), but also because of its nature (hunter's instinct, etc.) and certainly due to the influence of the environment (surroundings, type food, its balance, etc.).

The cat, while hunting for smaller rodents, ate them in full. For the bigger victim, he "separated" the flesh from the bone and devoured it without thoroughly chewing or "savoring the meal" (1). This way of eating was due not only to the nature of a lone hunter, but also to the structure of the teeth (small incisors, large canines and premolars, resembling a serrated-edge knife).

It is generally believed that wild cats specialize in hunting specific prey, for example only rodents or only birds, rather than a particular taste. This concept appeared together with man, cat domestication and commercial food production (4,9). And here the question arises, whether we are talking about taste preference, neophilic or neophobic behavior in contemporary cats, or about the influence of the monotony of the diet that forces changes in nutrition?

What is taste? In relation to a person – it is a specific sensation about a particular food, which we can define as sweet, salty, bitter or sour and depending on our preferences, define it as pleasant and desirable or not. In case of cats, we also speak of 4 basic tastes: salty, sour, bitter and umami, except for the sweet taste due to the lack of a genetically programmed receptor. Cat taste buds are most strongly stimulated by certain amino acids, such as: L-proline, L-cysteine, L-ornithine, L-lysine, L-histidine, or L-alanine (4,9). Ingested by humans, the above amino acids are perceived as sweet. It also turned out that amino acids with a decidedly "spicy" taste (such as: L-tryptophan, L-isoleucine, L-leucine, L-arginine, L-phenylalanine) have a negative impact on food intake in cats (4). This topic has been explored through an unpublished research by Rutherford, who tried to answer the question of what effect the concentration of dissolved amino acids in food has on food intake (8). Milk was chosen as a control food, in which the indicated amino acids were dissolved in various concentrations and their consumption was assessed.

Statistical analyzes showed that consumed milk with the amino acids dissolved in it: proline, lysine, histamine, glycine and cysteine at a concentration of 0.3% is tastier for cats than not supplemented with it. Nevertheless, the taste preference was apparently dose-dependent, as their higher concentration (0.6%), apart from proline and lysine, did not statistically significantly increase the results in the palatability tests (8).

Salt (sodium chloride) is also a good stimulant of taste buds, and its preference is probably due to the "memory of the salty taste" of victims' bodies, caught by cat ancestors and present wild animals, especially those living outside cities (2,4). These amino acids and salt are most often used to create "palatants" used by industry to improve the palatability of animal foods. Nevertheless, the very perception of "palatability" of the food does not appear to stem solely from the taste of the food itself. Smell, temperature and texture also affect palatability. And it is the sense of smell in cats that matters when choosing food. Some cat owners do not even notice that their cat is sniffing food, as it does in a very discreet way. Unlike a dog, a cat does not use its sense of smell to search for or locate anything, but to assess the freshness of food and the safety of its consumption, and to test new flavors in the same aspect (1).

The taste, smell, consistency and temperature of the food allow for a preliminary assessment of the choice of product for consumption. But is the first choice the cat's final choice, or is there anything else influencing it? It seems that the final product selection is influenced by the processes taking place in the digestive tract (digestion, absorption) and their results, i.e. certain substances, hormones, enzymes in the blood, brain, etc. If the food is well digestible, it does not result in any negative feelings, such as nausea, vomiting, abdominal pain, etc. and creates a general feeling of satiety, then the animal will normally choose in favour of it again. And this is assessed by a human being through a prism that the product which is chosen more often and eaten more therefore is tastier than the product left aside.

Both the first-choice tests (based only on the smell and taste), as well as the preference tests, tests of acceptability or other tests (including the element of product temperature, consistency, consumption amount assessment, the ratio of consumption of both feeds to general consumption during the specified period as well as plotting the consumption curve

of the products throughout the experiment, etc.) are used by the industry to produce suitably attractive cat food from the available products. Nevertheless, in case of this type of tests, it is very important to properly select the animals that participate in them. It turned out that cats, fed from the moment of weaning with a balanced commercial pet food, have greater "plasticity" and an easier transition from one diet to another (4).

This is probably due to the fact that those diets appear similar to cats in case they are balanced. Therefore, the characteristic effect of rejecting everything radically different from the known food (neophobia) is definitely less intense, and the choice of a new food results from the willingness to make a minimal, albeit "safe" change in the monotony of the diet used. In case of wild cats, the influence of diet monotony on the effect of new food preferences is much higher, which results from the lack of balance. A wild cat eats what it catches and although the body of the victim contains most of the macronutrients necessary for a cat, it does not contain all the elements of a complete diet. Therefore, in order to fully balance it, they look for food with a completely different taste (rejection of neophobia in favor of neophilia). This experience is repeated until the desired effect is obtained (5). Thus, a cat adapted from the external environment may make changes in preference tests more often, and the reason for this will have a completely different background than in cats from a cattery. The question is whether they are better testers, and whether it can be said that a domestic cat, fed with balanced food, is more neophobic with a tendency to reject diet monotony, and a free-living cat is more neophilic due to the need to balance the diet. And in connection with this dual concept of cat nature, can we even speak of a taste preference?

The problem can be even more complicated by introducing the concept of "taste memory" or "priority effect". It is not related to the very taste preference as such, but with the transfer of the mother-cat and the later, with so-called "safe" taste (1). The process of transmitting the "safe" flavor takes place already during pregnancy and occurs through the amniotic fluid, and afterwards continues after delivery through milk. After weaning, a mother cat shows the kittens what to hunt and what to eat. If the kitten are taken by a human, humans takes over the function of the cat in "teaching / creating" tastes. Nevertheless, the record of the taste conveyed by the mother is very strong. As an example, we can cite the experiment conducted by Wyrwicka, who gave pregnant cats food based on mashed potatoes and bananas (10). The message of taste was so strong that when the litter was able to eat and to choose foods on their own, they preferred those containing potatoes and bananas, even though there was meat next to it (10). In another experiment, the kittens were exposed to old and new food (in this case tuna) with and without the mother-female. In the presence of a female cat, the litter definitely chose the food in accordance with the mother's taste, while in the absence of her, some kittens, after numerous exposures, acting as a stimulus, chose new food (11).

This indicates a very strong influence of the coded "priority effect", which may underlie the later neophobic behavior of adult cats, fed with balanced food (4, 11). In contrast, those kittens that chose "new, unknown food" in subsequent exposures seemed to have a higher cognitive desire. And perhaps such kittens will in the future have a greater predisposition to neophilic behavior, especially with poorly or completely unbalanced nutrition.

If it is not about the smell and taste, but rather the nature of a cat and the balance of foods that influence the choices they make, what is so important in this balance? An attempt was made to answer this question by analysing the two-bowl product preference tests performed over a period of 10 years (2). Each time the food selected by cats as tastier was marked as A, less tasty as B. Through a series of analyses, it was shown that the choice of the preferred food A correlated negatively with an increase in the content of Ca, P, ash and fiber (2). Cats, having a choice of products with higher and lower contents of Ca, P and ash, always chose those with lower contents. This fact was explained by the need to maintain the mineral balance in the body. For the fiber content, similar observations were obtained. And although fiber is very important for proper motility and intestinal health, its increased amount in food significantly reduces its taste (2).

Beaver also describes the reduced consumption of products containing carbohydrates (3). It resulted not only from the lack of a sweet taste preference, but also from the gastric consequences (vomiting, diarrhea) of their excessive consumption (3). Therefore, one can consider whether a given problem should be considered in the aspect of aversion resulting from negative experiences related to the consumption of certain foods, or the preferences of those that do not produce the above symptoms. Returning to the analysis of the choice tests, it also turned out that the main factor influencing the choice of food by the cat was its body weight, while age and sex were of secondary importance. Heavier cats ate less, but showed a stronger preference for higher-fat foods, which are stereotypically considered tastier (2). This is explained by disorders resulting, inter alia, from overweight and obesity (leptin resistance), as well as from greater tolerance of diets with a higher fat content in obese cats (6,12).

An interesting observation also concerned the seasons of the year, when females ate more and tastier food in the winter, while males in the summer. This was due, inter alia, to the seasonally polyester nature of animals, for which winter is the period when females are excluded from reproduction (low estrogen levels) (2). Studies carried out on rats and humans also confirmed the need for increased consumption of high-energy foods during the diestrus period (7). The higher consumption of diets preferred by non-sterilized female cats in winter was also explained by their smaller body size in relation to males. Therefore, at lower temperatures, they could lose heat faster and more intensively, so they ate more to maintain homeostasis. In summer, however, high temperature makes it easier for cats to select a tastier food (and consequently ensures its higher consumption), due to the higher possibility of detecting volatile substances in the air (2). In non-sterilized female cats, the possibility of their detection is constant and does not depend on the temperature increase, because it is based on a natural need to protect themselves and the litter, regardless of environmental conditions (2).

The multitude of tests and research carried out, focusing on the perception of taste, gives a fairly wide and heterogeneous picture of the possibility of its evaluation. It seems, however, that the starting point for this type of considerations should be the nature of the cat and the analysis of its previous feeding method. Because, having a cat, you cannot change it in a broader sense, you can only try to understand it (including its nutritional needs) and accept it. And what does this mean for the owner of this animal regarding the choice of food taste? This can be concluded in a colloquial statement: "so many cats, so many preferred flavors", which is an optimistic option for food producers who will not run out of consumers.

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Trends in the market of dry pet food for dogs and cats

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The contemporary market of dog and cat food is characterized primarily by the search for market niches and the creation of products that, in the eyes of pet owners, will meet the specific nutritional needs of their pets. Bearing in mind the technological possibilities, the availability of raw materials and marketing ingenuity, gluten-free / grain-free products, containing significant amounts of fresh meat or a very long list of nutritional additives (holistic), or pet food for dogs living in cities (urban dog), have started to be promoted for some time now. Some of these trends are actually substantive, while others rather meet the needs of the owners than the animals themselves.

Urban dog

Foods intended for dogs living in the city (so-called urban dogs) have been on the market for just a few years. They appeared due to the fact that people's nutritional expectations and lifestyle are increasingly changing, starting to translate into animal nutrition. The emergence of the idea of adapting nutrition to the dog's place of living (city, etc.) in nutritional trends places greater emphasis on the living conditions of animals – not on the animals themselves. The concept of dog life in cities assumes that they are animals that do not have unlimited access to outdoor activities (only regular walks, sometimes more activity during the weekend), have a fairly large contact with places where other dogs are also staying (parks, streets, etc.) and are exposed to a relatively large accumulation of various types of toxins, including exhaust gases, etc. It is therefore not an environment of life which is too comfortable and is significantly different from one of the main current trends in dog nutrition, namely 'natural'. In humans, the combination of living in cities with eating freshly prepared meals has led to the development of various types of box diets on the market, delivered directly to the home or workplace of customers. This is translated into the nutrition of dogs kept in large cities by companies offering fresh meals prepared and delivered for dogs.

Producers of food for city dogs assume that these dogs are exposed to, among others, many pathogens and toxins. This is due to the relatively high concentration of dogs in cities and the possibility of easy transmission of germs during walks in public parks. Therefore, one of the features of city dog food is to support immunity. While the obvious ingredient of this type of food is high-quality protein (mainly amino acids), the permanent administration of substances such as beta-glucan, which is one of the strongest immunostimulants of food origin, with the food, becomes doubtful because continuous, several-week-long immunostimulation may ultimately lead to the destruction of the immune system, i.e. the opposite of the intended effect.

Producers try to counteract the presence of toxins (mainly exhaust fumes or smog dust) in the living environment of dogs adding a small amount of substances absorbing this type of compounds into the pet food – mainly clays, such as bentonite or montmorillonite. The absorbing properties of these compounds are known because they are commonly used in anti-diarrheal preparations, but it is not fully understood what the consequences of their permanent administration in small amounts are, whether they will not result in constipations.

From the point of view of dog owners residing in cities, the consistency of dogs' faeces is also very important, generally resulting from the way the food is digested. Therefore, the digestibility of the feed is of great importance, ensuring on the one hand the limitation of fermentation processes in the large intestine (reduction of the amount of produced gases), and on the other hand, proper digestion of the given food, ensuring that the amount of faeces produced by animals is minimized. Unfortunately, digestibility varies individually, which means that it cannot be assumed in advance that a highly digestible product in one dog will be equally well digested in another. The food packaging does not contain information about the digestibility of the food, but producers try to emphasize the content of highly digestible ingredients in products for city dogs, substances that reduce unpleasant stool odors and improve its consistency. The latter is supposed to make it easier for owners to clean parks after their pupils.

The list of ingredients and nutritional modifications in food intended for dogs living in cities is not too long as well as not too convincing. Producers pay attention to the addition of ingredients that improve, for example, the quality of fur, but good fur quality is not only required in city dogs. Very often, however, these dogs are also divided according to the size of the dog breed and as a result, food for small breed dogs living in cities is created. Of course, in such a case, the modification of the size of the kibble to suit the size of the dog's breed may also be of great importance.

Fresh meat

Another trend on the super premium dry food market is pet food containing fresh meat (instead of meals) as a raw material for production. This trend is surprising because the resulting feed is still a dry feed, and not semi-moist feed, and the production of such feed is much more expensive, which results from the higher price of the raw material and the equipment requirements for production. Initially, the addition of the production of "fresh meat" to dry foods was rather treated as marketing, because it was difficult to find data unambiguously confirming the actual benefits of serving such foods. For most owners, the term "fresh meat" is associated with, for example, raw pork neck or sirloin, and as a last resort, with raw minced meat. In production practice, however, fresh meat is simply raw material of animal origin that has not been dried and ground before being used for the production of feed, i.e. it is not meat meal. The technology of production with the use of large amounts of fresh meat is much more complicated than the production of food based on meals, because it requires the removal of water (water vapor) contained in this raw material during the technological process, which in the case of a very large addition of fresh meat to the feed significantly hinders the production and extends the drying time of the feed after extrusion.

However, such foods may have real nutritional benefits, as demonstrated by the research carried out. They show that dry foods based on more fresh meat are definitely tastier for dogs because they contain less bitter substances. As this taste is not very attractive to dogs, food containing

fresh meat is eaten more willingly. A second factor in improving the palatability of fresh meat foods is the fact that these foods contain significantly more fat inside food kibbles (not just on the surface). However, this means that in order for this food to have a suitable shelf life and not become rancid, it must have a low moisture content (preferably about 6-7%), a low water activity and must be kept under appropriate conditions. There is also a growing number of data proving that the addition of fresh meat as a raw material for the production of dry food may increase its digestibility by several percent. Better digestibility means your pet uses up considerably better protein, vitamins and minerals contained in the feed. Fresh meat food is also a better image, since in the eyes of most owners food containing e.g. 50% fresh meat is considered to be food consisting of half beef or chicken. Such declarations (eg 80% fresh meat) create a lot of customer interest.

Grain-free

Grain-free feeds are regarded by the market as products of higher quality and nutritional advancement level than traditional dry feeds offered on the market. This trend is surprising because cereals have been the basic ingredient of dry food for dogs and cats since they appeared on the market, and in dog food they can constitute even over 50% of raw materials used in production. From the technological point of view, cereals are a very good raw material, because they are relatively dry (their initial humidity does not differ much from the final humidity of the dry feed) and during their processing in the extruder there is no release of too much water vapor, and hence there is no risk of excessive pressure during feed production. In addition, the cereals contain starch, which is responsible for maintaining the appropriate properties of the feed croquettes after its production. A starch content of at least 20-25% (or more) in the final product ensures the maintenance of the consistency and cohesiveness of the kibble of the feed throughout its storage period (often 18 months). Starch is also a valuable nutrient – one gram provides about 3.5 kcal. This allows for the production of feeds with high value and energy density (the density of the dry feed is almost 4 times higher than that of the moist feed).

However, the necessity to add starch to dry foods does not mean the necessity to add cereal starch, as it can be replaced with potato starch – from ordinary or sweet potatoes, or possibly starch from other non-cereal plants. And such feeds are called "grain-free". Of course, the main benefit of grain-free food producers is the reduction of the risk of food allergies. Cereals can cause allergies because when whole grains are added to the food, they also contain vegetable protein. Barley contains about 12% protein, corn about 9% protein, and wheat about 12% protein. Such a protein will induce an allergic reaction in patients who are actually allergic to it.

The second argument in favor of grain-free foods is the limitation to almost zero the possibility of mycotoxins in the food. Mycotoxins are products of mould fungi that can appear in food in a situation where food production is mouldy or mould-contaminated grain is used. Such a risk actually exists, because cereals grown in countries in our latitude can be harvested despite too high humidity (when the summer is rainy) and end up in storage contaminated with fungal spores, which then begin to develop during storage and begin produce mycotoxins. However, it should be clearly noted that dogs can sometimes quite effectively metabolize mycotoxins in the liver and not all of them actually pose a threat to their health. This is somewhat different in cats, which by nature have a much weaker ability to detoxify mycotoxins. Mycotoxins in feed significantly impair palatability as they can impart a bitter aftertaste to the feed. In summary, the nutritional benefits of grain-free food are certainly the reduction of the risk of allergy in animals allergic to grain protein and the elimination of a potential source of mycotoxins.

Gluten-free

One of the varieties of grain-free foods are gluten-free foods. Cereals contain gluten in the protein fraction, which in humans is responsible for the symptoms of celiac disease, i.e. a disease causing the production of antibodies to gluten and, as a result, damage to the intestinal villi. In humans, about 1% of the population may be affected. In dogs, gluten intolerance in dogs has so far only been reported in Irish Setters. It is a form of gluten hypersensitivity with symptoms of chronic and recurrent diarrhea that is refractory to standard therapy and, in the absence of dietary gluten withdrawal, leads to malnutrition due to malabsorption of nutrients. The disease in this breed of dogs, like in people with celiac disease, causes atrophy of the intestinal villi. It also appeared that gluten intolerance was the basis of enteropathy and proteinaceous nephropathy in wheaten terriers, but recent scientific studies have excluded its involvement in the above diseases. There are, however, publications linking gluten with ethiopatogenesis PGSD (paroxysmal gluten-sensitive dyskinesia) in border terriers. In practice, therefore, it seems that the Irish Setter and the Border Terrier are the two breeds of dogs in which it is reasonable to exclude gluten from the diet.

The introduction of gluten-free foods to the market is based on the assumption that, similarly to human nutrition, there is an advantage of a gluten-free diet in healthy dogs over a grain diet, and on the opinion that gluten is harmful. For this reason, the place of cereals in dry foods has been taken by potato / sweet potato or tapioca (grain-free foods) or a combination of potatoes and rice, which is naturally gluten-free and most easily digestible (typical gluten-free foods). However, it must be clearly emphasized that in the available literature there is no information in the scientific community about the adverse effects of gluten and the positive effect of its absence in foods fed to healthy dogs. All scientific publications relate only to sick animals or suspected dogs. But providing animals with "gluten-free" food, however, may be relatively beneficial in animals with food allergies, since eliminating gluten from the diet simultaneously eliminates one of the vegetable proteins, which may be a potential allergen. As a result, gluten-free food can be given to animals in situations where it is necessary to provide a so-called elimination diet, as long as such food obviously contains only one animal protein source or protein hydrolyzate.

Therefore, the importance of (harmful) gluten in the diet of dogs should not be over-exaggerated and one should be very critical of any "news", because they can lead to too much simplification, distorting the credible message. Issuing nutritional opinions on the basis of not fully researched problems brings more harm than good, creating the so-called fake news. It seems that the gluten in the feed for healthy dogs is one of the "victims" of overly hasty opinions. Certainly, gluten is not recommended for animals intolerant to it, and gluten-free diets are among the therapeutic diets that we introduce only in sick or animals with suspicion of disease. There is no scientifically proven information that gluten-free products should be used universally in all healthy dogs. It is purely fashion, and like any fashion – this one will also pass.

Clean label

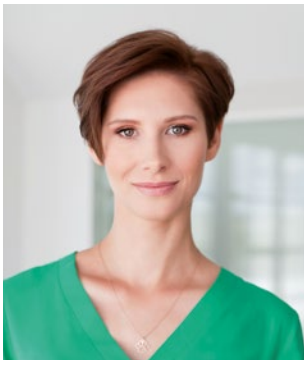
The idea of a clean label that has emerged in the food industry (and not only), is to some extent a response to those products that contain several or even several dozen items in their lists of ingredients. On the food market, products with a "clean label" are to be in contrast to holistic foods that sometimes contain huge amounts of food additives. The idea is very simple in this case - the product (and thus also the label) should contain only natural ingredients known to the customer. The product should give the customer some kind of guarantee that the products do not contain any food additives negatively associated among consumers. As a result, the pet owner has the feeling that even when buying commercial food, they know exactly what they are providing their pets with. And in the world of "natural" food, this is becoming increasingly important. From the point of view of consumer interests, the idea of the so-called clean label is commendable

as it reflects complete transparency in the formulation of the recipes for the products sold. It must be admitted, however, that from a formal point of view, the definition of a "clean label" is not a legal concept and its definition is not fully formalized, so it is subject to various types of interpretations. Nevertheless, in practice, it may mean the appearance on the market of commercial feeds with a very short composition, which is not so simple, especially in the case of dry pet food. Balancing a pet food from a short list of ingredients means that it is necessary to use products of very high quality or with special properties. And this, unfortunately, will be relatively expensive. In practice, it may appear that pet food prepared from a short list of ingredients will not be cheaper than pet food containing several dozen ingredients.

Instead of a summary – how to reach a new customer?

