

UNIVERZITET U BEOGRADU
FAKULTET VETERINARSKÉ MEDICINE

ZBORNİK PREDAVANJA
XLIII SEMINARA
ZA INOVACIJE
ZNAJJA VETERINARA



UNIVERZITET U BEOGRADU

FAKULTET VETERINARSKJE MEDICINE

**ZBORNİK PREDAVANJA XLIII SEMINARA
ZA INOVACIJE ZNANJA VETERINARA**

Beograd, 2022.

XLIII SEMINAR ZA INOVACIJE ZNANJA VETERINARA

Beograd, 25.02.2022.

Organizator:

Fakultet veterinarske medicine
Univerzitet u Beogradu

Organizacioni odbor:

Počasni predsednik: Prof. dr Milorad Mirilović, dekan

Predsednik: Prof. dr Danijela Kirovski

Članovi: Prof. dr Vanja Krstić, Doc. dr Milan Maletić, Doc. dr Slađan Nešić,
Doc. dr Ljubomir Jovanović, Asist. dr Branislav Vejnović, Maja Gabrić

Programski odbor:

Predsednik: Prof. dr Jakov Nišavić

Članovi: Prof. dr Ivan Jovanović, Prof. dr Vladimir Nešić, Prof. dr Nedeljko Karabasil, Prof. dr Dragan Šefer,
Prof. dr Sonja Radojičić, Prof. dr Ivan Vujanac, Doc. dr Miloš Vučićević



Izdavač:

Fakultet veterinarske medicine, Beograd
Centar za izdavačku delatnost i promet učila

CID

Za izdavača:

Prof. dr Milorad Mirilović, dekan FVM

Urednik:

Prof. dr Dragan Gvozdić

Lektura i korektura:

Prof. dr Ivan B. Jovanović

Prof. dr Jakov Nišavić

Prof. dr Dragan Gvozdić

Dizajn korica:

Prof. dr Ivan B. Jovanović

Prelom teksta:

Gordana Lazarević

Štampa:

Naučna KMD, Beograd, 2022

Tiraž: 450 primeraka

ISBN 978-86-80446-46-2

WHAT DIET SHOULD I CHOOSE FOR OPTIMAL PATIENT MANAGEMENT: A FUNCTIONAL OR VETERINARY DIET?

David Morgan*

Optimal patient care often involves a multimodal approach, combining medical, surgical, and nutritional management: e.g., canine atopic dermatitis, feline chronic kidney disease (renal insufficiency), osteoarthritis, chronic enteropathies, diabetes mellitus, cardiac insufficiency. For some conditions, nutrition may be the mainstay of management: e.g., overweight/obesity, urolithiasis, food responsive enteropathy, adverse food reactions. As part of their treatment strategies, veterinarians can choose from a wide range of nutritional products, from over-the-counter and functional feeds, freely available in shops and pet stores, or veterinary dietetic (prescription) feeds, dispensed by veterinarians. But which one is the best choice? Is it a simple case of always immediately choosing the veterinary diet? Or can we choose an alternative?

The choice of which is the best nutritional option depends on: (1) clinical examination and staging / severity of underlying pathology, matched to the ideal nutritional support, which has been based on the highest-ranking evidence based veterinary medicine. (2) client's wishes, e.g., do they actually want to feed a veterinary dietetic feed? (3) acceptability of the diet. (4) cost of feeding, based on short or long-term / lifelong requirements. Therefore, the best choice may not initially be immediately obvious.

Key Words: *Flexibility, Functional Feed, Microbiome, Veterinary Dietetic Feed*

INTRODUCTION

It is commonplace for veterinarians to incorporate specific nutrition into their patient's management protocol. There is a recognition that many diseases benefit from a multimodal approach, incorporating medical and or surgical strategies, alongside specific nutritional support through a targeted choice of ingredients and

* Morgan, David, BSc, MA, VetMB, CertVR, MRCVS, Aevum Pet Care, Belgrade, Serbia

formulation. This means there is an important central role for nutrition in many patients' optimal case management, far beyond *just* providing essential daily calories and nutrients (Kirk, 2006; Hand et al., 2015).

Disease specific veterinary nutrition started in 1928 when Dr. Mark L. Morris Sr. established Raritan Hospital for Animals in Edison, New Jersey, USA. Dr. Morris believed specialised nutrition could have a positive effect on the health of companion animals. Then, in 1939, a guide dog owner Mr Frank, asked Dr Morris to examine his dog Buddy. Dr Morris diagnosed kidney failure and believed Buddy could be helped with a food he had developed, dispensing a "kidney diet" called Raritan Ration B. This food was the original forerunner of the well-known Prescription Diet® k/d® Canine, and was the start of future veterinary diet formulations. Fast forward to 2022, and there is a wide choice of veterinary diets that nutritionally support many different conditions (Publications Office of the European Union, 2020, Commission Regulations (EU) 2020/354) and provide the clinician with more opportunities for optimal patient management through implementing a multimodal strategy of combining conventional therapy and nutrition. Finally, what are commonly referred to as "veterinary (prescription) diets" are officially referred to as a "Dietetic Feed" in the 2020/354 regulations and these terms will be used interchangeably in this text as will the terms "diet(s)" and "feed(s)".

This text is aimed at providing the context to the regulatory landscape for veterinary dietetic and functional feeds, and what are the fundamental steps needed to make the best choice of nutritional support for patients' as part of their optimal case management. Additionally, it is outside the scope of this text to go into detail about the detailed formulation of each diet and the nutritional requirements for support of specific pathologies. The reader is encouraged to access specific references if this detail is needed (Kirk, 2006; Hand et al., 2015).

Diagnostic Opportunities for Greater Optimal Patient Management

Over the last few decades, we have witnessed the incorporation of new and advanced diagnostic technology into daily clinic life: CT, MRI, ultrasound, endoscopy, in-clinic laboratory diagnostics (e.g., SNAP fPL Test, in-house analysers [IDEXX]) and laboratory services (e.g., IDEXX). New boundaries are also being broken with advanced technology helping target earlier implementation of management strategies in disease that have a high mortality and prevalence. Recently, artificial intelligence and machine learning have helped build an algorithm (Bradley et al., 2019) that predicts cats at risk of developing chronic kidney disease (CKD) up to 2 years before it occurs (RenalTech®/ Renal Detect, Antech). Feline CKD is a leading cause of mortality in cats over the age of 5, with a prevalence between 8% and 31% reported in geriatric cats (Bradley et al., 2019). Early detection of CKD allows for the implementation of management strategies that can help slow disease progression, with one key strategy being nutritional support with a diet that is protein and phosphorus restricted (International Renal Interest Society [IRIS]). Ultimately the goal in these patients is to improve the clinical ou-

tlook and quality of life, as well as avoid situations that might cause worsening of kidney function and acute kidney injury, such as administration of NSAIDs.

The advanced technology available, and knowledge, allows for investigations into previously challenging regions of the body, such as the gut microbiome, and its central role in whole-body health, and new treatment options such as faecal microbiome transplantation (FMT) (Pilla and Suchodolski, 2020). For the clinician there are also more opportunities to train for, and gain, European or American Diplomat specialised status. When coupled with University facilities, University staff and the upsurge of private equity investment in specialised veterinary hospitals and Diplomats, veterinarians continue to push the boundaries of what is possible in terms of diagnostics and optimal patient management strategies.

Additionally, clients have wider access to pet insurance, fixed monthly health-care plans, and have a greater awareness of human health which has been transferred to their pets (e.g., *humanisation of pets*), meaning that clients are also willing to pursue more complete diagnostic procedures and management recommendations for their pets.

Finally, the impact of Government measures to combat COVID has driven up companion animal ownership, with many people seeking pet companionship while confined to their home. Clients have had more disposable income and have been willing to spend more on their pets.

From a nutritional standpoint, over the last few decades there has been tremendous growth in the type and availability of veterinary dietetic formulations, aimed at keeping pace with all these advancements in veterinary diagnostics and therapy options. Many commercial companies are involved in investment into the creation and production of these diets, providing the veterinary clinics with a wide choice for their patients, alongside the ability for the clinic to generate a monetary income.