As all new trends in the nutrition of dogs and cats are more and more related to the expectations of their owners, adapting to the requirements of the new generation of animal owners, i.e. millennials. This social group is relatively well distinguished, and the research conducted on their expectations and consumer behavior clearly indicate that they are able to spend much more money on their animals than all other social groups. It is known that this is a group that perfectly uses electronic tools and the Internet, therefore the offer addressed to them must be based on this channel of reaching, although it is still not clear whether Internet communication will be sufficient to establish relationships with this group of customers and will make it possible to try out products that they only got to know in a digital form. Importantly, it is also unclear what specific properties of products for dogs and cats are important for millennials and how to construct such products. But the digitization of the pet food market is a fact. It is to be expected that in the near future it will be increasingly important to offer products tailored to the individual needs of dogs or cats. It is difficult to imagine the production of feed for individual dogs in factories with production capacity counted in tonnes of feed per hour, but the market expects products tailored to the requirements of individual animals. The beginning of this trend was the introduction of food for individual dog breeds with great market success. But now owners prefer to buy not only dog food for their breed in general, but for their own dog in particular. And this trend cannot be reversed, even though it is associated with huge production and technical difficulties for pet food producers.

Effecive weight loss in dogs



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Overweight and obesity are the result of excessive accumulation of fatty tissue in the body. Overweight in dogs is defined as weight gain greater than 10% to optimal weight and obesity greater than 20% (German, 2006). This phenomenon is more and more frequent, although its intensity varies depending on the country or region. It can be assumed that at least 20% of dogs sent to veterinary clinics in highly developed countries are obese (Niessen, 2013).

As with humans, obesity is the most common health problem in companion animals. It is associated with a range of co-existing diseases, such as pancreatic diseases, lower urinary tract diseases, cancer (mammary gland, skin), lipid metabolism disorders, bone and joint diseases (osteoarthritis), hypertension and kidney diseases (Lund et al., 2006; Alenza et al., 2000). Excessive body mass, apart from the obvious change in the appearance of the dog, also has its health consequences, of which the most dramatic for owners is the shortening of the life of the animals. Long-term studies in Labrador dogs showed that individuals who maintain a low (normal) body weight live an average of 2 years longer than dogs of the same breed kept under similar conditions, whose food intake was 25% greater (Kealy et al., 2002).

The main cause of obesity is the fact that the amount of calories is not adjusted to the animal's energy requirements. The person responsible for providing the source of energy to the animal is his carer. Obesity in dogs is due to over-food and snacks, to the administration of human food leftovers, and to other actions of the owner (Kienzle et al., 1998).

Therefore, the dog's guardian should know what the caloric content of the food is and should be able to determine the type and amount of snacks allowed. It is also imperative that each family member knows the rules of feeding and develops positive habits both in a dog and their own. This often appears difficult for the carer, as serving snacks is an important ritual for the caregiver's own mental needs.

Another problem is the overestimation of the amount of energy expenditure in relation to the calories consumed. Dog keepers often miss the fact that a dog's energy needs decrease with age. Interestingly, the risk of an animal becoming obese also increases with the age of the carer.

In addition, modern animals spend less energy than in previous decades, although their love of food does not diminish.

In recent years, the lifestyle of dogs (and humans) has changed and now most of them lead a relatively inactive lifestyle while maintaining constant access to high-calorie food. Most dogs live indoors and enjoy thermal comfort, while outdoor dogs use up to a third of their energy for thermogenesis.

The dogs' genetic features have evolved over the centuries to help the body cope with its limited food resources. Improving living conditions, safety, and the availability of food may be the cause of the epidemic of overweight and obesity without genetic changes, are at the root of the current obesity epidemic in pets.

Of course, overfeeding an animal is not the only cause of obesity. The deposition of excess body fat can be caused by drugs or hormonal disturbances. For causes of obesity in dogs, see Box 1:

Causes of obesity in dogs

- **iatrogenic causes (drugs with an increase in appetite as a side-effect, e.g. anti-epileptics),**
- **endocrine diseases (hypothyroidism, hypoadrenocorticism),**
- **individual features (age, sex, race, castration),**
- **lifestyle (level of physical activity),**
- **reasons related to the owner (e.g. his age, gender, income),**
- **nutritional factors (high-calorie products, number of meals a day, feeding food intended for humans),**
- **behavioral factors (eg humanization or misinterpretation of the animal's behavior)**

Is the carer always to blame?

It turns out that not every animal is equally able to lose weight. Genetic predisposition towards overweight and obesity occurrence, which are characteristic of some dog breeds, make losing weight not always easy. For example, approximately 25% of the Labrador population carries a mutation in the gene encoding POMC, which plays a key role in hypothalamic appetite control. In the leptin-melanocortin signaling pathway, a POMC mutation reduces the signal at the melanocortin 4 receptor (MC4R), making the dog less susceptible to feeling full (Raffan et al., 2016). Dogs with a mutation in the POMC gene do feel "hungrier" than others.

The mutation is related to body condition, body weight, and eating behavior. For each additional mutant allele, dogs score an average of 0.5 points higher on the BSC fitness assessment or approx. 2 kg heavier than dogs without the mutation. Reducing excessive appetite in dogs with the POMC gene mutation is a big challenge for their owners. (Raffan et al., 2015).

BCS is the basic tool for assessing the degree of fat cover of the dog

The 9-point Body Condition Score is a subjective tool. It is currently the most popular tool for estimating or assessing the severity of overweight or obesity, and for "predicting" or assessing likely normal body weights in dogs. It is a fast, cheap and non-invasive method.

BCS is based on visual and palpation evaluation of the dog's body. Table 1 gives descriptions of the dog silhouettes according to BSC. There is a strong correlation between the BSC rating and the percentage of body fat. Therefore, it is used to assess the correct body weight and condition of the animal (Table 1). However, one should remember about the exceptions related to the specificity of individual races. For example, greyhounds have a relatively large muscle mass than others - in their case, the rating of 5/9 will correspond to about 7.2% of body fat compared to the standard 20% assigned to the scale. The opposite will be the case for huskies, with a rating of 5/9 representing approximately 31-32% of body fat (Santarossa et al., 2017).

One of the greatest limitations of the BCS method is the fact that it focuses mainly on the assessment of fat content, ignoring the content of muscle mass. At the same time, it does not provide an exact possibility of estimating / assessing / determining what the optimal body weight should be.

It is suggested that the BCS score be used in parallel with the dog's Muscle Condition Score (MCS). The MCS scale shows / estimates whether the animal has normal body musculature, whether moderate or severe loss of it has occurred.

Some dog owners are unaware of their pet's excess weight. Numerous studies confirm that more than half of the owners of overweight and obese dogs underestimate the body condition of their pets, even when given precise guidelines on how to assess the degree of overweight (Courcier et al., 2009; Jagatheesan et al. 2017). As a result of an incorrect perception of the body condition of the animals, they do not find it necessary to modify their diet and / or physical activity, even though they are aware of the dangers of obesity.

The key role of the veterinarian

German and Morgan (2008) found that dogs in treatment centers are rarely weighed and body condition is assessed in only 2% of patients among all overweight dog consultations. This suggests that only a small number of animals with excess body weight are diagnosed and this issue is discussed with the carer. The number of dogs that actually start a weight loss program is even smaller.

Other studies have also found that not all owners are informed of their dog's abnormal body weight, potentially exacerbating the overweight phenomenon. Some veterinarians

Table 1. Assessment of body health (BCS) in dogs (FEDIAF, 2018).

Score	Location Feature	Estimated body fat (%)	%BW below or above BCS 5
5 ideal weight	Ribs not visible, but easily palpable, with thin layer of fat. Other bony prominences are palpable with slight amount of overlaying fat. Abdominal tuck when viewed from the side and well proportioned lumbar waist (hourglass shape) when viewed from above. Smooth contour or some thickening, bony structures palpable under a thin layer of subcutaneous fat	15-25%	0%
6 Slightly overweight	Ribs & other bony prominences Palpable with moderate fat cover. Abdomen Less obvious abdominal tuck when viewed from the side, hourglass shape less pronounced when viewed from above. Tail base Smooth contour or some thickening, bony structures remain palpable under moderate layer of subcutaneous fat.	20-30%	+10-15%
7 overweight	Ribs & other bony prominences Difficult to palpate, thick fat cover. Abdomen Little abdominal tuck when viewed from the side or waist, and back slightly broadened when viewed from above. Tail base Smooth contour or some thickening, bony structures remain palpable under subcutaneous fat.	25-35%	+20-30%
8 Obese	Ribs & other bony prominences Ribs are very difficult to palpate, with thick layer of fat. Other bony prominences are distended with extensive fat deposit. Tail base Appears thickened, difficult to palpate bony structures. General Ventral bulge under abdomen, no waist, and back markedly broadened when viewed from above. Fat deposits over lumbar area and neck.	30-40%	+30-45%
9 Grossly Obese	Ribs & other bony prominences Ribs are very difficult to palpate, with massive layer of fat; other bony prominences are distended with extensive fat deposit between bone and skin. Tail base Appears thickened, bony structures almost impossible to palpate. General Pendulous ventral bulge under abdomen, no waist, back markedly broadened when viewed from above. Fat deposits over lumbar area, neck, face, limbs and in the groin. A dip may form on the back when lumbar and thoracic fat bulges dorsally.	> 40%	> 45%

are reluctant to discuss this topic. This can prove to be a sensitive issue, especially if the carer is also overweight (McGreevy et al., 2005).

Estimating the optimal body weight based on the current body weight and BCS (body condition assessment)

The target body weight can be estimated based on the breed and on the health assessment. Any BCS grade between 5 and 9 is 10% of the excess body weight (eg BCS 7/9 is 20% of the excess body weight). The following formula can be used to estimate optimal body weight:

Optimal body weight = current body weight x (100 ÷ [100 + 10 x {current BCS - 5}]).

Example:

For a 40-kg dog, with a BCS of 8/9 (i.e. approximately 30% of the excess body weight), the correct weight can be calculated as follows:

40 kg x (100 ÷ [100 + 10 x {8 - 5}]) = 30.8 kg.

One should always bear in mind that these are only estimates to determine the optimum body weight.

However, veterinarians should educate their owners and inform them about the consequences of obesity and about a safe way to lose weight (Kipperman and German, 2018)

Interview - nutrition history

- is the dog the only animal in the house?
- who feeds the dog?
- how is the dog fed: daily rations / free feeding?
- what is the dog fed with: commercial food / home diet / mixed method / etc?
- how does the dog behave while eating?
- what is the dog's activity level walking / free range (access to the garden, etc.)?
- what is the dog's behavior while walking?

Developing a weight loss plan

The key step in establishing an effective weight loss plan is to conduct a thorough nutritional interview.

Ask the owner about all the foods and amounts the dog gets throughout the day, including any snacks and treats. Often, the owner does not know exactly how much food the dog is receiving. Afterwards, it is suggested to ask the carer to keep a diary for several days, in which he will write down the amount and type of each food given to the dog.

Slimming / Weight Loss Plan:

1. **assessment of the dog's weight and condition (BSC scale)**
2. **determining the optimal body weight for the dog based on the data obtained from nutritional history (age / disease, etc.) and on the analysis of current test results (blood / urine / other)**
3. **estimate the amount of calories in food currently consumed by the dog**
4. **determining the amount of calories that the dog will receive during the weight loss period, taking into account the formula: DER = 1 or 0.8 x [70 x (b.w.) 0.75)] and the data obtained from point 3.**
5. **selecting an adequate slimming diet and determining the daily ration in grams**
6. **an approximate estimate of the time required for the weight loss process, assuming a weekly weight loss ranging from 1-2% of current body weight**
7. **Recommendation to increase physical activity adjusted to age / degree of fat cover etc.**
8. **Telephone check-up and follow-up visits every 2 weeks during the initial period of weight loss, and then in steps of about 4 weeks.**

If the daily energy supply of the patient can be estimated, and the diet is properly balanced, weight is lost by introducing a slimming diet and increasing physical activity. Unfortunately, we do not always get a precise nutritional history. Sometimes it is not possible to determine the exact caloric intake of a dog because the dosages are not metered, the dog is fed together with other dogs, or the amount and type of food varies each day. In this situation, it is worth following the assumed plan when the dog is losing weight (see the box).

The goal of weight loss should not be to achieve an ideal body weight for a given animal. The degree of excess weight as well as the age of the dog and co-existing diseases are of key importance.

Pet food selection

In the process of losing weight, it is not advisable to reduce the dose of the household food. A significant reduction in the dose of the current pet food leads to nutritional deficiencies and metabolic disorders. The use of slimming diets is recommended. They are characterized by a protein content of 25-50% in dry matter, with a reduced amount of fat (5-15% DM) and an increased amount of dietary fiber (12-25% in DM). This allows you to reduce the caloric content of the diet while ensuring a feeling of satiety. It is worth adding, however, that such a high proportion of fiber in the feed increases the amount and frequency of defecation, which should be advised to the dog's owner. Diets also include a supplement substances supporting the slimming process, such as: L-carnitine, prebiotics and probiotics and antioxidants. Antioxidants are of particular importance as obesity is defined as a chronic inflammatory disease associated with an increased risk of damage from oxygen free radicals. It is also worth mentioning the support of the correct microflora of the gastrointestinal tract – "protection" of the intestine, stimulation of local and general immunity and limiting the risk of developing or reducing the already existing insulin resistance.

Each portion should be measured on a kitchen scale. It turns out that the measuring cups from the manufacturers are imprecise and often lead to overfeeding of the animal (Coe et al., 2019; German et al., 2011).

Meals should be divided into several smaller ones (4-5 during the day). It is worth encouraging the handler to use interactive toys, thanks to which it will be possible to slow down the pace of eating, which is especially important in dogs with polyphagia and / or aerophagy. Small but more frequent meals allow to optimize the digestive process and obtain a better satiety effect.

It is extremely important to control your dog's additional food sources. Carers are often unaware that serving snacks between meals disrupts the day's balance.

Calculation of the duration of the weight loss process

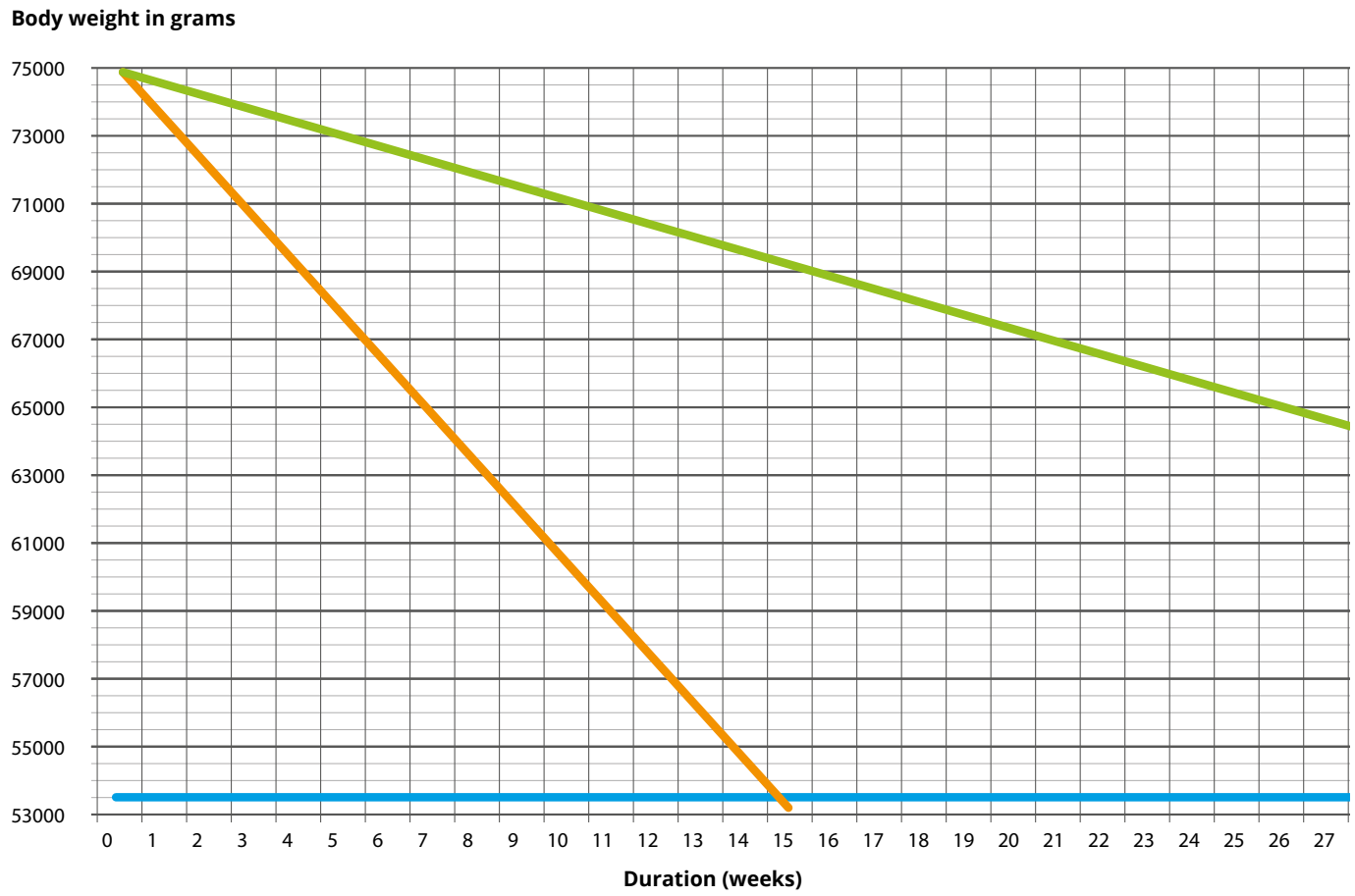
1. **Overweight bw. (kg) = current body weight - optimal body weight.**
2. **Optimal pace of weight loss (weekly) = current body weight. x 1%, minimum weight loss rate = current weight x 0.5%, maximum weight loss rate = current weight x 2%.**
3. **Estimated time needed to achieve optimal body weight = overweight in kg / week value of weight reduction. in kg**

Example:

Dog; large breed, current body weight:

1. **36 kg; optimal weight: 30 kg; overweight: 6 kg**
2. **optimal weight loss rate 1% of the current body weight. weekly: 1% x 36 kg = 0.36 kg**
3. **approximate weight loss time: (6 / 0.36) = approx. 17 weeks (4.25 months)**

Fig. 1. An example graph for an owner on which they should note their dog's weekly weight measurements.



Nutritional management after ending the weight loss process

1. **selection of the optimal food, tailored to the current needs of the animal**
2. **determining the daily food ration**
3. **preserving the transition period from a slimming diet to the target pet food, by mixing both products in the right proportions**
4. **recommendation to monitor body weight (weighing a dog every week / every 2 weeks, then every month); maintaining / increasing physical activity**
5. **control visits to the office to monitor the weight loss / fitness / Other - at least once a month for the next 6 months.**
6. **control after 6 months after ending the slimming process: body weight / condition / blood tests / other.**

It would be best to give up all the delicacies, but most owners cannot imagine not using the rewards. Then it is best to determine what snacks and in what quantities can be served. Any additions to a dog's diet can make up 10 to 20% of the calculated daily energy requirement for a dog with normal weight.

The owner will be following minimum and maximum rate of weight reduction over specific period (Figure 1). Keeping a chart is not only motivating for the owner, but it will also inform the veterinarian about the treatment progress and possibly about a need for dose modifications. Follow-up visits to the clinic should take place at least once a month. A method of calculating the time required to achieve the weight loss goal is presented in Box 5.

Once a normal/healthy body weight has been achieved, it is important to prevent the dog from gaining weight again. Unfortunately, almost half of the dieting animals gain weight again ("yo-yo" effect), which is related to the reversion to the owners' inappropriate eating habits (German et al., 2012).

It is recommended to use the same diet that was administered during the slimming process (or another with similar parameters) for half a year or for at least the same time as the period of slimming (Berwid-Wójtowicz, 2019).

The management of food regulation to maintain a reduced body weight is described in Box 6.

Summary

The weight loss process is a challenge for both the carer and the dog. Only a small percentage of pet owners enrol into a weight loss program, and an even smaller percentage successfully completes it.

A properly informed carer can avoid serious body weight injuries. In overweight animals, it is not recommended to exceed the value of 10% DER (Daily Energy Requirement). It is worth proposing low-calorie snacks (less than 30 kcal / delicacy). The best vegetables and fruits are served raw or blanched, i.e. zucchini, carrots, melons, apples.

It is worth considering the development of a weight monitoring program and regular evaluation of patients' BCS. As soon as the animal begins to gain weight unexpectedly, early intervention and corrective measures should be introduced. If an obese animal successfully sheds excess weight, veterinarians should closely monitor the post-weight loss period, including regular weight checks to ensure that it is kept at a stable level. Continuing to feed the veterinary diet after the weight loss period will prevent gaining of weight again.

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Basic information on the feeding of water-terrestrial / semi-aquatic turtles

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Introduction

Semi-aquatic turtles are animals commonly kept in amateur farm-bred, hence detailed knowledge of their nutritional needs is necessary. Due to the physiological and morphological diversity of this group of animals, it is a problem of a complex nature. In nature, semi-aquatic turtles inhabit a wide spectrum of environmental niches [2], and their diets and the range of food available vary considerably. Most of them are opportunistic predators or are omnivores, while herbivorous species are a definite minority. The diet of most turtles consists of invertebrates, small vertebrates and aquatic vegetation [4, 11, 26, 37, 38].

In popular science literature, only general information about their nutrition is available, and the nutrient needs of most species remain unknown. However, due to their varied feeding strategies and slow metabolism, these animals show a high tolerance for unbalanced diets. Despite this fact, the metabolic expenditure associated with shell mineralization, as well as longevity, make captive turtles susceptible to a wide range of health consequences caused by nutritional deficiencies over a period of several decades of life [30]. Most of the nutritional knowledge, documented and derived from empirical research, relates to species commonly farmed in Asia for consumption or North America for further trade in the global pet market. It should be remembered that the nutritional needs of individual animals are influenced by many factors, not only the species, but also age, sex, health condition and environmental conditions in which they live. For this reason, farm turtle diets may not be appropriate for hobby-kept animals. The animals are kept on farms for no longer than 3 years (until consumption size is reached), and in many cases the parental flocks are still obtained from nature and used intensively for a period of about 4-5 years. What's more, the composition and form of feed in the case of farm turtles are optimized mainly in terms of their highest possible use and maximization of growth and reproduction, and profits that follow, yet not their long-term impact on the animal's body.