Throughout all these advancements, nutrition has remained a central and core part of patient management. In part, we must provide their daily calories, along with the fundamental nutrients that support life. But this is where the simplicity stops. Today, there is tremendous investment in developing new and advanced dietary formulations, backed by high-ranking evidence based veterinary medicine (EBVM) in the form of research and peer reviewed publications. Clinicians quite rightly demand high-ranking EBVM in support of the choice of nutrition dispensed to aid in their patients` management.

Veterinary and Functional Diets: Availability and Regulations

Veterinary Diets (dietetic feeds): The rapidity in the development of new diagnostics, and the wide-reaching research behind dietary formulations aimed at the support of patient`s health, created a need to bring structure to the development and promotion of nutrition aimed at supporting companion animals with specific morbidities. To help bring this governance for the marketing and *fundamental* for-

mulation of specific veterinary diets, the European Union introduced Regulations to aid commercial companies, alongside State Regulatory Authorities, in the development, marketing, and promotion of dietary formulations placed on the market. The principal Regulations are the Commission Regulations (EU) 2020/354 (formerly Directive 2008/38/EC) that lay down specific criteria that needs to be followed and applied to the formulations and what appears on the packaging in terms of declared information in the labelling analysis and the descriptive verbatim wording that must be used (Publications Office of the European Union, 2020, Commission Regulations (EU) 2020/354). Part B of these regulations has the List of Intended Use, specifically the list of Particular Nutritional Purpose, which “*indicates*” the pathology the diet is aimed at supporting. The rest of Part B provides the required additional criteria for the diet, which will be explained later in this manuscript.

These Regulations (EU) 2020/354, often referred to as PARNUTs, as they regulate feeds intended for PARticular NUTritional purposes, can be easily downloaded (<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0354>) and are a short read, providing veterinarians with greater context in understanding the rationale behind the creation and marketing of veterinary dietetic feeds. Because veterinary diets represent “animal feed” that will be placed on the market, they are also covered by the more general European Regulations (EC) No 767/2009. However, veterinary diets should initially be assessed if they adhere fully to the PARNUTs regulations before moving to the more general Regulations (EC) No 767/2009. The first consideration is if the dietary formula has a Particular Nutritional Purpose that is in the List of Intended Use found in Part B of PARNUTs, and also meets all other criteria listed. If this first consideration is not met, the product cannot be placed on the market as a dietetic feed.

Despite the central role that veterinary diets can perform in patient management, as part of a multi-modal approach, or as the sole choice for a clinical intervention, they cannot be seen as a “*treatment*” or “*cure*” in the same way as an authorised veterinary medicine. This may sound paradoxical given that in some diseases such as urolithiasis, obesity, or as from stage 2 in dogs and cats with early-stage chronic kidney disease (<http://www.iris-kidney.com/guidelines/staging.html>), nutritional intervention can be regarded as the mainstay in patient management. However, veterinary dietetic feeds are not authorised veterinary medicines, in the same way as e.g., antibiotics, anti-inflammatories, and therefore cannot be thought of as the same, despite their obvious “*clinical benefit*” in disease management. Nutrition, no matter its formulation and ingredient content, must be fundamentally considered as a “*support*” of the patient. While the list of Particular Nutritional Purpose(s) found in the regulations could be thought of as a list of “*indications*”, it would be very unwise to use this terminology for a dietetic feed, “indications” should be reserved for the use of authorised veterinary medicines. Finally, State Authorities involved in regulation of veterinary medicines, can monitor the formulation, packaging, sale, marketing & promotion (including company web sites, social media) of these dietetic feeds intended for dispensing by veteri-

narians (e.g., UK Government's Veterinary Medicine Directorate). Transgressions from European and State Regulations can be enforced by these authorities, with a worse-case scenario that a company must recall its diet from sale in the market.

Functional Diets (feeds): A more recent appearance of dietary choice for companion animals has been incorporation of functional ingredients (e.g., a specific feedstuff and / or additive) into complete diets (Di Cerbo et al., 2017), and the widespread marketing of the resultant Functional Diets. While Functional Diet formulations are not created to exactly mirror veterinary dietetic feeds, there will be an inevitable and variable overlap in their choice of ingredients, including nutraceuticals, level of inclusion of key nutrients (e.g., protein, fat, carbohydrates, specific vitamins and other additives) and manufacturing processes (e.g., digestibility of key nutrients). Additionally, Functional diets are not formulated and marketed as veterinary dietetic feeds, and consequently do not follow PARNUTs. They are guided by European Regulations (EC) No 767/2009, which covers placing of a typical (animal) feed materials on the market: e.g., a complete and balanced dog or cat diet (Publications Office of the European Union, 2009, Commission Regulation (EC) No 767/2009). Therefore, the potential range of different Functional diet formulations can be quite extensive as compared to veterinary dietetic feeds, with the latter being "limited" by the approved list of Particular Nutritional Purpose found in PARNUTs.

The term 'functional food' was devised in Japan in the early 1980s (Arihara, 2014). The term described processed foods having disease-preventing and/or health-promoting benefits in addition to their (fundamental) nutritive value. For companion animals, we do not have an agreed definition of a Functional food, therefore, the best option is to adopt what is used for human consumption: "*Functional foods can be defined as dietary items that, besides providing nutrients and energy, beneficially modulate one or more targeted functions in the body, by enhancing a certain physiological response and/or by reducing the risk of disease*". Functional Foods can be further defined by their choice of ingredients and or additive: "*A functional ingredient is a bioactive compound [e.g., omega-3 fatty acids, vitamin antioxidants, prebiotics, botanical phytonutrients, minerals] that can be used in the manufacture of functional food products. These bioactive compounds can be obtained from a variety of sources such as primary produce, marine sources, microorganisms and inorganic raw materials*". In human nutrition, functional foods overlap with nutraceuticals, medical foods, probiotics, designer foods, pharmafoods, and vitafoods (Arihara, 2014).

These days, there is a lot of nutritional terminology that pet owners and veterinarians are confronted with, and it can be very confusing to tease everything apart and get clarity. For nutraceuticals, we can again look to a definition from human nutrition: "*a "Nutraceutical" is a substance that may be considered a food or part of a food which provides medical or health benefits, encompassing prevention and treatment of disease. Products as diverse as isolated nutrients, dietary supplements and diets to genetically engineered "designer" foods, herbal products, and processed foods (cereals, soups, beverages) may be included under*

the umbrella of nutraceuticals" (Dudeja and Gupta, 2016). Once again, attention must be taken when using the terms "prevention" and "treatment" when linked to disease as they are considered medicinal claims (enforced by EU Regulations No 767/2009) and should be reserved for approved veterinary medicines and not any type of companion animal diet. Finally, we have the term "superfood": *"The term "superfood" refers to foods that are beneficial to human health due to their high levels of nutrients and/or bioactive phytochemicals such as antioxidants"* and are often thought of as individual ingredients that are rich in certain compounds, for example antioxidants, fibre, or fatty acids (Taulavuori *et al.*, 2013). However, the term "superfood" has been used ambiguously in popular media, and often marketed with misleading health claims of preventing and curing ailments. Lack of agreed consensus and regulatory control, results in variations in the definition of Functional Foods and Superfoods, and it is inevitable there is overlap of potential ingredients and formulations. For simplicity and clarity, the focus of this script will be on Veterinary dietetic and Functional diets.

What's the best choice for the patient? A Veterinary or Functional Diet?

With such a wide choice of dietary formulations available, both veterinary and functional, there needs to be a logical approach to making a decision. The ultimate goal must always be to ensure that patient care is kept as optimal as possible, throughout the management period: which may be short-term (e.g., days, 1-2 weeks), long-term (e.g., 3-4 weeks, months) or indefinite (lifelong). Understanding the presenting pathology, and its potential response to nutritional intervention, will be central in our decision-making process. The signalment provides crucial data on the age, breed and sex (entire or neutered) of the dog or cat and by ruling in or out certain diagnoses, the data can already start to create a problem list (Hedhammar, 2010).