Nevertheless, knowledge about the nutritional needs of the most popular farmed species of semi-aquatic turtles can provide useful guidance on the nutrition of species kept in homes or zoos.

Nutritional requirements

Contrary to domestic or farm animals, for the majority of semi-aquatic turtles, the nutritional requirements of the species or age/ technological groups and the related nutritional recommendations were not determined. For this reason, feeding of this group of animals is most often carried out on the basis of general principles specified on the basis of practical experience with species from the Emydidae family. However, one should note that these assumptions may not hold well for highly specialized species such as the matamata turtle (Chelus fimbriata). For such turtles, a diet that reflects their diet in the wild should be adopted. The semi-aquatic turtle for which the nutritional requirements are best known is the Chinese softshell turtle (Pelodiscus sinensis). Due to its widespread farm breeding in Asia (approx. 350,000 tons of live cattle per year), many studies were carried out on the nutritional requirements (Table 1) and breeding of this species. It should be emphasized that the diet of this group of reptiles significantly changes with age. In the first days of life, young turtles may not consume food, because a significant part of their nutrients comes from the absorbed yolk sac [31]. In the case of most species of semi-aquatic turtles, after hatching, they are almost completely carnivorous [3, 4], and their growth rate is closely correlated with the content of crude protein in the food [11]. Its optimal level depends on the level of energy supplied in the diet [32]. Maintaining an adequate protein-energy ratio is extremely important, due to the fact that too low level can lead to growth restriction and reduced feed intake. One should also pay attention to the quality of the supplied protein, determined by the amino acid composition. For turtles, methionine and cysteine are the limiting amino acids, but no studies have

been conducted to determine the need for lysine. The content of exogenous taurine is also considered important, especially when using foods based on protein of plant origin [14]. The total protein content of the diet of captive turtles may be lowered as the animals reach sexual maturity as their rate of growth becomes slower. It is also recommended to increase the proportion of plant foods in the diet of adult turtles. In the case of adult, slow-growing, non-breeding turtles, the nitrogen and energy balance should be kept slightly above zero in order to avoid obesity of the animals [35].

Compared to the recommendations for commercially kept turtles, it is advisable to slightly reduce the energy and protein content in hobby breeding to prevent too rapid growth which is associated with insufficient skeletal development and health problems. Due to the low energy expenditure of captive turtles and the high availability of food, in most cases it is not necessary to have additional sources of fat in the diet. However, its optimal content in the diet has been estimated to be around 9%. However, no significant differences were found in the growth efficiency of turtles depending on the source of fat used in the diet [25]. For turtles, as vertebrates with the highest skeletal mass to body mass ratio, it is extremely important to consume adequate amounts of calcium and phosphorus with food. Too low ratio of calcium to phosphorus in the diet can lead to shell malformations as well as slow growth. Other minerals, in particular magnesium, iron, zinc and copper, also play an important role in the metabolism and mineralization of the shell of turtles [8, 9, 17, 19, 41]. You should also not forget about the optimal content of vitamins that are crucial for turtles. Vitamin C, which improves stress resistance, and vitamin A, which can also be synthesized by turtles from β-carotene and other carotenoids (lutein, canthaxanthin), play an important role - therefore the content of these compounds in the food should be taken into account. Under the influence of UVB radiation, vitamin D3 is synthesized in the skin of turtles, but for carnivorous and omnivorous species it should also be supplied with the feed [13]. Unfortunately, despite the key role of vitamin D3 in the process of shell mineralization, the demand for it among turtles is still poorly understood [29].

Nutritional strategies used in the feeding of captive turtles

In breeding practice, two main feeding strategies are used, based on many years of experience of breeders and zoos keeping turtles. The first is the use of unbalanced, raw diets consisting of unprocessed or minimally processed ingredients such as live, frozen or dried foods. Their main purpose is to imitate the natural diet of turtles for which the nutritional requirements have not yet been defined. The second strategy is to use commercial diets that may be considered suitable for most commonly kept species (Emydidae and Pelomedusidae). Another issue to be resolved is the frequency of feeding and the amount of food given to turtles, which in the natural environment is limited by its availability, seasonality, and in case of predatory species also depends on hunting success. These factors lead to periodic starvation stimulating the organism to use up energy reserves, which results in a lower than in captivity growth rate and reproduction than resulting from the genetic potential of these animals. This is the opposite of captivity, where constant access to an optimal diet reveals the full genetic potential. Despite this, limited access to food, and in particular low energy supply, is conducive to maintaining good health and longevity [23].

Semi-aquatic turtles are characterized by the ability to consume large amounts of feed. Red-eared slider (Trachemys scripta elegans) is able to consume food with a weight corresponding to 12% of its body weight during one meal. It has been experimentally determined that for Chinese softshell turtles, optimal feed intake during one meal is 4% of body weight, and higher feed intake may lead to lower digestibility of nutrients [24].

Commercial turtle feed manufacturers often recommend ad libitum or timeframe dosing several times a day. However, restricting the amount of feed, rather than the time it is available, is a more effective solution for preventing overfeeding, obesity and overgrowth.

Unprocessed diets in turtle nutrition

The use of unprocessed diets is considered to be the most appropriate for reintroduction turtles as well as for those used for reproduction in conservation programs. This diet should be as close as possible to what these turtles could obtain from their natural environment. For this reason, in most cases it is based on invertebrates, insects, insect larvae and sometimes small vertebrates. This is to enable an animal to exhibit near-natural behavior during the meal. Many zoos and also many breeders use multi-ingredient foods with solidified gelatin (puddings). This type of nutrition can be classified between the use of unprocessed diets and commercial feeds. Puddings consist of multi-ingredient mixes and are the easiest way to provide turtles with a varied diet based on fresh and frozen products. Their main advantage is the possibility of introducing changes in the composition of the mixture on an ongoing basis, depending on the availability of ingredients and other factors. All ingredients used in the creation of unprocessed diets should be fresh or once frozen.

Table 1. Summary of published studies on the nutritional requirements of young Chinese turtles (Pelodiscus sinensis).

	Unit	Optimum amount	Authors
Protein/energy ratio	mg/kj-1	32 - 36	[44]
Protein	%	39,0 - 46,5	[21,32, 43, 44]
Fat	%	8,8	[18]
Calcium	%	5,7	[17]
Phosphorus	%	3,0	[17]
Methionine	%	1,03	[15]
Methionine	% protein	2,48	[15]
Cysteine	%	0,25	[15]
Cysteine	% protein	0,60	[15]
Taurine	%	0,90	[14]
Magnesium	mg/kg	970 – 980 650 – 750 (diet without phytic acid)	[8]
Iron	mg/kg	266 – 325	[9]
Zinc	mg/kg	35 – 46	[19]
Copper	mg/kg	4 – 5	[42]
β-carotene	mg/kg	49 – 89	[6]
Vitamin C	mg/kg	2500 – 5000	[45]
Vitamin A	mg/kg	2,58 – 3,84	[7]
Vitamin E	IU/kg-1	40	[16]
Vitamin K	mg/kg	16.6	[39]

Too long storage time or repeated defrosting may lead to a reduction in their nutritional value and microbiological contamination. When using solidified and other cold-stored foods, they should be administered thawed to animals at the ambient temperature in which turtles are kept. It should be noted that even in case of raw diets imitating a natural diet, their nutritional value should be balanced. Insects are a rich source of high-quality protein in turtle nutrition. The main advantage of these invertebrates is the possibility of their quick and easy reproduction, and what is more, they are a component of turtle diets in their natural environment [22, 34].

These features make them a very important component of fodder also in the nutrition of hobby bred turtles. Despite the high amount of chitin contained in insect exoskeletons, it is well digested with the use of chitinase and chitobiose produced by the stomach and pancreas of turtles [29]. The disadvantages of using insects in diets are their lower-than-optimal ratio of calcium to phosphorus and the low content of vitamins A and D3, which requires supplementation of calcium and the aforementioned vitamins, however, these deficiencies can be eliminated by feeding insects with high-value foods, the so-called "gut loading". Fish is also a nutrient-rich component that occurs naturally in turtle diets. They are a source of protein with a high content of key amino acids (lysine, methionine, cysteine).

What's more, they are a good source of vitamins, including A, B and D3, minerals and long-chain polyunsaturated fatty acids [40]. Small fish served in full should be fed frequently in most species and be a major part of the diet of typically fish-eating species. The presence of small live fish in aquaterrariums can stimulate turtles' natural hunting reflex. However, too high share of species from the Cyprinidae family in the diet should be avoided, due to the high content of thiaminease, which breaks down vitamin B1 [27].

For many years, the main source of protein in hobby turtle breeding was meat obtained from mammals or birds, which does not constitute a significant part of the turtles' diet in the wild. However, the biggest obstacle in serving is the form (filleted meat), regardless of the species, despite the high protein content, is poor in vitamins and minerals. However, whole carcasses (e.g. mice, rats or chickens) are often used in nutrition of hobby turtles. Bones and the content of the digestive tract of vertebrates are a valuable source of vitamins and minerals [12], and fur and feathers mechanically stimulate the digestive tract of turtles similarly to plant fiber. Among the most frequently used food rodents, adult mice are the most beneficial in the feeding turtles, due to their high mineral content and optimal calcium to phosphorus ratio [27]. If the above-mentioned components are not available or the turtles refuse to eat them, offal, in particular the liver and kidneys, may be a good alternative due to the good amino acid composition and high content of lipophilic vitamins [1]. However, one should be careful when feeding large amounts

crude liver considering the risk of vitamin A overdose [28].

In order to imitate the natural diet and most adult tortoises should eat varying amounts of plant-based foods. In breeding practice, aquatic vegetation such as duckweed (Lemna spp.), potamogeton (Elodea spp.) and coontails/ hornworts (Ceratophyllum spp.) are commonly used in turtle nutrition. Also, algae, especially Spirulina spp., are a good addition to

Tabela 1. Nutrient content in commercial turtle feed as declared by its producer

Nutrient (%)	General feed-stuffs[1]	Age-appropriate feedstuffs[2]		
	All turtles	young	Growth formula	adult
Crude protein (min)	38	39	35	25
Fat (min)	7,4	10	5	5
Fiber (max)	3,4	3	5	8
Calcium (min)	2,2	ND[3]	ND[3]	ND[3]
Phosphorus (min)	1,2	1	1	1

[1]Based on average nutrient content declared in 15 commercial feeds recommended by producers for all turtles

[2]Based on the declared nutrient content of feedstuffs recommended by the producer as age appropriate

[3]ND – no declaration

Fig. 1

Fig. 2

Fig. 3

the diet of turtles, usually available in dried form. The aquatic vegetation can be constantly present in aquaterrariums and consumed by turtles between meals. Fruit can also be included in the diet of some tropical and subtropical species, but in the case of red-eared turtles (Trachemys scripta elegans), this led to digestive disorders [36].

Commercial diets in turtle nutrition

Most of the turtle foods on the market are extruded or high temperature pelleted with a dry matter content of 90%. They are based on components of plant origin, and their exemplary nutritional values declared by the producers are presented in Table 2.

The levels of calcium and phosphorus contained in commercial feeds, despite the correct ratio, are relatively low compared to the recommended ones. At the same time, the declared nutrient contents are very often not precisely defined, but only as minimum or maximum values. Nevertheless, the composition of commercial blends seems to meet the turtles' overall protein and fat requirements.

Compared to the fresh ingredients, the amount of vitamins contained in commercial diets may be partially reduced due to incorrect storage and processing. In practice, the use of commercial feed supplemented with fresh products to ensure an optimal and varied diet [31]. However, the disadvantage of such a solution is the difficulty in determining the exact energy and nutrient supply. Commercial feed consists mainly of components of animal origin, cereals, soybean extraction meal and mineral and vitamin additives. In foods based on plant-derived products, the content of key amino acids could be insufficient for carnivorous species.

Effects of stress, improper diet and environmental conditions, eating stereotypes

Hobby-kept turtles are exposed to many environmental stressors. This problem is often ignored in the belief that they are less susceptible to their influence than higher vertebrates. A very common stress response problem among turtles is anorexia, which may be a consequence of hypothermia, a medical condition, chronic pain or persecution by other individuals.

Juveniles are especially vulnerable, as well as turtles caught from the wild and animals transferred to new surroundings. Very often, due to poor acclimatization, they refuse to eat.

In the case of adults, if this situation persists for more than two weeks, it may be interpreted as a sign of disease or a sign that the environmental conditions are abnormal. The reason for this, especially in the case of young and naturally derived animals, may be an unacceptable form of food, e.g. pellets. Long-term nutrient deficiencies can lead to progressive wasting of the body (cachexia). Combating both anorexia and cachexia should focus on improving environmental conditions and increasing the energy of the diet. In order to avoid hypophosphatemia and hypocalcaemia, the treatment of animals suffering from anorexia and cachexia should not be too rapid, and the energy level in the diet should be increased by 10-50% only if the response to therapy is correct.

All the above-mentioned factors often slow down growth, however, turtles show the ability to compensate for growth while providing a balanced diet and supplementing deficiencies [43]. In many cases, turtle owners use only one or more types of feed for many years without diversifying their pupils' diets. This not only leads to metabolic disturbances, but also causes a nutritional stereotype of refusal to eat food other than that which the animal has been fed for years. Turtles definitely prefer the food they are used to over the newly introduced [5]. In the absence of acceptance of nutritional changes, an alternative may be to introduce live food into the diet to stimulate feed intake and enrich the turtles' diet.

The problem of obesity in turtles

Another very important problem in hobby turtle breeding is the positive energy balance. Energy consumption higher than the expenditure associated with metabolic changes accelerates growth and has a positive effect on young animals, while in the nutrition of adult turtles it may lead to obesity, defined as the accumulation of excessive amounts of adipose tissue in the animal's body [12]. The most predisposed to obesity are species with a low-mobility lifestyle, such as the common snapping turtles (Chelydra spp.), common musk turtles (Sternotherus spp.) and African side-necked turtles (Pelomedusa spp. And Pelusios spp.). A good way to monitor the fatness of animals is to regularly determine their BCS (Body Condition Score) [35]. This index is assessed mainly on the basis of the carapax length to body weight ratio, however, a visual assessment should also be performed [20, 35, 40]. The excess of adipose tissue is stored mainly in the body cavity and internal organs, which may lead to serious disorders of their functioning [10]. On the basis of research conducted among Pelomedus spp. and Pelusios spp., up to 22% of hobby-kept turtles are overweight or obese [35]. Treatment of

Fig. 4

Fig. 5

Fig. 6

obesity should mainly focus on limiting the supply of energy in a food ration to not less than 60% of the initial value, and weight loss should not be greater than 0.5 to 1% per week [27]. In practice, following the rules related to the appropriate feeding frequency seems to be the best method of obesity prevention. It is assumed that newly hatched turtles should receive food 6 times a week, individuals from 6 months to two years of age 3-4 times a week, and older turtles up to 2 times a week. Additionally, turtles should be stimulated to reproduce seasonally by manipulating environmental factors, because the lipogenesis that occurs then, which is part of the mechanism that prepares for follicle-genesis, is an important factor preventing excessive fatness [10].

Summary

Despite increasing scientific knowledge in the field of semi-aquatic turtles feeding, due to the lack of proper nutritional guidelines for most species, the main sources of information on proper nutrition is still the knowledge and experience of breeders. The composition and form of the diets used should be verified by long-term experiments including digestibility experiments conducted at different stages of turtle life. Nevertheless, the basic principles of nutrition may be:

1. The need to provide a varied diet as close as possible to what the animal eats in the natural environment, ensuring optimal growth and mineralization of the skeleton.
2. Proper use of commercial feed ensures the right amount of nutrients, however, overfeeding should be avoided and the type of formula used should be adapted to the needs of a given species.

Despite the lack of specific nutritional requirements for individual species, one can successfully follow the recommendations developed for farmed species.

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From coprophagia to longevity?

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The issues of eating disorders are a serious challenge for a veterinarian and a very big problem for the animal owner. The most common ones are: lack of appetite (anorexia), excessive appetite (polyphagia) often complicated by swallowing air (aerophagia) and distorted appetite (pica).

Coprophagia is also a behavior typical of wild animals, but undesirable in companion animals. This term comes from a Greek words kopros – faeces and phagein-eat, and defines the tendency of animals to eat their own (autocoprophagia) or someone else's stool. The problem is usually confined to one species, but also extraspecific coprophagia is observed, associated with eating faeces of herbivores (ruminants, horses, rodents) and even carnivores (cats). Coprophagia is associated with animals kept in groups, where the risk of its occurrence is 33% higher than in a single-dog farm (American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders 2013. 5th ed. Arlington)

Autocoprophagia, on the other hand, is most commonly observed in puppies, and its cause is partly attributed to the natural curiosity of a properly developing dog that learns about its surroundings. At the same time, the lack of sufficient stimuli from the environment, the limited number of toys, and the lack of contact with other individuals of its species and with humans make the dog shift its interest to objects in the immediate vicinity. They begin to nudge the bowl and pour out the water, nibble the kennel, tear up the lair, play with the faeces and even eat them. In the absence of the owner's reaction, which should consist in enriching the animal's surroundings and establishing closer contact with it, the dog perpetuates the behavior that it invented, and undesirable for humans behavior. Coprophagia in puppies may also "imitate" the behavior of the mother who eats the faeces and cleans her lair. Unfortunately, it may also result from the lack of hygiene in the box and / or improper upbringing methods related to punishing the dog for taking care of its physiological needs at home. In this case, the dog eats its faeces, in fear of punishment. And if by acting in this way they avoid punishment, they become convinced that this behavior is correct and therefore they repeat it. It was also noticed that the lack of proper hygiene in the boxes promotes the coding of food consumption in dogs conditioned by the smell of faeces, which may also lead to coprophagia in the future (Hart, 2011; Hart et al. 2018).

The dog is a herd animal and coprophagia is a behavior associated with its "protection". Often in the case of group keeping of different aged animals, it turns out that younger animals eat the faeces of older and / or sick dogs. This is due to the instinct to protect the herd from predators, which focuses on finding weaker, old and / or sick animals that are easy prey for them. Another explanation is the ancestral tendency hypothesis to keep the area around its habitat clean. According to her, animals eat feces in order to remove the source of possible intestinal parasites. It is significant that dogs eat the so-called fresh faeces, i.e. not older than 2 days, in which the invasive form of the parasite did not develop (Hart, 2011; Hart et al. 2018).

The aforementioned notion of a herd also raises the hypothesis that the lack of proper emotional contact with the owner forces the animal to dramatically desire to attract the attention of its guardian, even if it is tantamount to an imminent punishment. Long-term stress, anxiety, isolation, limitation of the free range, etc. are factors that violate the emotional comfort zone of an animal may lead to a number of disorders, including coprophagia. The lack of sufficient food, water, or even prolonged starvation of the dog forces them to look for food, most often in places where municipal waste is collected. Nevertheless, with the simultaneous isolation and lack of access to any food source, faeces are eaten and then items available in its surroundings. And in this case coprophagia or a distorted appetite is nothing but a fight for life, which should never take place in the human world.

Coprophagia is also a problem for hyperactive and overly voracious dogs, known as "greedy eaters". And it was the research on this group that allowed the identification of dogs in which coprophagia has never been observed, and their behavior in relation to faeces was even described as aversion (Hart et al. 2018).

The causes of coprophagia were also searched for in the diet, and most of all in its improper balance. Failure to cover the nutritional needs of animals, low-quality food, difficult to digest, long-term monodietetical deficiency, etc. reduces the absorption of nutrients and can lead to malnutrition. In the studies summary on coprophagia, occurring in rodents and other animal species, including primates, in natural conditions and in zoos, it was found that this disorder is a way to replenish substances produced by the microflora of a healthy individual. Similar results were obtained in puppies eating their mother's faeces in order to obtain vitamin B12, a metabolite of her properly developed intestinal microflora (Rosenberg et al. 2016; Combes et al. 2014; Danchin et al. 2017).

Eating faeces is also observed in the course of diseases of the gastrointestinal tract, mainly of the pancreas. This organ is involved in the digestive process and indirectly absorbing most of the nutrients. It also secretes a number of antimicrobial factors that determine the proper state of the microbiome in a healthy animal. Deficiency or lack of enzymes and other components of pancreatic juice can lead to digestive, absorption and microbial disorders. Incorrect amount and type of intestinal flora favor the growth of potentially harmful bacteria, weakening of the intercellular connections of the gastrointestinal epithelium, disturbances in colonocyte nutrition, and impaired cellular and humoral immunity (Honneffer et al. 2014).

As the potential of a healthy individual's normal microbiome is enormous, as indicated by a very large gene pool (Simpson et al. 2002), the topic of its transplantation and use in sick animals has emerged. Inoculating the correct microflora is not a new method. The first description of the use of faecal suspension in healthy people to treat food poisoning, "fever disease" ("Wen Bing"), and typhoid fever was found in Hong Ge's 4th century AD book of emergency medicine. (Zhang et al. 2018). In Europe, the first publications related to the effectiveness of using "fecal enemas" in people with severe pseudomembranous

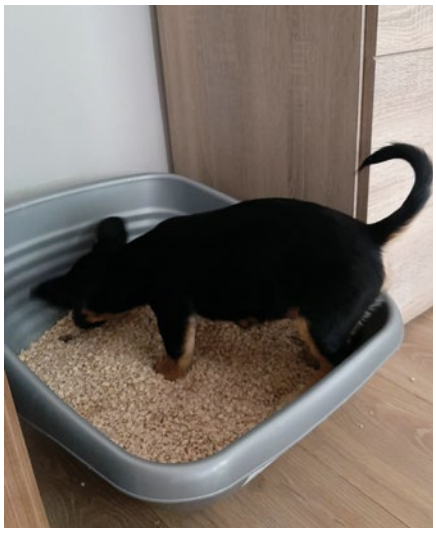

Fig. 1

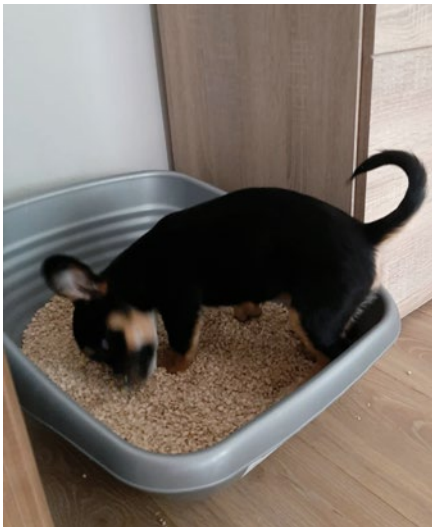

Fig. 2

Fig. 3

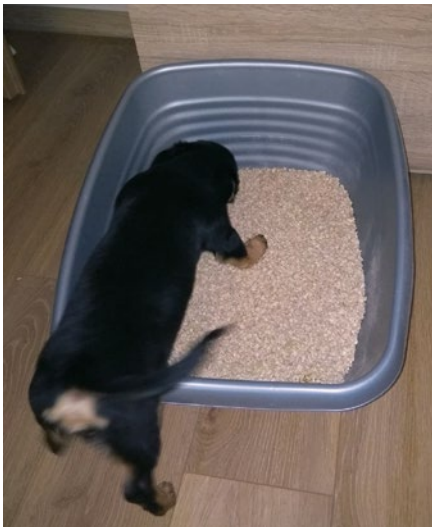

Fig. 4

colitis appeared only in 1958. (Eiseman et al. 1958). And the intestinal microflora transplantation (FMT - Fecal microbiota transplantation) from a healthy person was included in the treatment guidelines for recurrent Clostridium difficile infection in 2013 (Surawicz et al. 2013). At present, FMT seems to be an effective method of reconstructing the microflora of patients with recurrent gastrointestinal diseases (mainly Clostridium difficile infection, inflammatory bowel disease - IBD), diabetes, liver cirrhosis or diseases resulting from the disturbance of the interaction of the "gut-brain" axis (Zhang et al. 2018).

In the case of animals, the first publications concerned ruminants with a diagnosed lack of appetite and / or atony of the gastrointestinal tract, which were administered the rumen content obtained from a healthy animal. Subsequent reports talked about the effectiveness of intestinal microflora transplantation in terms of circoviral prophylaxis in sows, parvovirosis therapy in puppies and colitis in horses (Niederwerder et al. 2018). The use of transplanted microflora has also found application in the treatment of persistent, antibiotic-resistant infections caused by Clostrodium perfringens in dogs (Murphy et al. 2014). In cats, the effectiveness of this type of therapy in the case of chronic ulcerative colitis has been described (Furmański et al. 2017). Nevertheless, it should be noted that the use of FMT in the treatment of gastrointestinal diseases in animals is at its early stage of research. There is also very little scientific information about its impact on most parenteral diseases, such as neurological behavioral disorders, respiratory diseases, cancer and "geriatric" diseases.

Although FMT is at an early stage in veterinary research, the work so far has proved that it is a promising tool for practical use (Niederwerder et al. 2018).

MT is not the only method of changing the gastrointestinal microflora. A much simpler way is to administer probiotics orally, often in combination with prebiotics. Very interesting research was published by Xu et al. in 2019, who gave 90 dogs a supplement composed of 3 strains of bacteria: Lactobacillus casei Zhang, L. plantarum P-8 and Bifdobacterium animalis subsp. lactis V9. Dogs, depending on their age, were assigned to the following groups: older animals (5-13 years old), adults (from 9 months to 24 months) and growing animals (under 8 months). All were administered the formulation at the dose of 2 x 10^9CFU / g for 60 days. After the end of the experiment, it turned out that the gastrointestinal microflora of the older dogs on day 60 of the study reflected the microbiota composition characteristic of younger dogs. In older animals, after the introduction of probiotics, an improvement in appetite and balance of body weight was observed, resulting from better use of nutrients. There was also a decrease in the concentration of inflammatory factors with a simultaneous increase in immunity. All changes were attributed to the restoration of the microbiome following the introduction of probiotic bacterial strains into the dog's diet (Xu et al. 2019).

The aging of the organism and its microflora is related to, inter alia, an increase in the level of inflammatory factors and a decrease in immunity (Smith et al. 2017). It is believed that the above changes may reduce the survival time of the animals. So, if we renew and / or strengthen the microflora of the digestive tract, will we slow down (inhibit) the aging process by using the body's natural striving to maintain / maintain immune homeostasis? (Guo et al. 2014). Perhaps the whole theory of longevity is based on the preservation / maintenance of normal gut microflora, and the life of the macro-organism is much more dependent on bacteria than we have ever thought.

Regardless of how the gastrointestinal microflora is changed (faecal suspension transplantation / probiotics / others), coprophagia in companion animals is highly undesirable behavior. Additionally, it can be a source of parasitic infections and even poisoning. The literature describes a case of carprofen poisoning in a young dog resulting from coprophagia (Hutchins et al. 2013). The owners had two dogs - an older one who regularly received a non-steroidal analgesic and a young female, a crossbreed under 1 year of age. Both dogs shared the same runway, and the younger animal tended to be coprophagic. At one point, the owners noticed the younger dog's decreased well-being, increased thirst, and urinary incontinence.

Carprofen was found in blood serum and liver biopsy samples. The dog survived thanks to the quick reaction of the carers, the implementation of appropriate treatment and behavioral therapy. This case shows the serious consequences of eating excrement and that this problem should not be underestimated. Therefore, despite the fact that coprophagia results from the behaviour to a large extent, that is natural for the world of wild animals, for safety reasons it is an undesirable phenomenon in the case of animals accompanying humans. In its treatment and prevention, one should use appropriate behavioural tools, a proper diet and basic rules of maintaining hygiene in the dog's environment. At the same time, taking into account the potential contained in the microbiome (the theory of longevity?), it should be used in a properly scientifically documented manner in accordance with the medical and veterinary art.

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Nutrition and supplementation of reptiles

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Reptiles are a very diverse group of cold-blooded vertebrates. They are animals living in environments ranging from desert to aquatic ones, including predators, insectivores, omnivores and vegetarians. They differ in shape, size (from a few cm – Lygodactylus sp. gecko – up to several meters - saltwater crocodile), lifestyle and nutritional requirements. In this article, I will introduce you to the diet of the most popular household species.

Turtles

Like other reptiles, turtles live in a diverse environment. Very generalizing, it can be roughly said that aquatic turtles are predatory and terrestrial turtles are herbivorous. However, it should be remembered that depending on the habitat of these reptiles and the climate, their diet is very varied. In the case of tropical species that are active all year round, the composition of the diet varies according to the season. The food preferences of young and adult individuals may also differ.

Tortoises / terrestrial turtles

One of the most popular household terrestrial turtles are steppe turtles living in nature, among others. areas of Kazakhstan, Uzbekistan and Turkmenistan, as well as species of European turtles inhabiting the countries of the Mediterranean basin – i.e. Greek, Mauritanian and surrounded by coasts. All of these species share similar food preferences. In places inhabited by the described species, there is only an abundance of fresh food for these species in spring. These are all kinds of herbs, grasses and flowers, and in mid-June the vegetation begins to dry up. During the growing season, reptiles consume nearly 300 different species of plants. The diet of these animals is varied, but low in protein, fats and simple sugars, and rich in dietary fiber. In terrarium breeding, we should give turtles the most diverse food, based on meadow plants, such as: dandelion, plantain, broadleaf plantain, nettle, white and purple nettles, chickweed, shepherd's purse, clover, yarrow. The diet should be supplemented with flowers: daisies,

Fig. 2

dandelions, clovers, pansies, mallow, hibiscus, marigold, nasturtium, centaury. Fresh leaves, sprouts and flowers should dominate the diet in the spring and summer period. In the second half of summer, one should start mixing fresh food with dried herbs and hay to increase the fiber content of the diet and start preparing the turtles for wintering. In the case of these species, the administration of root vegetables such as carrots and fruit should be avoided. The high sugar content of these products enhances intestinal fermentation by changing the pH of the chyme. This, in turn, may lead to diarrhea, flatulence and disturbances of the intestinal microflora, especially excessive proliferation of protozoa, and, consequently, deterioration of the animal's condition. The once widely used diet based on lettuce, apple, banana, carrot and white cheese, although readily eaten by turtles, in the long run leads to irreversible metabolic disorders and damage to the kidneys and liver. These products can only be eaten occasionally by these reptiles. For several years now, leopard turtles from South Africa, where they live in the savannas, have been gaining popularity due to their beauty. These turtles are quite large and are the fourth largest tortoises in the world. Adults depending on the subspecies, they reach the size of 46 cm to even 70 cm in length. Even larger specimens are occasionally found. In the case of these turtles, it is quite difficult to compose a proper diet, and thus ensure proper growth. In nature, these animals feed on what they find in the hostile, dry climate they inhabit. They are mainly succulents, prickly pears and dry grasses. In home conditions, the basis of the diet should be fresh grass 50-70% and the previously mentioned meadow plants recommended for steppe and Greek turtles. Large hay can be fed with herbs of good quality. In winter, we can use: chicory, arugula, lamb's lettuce, radish, herbs in pots, e.g. thyme, basil, oregano, mint, coriander (aromatic plants are sometimes eaten depending on individual preferences), planted at home: marigolds, pansies, alfalfa. The diet can be supplemented 2x a month with pumpkin, squash, zucchini and fresh cucumber. Aldabra giant tortoises, such as the leopard tortoise, require such a restrictive and poor diet as to ensure even and proper growth. In individuals fed with high-protein food and overfed, pyramidization and other distortions of the carapace (the upper part of the carapace) and strong decalcification often occur. In the case of this species, one cannot forget about the regular daily supplementation of calcium in growing individuals – that is, for the first 6-8 years of life.

Semi-aquatic turtles

The most popular, despite the ban on trade in them for several years, are North American red-eared sliders/terrapins, cumberland sliders and river cooters. Currently, Asian turtles are slowly taking their place. The listed species are omnivorous reptiles. In their youth, the basis of their food are aquatic invertebrates: tubifex, bloodworm, daphnia (water fleas), cyclops, but also snails. The diet of adults becomes more varied, turtles eat aquatic plants, which, depending on the season, may constitute 20-40%, and the menu, invertebrates and small fish. Occasionally they eat the flesh of warm-blooded vertebrates (birds or mammals), usually when they find carrion in the water. Young animals should be fed 1 to 2 times a day with the most varied food, because they are quite sensitive to vitamin A deficiency. Feeding only dried gammarus and dried smelt can lead to deficiencies quite quickly. In the case of adult animals, food is given every 2-3 days. Turtles, especially aquatic turtles, learn to beg for food, similarly to dogs, which very often leads to obesity in these reptiles.

Fig. 1

Lizards

Lizards kept in terrariums can be divided into several groups due to their diet. The most common species we encounter are insectivorous species, such as agama, common leopard gecko, anolises (Carolina anole) or small species of Varanidae. The diet of these lizards should consist of different species of insects. And here, as in the case of turtles, the more varied, the better. The basis should be different species of crickets and cockroaches, and supplements should be made of mealworms, superworms, locusts, and wax moth larvae. In the case of central bearded dragons, the addition of plant food is important, especially in adults. Basil, dandelion, lamb's lettuce, grated carrots are great, served twice a week. It should be remembered that insects do not have a calcium skeleton and are also a deficient food. They contain a lot of phosphorus and quite a little calcium, which is why insectivorous lizards should be given calcium supplements. In the case of nocturnal animals that are not exposed to UVB lamps, it is important to choose calcium with the addition of vitamin D3.

Typical herbivorous lizards are green iguanas and Uromastyx, although insects may initially dominate their diet, especially

Fig. 3

Fig. 4

in the case of young and growing individuals. The diet of adults is similar to that of tortoises. Fresh plant food is given every day, and it is worth for adult individuals to fast once a week. The basis of the diet in the spring and summer season can be wild weeds, in addition, we provide farm plants such as arugula, endive, Chinese cabbage, sprouts. One should make sure that leaves and flowers constitute the majority of what we offer to reptiles, vegetables should be a minority, and fruit only a rare delicacy. In addition to fresh food, we also serve dried herbs, you can successfully use sets of dried herbs for lizards and tortoises or those intended for rodents. It is important to remember about a very important element of the Uromastyx diet, which are mixtures of dry seeds, i.e. lentils, peas, corn, rice, soybeans and sunflower seeds.

Fruit geckos, such as felsumas, or Crested/eyelash gecko, apart from insects should have the addition of fruit mousses and honey in their diet, or specially composed pulp intended for these species. In the case of these lizards, the preparation of ready-made mash is much more convenient, and also provides access to a properly composed mixture. On the Polish market, there are instant foods available from several producers, dedicated to this group of reptiles.

Feeding varanidae can be a challenge. They are unconditionally predatory animals, however, depending on species and size, their diet is dominated by insects and other invertebrates, eggs, and vertebrate animals of various sizes, including fish. A common mistake made in the nutrition of the most popular species, which is the Savannah monitor, is to feed offal and chicken breast and overfeed these animals. As a result of the administration of pure meat, without ballast material, secondary nutritional hyperparathyroidism develops, and as a result, the so-called Metabolic Bone Disease - MBD. Sick animals are unable to move around and eat, often develop pathological bone fractures and die if left untreated. The diet of young varanidae should be dominated by various insects, snails and eggs, in older animals we include rodents in the menu. It should be remembered that we do not feed dragons every day. Adults should be fed 1-2 times a week, depending on the size of the meal, and young ones every 2 days.

In the case of turtles and lizards, supplementation is a very important element of proper nutrition. The element deficient in a large number of these captive reptiles is calcium. Most of the foods we offer reptiles have an excess of phosphorus in relation to calcium, which results in a relative or absolute deficiency of the latter. For this reason, calcium in the form of carbonate or gluconate should be supplemented in the diet of lizards and turtles. Calcium should be used with each meal in young, fast-growing animals, as well as in breeding females during the breeding season. In the case of adults who have completed their growth, it is sufficient to administer calcium supplements twice a week. As mentioned earlier, when taking care of nocturnal lizards, we use calcium with the addition of vitamin D3. There is a large offer of calcium preparations on the market, cheaper and more expensive. Which one to choose? Well, you should look for products containing micronized calcium, which is much more easily absorbed by the body and better absorbed in the intestines. Often the recommended diet is a natural source of the mentioned element, however, in the case of young animals or those suffering from MBD, it cannot be the only one, because the calcium carbonate contained in it is relatively poorly absorbed from the gastrointestinal tract, especially if it is administered in the form of pieces and not powdered. It should be remembered that there are vitamin and mineral preparations available on the market, which also contain calcium in their composition. Unfortunately, they cannot be an alternative to a pure calcium preparation because the content of this element is too low. Vitamin and mineral preparations should be added to the food once a week as a supplement to other micro and macro elements and vitamins. In the case of chameleons, vitamin A supplementation is very important. These reptiles are sensitive to the deficiencies, which usually result in death in young animals. It is important that mainly breeding females and young animals should be supplemented with vitamin A in a dose of 1000 IU/kg every 2 weeks.

Snakes are reptiles with completely different food preferences, and therefore rarely suffering from deficiencies. Snakes are fed mainly by rodents and, less frequently, by birds (day-old chickens, quails, hens). They eat their prey entirely, including hair or feathers, the contents of the digestive tract and bones. This provides them with a complete balanced diet. But ... Well, it must be a but. Today, we are turning away from feeding snakes with live food for ethical and humanitarian reasons. They are given the so-called frozen foods. These are the above-mentioned feed animals, but previously slaughtered and deep-frozen. Long-term storage of frozen food reduces its value. Some vitamins, including vitamin C, are decomposed. In snakes, fed with long-term frozen food, vitamin C deficiency may appear, manifested by disturbed collagen synthesis and, as a result, skin thinning and cracking. Therefore, once every 3-4 feedings with frozen food the victim should be injected with a portion of the vitamin and mineral mixture intended for predatory reptiles.

Nutrition and supplementation of reptiles is quite a difficult topic, it requires very good knowledge of the requirements of the species. In the case of turtles and lizards, the key to success is to use the most balanced and varied diet possible, as well as not overfeeding the animals.

Fig. 5

Intestinal Cat – dry food diet in gastrointestinal diseases – searching for an alternative to wet food diet

Cats are absoulte carnivores, predators with a highly preserved hunting instinct, which, in addition, obtain most of their water from food. A can, sachet or tray is a suitable option for ready-made foods, which is also convenient for the carer. Most cats prefer wet food, but there are also some that only eat dry food. This form, or rather - mixed feeding (wet + dry food), is also chosen by professionally active pet owners who do not want to leave their pets without food, while they work away from home.

The same is true for sick animals, especially those with chronic gastric disorders. Then it is worth having an alternative to an easily digestible moist diet and such an option can be the Intestinal Cat dry diet. Its greatest advantage is high digestibility and caloric content (420 kcal / 100 g), appropriate protein content from an animal source and relatively low-fat content (about 15%).

The dry diet/food also has an ingredient, carbohydrates, which is rated very poorly by most cat owners. And which, due to the production process – extrusion, cannot be avoided. For clarification purposes, it is worth noting that the dry food production process also improves the digestibility of carbohydrates. Additionally, the problem with carbohydrates in dry food/diets is not due to the cat's inability to digest them, but to their inability to use them. In cats, the activity of enzymes responsible for carbohydrate metabolism is low, because proteins have always been the source of endogenous glucose (energy). And the cat's genetic material, which encodes the activity of certain enzymes, has not undergone significant changes in the process of domestication, unlike the dog's.

Scientific studies, based on the performed tests, assessing the digestibility of various carbohydrate sources, indicated rice as the best digested and used ingredient. Carbohydrates also include fiber, which is the worst digestible component and can reduce the digestibility of other nutrients. Therefore, if the product has a high protein and fat digestibility and a low fiber content, it can be expected that the digestibility of the carbohydrates will also be high.

An appropriate test was performed on adult cats to confirm the digestibility of the Intestinal Cat dry diet. The obtained results (Table 1) indicate high digestibility of individual components and the possibility of using the Intestinal Cat diet in digestive and absorption disorders as well as exocrine pancreatic insufficiency. This diet is also suitable for convalescence and can be used in kittens.

To sum up, the Intestinal Cat diet is a product very well accepted and assimilated by cats and may constitute an alternative or a supplement to the Intestinal wet diet or be the basis for dietary management in the prviously indicated disorders in cats.

Table 1. Results of the Intestinal Cat diet digestibility test

Digestibility (%)	Intestinal Cat	Recommended by COMMISSION REGULATION (EU) 2020/354 of 4 March 2020
Protein	86,8±1,43	≥ 85 %
Fat	92,0±0,51	≥ 90 %
Carbohydrates	87,3±1,16	≥ 32 %

The practical importance of information related to the digestibility of the Intestinal Elimination diet

Diseases of the gastrointestinal tract in dogs may be transient gastric problems, associated with nutritional errors, or serious chronic disorders leading to severe malnutrition. Therefore, appropriate (and promptly undertaken) medical and veterinary treatment is of great importance. In addition to pharmacotherapy in gastrointestinal diseases, it is recommended to introduce an easily digestible diet. This type of food belongs to the so-called special dietary needs. In this case, its task is to compensate for and/or limit disturbances in digestion and intestinal absorption, support lipid metabolism in the event of hypercholestrolemia, and support the recovery process, returning to proper nutrition. All features of an easily digestible diet recommended in the above-mentioned cases are legally regulated by Commission Regulation (EU) 2020/354 of March 4, 2020 and listed in the points below:

1. High digestibility (crude protein ≥ 85%; crude fat ≥ 90%; carbohydrates: ≥ 32%)
2. Increased level of electrolytes (sodium ≥ 1.8%; potassium ≥ 0.6%)
3. Limited level of fat (fat ≤ 110 g/kg of complete feedingstuff with a moisture content of 12%)
4. High energy with high protein content (caloric content ≥ 3 520 kcal and crude protein content ≥ 250 g/kg of complete feedingstuff with a moisture content of 12%).

Diet is a special-purpose product, therefore the decision to introduce it into therapy, the duration of its use and discontinuation of its administration should always be consulted with a veterinarian.

Which information from the indicated above is mentioned on the label, and for which can we ask the manufacturer of the diet?

All mandatory information regarding the analysis of ingredients and the nature of the diet should be included on the product packaging label. And hence, on the front of the Intestinal Elimination package, there is information about the digestibility of the diet under the term - "digestibility", and additional information related to the possibility of its use as an elimination diet – "elimination" due to the use of only one protein source – "monoproteins" (Fig. 1). On the back of the label, under "Analytical Ingredients", you will find all the required nutrients for an intestinal diet, i.e.: raw protein: 30%; crude fat: 10%; crude fiber: 2%; crude ash: 8.5%; calcium: 1.80%; phosphorus: 1.20%; potassium: 0.50%, sodium: 0.20%, magnesium: 0.12%, chlorine: 0.27% and its calorific value: 360 kcal / 100 g. And from the above data we can conclude that the indicated parameters are recommended values for an intestinal diet. In the case of the Intestinal Elimination product, all the requirements of an easily digestible diet included in the EU Commission Regulation were met. The digestibility of individual nutrients in the intestinal diet is of particular importance. High digestibility translates into high absorption and use of substances with minimal expenditure on the part of the body. This is extremely important, as it allows you to speed up the recovery and recovery / convalescence / weight recovery process with no or minimal energy consumption. The information on the digestibility of the Intestinal Elimination diet on the front of the package was confirmed by an appropriate digestibility study. The test was carried out on the species for which the diet is intended, i.e. dogs, in accordance with the standard procedure related to the performance of this type of test and maintaining animal welfare.

The obtained results (tab. 1). indicate a sufficiently high digestibility of all components of the Intestinal Elimination diet for dogs. They comply with the recommendations indicated in the EU Commission Regulation 2020/354 of March 4, 2020, relating to special purpose feed.