The patient's anamnesis then provides more in-depth information, helping to finalise the problem list and differential diagnoses. Once a definitive diagnosis is made the most appropriate approach to management can be made. If changing the patient's diet is part of a multimodal approach, or the principal approach for management or further diagnostics e.g., Adverse Food Reaction (Hand *et al.*, 2015), it is important to align and gain agreement with the client as to the final decision. This helps make sure they are clear as to why the choice was made and will help with compliance towards feeding. As part of this agreement, the client's wishes need to be understood and incorporated into a discussion, e.g., do they like the idea of feeding a veterinary diet? Is there any potential issue around the acceptability of the diet, is palatability going to be an issue (e.g., reduced appetite in cats with late-stage chronic kidney disease)? Providing an indication of the daily cost of feeding, based on short or long-term / lifelong requirements, will help with managing the client's expectations and help avoid misunderstandings.

If the underlying pathology unequivocally means that the best choice is a specific dietary formulation, such as a restricted protein and phosphorus dietetic

“Kidney Diet” for a cat with stage 2, 3 or 4 Chronic Kidney Disease (Elliott et al., 2000; Hand et al., 2015), the client should be informed of the benefits of the diet in helping positively support the day-to-day management of the condition and its progression. If the recommendation is for lifelong feeding because the condition is both progressive and / or irreversible (e.g., feline chronic kidney disease/insufficiency, osteoarthritis, chronic cardiac insufficiency) then the client should be informed of the potential loss of health benefits if the proposed diet is not implemented.

The *best* choice of diet will bring together the signalment, anamnesis, diagnosis, medical management, and the client’s requirements. From this process a decision on the nutrition that can help support the patient, alongside any medical management, can be made (fig 1).

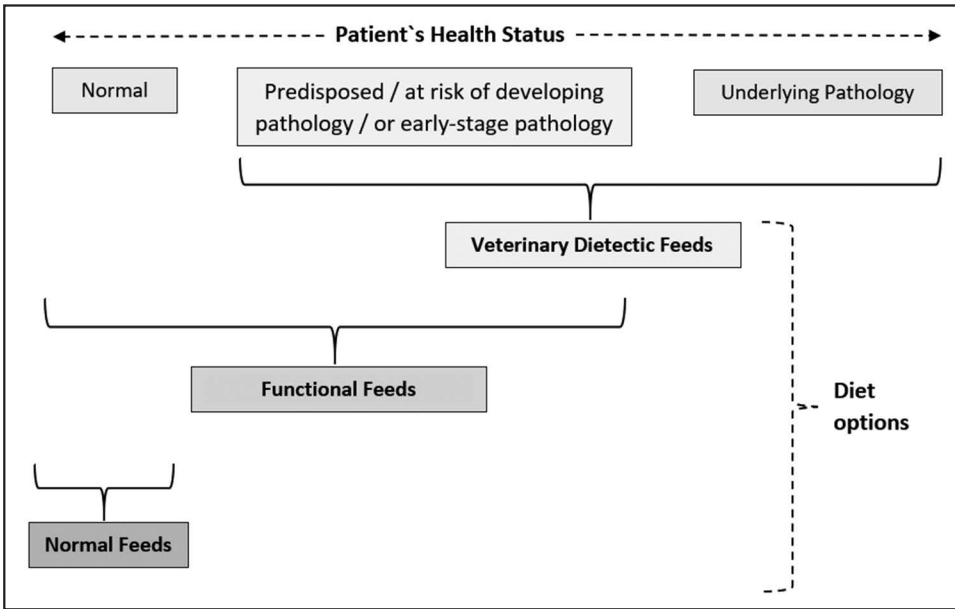


Figure 1. There is great flexibility available to veterinarians and their clients for the best choice of nutritional support for their pet, in health, when predisposed / at risk to pathology, or when they have developed pathology. Careful assessment must be made of the patient, and through an open discussion with the client, a feed can be chosen. Repeated patient monitoring is required to assess if any modification to the feeding regimen is required.