Table 1. Monoprotein diet
The results of the digestibility test of the Intestinal Cat diet.

Digestibility (%):	Intestinal Elimination	Recommended by COMMISSION REGULATION (EU) 2020/354 of 4 March 2020
Crude protein	86,4±1,90	≥ 85 %
Crude Fat	94,2±1,17	≥ 90 %
Carbohydrates	87,6±1,90	≥ 32 %

Summary:

Declaring a special-purpose product with specific features and a health-promoting effect is associated with its legal authorization and confirmation of its value in appropriate tests. The Intestinal Elimination Diet for Dogs is a very good example showing how to provide the consumer with legal and confirmed information in a simple and legible way.

Assessment of dry food quality on the basis of the analysis of the composition, balance and digestibility of adult dog food Raw Paleo Adult Turkey

Ready-made foods (dry or moist) are products that are increasingly used in the daily nutrition of dogs and cats. Their absolute advantage is a precise balance, adequate to the nutritional needs of animals and there is no need for additional supplementation when using complete feedstuffs. The undeniable advantage is also the convenience of preparing and serving a meal (opening the package and administering a dose) and the possibility of taking food or buying it (available in different countries) when traveling with an animal. Surveys conducted among dog and cat owners showed that the owners pay the most attention to the raw materials used in the production of the food (approx. 80% of respondents), the functionality of the ingredients (approx. 79%) and the type and content of protein (approx. 66-69). %) in food. Less than 42% of dog and cat carers perceive the importance of feeding "grain-free" or "gluten-free" products (Table 1).

The composition of the feed, the origin of the raw materials used in its production, the nutritional balance, the added nutrients and functional substances are important elements influencing the perception of its quality. As elements that must be placed on the product label, it is possible to predict the amount of nutrients consumed by the animal. Nevertheless, to be sure to what extent the body uses them, digestibility studies should be carried out. These are feeding tests carried out on the species (dog / cat / other) for which the food is intended. They consist of a part involving animals (overfeeding with a test product, assessment of the consumption, body weight and condition of the dog, collection and assessment of faeces) and a laboratory part (chemical analysis of food and faeces).

It is not compulsory to carry out digestibility tests on pet food, but it is nevertheless one of the simplest and most reliable methods of assessing digestibility. Digestibility should also be considered as one of the parameters in assessing feed quality. High digestibility of the product indicates its high quality and the appropriate selection of raw materials depending on the species for which it is intended. Hence, in the case of carnivorous animals, the most digestible protein is protein of animal origin (Clauss et al.), Therefore, meat raw materials are used in the production of feed. And because the most element difficult to digest in the food for predators is fiber, food producers limit its content to the amount necessary for the proper functioning of the digestive tract. It should also be taken into account that the effect of appropriately selected production process (temperature, time, etc.) influences the digestibility of nutrients in the final product. However, it can be concluded that products with high or sufficiently high digestibility for the species are the best quality products under the above-mentioned conditions.

Below, we present how to evaluate the assessment of Raw Paleo Turkey Adult Dry Dog Food, prepared from 80% turkey based on composition data, chemical analysis, added nutrients per kilogram and digestibility tests.

Analysis of the composition of feed based on the values given on the label with regard to dietary additives per kg

Complete and balanced food for adult dogs, consisting of: turkey (80 g) including: freshly prepared turkey (50 g); dried turkey (23.5 g), turkey fat (4.5 g), turkey sauce (2.0 g); sweet potatoes (26 g), potatoes (25 g), freshly prepared carrots (15 g); salmon oil (3 g); minerals, vitamins, green New Zealand mussels (0.25 g); borage seed oil (0.15 g).

The balance of the feed is settled by introducing additives indicated in the section on dietary supplements per kilogram. These include: Vitamin A (Retinyl Acetate) 14,425 IU; vitamin D3 (cholecalciferol) 2,000 Iu; vitamin E (alpha tocopherol acetate) 95 IU; zinc (zinc sulfate monohydrate) 50 mg; iron (iron II sulfate monohydrate) 50 mg; manganese (manganese sulfate monohydrate) 35 mg; copper (copper II sulfate pentahydrate) 15 mg; iodine (calcium iodate anhydrous) 1 mg; selenium (sodium selenite) 0.3 mg.

The composition shows that 80% of the raw material contained in the recipe is turkey, in various forms: freshly prepared, dried, fat or turkey meat sauce. The high content of this raw material indicates the willingness to balance as many nutrients as possible from an animal source. It should be taken into account that turkey is not only protein, amino acids, fat (fatty acids), but also vitamins, mainly from group B (niacin, vitamins: B2 and B6) and minerals (mainly: iron, zinc and phosphorus). The use of the above nutrients from animal raw materials is the most natural and best digestible food source for a relatively carnivorous animal. Additionally, the addition of freshly prepared meat to the composition has a positive effect on the taste of the food. At the same time, if we limit the protein source to only one in a complete product, in order, inter alia, to reduce the risk of allergy to other proteins, than used, its composition must be precisely balanced. It should be mentioned that in prescription it is much more difficult to arrange and requires higher financial outlays in the production process.

Raw Paleo Adult Turkey composition also shows that the fat and fat-soluble essential fatty acids and vitamins are exclusively derived from turkey fat, salmon oil and borage seed oil. To obtain the amount of vitamins A and D appropriate to the needs of an adult dog, the recipe was supplemented with retinyl acetate and cholecalciferol, which are declared in the "dietary supplements per kg" section. All dietary additives indicated on the label are listed by name, with a chemical name or group number assigned by the European Union Register of Feed Additives.

A naturally rich source of Omega-3 polyunsaturated fatty acids: eicosapentaenoic (EPA) and docosahexaenoic (DHA), shown in the composition of the feed, is salmon oil enriched with New Zealand mussels. Omega-3 acids are of great importance and have multidirectional action, from anti-inflammatory in terms of joint protection and therapy, to the effect of regulating appetite in the central nervous system.

Although carbohydrates are not listed in the dog's nutrient tables by FEDIAF, AAFCO, or NRC etc., they play an important role as a source of easily digestible energy and fiber. Their addition is also of technological importance, ensuring the appropriate cohesiveness of the granules. The most common source of energy that is easily digestible for a dog is white rice. Nevertheless, if there is a need to keep a grain-free recipe, this function is performed by potatoes or sweet potatoes. The digestibility of starch from the above sources is similar. Carbohydrates are also fibers (potatoes, sweet potatoes, carrots), which perform a number of functions in the body, from stimulating the digestive tract to prebiotic activity, which is also gaining importance in animals. Properly selected fiber helps to shape the intestinal microflora, nourish and regenerate epithelia, reduce insulin resistance, regulate appetite and stimulate immunity.

The ingredients, according to the legal requirements, are arranged according to their decreasing amounts in the feed recipe. In line with the concept of mono-protein feed, turkey is used as a protein source. Raw Paleo Adult Turkey also complies with the "grain-free" product clause. The feed is a complete and balanced product, which is confirmed by the composition, chemical analysis and the information contained in the dietary supplements per kilogram section. As a result, Raw Paleo Adult Turkey can be the only food for adult dogs from the age of 1.

Summarizing the analysis of the composition / dietary additives per kg of Raw Paleo Adult Turkey, it can be said that they meet the requirements set by the consumer.

Table 1. Criteria for the choice of feed for dogs/cats (Flores, PET food forum 2017)

What's most important when deciding on a feed?	Dog carers	Cat carers
Providing your pet with more natural nutrition	84%	84%
Raw materials used	80%	81%
Food with the functional properties my pet requires	79%	79%
No artificial colors or additives	72%	71%
Type of protein used	69%	67%
High protein content	68%	66%
Ingredients from sustainable farming	65%	62%
Possibility to choose various flavors of the product	56%	64%
Price per kilo	52%	50%
Brand	44%	42%
Country of production	42%	41%
Grain-free	41%	38%
Gluten-free	40%	37%

Table 2. Digestibility of Raw Paleo Adult Turkey food ingredients obtained from a digestible test on adult dogs.

Digestibilty (%):	Average	SE
Sucha masa	79,4	1,57
Materia organiczna	84,6	1,15
Crude protein	77,4	5,16
Crude fat	89,7	0,82
Carbohydrates	90,2	2,27
Energy	94,9	0,39

The composition is simple and understandable in its message and in accordance with legal regulations.

Chemical analysis of feed

The analytical composition shows the nutrient content of the food. Legally, the label must indicate the minimum content of protein, fat, fiber and raw ash, as well as the moisture content, if the product has more than 14% water in the composition.

In the analytical composition of Raw Paleo Adult Turkey, the declared crude protein content is: 23%, crude fat: 15%, crude fiber: 2.5%; and crude ash: 7.5%. After the laboratory analysis performed in the UniLab laboratory, the above-mentioned nutrient content has been confirmed in the test sample. At the same time, in comparison with the FEDIAF data (2019) recommending the minimum content of nutrients for adult dogs, the adequacy of the feed balance was confirmed.

To sum up: the analytical composition indicates the legitimacy of using Raw Paleo Adult Turkey in the group of adult dogs..

Food digestibility test

The digestibility of food for adult dogs was tested at the Department of Internal Diseases with the Clinic of Horses, Dogs and Cats of the UPWr, in accordance with the adopted procedure for their conduct. After a 3-day overfeeding period, the actual 7-day digestibility test was initiated, during which food consumption and faecal quality were monitored daily, scored from 1-5 (1 being very hard faeces and 5 being diarrhea). On the first and last day of the test, the dogs were weighed, and from day 4 to 7, apart from scoring, the faeces were collected and frozen in separate, labeled containers at -18°C until laboratory tests were performed. The aforementioned analyzes were carried out in the UniLab laboratory specializing in this type of tests. After determining the content of crude protein, crude fat, crude fiber and crude ash and moisture content in the test feed and aggregating stool samples from the collection period, the digestibility of individual nutrients was determined (Table 2). All determinations were made in accordance with the methods recommended for this type of determination, which are contained in the FEDIAF GUIDE TO GOOD PRACTICE FOR THE MANUFACTURE OF SAFE PET FOODS (publ. 2019).

An adult dog food digestibility study indicated that Raw Paleo Adult Turkey is characterized by very high digestibility of energy (> 94%), carbohydrates (> 90%) and fat (> 89%) and moderately high protein digestibility (> 77%). It should be noted that most dog food products do not achieve such high digestibility parameters, which usually oscillate around 80-85% for carbohydrates and fats and about 70-75% for proteins. The obtained results indicate appropriately selected, high-quality raw materials used in the production of feed and a correctly conducted technological process.

Based on the analysis of the composition, analytical ingredients, dietary additives and digestibility tests, it can be concluded that Raw Paleo Adult Turkey is a high-quality pet food. The digestibility test that was carried out on a group of adult dogs for which the above food is intended is especially important. It indicates the possibility of using the nutrients provided in the food to the maximum extent.

Any kind of non-invasive animal testing to assess faecal quality, palatability and acceptability, as well as digestibility and other tests involving longer feeding are not normally performed. Their price, due to the type of research (animal tests), is high, but at the same time it should be emphasized that they are conducted in accordance with the principles of animal welfare. However, the results obtained from them are an undeniable added value when estimating the quality of feed.

References::

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Adverse reactions to food (food allergy, intolerance, etc.)

Food and water are the most important components of life on earth. Nevertheless, it happens that not every ingredient is well tolerated by the body. The best example are diseases belonging to the group of the so-called adverse reaction to food (ARF/ADRs), the most common of which are food allergies and intolerances.

The main difference in the responses that occur to food allergies and intolerance relates to the involvement of the immune system (or its lack) in response to a specific food component. If the immune system participates in it, we talk about the so-called food allergy. However, in the absence of his reaction, we are dealing with the so-called food intolerance. Food intolerances usually result from the lack or too little activity of certain enzymes. The best known are lactose and gluten intolerance.

Lactose is the disaccharide found in milk. In the absence or too low activity of the enzyme – lactase, which breaks down this disaccharide, diarrhea occurs, which is an expression of intolerance to this disaccharide. In this case, the only appropriate course of action is to avoid lactose-containing products and / or to consume lactose-free products.

Gluten intolerance is much less common than lactose intolerance. This problem is also rare in humans (about 1-5% of the population), although in them it may take the form of a severe disease – celiac disease. Gluten intolerance in dogs has only been described in Irish Setters. It also appeared to be the basis of enteropathy and proteinaceous nephropathy in wheaten terriers, but recent scientific studies have ruled out its participation in the above diseases (Vaden SL, Sellon RK, Melgarejo LT, Williams DA, Trogdon MM, VanCamp D, Argenzio RA. Evaluation of intestinal permeability and gluten sensitivity in Soft-Coated Wheaten Terriers with familial protein-losing enteropathy, protein-losing nephropathy, or both. Am J Vet Res. 2000 May; 61 (5): 518-24). On the other hand, we begin to talk about the gluten-dependent PGSD (Paroxysmal gluten-sensitive dyskinesia) in border terriers (Characterization of Paroxysmal Gluten-Sensitive Diskinesia in Border Terriers Using Serological Markers M. Lowrie, OA Garden, M. Hadjivassiliou, DS Sanders, R. Powell, and L. Garosi, J Vet Intern Med 2018; 32: 775–781; Lowrie M, Hadjivassiliou M, Sanders DS, Garden OA. A presumptive case of gluten sensitivity in a border terrier: a multisystem disorder? Vet Rec. 2016 Dec 3; 179 (22): 573). And perhaps the Irish Setter and the Border Terrier will be the two dog breeds in which it is rational to exclude gluten.

Food allergy is a disease that is very difficult both in diagnosis and in dietary and therapeutic management. The most common allergen is protein (a large molecule glycoprotein, i.e. over 40,000 kDa). Common dog allergens are beef, dairy, wheat, eggs and chicken. For cats, it is beef, dairy, fish and lamb. Hypersensitivity reactions to non-protein products, e.g. carbohydrates that are part of hapten-binding proteins (e.g. inulin) or that are part of the antigenic part of glycoproteins, are less common in carnivores than in humans.

One of the strongest food allergens is: milk casein, fish tropomyosin and proteins of crustaceans and molluscs. Among the proteins of plant origin, there are superfamily proteins: Bet v1 (fruits, soybeans, vegetables), cupins (nuts, vegetables, seeds), prolamines (grains, fruits, vegetables), C1 cysteine proteases (soybeans, kiwi) or profilin (fruits, vegetables, legumes). The allergic part of the protein can be linear or three-dimensional. And in the case of the conformational nature of the allergen, it is more often denatured during digestive processes or during thermal processing, thanks to which, for example, children allergic to milk proteins or eggs, tolerate processed products with their participation. Allergy is also characterized by its geographical diversity, related to specific foods (allergens) and dietary preferences, e.g. in Singapore there is often an allergy to bird's nest soup, and in France to mustard seeds. Clinical and immunological differences are also visible in patients with the same type of allergy, but coming from different countries, e.g. in patients from the USA, a very strong reaction to peanuts concerns mainly the allergen Ara h1, Ara h2 and Arah3, in Spaniards – Arah9, and in Swedes – Bet v 1 homologue of Ara h865yt5tgh. The differences in the intensity of the reaction and the reaction itself to specific allergens result from the overlapping of genetics, the environment and even the method of food preparation.

Also in the case of dogs, age, clinical signs and the course of allergic reactions varies greatly. In studies conducted in Switzerland, West Highland white terriers, Rhodesian ridgebacks and pugs were found to be predisposed to more frequent adverse food reactions and canine atopic dermatitis (CAD) than dogs of other breeds. In addition, it was observed that AFR was characterized by gastrointestinal symptoms, which in 48% of dogs developed earlier (in dogs less than 1 year old) than in CAD. Similar results were obtained in studies conducted in the USA.

In the case of cats, only Abyssinian cats have a suggested breed predilection for atopy-like disease (ALD). However, there are no gender-related predispositions, although 59% of ALD and cutaneus form of adverse reaction to food (CARF) cases were in female cats. The mean age of cats diagnosed with CARF is approximately 3.4 years, although ALD may be earlier and 72% of the animals tested had it under the age of 3 years.

Food allergen blood tests that are used commercially in the diagnosis and / or diet therapy of adverse reactions to food turn out to be insufficiently reliable. It is not known whether this is due to the test methodology involved in the allergen response or the involvement of IgE in dog AFR. In comparative studies conducted in healthy dogs and with ARF and CAD, higher IgE titres were found in the group of dogs with ARF and CAD compared to healthy animals, which, however, cannot be the basis for differentiating these groups. In a study by Zimmer et al., It turned out that no changes in IgE or IgG levels were found in dogs with ARF following an elimination diet, and Halliwell et al. found elevated levels of IgG in both ARF and CAD dogs as well as and in healthy dogs. Therefore, the presence of IgG only indicates exposure or cross-reacting allergens, but not the role of IgG in the pathogenesis of AFR. Likewise, one can also comment on the proliferation of antigen-specific lymphocytes, the response of which can be seen more frequently in animals with AFR and CAD than in healthy dogs, which, however, cannot in any way constitute grounds for differentiating these groups.

The elimination diet is still a reliable diagnostic tool, but most scientists suggest the use of a home mono-protein diet (for cats), as well as a mono-protein and monocarbohydrate diet (for dogs) at this stage. It should be mentioned, however, that the home elimination diet is not a balanced diet as its main goal is to eliminate potential allergens. Therefore, it is not recommended for growing animals, less than 1 year old. In such a case, it is recommended to introduce commercial hydrolyzed elimination diets, which are complete, balanced diets. The hydrolysis of proteins allows them to be reduced in size to the point where they become "unrecognizable" by the host's immune system, so we do not observe any reaction (skin, food or other) after administration. Most often, the particle size is reduced to

8-10K kDa, although there are also those below 3-5K kDa.

Among the hydrolysed proteins, poultry or fish proteins and soy proteins are the most commonly used. Their effectiveness has been confirmed by clinical tests in dogs and cats with suspected food allergy. Animals experienced pruritus and / or diarrhea when using poultry, fish or soy protein. No undesirable symptoms were observed when the hydrolyzate of the above proteins was introduced. And what is the most important – hydrolyzed diets are complete and balanced diets, so they can also be used in growing animals. The duration of the elimination stage was extended from 6-8 weeks to 10-12 weeks, regardless of species (dog / cat). And although the improvement in health may be visible after 10-14 days, it is not recommended to stop the elimination diet below 10-12 weeks.

After the "allergen elimination" step, it is possible to check which protein is the real allergen. This process involves introducing proteins from the previous diet individually into the animal's diet. The time required to confirm a specific allergen(s) depends on the variety of the animal's diet, and with a large number of ingredients, it can take up to 6 months and more.

In the case of determining specific food allergens – we can choose a diet based on a protein that does not "sensitize". Again, mono-protein / monoprotein diets or diets are usually used. These are products that contain only one source of protein. Since most commercial feeds contain mixed sources of protein (poultry / beef, poultry / fish, etc.), in the case of monoprotein feeds, less typical proteins are selected, e.g. rabbit, ostrich, kangaroo or from insects, etc. Insect proteins have become very popular in recent years – fly larvae – hermetia illucens, cockroaches, grasshoppers, etc. Insects grown on organic waste and used as feed for monogastric animals can reduce the production of animal protein and its impact on external environment (Animals (Basel). 2019 May 24; 9 (5). pii: E278. doi: 10.3390 / ani9050278.A First Attempt to Produce Proteins from Insects by Means of a Circular Economy. Cappellozza S1, Leonardi MG2, Savoldelli S3, Carminati D4, Rizzolo A5, Cortellino G6, Terova G7, Moretto E8, Badaile A9, Concheri G10, Saviane A11, Bruno D12, Bonelli M13, Caccia S14, Casartelli M15, Tettamanti G16). Apart from the obvious economic effect, it also turned out that the insect protein has a very good profile of amino acids and fatty acids, which can successfully replace the existing sources of animal origin. Doubts were raised by the taste of products based on dried insects, but the research conducted in this respect showed that this type of dry food / diets is not inferior to products with a typical protein source.

Vet Expert's solution in the event of suspected food allergy / intolerance or other skin or gastrointestinal diseases requiring the introduction of one type of animal protein are the following diets:

1. *A mono-protein diet based on the protein of dried insects –* ***Hypoallergenic dog***
2. *Monoprotein diet based on salmon protein –* ***Dermatosis Salmon and Potato***
3. *Monoprotein diet based on rabbit protein –* ***Dermatosis Rabbit and Potato***
4. *Monoprotein diet based on turkey protein –* ***Intestinal Elimination***

A characteristic feature of Vet Expert diets (apart from the Hypoallergenic dog diet) is a high percentage of fresh meat in the feed (from 35-47%). From the point of view of production technology, the introduction of fresh meat has a significant impact on improving the texture and cohesiveness of granules of dry food (Koppel K., Gibson M, Alavi S., Aldrich G .: The Effects of Co-operating Process and Meat Inclusion on Pet Food. Flavor and Texture Characteristics. Animals 2014, 4, 254-271). What is more important, however, is that in assessing the digestibility of feeds with fresh meat, compared to those with meals, they had higher digestibility of dry matter, organic matter, crude protein, fat and energy (Nery J., Goudez J., Biourge V., Tournier C., Leray V., Martin L., Thorin C., Nguyen P., Dumon H .: Influence of dietary protein content and source on colonic fermentative activity in dogs differing in body size and digestive tolerance. J Anim Sci. 2012. 90: 2570-2580). High digestibility ensures better absorption of nutrients from this type of products, which significantly increases the nutritional value of the diet and is of great importance for a sick animal. (Murray S.M., Patil. A.R., Fahey G.C., Merchen N. R. Jr., Hughes D.M .: Raw and rendered animal by-propducts as ingredients in dog diets. J. Anim. Sci. 1997; 75: 2497-2505).