The rationale behind dietary options

Veterinary Formulations

The PARNUTs Commission Regulations (EU) 2020/354 provide twenty-one separate Particular Nutritional Purposes for dogs and cats. The majority address both species, e.g., “Reduction of excessive body weight”, but some are species specific, e.g., “Reduction of copper in the liver” for dogs only, and “Reduction of

iodine levels in feed in case of hyperthyroidism” for cats only. Part B of the regulations provides the List of Intended Uses and lays out, in six columns, the requirements and / or recommendations, that commercial companies need to incorporate into the product’s formulation and communication on the packaging. Table 1 summarises three Particular Nutritional Purposes and the requirements required to place these products onto the market. It should be noted that column 5 indicates the “Recommended length of time” that the product is to be fed for. If there is a limited feeding period mentioned, column 6 provides further guidance that needs to be listed on the packaging and gives the veterinarian an option to extend feeding: e.g., “It is recommended that advice from a veterinarian be sought before use and before extending the period of use.” Due to the specific Essential Nutritional requirements laid out in column 2, veterinary diets will be carefully formulated around some key requirements and the quality assurance procedures, which monitor the accuracy of the final analysis, will be rigorous. The required declarations will actually also be covered by the general regulations that cover general (animal) feed materials, namely Article 17(2) and Annex IV of Regulation (EC) No 767/2009. Additionally, any additives added or declared, are covered by Regulation (EC) No 1831/2003. The formulators can include certain feed materials (ingredients) and / or additives, which are not listed in column 2, if they feel these additions will be beneficial. An example are omega-3 fatty acids for “Support of renal function in case of chronic renal insufficiency”, and their addition is now covered by requirements laid out in column 4, “Labelling declarations” (table 1).

It is clear that the dispensing of these dietetic veterinary feeds and monitoring of a patient’s clinical response to medical treatment and the chosen nutritional support, is an important responsibility of the veterinarian and their clinic team.

Functional diets (feeds)

“Novel foods and food components have been identified as “functional” because they provide health benefits beyond the provision of essential nutrients, such as vitamins, minerals, water, proteins, carbohydrates and fats” (Di Cerbo et al., 2014). *“Functional foods provide health benefits if they are consumed on a regular basis as part of a varied diet”*, although extensive clinical studies representing high ranking EBVM, are sadly lacking for dogs and cats (Di Cerbo et al., 2014). Despite this, there is a varied range of Functional diet formulations available commercially (table 2). It is clear that some of the Essential Nutritional Characteristics mentioned in Column 2 of the PARNUTs Regulations (table 1), can be incorporated into a functional formulation. However, any Particular Nutritional Purpose listed in Column 1 of PARNUTs, cannot be mentioned verbatim, otherwise the diet now falls under these dietetic feed regulations. Functional diets should be a Complete feed, by providing the daily ration of the dog or cat. While functional treats / snacks exist, which are Complementary feeds (sufficient for a daily ration only if used in combination with other feed), the focus of this text is complete feeds.

Table 1. Selected data for three key Particular Nutritional Purposes. Information has been taken from Part B, List of Intended Uses, Commission Regulations (EU) 2020/354 (PARNUTs). Refer to the official file for the full explanation and list.

Particular nutritional purpose	Essential nutritional characteristics	Species or category of animal	Labelling declarations	Recommended length of time	Other provisions (not all provisions have been listed)
1	2	3	4	5	6
Support of renal function in case of chronic renal insufficiency	High quality proteins and phosphorus ≤5g/kg complete feed with a moisture content of 12% and crude protein ≤220 g/kg complete feed with a moisture content of 12%	Dogs	Protein source(s) Calcium Phosphorus Potassium Sodium Essential fatty acids (if added)	Initially up to 6 months	Recommended digestibility of proteins: minimum 85 %. Indicate on the labelling: 'It is recommended that advice from a veterinarian be sought before use and before extending the period of use.'
	High quality proteins and phosphorus ≤6.5 g/kg complete feed with a moisture content of 12% and crude protein ≤320 g/kg complete feed with a moisture content of 12%	Cats			
Dissolution of struvite stones	Urine undersaturating properties for struvite And/or Urine acidifying properties And Magnesium ≤1.8 g/kg complete feed with a moisture content of 12%	Dogs and Cats	Phosphorus Calcium Sodium Magnesium Potassium Chloride Sulfur	5 to 12 weeks	Indicate on the labelling: – 'It is recommended that advice from a veterinarian be sought before use and before extending the period of use.' – 'Urine undersaturating properties for struvite and/or Urine acidifying properties.' Declaration of conformity supporting undersaturating and/or acidifying properties of the diet shall be made available to the relevant competent authorities upon request.

cont. Table 1.