The Vet Expert diets recommended for the digestive tract and skin diseases, including food allergies and / or intolerance, differ in the content of basic macronutrients and additives. Therefore, it can be easier to fit a diet tailored to the needs of a specific animal, e.g. in the case of a suspected poultry allergy and poor animal condition (underweight, emaciation, condition 2/5 on the 5-point BSC scale), it is recommended to introduce Dermatosis salmon and potato – a grain-free formula with a high content of easily digestible protein (28%) and fat (18%). The appropriate ratio of protein to energy in the diet ensures optimal nutrition of the organism. For adult animals, the optimal choice is Dermatosis Rabbit and Potato with 26% protein and 15% fat. Both products contain an increased proportion of Omega-6 and 3 acids, which promotes the processes of healing, renewal and regeneration of the epithelium / epidermis, nourishment of the body (Omega-6) and inhibition of inflammatory reactions (Omega-3).

The gold standard of the Vet Expert diet line for suspected food allergy / intolerance is, however, a diet based on dried insect protein (*Hermetia Illusens*) – Hypoallergenic dog. Apart from the unusual source of protein, its content in the diet has been reduced to 20%, while the fat content is 15%. The product also belongs to the group of grain-free foods enriched with Omega-6 and 3 acids.

An interesting nutritional solution is the Intestinal Elimination diet – a monoprotein diet based on turkey protein (fresh- + dried) with additionally reduced fat content (10%). This type of product may be an excellent dietary solution in the case of suspected gastrointestinal and pancreatic diseases. The fat content reduced to 10% significantly reduces the stimulation of the secretory glands of the digestive tract, stabilizes its motor function and improves the absorption of nutrients. At the same time, an increased amount of easily digestible protein (30%) from turkey ensures its incorporation into the regenerating cells and tissues of the organism. Additionally, the product contains ginger, which facilitates the digestion process, has a gentle warming and protective effect. The FOS and MOS recipes from natural sources (chicory) introduced into the composition have a stabilizing effect on the condition of the microflora and strengthen local and general immunity. It is more and more often said that the correct microflora of the digestive tract has a huge impact on the broadly understood "health" of the whole organism. And since the microflora is absolutely dependent on the diet and the current health of the digestive tract, the whole, i.e. for digestive tract and microflora, a diet constitutes a kind of complex of interconnected, mutually influencing and dependent vessels.

Summing up the line of diets that can be used in the case of suspected food allergy / intolerance and other diseases of the digestive tract and skin, there is one more correction that the animal in the bowl makes – the palatability of the diet. In this case, both the recipe and the nutrient balance make the Vet Expert diets eagerly eaten by dogs.

HYPOALLERGENIC INSECT

HERMETIA ILLUCENS PROTEIN & DRIED POTATO

Complete and balanced dietary food for dogs, the administration of which reduces the occurrence of intolerance to ingredients and nutrients.

Dietetic indications

- Support of skin function in the case of dermatosis and excessive loss of hair
- Reduction of ingredient and nutrient intolerances
- Food allergies – as an elimination diet

Contraindications

- Intolerance to diet ingredients and nutrients
- Not recommended for puppies and dams in reproduction period

HYPO-ALLERGENIC · SKIN SUPPORT · ELIMINATION DIET · INSECT MONOPROTEIN · GLUTEN FREE

Packaging:

12 kg and 2 kg

FEATURES	BENEFITS
Monoprotein	The insect larvae *Hermetia illucens* is a single source of animal protein in the diet. This novel source of protein significantly reduces the risk of intolerance of ingredients and nutrients.
Omega-6 fatty acids	The optimal content of Omega-6 acid supports the proper functioning of the skin, improves the quality of the hair and reduces the symptoms of intolerance to ingredients and nutrients.
Omega-3 fatty acids	The optimal content of Omega-3 acid supports the functioning of the skin and improves the quality of the coat, which allows for effective protection against the penetration of environmental allergens into the body.
Gluten - free	It does not contain grains or gluten, which reduces the risk of allergy to cereal proteins and gluten intolerance.
Multidirectional action	Reduction of intolerance of ingredients and nutrients, a diet supports the functions of the skin in the case of dermatoses and hair loss.

Composition:

Dried insects, dried sweet potato, dried potato, potato starch, poultry fat, minerals, salmon oil (0,5%), flaxseed oil (0,3%).

Nutritional additives per kg:

Vitamins: Vitamin A (retinyl alpha-acetate) 18000 IU, vitamin D3 (cholecalciferol) 1800 IU, Vitamin E (all-rac alphatocopherol acetate) 500 IU;

Trace elements: copper (copper (II) pentahydrate) 10 mg, copper (chelated copper with glycine hydrate) 5 mg, zinc (zinc sulphate monohydrate) 100 mg, zinc (zinc chelate with glycine hydrate) 50 mg, iron (sulphate ferrous monohydrate) 70 mg, iron (iron chelate with glycine hydrate) 35 mg, manganese (manganese (II) oxide) 50 mg, manganese (manganese chelate with glycine hydrate) 25 mg, iodine (calcium iodate, anhydrous) 2.0 mg, selenium (sodium selenite) 0.1 mg;

Provitamins: Taurine 1000 mg, L-carnitine 50 mg;

Contains natural antioxidants

Analytical constituents	As Fed	Dry Matter	Per 100 kcal ME
Crude protein	21.00%	22.80%	6.2 g
Oils and fats	16.00%	17.40%	4.7 g
Crude fibre	5.60%	6.09%	1.64 g
Crude ash	8.00%	8.70%	2.3 g
Moisture	8.00%		
Omega-3 fatty acids	0.43%	0.46%	126 mg
Linoleic acid (LA)	27 g/kg	29.35 g/kg	0.79 g
EPA+DHA	0.9 g/kg	1 g/kg	26 mg
Calcium	1.20%	1,30%	352 mg
Phosphorus	0.90%	1,00%	264 mg
Taurine	1000 mg/kg	1087 mg/kg	29.3 mg
L-carnitine	50 mg/kg	54.3 mg/kg	1.5 mg
Metabolisable energy:			
kcal/100 g	341		
kJ/100 g	1425		

DERMATOSIS SALMON

SALMON & POTATO

Complete and balanced dietary food for adult dogs, the administration of which supports the functions of the skin in case of dermatosis and excessive hair loss and limits the occurrence of ingredient and nutrient intolerances. Contains high levels of essential fatty acids, selected proteins and a limited source of protein (salmon) and carbohydrates (potatoes and rice). The food recipe is mono-protein and gluten free.

Dietetic indications

- Support of skin function in the case of dermatosis and excessive loss of hair
- Reduction of ingredient and nutrient intolerances
- Food allergies - as an elimination diett

Contraindications

- Pancreas disease, chronic renal failure, hepatic encephalopathy
- Not recommended for puppies and dams in reproduction period

SKIN SUPPORT · MONOPROTEIN RICH IN Ω3, Ω6 · FRESH SALMON · GLUTEN FREE · ELIMINATION DIET

Packaging:

12 kg and 2 kg

FEATURES	BENEFITS
Monoprotein	Diet contains a single source of animal protein (salmon), which helps to avoid the presence of other animal protein allergens in the diet that might cause symptoms in dogs.
Gluten-free	The recipe doesn't contain gluten, the sources of carbohydrates are potatoes and rice.
Omega-6 fatty acids	The optimal content of Omega-6 acids supports the proper functioning of the skin and improves the quality of the hair. Omega-6 acids have a health-promoting effect in the case of dermatoses and hair loss.
Omega-3 fatty acids	Omega-3 content supports skin functions and improves the quality of the coat. It also supports the skin barrier, which protects against penetration of environmental allergens to the body.
FOS (fructooligo-saccharides) MOS (mannanoli-gosaccharides)	Prebiotics used by bacteria in the digestive tract ensure the stabilization of the intestinal microflora, provide energy for the cells of the large intestine and non-specifically stimulate the immune mechanisms in the digestive tract.
***Yucca schidigera* / Mojave Yucca**	Limits the content of metabolites in the digestive tract, reduces the unpleasant smell of faeces.
Ginger	The addition of ginger stimulates the peristalsis of the digestive tract, and has protective and soothing action in the gastrointestinal tract.
Multidirectional action	A diet that supports the functions of the skin in the case of dermatoses and excessive hair loss and reduces the risk of intolerance to ingredients and nutrients.

Composition:

Fresh salmon (40%), meal from salmon (25%), potatoes (20%), animal fat, rice, beet pulp, fish meal, yeast, hydrolysed salmon (5%), fish oil, inulin (FOS 0.25%), sodium chloride (table salt), MOS (250 mg/kg), lemon extract, extract from *Yucca schidigera* 0.03%, potassium chloride, monocalcium phosphate, ginger 0.05%.

Nutritional additives per kg:

Vitamins: vitamin A 20000 IU, vitamin D3 2000 IU, vitamin E 600 mg;

Trace elements: iron 75 mg, iodine 3,5 mg, copper 10 mg, manganse 7.5 mg, zinc 120 mg, selenium 0.12 mg;

Provitamins: taurine 750 mg, L-carnitine 70 mg;

Aminoacids: L-glutamine 100 mg;

Technological additives: natural antioxidants – tocopherol extracts of vegetable oils 280 mg.

Analytical constituents	As Fed	Dry Matter	Per 100 kcal ME
Crude protein	28.00%	30.50%	7.0 g
Crude oils and fats	18.00%	19.60%	4.5 g
Crude fibre	2.30%	2.50%	0.6 g
Crude ash	7.00%	7.60%	1.8 g
Moisture	9.00%		
Omega-6 fatty acids	2.95%	3.20%	739 mg
Linoleic acid	2.55%	2.44%	639 mg
Omega-3 fatty acids	1.10%	1.20%	276 mg
EPA + DHA	0.50%	0.60%	125 mg
Calcium	1.10%	1.20%	276 mg
Phosphorus	0.70%	0.80%	175 mg
L-glutamine	100 mg/kg	109 mg/kg	2.5 mg
Taurine	750 mg/kg	824 mg/kg	19 mg
L-carnitine	70 mg/kg	76 mg/kg	1.8 mg
Metabolisable energy:			
kcal/100 g	399		
kJ/100 g	1668		

DERMATOSIS RABBIT

RABBIT & POTATO

Complete and balanced dietary food for dogs, the administration of which supports the functions of the skin in the event of dermatosis and excessive hair loss and reduces the occurrence of intolerance to ingredients and nutrients.

Dietetic indications

- Support of skin function in the case of dermatosis and excessive loss of hair
- Reduction of ingredient and nutrient intolerancess
- Food allergies – as an elimination diet

Contraindications

- Pancreas disease, chronic renal failure, hepatic encephalopathy
- Not recommended for puppies and dams in reproduction period

SKIN SUPPORT · MONOPROTEIN · 35% FRESH RABBIT · GRAIN FREE · ELIMINATION DIET

Packaging:

12 kg and 2 kg

FEATURES	BENEFITS
Monoprotein	Diet contains a single source of animal protein (rabbit), which helps to avoid the presence of other animal protein allergens in the diet that might cause symptoms in dogs.
Grain-free	The only source of carbohydrates are potatoes. The recipe contains no grains, which reduces the risk of gluten intolerance and allergies to cereal proteins.
Omega-6 fatty acids	The optimal content of Omega-6 acid supports the proper functioning of the skin and improves the quality of the hair. Omega-6 acids have a health-promoting effect in the case of dermatoses and hair loss.
Omega-3 fatty acids	The optimal content of Omega-3 acid supports the functioning of the skin and improves the quality of the coat, which allows for effective protection against the penetration of environmental allergens into the body.
FOS (fructooligosaccharides) MOS (mannanoligosaccharides)	Prebiotics used by bacteria in the digestive tract ensure the stabilization of the intestinal microflora, provide energy for the cells of the large intestine and non-specifically stimulate the immune mechanisms in the digestive tract.
***Yucca schidigera* / Mojave Yucca**	It limits the content of metabolites in the digestive tract, reduces the unpleasant smell of faeces.
Ginger	The addition of ginger stimulates the peristalsis of the digestive tract, and has protective and soothing action in the gastrointestinal tract.
Multidirectional action	A diet that supports the functions of the skin in the case of dermatoses and excessive hair loss and reduces the risk of intolerance to ingredients and nutrients.

Composition:

Fresh rabbit meat (35%), dehydrated rabbit protein (20%), potato (20%), potato protein (7%), rabbit hydrolyzate (5%), oils and fats (5%), beet pulp (3%), yeasts (2%), carob meal (1%), sodium chloride (0.8%), sodium polyphosphates (0.30%), potassium chloride (0.1%), inulin (FOS, 1000 mg/kg), ginger (1000 mg/kg), Mannanoligosaccharides (MOS, 260 mg/kg), *Yucca schidigera* (0.02%).

Nutritional additives per kg:

Vitamins: vitamin A 20000 IU, vitamin D3 1900 IU, vitamin E 250 mg, vitamin C 100 mg, biotin 4.0 mg;

Trace elements: iron (iron (II) sulphate monohydrate) 83 mg, iodine (potassium iodide) 3.9 mg, copper (copper (II) sulphate, pentahydrate) 11 mg, manganese (manganous sulphate, monohydrate) 8.3 mg, zinc (zinc oxide) 132 mg, selenium (sodium selenite) 0.14 mg;

Provitamins: L-carnitine 70 mg, taurine 30 mg;

Technological additives: natural antioxidants – tocopherol extracts of vegetable oils.

Analytical constituents	As Fed	Dry Matter	Per 100 kcal ME
Crude protein	26.00%	28.5%	6.8 g
Crude fat	15.00%	16.5%	3.9 g
Crude fibre	2.50%	2.75%	0.6 g
Crude ash	7.20%	7.9%	1.8 g
Moisture	9.00%		
Calcium	1.10%	1.2%	290 mg
Phosphorus	0.80%	0.9%	210 mg
Omega-3 fatty acids	0.45%	0.5%	118 mg
Omega-6 fatty acids	2.43%	2.7%	636 mg
Linoleic acid	2.22%	2.44%	581 mg
EPA+DHA	400 mg/kg	440 mg/kg	10.5 mg
Taurine	30 mg/kg	33 mg/kg	785 µg
L-carnitine	70 mg/kg	77 mg/kg	1.8 mg
Metabolisable energy:			
kcal/100 g	382		
kJ/100 g	1597		

INTESTINAL ELIMINATION

DIGESTION SUPPORT & FOOD INTOLERANCE CONTROL

A complete and balanced dietary food for adult dogs recommended to support the reduction of intestinal absorptive disorders, to compensate for maldigestion and in case of exocrine pancreatic insufficiency. The recipe of the diet is monoprotein and gluten-free, which means that the only source of animal protein is turkey, and the selected sources of carbohydrates are sweet potatoes, potatoes and brown rice. **Therefore, Intestinal Elimination may be given to dogs with ingredient and nutrient intoleranes**. Additional support for the proper functioning of the digestive tract and intestinal microflora are powdered ginger, psyllium, mannanoligosaccharides and fructoologosaccharides.

Dietetic indications

- Compensation for maldigestion
- Reduction of intestinal absorptive disorders
- Chronic pancreatic insufficiency
- Ingredient and nutrient intolerances
- Can be used in puppiess

Contraindications

- Do not use in acute pancreatitis
- Do not use in chronic renal failure or hepatic encephalopathy

MONOPROTEIN TURKEY | GLUTEN FREE | REDUCED FAT | MANNANOLIGO-SACCHARIDES | FRUCTOOLIGO-SACCHARIDES | GINGER

Packaging:

12 kg and 2 kg

FEATURES	BENEFITS
High protein content	The optimally high content of easily digestible protein allows for proper regeneration of enterocytes, reconstruction of intestinal villi, and consequently - proper nutrition of the body.
Monoprotein	One source protein of animal origin (turkey) lowers the risk of intolerance to ingredients and nutrients.
Low fat	The limited amount of fat enables the diet to be used in animals with chronic pancreatic insufficiency.
Low fibre	Low fiber content does not burden the gastrointestinal tract, but gently stimulates the intestinal motor activity.
FOS (fructooligosaccharides)	FOS is used by the beneficial bacteria as a medium for their growth, which helps to balance the microflora. Indirectly, through the metabolites of the gastrointestinal microflora, it stimulates local immunity.
MOS (mannanoligosaccharides)	MOS have a unique ability to stimulate the natural mechanisms of non-specific immunity in the gastrointestinal tract.
Ginger	The addition of ginger stimulates the peristalsis of the digestive tract, has protective and soothing action in the gastrointestinal tract.
Gluten-free	The formula is gluten-free and carbohydrates are derived from sweet potatoes, potatoes and brown rice, reducing the risk of gluten intolerance.
Scientificaly proven high digestibility*	High digestibility enables feeding in case of compensation for maldigestion and exorcine pancreatic insufficiency.

* Intestinal Elimination diet digestibility test report 2020.

Composition:

Turkey 47% (including 27% dried turkey, 17% freshly prepared turkey 2% turkey gravy, 1% turkey fat), sweet potatoes, brown rice, potatoes, peas, pea protein, chick peas, linseed, vitamins and minerals, powdered ginger, powdered psyllium, yucca extract, fructooligosaccharides (prebiotic FOS, 1000 mg/kg), mannanooligosaccharides (prebiotic MOS, 1000 mg/kg).

Nutritional additives per kg:

Vitamins: Vitamin A (retinyl acetate) 14400 IU, vitamin D3 (cholecalciferol) 1925 IU, vitamin E (alphatocopherol acetate) 95 IU;

Trace elements: zinc (zinc sulphate monohydrate) 48 mg, iron (iron (II) sulphate monohydrate) 48 mg, manganese (manganous sulphate monohydrate) 33 mg, copper (copper (II) sulphate pentahydrate) 12 mg, iodine (calcium iodate anhydrous) 0.9 mg;

Binders: clinoptilolite of sedimentary origin 6 g.

Analytical constituents	As Fed	Dry Matter	Per 100 kcal ME
Crude protein	31.00%	33.70%	8.9 g
Crude oils and fats	8.00%	8.70%	2.3 g
Crude	2.00%	2.20%	0.6 g
Crude ash	9.00%	9.80%	2.6 g
Moisture	8.00%		
Calcium	1.70%	1.80%	488.5 mg
Phosphorus	1.10%	1.20%	316 mg
Potasium	0.085%	0.092%	24 mg
Sodium	0.20%	0.22%	57 mg
Omega-3	0.30%	0.33%	0.1 g
Omega-6	1.70%	1.80%	0.49 g
Metabolisable energy			
kcal/100 g	348		
kJ/100 g	1455		

VET EXPERT PRODUCTS RECOMMENDED IN SUPPORTING ALLERGY/FOOD INTOLERANCE/SKIN DISORDERS MANAGEMENT

BioProtect

Contains live bacterial cultures

A supplement designed for cats and dogs with abnormal gastrointestinal microflora. Especially recommended for use alongside antibiotic treatment, in diarrhea, and after deworming. The product can also be administered as a prophylactic in growing animals and pets prone to constipation. The bacteria, regulates the beneficial microflora of the digestive tract, improves non-specific immunity, and reduces the risk of diarrhea.

Composition:
Live bacterial cultures 5x10^9 CFU/g (*Enterococcus faecium, Lactobacillus rhamnosus*), mannan-oligosaccharides 100 mg, fructo-oligosaccharides 100 mg.

Packaging:
60 capsules

Dosage:
1-2 capsules daily

BioProtect paste

Comprehensive absorption and regulation with electrolytes and probiotics

Designed for cats and dogs with acute gastrointestinal microflora disorders, the product counteracts the negative consequences of acute gastrointestinal conditions and diarrhea. The supplement contains as many as two absorptive substances. Recommended for use during episodes of diarrhea and immediately after the symptoms subside.

Composition:
Dextrose, glycerin, carob gum, fructo-oligosaccharides (FOS), activated carbon, sodium chloride, potassium chloride, magnesium chloride, *Enterococcus faecium* 5.5 x 10^8 CFU/ml, bentonite – montmorillonite 345 mg/ml.

Packaging:
syringe 15 ml

Dosage:
<5 kg BM – 1 ml 2 times daily
5-10 kg BM – 2 ml 2 times daily
10-25 kg BM – 4 ml 2 times daily
25-40 kg BM – 6 ml 2 times daily
>40 kg BM – 8 ml 2 times daily

CoproVet

Effectively reduces the risk of coprophagia

Designed for dogs and cats with intestinal tract disorders resulting from poor digestion or malabsorption. It can also be used in animals with physiological coprophagia.

Composition:
Bromelain (dried pineapple) 100 mg, fructo-oligosaccharides (FOS) 100 mg, *Yucca Schidigera* 50 mg, live bacterial cultures 5x10^9 CFU/g (*Enterococcus faecium, Lactobacillus rhamnosus*).

Packaging:
30 capsules

Dosage:
Dogs and cats <10 kg BM
– 1 capsule daily
Dogs >10 kg BM
– 2 capsules daily

ViewVet

Supports eye function

A supplement for cats and dogs, designed to support normal eye function. It helps keep the eyes healthy at the cellular level, reduces oxidative stress, and boosts immunity. It can be used as a prophylactic in dogs at risk of ocular disorders. Recommended for patients treated by veterinary opthalmologists, senior dogs, active dogs, as well as before and after eye surgeries.

Composition:
Grape seed extract (*Vitis vinifera*) 60 mg, acerola fruit extract (source of vitamin C) 35 mg, green tea leaf extract 20 mg, turmeric extract (curcumin) 35 mg, vitamin E 25 IU, Marigold flower extract (*Tagetes erecta*) – source of lutein 4 mg and zeaxanthin 1 mg, beta-carotene 10 mg, taurine 5 mg, zinc 2.5 mg, selenium 0.4 mcg, DHA 64 mg, vitamin B3 1.2 mg, vitamin B5 1 mg, vitamin A 400 IU, vitamin B1 0.1 mg, vitamin B6 0.1 mg, folic acid 20 mcg, biotin 10 mcg, vitamin B12 2.5 mcg.

Packaging:
45 Twist Off capsules

Dosage:
1 capsule per 10 kg body mass daily

VetoSkin 60/90

Comprehensive support for dermatological disorders

A supplement for cats and dogs with skin disorders that manifest with a dry and mat coat, hair loss, and flaking skin. A balanced level of omega acids contains all the necessary composition to enhance skin function.