Particular nutritional purpose	Essential nutritional characteristics	Species or category of animal	Labelling declarations	Recommended length of time	Other provisions (not all provisions have been listed)
1	2	3	4	5	6
Reduction of excessive body weight	Metabolizable Energy <3060 kcal/kg complete feed with moisture content of 12% Or Metabolizable Energy <560 kcal/kg complete feed with moisture content of 85% Metabolizable Energy <3190 kcal per kg complete feed with moisture content of 12% Or Metabolizable Energy <580 kcal per kg complete feed with moisture content of 85%	Dogs Cats	Energy value	Until target body weight is achieved and after if required to maintain target bodyweight	To ensure that minimum requirements are met, the nutrient levels of a diet for reduction of excessive bodyweight should be increased accordingly to compensate for the restricted daily energy intake

Table 2. Examples of some functional dietary formulations for dogs: note, the list is not exhaustive, it is intended to highlight the potential range of choices available.

Functional Diet category	Examples of dietary formulation approach, functional feedstuff and or additive inclusion
Neutered Dog & Cat / Light	Reduced / Moderate fat, High protein L-carnitine
Calm & Relax	alpha-casozepine L-tryptophan
Senior	Moderate fat, moderate-high protein Phosphorus reduction (?) Extra antioxidants, vitamins (Vit E), phytonutrients (botanicals) Probiotics, Prebiotics Glucosamine & Chondroitin sulphate medium-chain triglycerides omega-3 fatty acids (EPA, DHA)
Skin & Coat Support	High quality protein Omega 3 fatty acids, Omega 6 fatty acids
Joint Support	Glucosamine & Chondroitin sulphate Turmeric, Green lipped mussels Omega-3 fatty acids
Hypoallergenic	Novel protein(s), highly digestible Single (novel) protein, single carbohydrate
Digestion support	Probiotics, Prebiotics, Postbiotics Fermentable fibre(s) Low to Moderate fat, moderate protein, highly digestible
Weaning Diet	Omega-3 (EPA and DHA) Highly digestible
Oral Care	Brown Seaweed (<i>Ascophyllum nodosum</i>) Polyphosphates

Functional diets provide great flexibility in providing “*extra*” nutritional support through incorporation of specific ingredients / additives or increasing the content of these compounds. Some overlap with dietetic formulations is inevitable: the final percentage analysis, energy density, ingredients / additives, or digestibility, are all areas of potential commonality between formulas.

For the veterinarian and their patients, functional feedstuffs (ingredients) and / or additives incorporated into diets can provide a nutritional matrix that can help support certain requirements not covered by a Particular Nutritional Purpose or bridge the gap between a regular feed material and a dietetic feed, based on the anamnesis, diagnosis and objective of optimal patient management. This option can help with the client’s compliance towards feeding and potentially facilitate eventually moving onto a dietetic feed: e.g., a reduced fat and calorie functional formula for pets that are overweight or at risk of becoming overweight / obese,

then moving to a more restricted fat and calorie dietetic formula if the pet's body condition score increases. Another practical example is screening cats over 7 years of age for CKD using the RenalTech® / Renal Detect (Antech), technology that can predict cats at risk of developing CKD in the following year: for cats that are not at an immediate risk, but could be predisposed to developing CKD at a later date, they can be transitioned onto a Mature / Senior Functional feed, and for cats that are detected to be already "at risk", they can be transitioned onto a veterinary dietetic feed, such as an *early* Renal formula (fig 2). Those cats that are already beyond the IRIS staging threshold for dietary support (International Renal Interest Society [IRIS]), can be transitioned onto a more restricted Renal formula (fig 2), alongside other recommended medical management modalities.