Composition:
Omega-3 (from fish oil) 145 mg, omega-6 (from borage oil) 145 mg, zinc 56 mg, vitamin B12 5 mg, biotin 1 mg, vitamin B2 0.5 mg, vitamin B6 0.26 mg, vitamin B1 0.22 mg.

Packaging:
60 / 90 Twist Off capsules

Dosage:
<15 kg BM – 1 capsule daily
>15 kg BM – 2 capsules daily

Specialist Shampoo

Antibacterial and antifungal shampoo

A dermocosmetic shampoo for skin prone to bacterial and fungal infections, which may be used to support the treatment of skin diseases caused by bacteria and fungi.

Action
The active ingredients cleanse the skin and coat and help them maintain their normal pH. Mild foaming agents and carefully selected substances improve the quality of coat and speed up its regeneration. The additional presence of chlorhexidine and ketoconazole ensures high effectiveness in the treatment of bacterial and fungal skin infections.

Packaging
250 ml
Display 20 x 15 ml sachets

How to use
Rinse the coat with lukewarm water, apply the shampoo (small dogs with short hair - c. 2 ml, large dogs with long hair - c. 30 ml; a tablespoon is equivalent to 10 ml), create foam, and massage the skin gently for around 5 minutes. Make sure to keep the product out of eyes and ears, then rinse off thoroughly. Repeat if necessary.

Hypoallergenic Shampoo

Hypoallergenic shampoo

A dermocosmetic shampoo with oat proteins, recommended for cats and dogs with sensitive skin, prone to irritation, allergy, dryness, or intolerant to other shampoos. It can be safely used in growing animals.

Action
The shampoo contains very mild surfactants and emollients, as well as a range of softening and moisturizing agents. Oat proteins are very easily absorbed by the skin and coat, which ensures that the skin is moisturized and elastic, while the coat is glossy. Allantoin soothes and regenerates, while panthenol accelerates regeneration and supports damage repair.

Packaging
250 ml
Display 20 x 15 ml sachets

How to use
Rinse the coat with lukewarm water, apply the shampoo (small dogs with short hair - c. 2 ml, large dogs with long hair - c. 30 ml; a tablespoon is equivalent to 10 ml), create foam, and massage the skin gently for around 5 minutes. Make sure to keep the product out of eyes and ears, then rinse off thoroughly. Repeat if necessary.

Chlorhexidine Spray

Dermatological NanoSilver Line

A product for local use in cats and dogs as adjuvant treatment in bacterial skin lesions.

Action
Nanosilver shows strong antibacterial and antiseptic properties, accelerates tissue damage repair and regenerates the skin. Chlorhexidine is a strong antibacterial and bacteriostatic agent. Lanolin and panthenol moisturize and soothe irritations, while the chamomile extract soothes, reduces inflammation, and alleviates itching and stinging.

Packaging
100 ml

How to use
Spray evenly on skin lesions from a distance of 15-20 cm.

Hot Spot Spray

Dermatological NanoSilver Line

A product for local use in cats and dogs as adjuvant treatment in allergic skin lesions, hot spots, and as a first-line treatment for scratched and chafed skin.

Action
Nanosilver shows strong antibacterial and antiseptic properties. Tea trea oil is a well-known antiseptic. Aloe vera oil reduces skin inflammation and speeds up damage repair, panthenol moisturizes, soothes irritation, and regenerates the skin, while the chamomile extract soothes, reduces inflammation, and alleviates itching and stinging.

Packaging
100 ml

How to use
Spray evenly on skin lesions from a distance of 15-20 cm.

Moisturizing Spray

Dermatological NanoSilver Line

A moisturizing and regenerating product for cats and dogs, ideal for the treatment of skin lesions, scars, chafed skin, and slowly healing wounds. A must have in the daily care for dry and atopic skin thanks to its content of urea, known for its moisturizing properties and the ability to keep water in the epidermis. High in betaine and panthenol, the product also soothes irritations.

Action
Nanosilver shows strong antibacterial and antiseptic properties, speeds up tissue damage repair and helps regenerate the skin. Lactic acid stimulates the production of ceramides, which helps better protect and moisturize the skin; it also regulates cell renewal and removes calloused epidermis.

Packaging
100 ml

How to use
Spray evenly on skin lesions from a distance of 15-20 cm.

Otiflush Ear Solution

An ear flush solution for cats and dogs

Action
The optimal pH 5 and chlorhexidine have a proven antifungal and antibacterial effect. OtiFlush can be used for rinsing inflamed ear canals, as monotherapy or in preparation for treatment. The product does not increase bacterial resistance.

Packaging
125 ml

How to use
Apply a small quantity of the lotion to the external ear canal, gently massage the ear base, remove excess lotion with a cotton swab.

Otihelp Ear Lotion

Ear lotion for cats and dogs

Action
The optimal pH 5 and chlorhexidine have a proven antifungal and antibacterial effect. OtiHelp is ideal for maintaining and restoring the normal function of auditory canals. It can be used in bacterial and fungal infections regardless of etiology.

Packaging
75 ml

How to use
Apply a small quantity of the lotion to the external ear canal, gently massage the ear base, and remove excess lotion with a cotton swab.

Oticurant®

A powder designed for daily ear hygiene

Oticurant® is ideal for cats and dogs. The product supports the normal physiological condition of the ear, soothes itching, and prevents unpleasant odors. The disagreeable smell is caused by the proliferation of fungi and bacteria, which begin to grow at an uncontrollable rate as a result of the wax and moisture that accumulate in the auditory canal. The metabolic side products of fungi are the source of unpleasant odor. Oticurant® restores the physiological balance by binding the moisture and wax that nourish fungi and bacteria and promote their proliferation. Lactic acid lowers the pH, which makes the environment even less hospitable. Research has also confirmed Oticurant® to have strong absorptive properties, which guarantees optimally clean ears.

Packaging
Sachets: 24 items

How to use
If Oticurant® is used for the first time, apply the contents of one sachet per ear every day for 5 days, and, subsequently, one sachet per ear once a week as hygiene treatment. Use 1/2 of a sachet per ear for dogs with a body mass below 10 kg and 2 sachets for those weighing more than 40 kg. 24 sachets should be enough for a three-month therapy for dogs between 10 and 40 kg.

OBESITY

L-CARNITINE & LOW ENERGY

Complete and balanced dietary wet food for adult dogs, the purpose of which is to reduce excessive body weight or stabilise it after weight loss. The food is low in calories and the addition of L-carnitine supports metabolism of fatty acids.

Dietetic indications

- Reduction of excessive body weight
- Maintaining a stable body weight after weight loss
- Recommended for animals with low activity or after sterilization / castration
- Regulation of glucose supply (*Diabetes mellitus*)
- Support of heart function in the case of chronic cardiac insufficiency

Contraindications

- Do not use in oxalate urolithiasis
- Do not use in dogs with pancreas disease and severe hepatic impairment (hepatic encephalopathy)
- Do not use in dogs with renal insufficiency and metabolic acidosis
- Not recommended for puppies and dams in reproduction period

LOW CALORIES | LOW FAT | INCREASED L-CARNITINE | INCREASED FIBRE | TASTY

Packaging:

400 g

FEATURES	BENEFITS
Low fat and calories	Limiting the amount of calories in the diet (low fat content) allows for effective weight reduction while maintaining dosage restrictions and ensures the maintenance of a stable body weight after after reaching the target weight.
High protein content	The high protein content helps maintain muscle mass while losing weight.
Fibre	Fiber stimulates gastrointestinal motility and ensures good satiety control.
L-carnitine	It supports the metabolism of fatty acids in cells, supports the process of lipid metabolism and the effective use of energy in the cell.

Composition:

poultry (44%), lamb (20%), gelatine hydrolysate, rice (4%), wheat bran (1%), cellulose (1%) salmon oil (0.2%), sunflower oil (0.2%)

Nutritional additives per kg:

Vitamins: vitamin D3 200 IU;
Trace elements: zinc as zinc sulfate monohydrate 25 mg, manganese as manganous sulfate monohydrate 1.4 mg, iodine as calcium iodate anhydrous 0.75 mg;
Provitamins: L-carnitine 200 mg.

Analytical constituents	As Fed	Dry Matter	Per 100 kcal ME
Crude protein	10.80%	49.00%	12.9 g
Crude fat	2.90%	13.00%	3.5 g
Crude ash	2.10%	9.50%	2.5 g
Crude fibre	1.70%	7.70%	2 g
Moisture	78.00%		
Calcium	0.20%	0.90%	0.24 g
Phosphorus	0.16%	0.70%	0.19 g
Sodium	0.16%	0.70%	0.19 g
Potassium	0.20%	0.90%	0.23 g
Magnesium	0.02%	0.10%	24 mg
Omega-6	0.60%	2.70%	0.7 g
Omega-3	0.10%	0.50%	0.12 g
Starch	0.30%	1.40%	0.4 g
Total sugar	0.00%	0.00%	0.4 g
Metabolisable energy			
kcal/100 g	84		
kJ/100 g	351		

OBESITY

L-CARNITINE & LOW ENERGY

Complete and balanced dietary food for dogs, the purpose of which is to reduce excessive body weight or stabilise it after weight loss. The food is low in calories and the addition of L-carnitine supports metabolism of fatty acids.

Dietetic indications

- Reduction of excessive body weight
- Maintaining a stable body weight after weight loss
- Recommended for animals with low activity or after sterilization / castration

Contraindications

- Do not use in oxalate urolithiasis
- Do not use in dogs with pancreas disease and severe hepatic impairment (hepatic encephalopathy)
- Do not use in animals with renal insufficiency and metabolic acidosis
- Not recommended for puppies and dams in reproduction period

LOW FAT | INCREASED L-CARNITINE | INCREASED FIBRE | LOW CALORIES

Packaging:

12 kg and 2 kg

FEATURES	BENEFITS
Low fat and calories	The reduced energy value enables effective body fat burning during weight loss and prevents weight gain after reaching the target weight.
Increased fibre	Beet pulp and apple pulp belong to the group of moderately fermentable and water-absorbing fibers. The water-absorbent fiber binds water, which increases the volume of the gastrointestinal contents. The filling of the digestive tract stimulates the feeling of fullness and also stimulates its peristalsis (beneficial in constipation). Additionally, the fibre is involved in the stabilization of blood glucose levels and the reduction of insulin resistance.
L-carnitine	It supports the metabolism of fatty acids in cells, supports the process of lipid metabolism and the effective use of energy in the cell.
Resistant starch	It is not digested and absorbed in the digestive tract. It is broken down by bacteria in the large intestine, providing, among other things, short-chain fatty acids (energy for colonocytes), lowering the pH.

Composition:

dehydrated poultry protein, corn (25%), fresh chicken (10%), corn gluten meal, beet pulp, cellulose, apple pulp, rice, amylose corn starch (resistant starch), hydrolyzed poultry liver, poultry fat, linseed, minerals, fish oil, glucosamine (0.09%), chondroitin (0.02%).

Nutritional additives per kg:

Vitamins: vitamin A 17000 IU, vitamin D3 1750 IU, vitamin E 300 mg;

Trace elements: iron (iron sulphate monohydrate) 68 mg, iodine (potassium iodide) 3.2 mg, copper (copper sulphate pentahydrate) 9 mg, manganese (manganous sulphate monohydrate) 6.8 mg, zinc (zinc oxide) 108 mg, selenium (sodium selenite) 0.11 mg;

Provitamins: L-carnitine 2500 mg;

Antioxidants: Tocopherol extracts of vegetable oils.

Analytical constituents	As Fed	Dry Matter	Per 100 kcal ME
Crude protein	30.00%	32.00%	9.6 g
Crude fat	10.00%	10.90%	3.2 g
Total dietary fibre (TDF)	15.00%	16.40%	4.8 g
Crude fibre	10.00%	10.90%	3.2 g
Crude ash	6.00%	6.50%	1.9 g
Moisture	9.00%		2.9 g
Calcium	0.90%	1.00%	0.3 g
Phosphorus	0.80%	0.90%	0.26 g
L-carnitine	2500 mg/kg	2747 mg/kg	80 mg
Glucosamine	0.09%	0.10%	28.85 mg
Chondroitin	0.02%	0.02%	6.41 mg
Metabolisable energy			
kcal/100 g	312		
kJ/100 g	1304		

INTESTINAL

HIGH DIGESTIBILITY & LOW FAT & INCREASED LEVEL OF POTASSIUM AND SODIUM

Complete and balanced dietary food adult and growing dogs. Recommended in reduction of intestinal absorptive disorders, compensation for maldigestion and in case of exorcine pancreatic insufficiency.

Dietetic indications

- Compensation for maldigestion
- Reduction of intestinal absorptive disorders
- Chronic pancreatic insufficiency
- Can be used in puppies

Contraindications

- Do not use in acute pancreatitis
- Do not use in chronic renal failure and hepatic encephalopathy

Packaging:
12 kg and 2 kg

INTESTINE | REDUCED FAT | FRUCTOOLIGO-SACCHARIDES (FOS) | GINGER | TASTY

FEATURES	BENEFITS
High protein content	High content of easily digestible protein ensures optimal regeneration of enterocytes, intestinal villi renewal and optimal trace elements absorption
High digestibility	High digestibility diet, scientificly proven*, enables feeding in case of compensation for maldigestion and exorcine pancreatic insufficiency.
Low fibre	The reduced fibre amount improves the digestibility of the administered food and reduces the size of faeces.
Low fat	The reduced fat amount inhibits pancreatic stimulation in animals with exocrine pancreatic insufficiency.
Soluble carbohydrates (inulin)	It is a source of fructooligosaccharides used by gastrointestinal bacteria. This ensures stabilization of the intestinal microflora and provides energy for large intestine cells.
Increased potassium and sodium content	Allows for compensation of losses caused by vomiting or diarrhea.
Ginger	The addition of ginger stimulates the peristalsis of the digestive tract, protects and has soothing effect in the gastrointestinal tract.

* Intestinal Dog digestibility test report, published in Veterinary Life 2018 n 3, p.28

Composition:

Rice, dehydrated poultry, corn, fresh chicken, beet pulp, hydrolyzed poultry liver, minerals, L-glutamine (1%), carob, poultry oil, inuline (source of FOS, 7500 mg/kg), fish oil, ginger (1000 mg/kg), yeast, mannanoligosaccharides (MOS), citrus extracts, glucosamine, *Yucca schidigera*, chondroitin.

Nutritional additives per kg:

Vitamins: vitamin A 16000 IU, vitamin D3 1600 IU, vitamin E 500 mg;

Trace elements: iron (iron (II) sulphate monohydrate) 75 mg, iodine (potassium iodide) 3.5 mg, copper (copper (II) sulfate pentahydrate) 10 mg, manganese (manganous sulphate, monohydrate) 7.5 mg, zinc (zinc oxide) 120 mg, selenium (sodium selenite) 0.12 mg;

Technological additives: Antioxidants: Tocopherol extracts of vegetable oils.

Analytical constituents	As Fed	Dry Matter	Per 100 kcal ME
Crude protein	30.00%	33.00%	8.3 g
Crude oils and fats	10.00%	11.00%	2.8 g
Crude fibre	2.80%	3.10%	0.8 g
Crude ash	7.00%	7.70%	1.9 g
Moisture	9.00%		
Calcium	1.30%	1.43%	361 mg
Phosphorus	0.80%	0.88%	222 mg
Potassium	1.20%	1.32%	333 mg
Sodium	0.25%	0.27%	69 mg
Metabolisable energy:			
kcal/100 g	360		
kJ/100 g	1505		

INTESTINAL

HIGH PROTEIN CONTENT, MOS & FOS

Complete and balanced dietary food adult and growing dogs. Recommended in reduction of intestinal absorptive disorders and compensation for maldigestion.

Dietetic indications

- Compensation for maldigestion
- Reduction of intestinal absorptive disorders
- Can be used in puppies

Contraindications

- Do not use in acute pancreatitis
- Do not use in chronic renal failure or hepatic encephalopathy

INTESTINE

MOS
MANNANOLIGO-SACCHARIDES

FOS
FRUCTOOLIGO-SACCHARIDES

INCREASED PROTEIN

TASTY

Packaging:

200 g and 400 g

FEATURES	BENEFITS
High protein content	High content of easily digestible protein ensures optimal regeneration of enterocytes, intestinal villi renewal and optimal trace elements absorption.
Monoprotein	Selected and limited to one source protein of animal origin (lamb) lowers the risk of intolerance of ingredients and nutrients.
Grain-free	The recipe is grain-free and the only carbohydrate source is potatoes, which may reduce the risk of gluten intolerance and allergy to cereal proteins.
FOS (fructooligosaccharides)	FOS is used by the beneficial bacteria as a medium for their growth, which helps to balance the microflora in the digestive tract. Indirectly, through the metabolites of the gastrointestinal microflora, it stimulates local immunity.
MOS (mannanoligosaccharides)	MOS have a unique ability to stimulate the natural mechanisms of non-specific immunity in the gastrointestinal tract.

Composition:

Lamb (50%), potatoes (10%), minerals (1%), FOS (0.1%), MOS (0.1%), Yucca schidigera (0.1%), salmon oil (0.1%).

Nutritional additives per kg:

Vitamins: vitamin D3 200 IU;

Trace elements: zinc as monohydrate zinc sulphate 25 mg, manganese as sulphate manganese, monohydrate 1.4 mg, iodine as calcium iodate, anhydrous 0.75 mg.

Analytical constituents	As Fed	Dry Matter	Per 100 kcal ME
Crude protein	8.60%	43.00%	9.3 g
Crude fat	5.20%	26.00%	5.7 g
Crude fibre	1.90%	9.50%	2.1 g
Crude ash	0.50%	2.50%	0.54 g
Moisture	80.00%		
Calcium	0.18%	0.90%	0.2 g
Phosphorus	0.15%	0.75%	0.2 g
Sodium	0.16%	0.80%	0.2 g
Potassium	0.30%	1.50%	0.32 g
Omega-6 FA	0.40%	2.00%	0.43 g
Omega-3 FA	0.10%	0.50%	0.11 g
Energy (kcal/100 g)	92		

LARGE PUPPY

FOOD FOR LARGE AND GIANT - BREED PUPPIES (OVER 25 KG)

80g TURKEY per 100g

Indications

RAW PALEO® Large Puppy is complete and balanced for large-breed puppies (adult body mass over 25 kg) intended to use from weaning to 18 months of age. It is grain-free and monoprotein, which means turkey is the only source of animal protein. The addition of New Zealand mussel, chondroitin sulphate and glucosamine has a positive effect on the development of the skeletal system and the function of joints in growing large-breed dogs. The addition of DHA helps support vision and brain development. Salmon oil supports skin and coat condition, as well as nervous system. The high palatability of the feed is due to freshly prepared ingredients: turkey and carrots.

Packaging

2,5 kg and 12 kg

A new food should be introduced gradually by mixing it with the previous food over a period of approx. 2 weeks.

MONOPROTEIN TURKEY | GRAIN-FREE RECIPE | FRESHLY PREPARED BEEF & CARROTS | BRAIN DEVELOPMENT SUPPORT | SKIN & COAT | JOINTS SUPPORT

PROPERTIES	BENEFITS
Monoprotein (turkey)	A single source of animal-derived protein reduces the risk of food allergy to other proteins beyond those indicated.
Grain-free recipe	The carbohydrate sources are sweet potatoes and potatoes. The formula contains no maize, soya, wheat or oats, which reduces the risk of gluten intolerance and allergies to cereal and soya proteins.
Salmon oil	The best source of Omega-3 polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These acids show a number of pro-health effects in terms of supporting the proper work of heart, kidneys, brain, joints, skin and other organs and systems.
High palatability	High palatability due to freshly prepared beef with carrots.
Glucosamine, chondroitin and *Perna canaliculus* mussel extract	Glucosamine and chondroitin sulphate support normal joint function. These are two of the best known protective components for joint cartilage. Green lipped mussel extract has a chondroprotective effect. All of these ingredients have a supporting effect on the normal metabolism of cartilage in growing dogs, especially large breeds.
DHA acid	In puppies, it influences the correct development of the central nervous system and the organ of vision. It supports learning and association abilities and improves communication skills. As an acid from the n-3 family it has many other pro-health functions exerted on the animal organism.

ANALYTICAL CONSTITUENTS	AS FED
Crude protein	28.0%
Crude fats	15.0%
Crude fiber	2.0%
Crude ash	7.5%
Omega-6 fatty acids	2.6%
Omega-3 fatty acids	0.8%
Calcium	1.4%
Phosphorus	1.1%
Moisture	8.0%
Metabolic energy kcal/100 g	385

ADDITIVES PER KG

Vitamins:

- Vitamin A 14423 IU
- Vitamin D3 (cholecalciferol) 1923 IU
- Vitamin E (alpha-tocopheryl acetate) 96 IU

Trace elements:

- Zinc (zinc sulfate monohydrate) 50 mg
- Iron (iron II sulfate monohydrate) 50 mg
- Manganese (manganese sulfate monohydrate) 35 mg
- Copper (copper II sulphate pentahydrate) 14 mg
- Iodine (calcium iodate anhydrous and potassium iodide) 1 mg
- Selenium (sodium selenite) 0,28 mg

COMPOSITION

Content per 100 g:

- Turkey 80 g
- Freshly prepared turkey 48,5 g*
- Dried turkey 25 g
- Turkey fat 4,5 g
- Turkey meat sauce 2 g
- Sweet potatoes, potatoes
- Freshly prepared carrots 12,8 g*
- Salmon oil 3 g
- Green lipped mussel 0,3 g
- Minerals
- Vitamins
- DHA supplement 0,5 g
- Glucosamine 961 mg
- Chondroitin 961 mg

* Equivalent of 31% freshly prepared turkey and 10% freshly prepared carrots before removal of water

LARGE ADULT

FOOD FOR ADULT DOGS OF LARGE AND GIANT - BREED (OVER 25 KG)

Indications

RAW PALEO® Large Adult is a complete and balanced food for large breed dogs (over 25 kg) from the age of 1.5 years. It is grain-free and the carbohydrate sources are sweet potatoes and potatoes. The monoprotein formula means that the only source of animal protein is turkey. Natural chondroprotective substances from *Perna canaliculus* mussels help to support joint health in large breed dogs, while the addition of salmon oil and borage oil promotes skin and coat condition. The high palatability of the food is due to the very high proportion of freshly prepared ingredients: turkey and carrots.

Packaging

2,5 kg and 12 kg

A new food should be introduced gradually bymixing it with the previous food over a period of approx. 2 weeks.

MONOPROTEIN TURKEY | GRAIN-FREE RECIPE | FRESHLY PREPARED BEEF & CARROTS | DIGESTION MOS & FOS | SKIN & COAT | JOINTS SUPPORT

PROPERTIES	BENEFITS
Monoprotein (turkey)	A single source of animal-derived protein reduces the risk of food allergy to other proteins beyond those indicated.
Grain-free recipe	The carbohydrate sources are sweet potatoes and potatoes. The formula contains no maize, soya, wheat or oats, which reduces the risk of gluten intolerance and allergies to cereal and soya proteins.
Salmon oil	The best source of Omega-3 polyunsaturated fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These acids show a number of pro-health effects in terms of supporting the proper work of heart, kidneys, brain, joints and other organs and systems.
Borage oil	The richest source of gamma-linolenic acid (GLA) among oils. Supports proper functioning of skin and coat. It is a component of substances constituting a barrier protecting against evaporation of water from the body and against penetration of and against the penetration of allergens or harmful agents to the skin.
High palatability	High palatability due to freshly prepared turkey with carrots.
***Perna canaliculus* mussel extract**	New Zealand green lipped mussel extract is a source of glycosaminoglycans - natural building blocks of joint cartilage; supports correct functioning of joints.

ANALYTICAL CONSTITUENTS	AS FED
Crude protein	23,0%
Crude fats	15,0%
Crude fiber	2,0%
Crude ash	7,5%
Omega-6 fatty acids	2,6%
Omega-3 fatty acids	0,7%
Calcium	1,4%
Phosphorus	1,1%
Moisture	8,0%
Metabolic energy	
kcal/100 g	380

ADDITIVES PER KG

Vitamins

- Vitamin A (retinyl acetate) 14425 I U
- Vitamin D 3 (cholecalciferol) 2000 IU
- Vitamin E (octan alfa-tokoferolu) 95 mg

Trace elements:

- Zinc (zinc sulfate monohydrate) 50 mg
- Iron (iron II sulfate monohydrate) 50 mg
- Manganese (manganese sulfate monohydrate) 35 mg
- Copper (copper II sulphate pentahydrate)15 mg
- Iodine (calcium iodate anhydrous and potassium iodide) 1mg
- Selenium (sodium selenite) 0,3 mg

COMPOSITION

Content per 100 g:

- Turkey 80 g
- Freshly prepared turkey 50 g*
- Dried turkey 23,5 g
- Turkey fat 4,5 g
- Turkey meat sauce 2 g
- Sweet potatoes, potatoes
- Freshly prepared carrots 15,8 g*
- Salmon oil 3 g
- Yeast
- Minerals
- Vitamins
- Green lipped mussel 0,3 g
- Borage oil

* Equivalent of 32% freshly prepared turkey and 10% freshly prepared carrots before removal of water

PUPPY

PUPPY WET FOOD

MONOPROTEIN | HIGH PROTEIN CONTENT | GRAIN-FREE RECIPE | OMEGA-3 OMEGA-6 | BONE SUPPORT | WITHOUT FLAVOUR ENHANCERS OR PRESERVATIVES

Indications
RAW PALEO® Puppy is a complete and balanced feed for growing dogs from weaning to maturity (around 1 year of age). It also meets the requirements of pregnant and lactating bitches. The formula is grain-free and monoprotein, which means that the only source of animal protein is beef. It contains no preservatives.

Package: 400 g, 800 g

BEEF

COMPOSITION:
Beef and beef offal 70%, Beef broth 28,7%, Minerals 1%, Sunflower oil 0.2%, Eggshell powder 0.1%

Analytical constituents:
Crude protein 10.7%, Crude fat 6.9%, Crude ash 2.0%, Crude fibre 0.3%, Moisture 75%

ADDITIVES PER KG:
Vitamin D3 200 IU, Zinc (as zinc chelate with glycine hydrate) 25 mg, Manganese (manganese sulphate II monohydrate) 1,4 mg, Iodine (calcium iodate, anhydrous) 0,75 mg

Indications
RAW PALEO® Puppy is a complete and balanced food for growing dogs from weaning to maturity (around 1 year of age). It also meets the requirements of pregnant and lactating bitches. The recipe is grain free and monoprotein, which means that the only source of animal protein is lamb. It contains no preservatives.

Package: 400 g, 800 g

LAMB

COMPOSITION:
Lamb and lamb offal 70%, Lamb broth 28,7%, Minerals 1%, Linseed oil 0.2%, Egg shell powder 0.1%

Analytical constituents:
Crude protein 10.6%, Crude fat 6.9%, Crude ash 2.10%, Crude fibre 0.30%, Moisture 75%

ADDITIVES PER KG:
Vitamin D3 200 IU, Zinc (as zinc chelate with glycine hydrate) 25 mg, Manganese (manganese sulphate II monohydrate) 1,4 mg, Iodine (calcium iodate, anhydrous) 0,75 mg

Indications
RAW PALEO® Puppy is a complete and balanced food for growing dogs from weaning to maturity (around 1 year of age). It also meets the requirements of pregnant and lactating bitches. The recipe is grain-free and monoprotein, which means that the only source of animal protein is turkey. It contains no preservatives.

Package: 400 g, 800 g

TURKEY

COMPOSITION:
Turkey and turkey offal 70%, Turkey broth 28.7%, Minerals 1%, Salmon oil 0.2%, Eggshell powder 0.1%

Analytical constituents:
Crude protein 10.3%, Crude fat 5.3%, Crude ash 2.50%, Crude fiber 0.30%, Moisture 78%

ADDITIVES PER KG:
Vitamin D3 200 IU, Zinc (as zinc chelat with glycine hydrate 25 mg, Manganese (manganese sulphate II monohydrate) 1,4 mg, Iodine (calcium iodate, anhydrous) 0,75 mg, Copper (as copper sulfate pentahydrate) 1mg

ADULT

WET FOOD FOR ADULT DOGS

MONOPROTEIN | HIGH PROTEIN | GRAIN-FREE RECIPE | OMEGA-3 OMEGA-6 | WITHOUT FLAVOUR ENHANCERS OR PRESERVATIVES

UP TO 70% MEAT & OFFAL

Indications

RAW PALEO® Adult is a complete and balanced food for adult dogs from the age of maturity (after 1 year). The feed is Grain-Free Recipe and monoprotein, which means beef is the only source of animal protein. Contains no preservatives.

Package: 400 g, 800 g

BEEF

COMPOSITION:

Beef and beef offal 70%, Beef broth 28.8%, Minerals 1%, Sunflower oil 0.2%

Analytical constituents:

Crude protein 10,8%, Crude fat 6.9%, Crude ash 2.0%, Crude fibre 0.3%, Moisture 75%.

ADDITIVES PER KG:

Vitamin D3 200 IU, Zinc (as zinc chelate with glycine hydrate) 25 mg, Manganese (manganese sulphate II monohydrate) 1,4 mg, Iodine (calcium iodate, anhydrous) 0,75 mg

Indications

RAW PALEO® Adult is a complete and balanced food for adult dogs from the age of maturity (after 1 year of age). The feed is Grain-Free Recipe and monoprotein, which means that the only source of animal protein is lamb. It contains no preservatives.

Package: 400 g, 800 g

LAMB

COMPOSITION:

Lamb and lamb offal 70%, Lamb broth 28.8%, Minerals 1%, Linseed oil 0.2%

Analytical constituents:

Crude protein 10,7%, Crude fat 6.9%, Crude ash 2.10%, Crude fibre 0.30%, Moisture 75%

ADDITIVES PER KG:

Vitamin D3 200 IU, Zinc (as zinc chelate with glycine hydrate) 25 mg, Manganese (manganese sulphate II monohydrate) 1.4 mg, Iodine (calcium iodate, anhydrous) 0.75 mg

Indications

RAW PALEO® Adult is a complete and balanced food for adult dogs from the age of maturity (after 1 year of age). The feed is Grain-Free Recipe and monoprotein, which means that the only source of animal protein is turkey. It contains no preservatives.

Package: 400 g, 800 g

TURKEY

COMPOSITION:

Turkey and turkey offal 70%, Turkey broth 28.8%, Minerals 1%, Linseed oil 0.2%

Analytical constituents:

Crude protein 10.3%, Crude fat 5.3%, Crude ash 2.50%, Crude fiber 0.30%, Moisture 78%

ADDITIVES PER KG:

Vitamin D3 200 IU, Zinc (as zinc chelate with glycine hydrate) 25 mg, Manganese (manganese sulphate II monohydrate) 1.4 mg, Iodine (calcium iodate, anhydrous) 0.75 mg, Copper (as copper sulphate pentahydrate) 1 mg

LIGHT

WET FOOD. LOW CALORIE FOR ADULT DOGS

MONOPROTEIN | LOW CALORIE | OMEGA-3 OMEGA-6 | WITHOUT FLAVOUR ENHANCERS OR PRESERVATIVES

UP TO 70% MEAT & OFFAL

Indications

RAW PALEO® Adult Dog Light is a complete and balanced food for adult dogs prone to overweight from adulthood (after 1 year of age). It is gluten-free (Gluten Free Recipe) and monoprotein, which means that the source of all animal ingredients is beef. It contains no preservatives.

Package: 400 g

GLUTEN-FREE RECIPE

BEEF

COMPOSITION:

Beef and beef offal 65%, Beef broth 28.8%, Minerals 1%, Rice 5%

Analytical constituents:

Crude protein 10.7%, Crude fat 6.6%, Crude ash 2.1%, Crude fibre 0.5%, Moisture 75%

ADDITIVES PER KG:

Vitamin D3 200 IU, Zinc (as zinc chelate with glycine hydrate) 25 mg, Manganese (manganese sulphate II monohydrate) 1,4 mg, Iodine (calcium iodate, anhydrous) 0,75 mg

Indications

RAW PALEO® Adult Dog Light is a complete and balanced food for adult dogs prone to overweight from adulthood (after 1 year of age). It is Grain-Free Recipe and monoprotein, which means that the source of all animal ingredients is beef. It contains no preservatives.

Package: 400 g

GRAIN-FREE RECIPE

LAMB

COMPOSITION:

Lamb and lamb offal 65%, Lamb broth 28.8%, Carrots 5%, Minerals 1%

Analytical constituents:

Crude protein 10,6%, Crude fat 6.6%, Crude ash 2.2%, Crude fibre 0.5%, Moisture 75%

ADDITIVES PER KG:

Vitamin D3 200 IU, Zinc (as zinc chelate with glycine hydrate) 25 mg, Manganese (manganese sulphate II monohydrate) 1.4 mg, Iodine (calcium iodate, anhydrous) 0.75 mg

Indications

RAW PALEO® Adult Dog Light is a complete and balanced food for adult dogs prone to overweight from the age of maturity (after 1 year of age).The food is grain-free and monoprotein, meaning that turkey is the source of all animal ingredients. It contains no preservatives.

Package: 400 g

GRAIN-FREE RECIPE

TURKEY

COMPOSITION:

Turkey and turkey offal 65%, Turkey broth 28.8%, Potatoes 5%, Minerals 1%

Analytical constituents:

Crude protein 10.3%, Crude fat 5.1%, Crude ash 2.50%, Crude fiber 0.50%, Moisture 77%

ADDITIVES PER KG:

Vitamin D3 200 IU, Zinc (as zinc chelate with glycine hydrate) 25 mg, Manganese (manganese sulphate II monohydrate) 1.4 mg, Iodine (calcium iodate, anhydrous) 0.75 mg, Copper (as copper sulphate pentahydrate) 1 mg

The dosage of **RAW PALEO Light** cans is the only one given in grams in order to optimally match the amount of food given to your dog's daily needs.

KITTEN

WET FOOD FOR GROWING CATS

MONOPROTEIN · HIGH PROTEIN · GRAIN-FREE RECIPE · CONTAINS TAURINE · OMEGA-6 OMEGA-3 · BONE SUPPORT · WITHOUT FLAVOUR ENHANCERS AND PRESERVATIVES

UP TO 70% MEAT & OFFAL

Indications

RAW PALEO® Kitten is a complete and balanced food for growing cats from weaning to one year of age. The food is Grain Free Recipe and monoprotein, which means that beef is the only source of animal protein. Powdered eggshells are the source of calcium in the recipe. No preservatives.

Package: 100 g

BEEF

COMPOSITION:

Beef and beef offal 70%, Beef broth 28.8%, Minerals 1%, Salmon oil 0.2%, Egg shell powder 0.1%

Analytical constituents:

Crude protein: 10.7%, Crude fat: 6.9%, Crude ash: 0.3%, Crude fibre: 2.1%, Moisture: 78%

ADDITIVES PER KG:

Vitamin D3 (cholecalciferol) 200 IU, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg, Iodine (as calcium iodate, anhydrous) 0.75 mg, Taurine 1500 mg

Indications

RAW PALEO® Kitten is a complete and balanced food for growing cats from weaning to one year of age. The formula is Grain Free Recipe and the source of animal protein is venison. Powdered eggshells are the source of calcium in the recipe. No preservatives.

Package: 100 g

GAME

COMPOSITION:

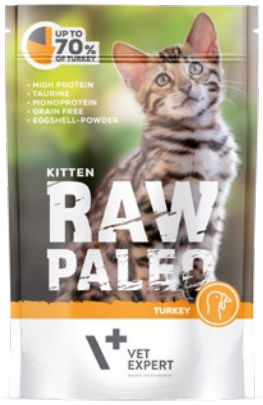
Game meat and game meat offal 70%, Game meat broth 28.8%, Minerals 1%, Hemp oil 0.2%, Egg shell powder 0.1%

Analytical constituents:

Crude protein: 10.5%, Crude fat: 6.3%, Crude ash: 0.3%, Crude fibre: 2.2%, Moisture: 76%

ADDITIVES PER KG:

Vitamin D3 (cholecalciferol) 200 IU, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg, Iodine (as calcium iodate, anhydrous) 0.75 mg, Taurine 1500 mg



Indications

RAW PALEO® Kitten is a complete and balanced food for growing cats from weaning to one year of age. The food is Grain-Free Recipe and mono-protein, which means that the only source of animal protein is turkey. Powdered eggshells are the source of calcium in the recipe. No preservatives.

Package: 100 g

TURKEY

COMPOSITION

Turkey meat and offal 70%, Turkey broth 28.7%, Minerals 1%, Sunflower oil 0.2%, Egg shell powder 0.1%

Analytical constituents:

Crude protein: 10.3%, Crude fat: 5.3%, Crude ash: 0.3%, Crude fibre: 2.5%, Moisture: 79%.

ADDITIVES PER KG:

Vitamins: Vitamin D3 (cholecalciferol) 200 IU, Minerals:, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg, Iodine (as calcium iodate, anhydrous) 0.75 mg, Provitamins: Taurine 1500 mg

ADULT

WET FOOD FOR ADULT CATS

UP TO 70% MEAT & OFFAL

MONOPROTEIN · HIGH PROTEIN · GRAIN-FREE RECIPE · CONTAINS TAURINE · OMEGA-6 OMEGA-3 · WITHOUT FLAVOUR ENHANCERS AND

Indications
RAW PALEO® Adult Cat is a complete and balanced food for adult cats aged 1 year and over. The food is Grain Free Recipe and monoprotein, which means beef is the only source of animal protein. No preservatives.

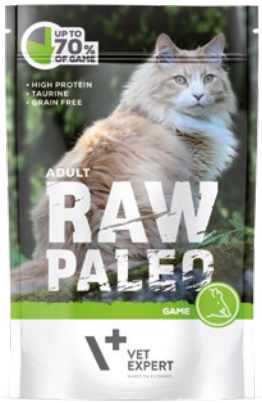
Packaging: 100 g

BEEF

COMPOSITION:
Beef and beef offal 70%, Beef broth 28.8%, Minerals 1%, Salmon oil 0.2%

Analytical constituents:
Crude protein: 10.7%, Crude fat: 6.9%, Crude ash: 0.3%, Crude fibre: 2.1%, Moisture: 78%

ADDITIVES PER KG:
Vitamin D3 (cholecalciferol) 200 IU, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg, Iodine (as calcium iodate, anhydrous) 0.75 mg, Taurine 1500 mg



Indications
RAW PALEO® Adult Cat is a complete and balanced food for adult cats aged 1 year and older. Grain Free Recipe with venison as the animal protein source. No preservatives.

Packaging: 100 g

GAME

COMPOSITION:
Venison and game offal 70%, Venison broth 2.8%, Minerals 1%, Hemp oil 0.2%

Analytical constituents:
Crude protein: 10.5%, Crude fat: 6.3%, Crude ash: 0.3%, Crude fibre: 2.2%, Moisture: 76%

ADDITIVES PER KG:
Vitamin D3 (cholecalciferol) 200 IU, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg, Iodine (as calcium iodate, anhydrous) 0.75 mg, Taurine 1500 mg

Indications
RAW PALEO® Adult Cat is a complete and balanced food for adult cats aged 1 year and over. The food is Grain Free Recipe and mono-protein, which means turkey is the only source of animal protein. No preservatives.

Packaging: 100 g

TURKEY

COMPOSITION:
Turkey and turkey offal 70%, Turkey broth 28.8%, Minerals 1%, Sunflower oil 0.2%

Analytical constituents:
Crude protein: 10.3%, Crude fat: 5.3%, Crude ash: 0.3%, Crude fibre: 2.5%, Moisture: 79%

ADDITIVES PER KG:
Vitamin D3 (cholecalciferol) 200 IU, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg, Iodine (as calcium iodate, anhydrous) 0.75 mg, Taurine 1500 mg

STERILISED

WET FOOD FOR STERILISED CATS

MONOPROTEIN · HIGH PROTEIN · L-CARNITYNA · CONTAINS TAURINE · OMEGA-6 OMEGA-3 · WITHOUT FLAVOUR ENHANCERS AND PRESERVATIVES

UP TO 70% MEAT & OFFAL

Indications

RAW PALEO® Sterilised Cat is a complete and balanced food for adult cats predisposed to overweight or obesity, and for sterilised cats from the age of one. The food is Grain-Free Recipe and monoprotein, which means that beef is the only source of animal protein. L-Carnitine and DL Thionine have been added to the recipe. No preservatives

Packaging: 100 g

GRAIN-FREE RECIPE

BEEF

COMPOSITION:

Beef and beef offal 68%, Beef broth 29%, Sweet potatoes 2%, Minerals 1%

Analytical constituents:

Crude protein: 10.6%, Crude fat: 6.7%, Crude ash: 0.5%, Crude fibre: 2.1%, Moisture: 78%

ADDITIVES PER KG:

Vitamin D3 (cholecalciferol) 200 IU, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg, Iodine (as calcium iodate, anhydrous) 0.75 mg, Taurine 1500 mg, DL-methionine 20 mg, L-carnitine 200 mg

Indications

RAW PALEO® Sterilised Cat is a complete and balanced food for adult cats predisposed to overweight or obesity, and for sterilised cats from the age of one. The formula is Grain Free Recipe and the source of animal protein is wild game. L-Carnitine and DL-Methionine have been added to the recipe. No preservatives.

Packaging: 100 g

GRAIN-FREE RECIPE

GAME

COMPOSITION

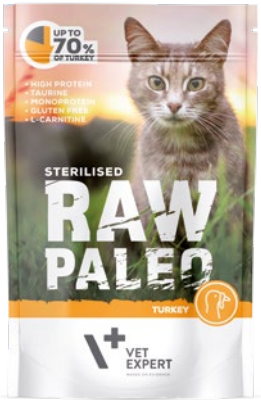
Game and game offal 68%, Game broth 29%, Parsnip 2%, Minerals 1%

Analytical constituents:

Crude protein: 10,4%, Crude fat: 6,1%, Crude ash: 0,4%, Crude fibre: 2,2%, Moisture: 76%

ADDITIVES PER KG:

Vitamins: Vitamin D3 (cholecalciferol) 200 IU Mineral components:, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg, Iodine (as calcium iodate, anhydrous) 0.75 mg, Provitamins: Taurine 1500 mg, DL-methionine 20 mg, L-carnitine 200 mg



Indications

RAW PALEO® Sterilised Cat is a complete and balanced food for adult cats with predispositions to overweight or obesity as well as for sterilised cats from the age of 1 year. The food is gluten-free (Gluten Free Recipe) and monoprotein, which means that the only source of animal protein is turkey. L-Carnitine, and DL Me- thionine have been added to the recipe. No preservatives.

Packaging: 100 g

GRAIN-FREE RECIPE

TURKEY

COMPOSITION:

Turkey and turkey offal 68%, Turkey broth 29%, Rice 2%, Minerals 1%

Analytical constituents:

Crude protein: 10.2%, Crude fat: 5.1%, Crude ash: 0.5%, Crude fibre: 2.5%, Moisture: 77%

ADDITIVES PER KG:

Vitamin D3 (cholecalciferol) 200 IU, Zinc (as zinc sulphate monohydrate) 25 mg, Manganese (as manganese sulphate II, monohydrate) 1.4 mg ,Iodine (as calcium iodate, anhydrous) 0.75 mg, Taurine 1500 mg, DL-methionine 20 mg, L-carnitine 200 mg

RAW® PALEO

VET EXPERT

FOLLOWING THE INSTINCT

DRY FEED INSPIRED BY NATURE

FRESHLY PREPARED INGREDIENTS

PALATABILITY

Ω3 FOS MOS

FUNCTIONAL ADDITIVES

GRAIN - FREE