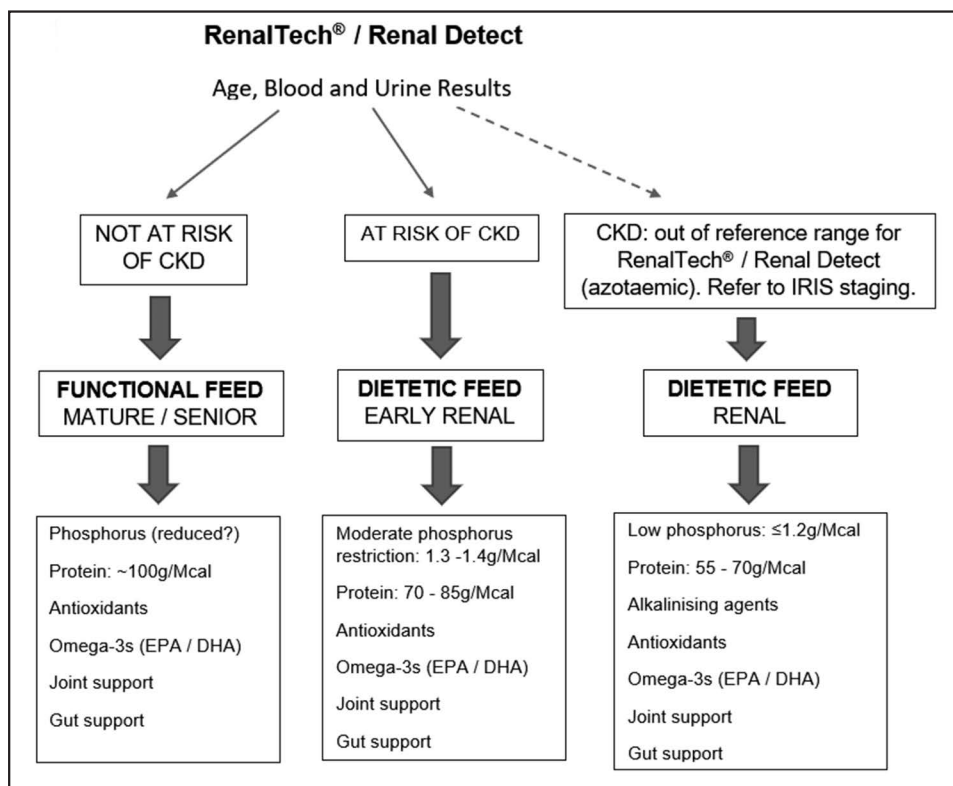


Figure 2. Screening of 7+ year old cats for risk of developing chronic kidney disease (CKD) using RenalTech® / Renal Detect and based on age, blood and urine results (RenalTech® / Renal Detect, Antech). If the cat is not at immediate risk of developing CKD then a Functional Feed can be given. Cats identified of being at risk or are already at a stage of CKD that requires specific dietary intervention (based on IRIS staging), can be fed an early renal, or a renal veterinary dietetic feed, respectively.

Although all dietary formulations, veterinary dietetic and functional, and their marketing, are tightly regulated by established laws, there are some situations

that veterinarians need to be aware of, that can help dictate their final choice of product. One example are diets marketed as “Hypoallergenic”, targeting suspect adverse food reactions / sensitive skin / sensitive digestion. Clients may often make their own “*diagnosis*” without a visit to their veterinarian, prompting the purchase of such diets from a supermarket or pet shop. While these types of diets are commercially popular, the terminology “hypoallergenic” has no official definition and therefore leads to many variations in protein source (species) and the numbers of proteins used. We also see Novel Protein, Single Protein and Limited Antigen diets made available for managing adverse food reactions. The problems to be aware of are that in some instances, the protein specie(s) chosen may already be commonly used in regular feed materials, meaning it is not universally “novel”. Additionally, publications have shown that in diets labelled that they contain a limited or “novel” protein source, can be “cross contaminated” with undeclared protein (Ricci et al., 2018; Raditic, Remillard and Tater, 2011). This “contamination” has taken place during the manufacturing process if the machinery is not thoroughly cleaned between production runs with other recipes, or if improper storage and transportation of the key raw ingredients has occurred. This means hypoallergenic / novel protein diets could contain additional protein species, albeit as traces, which are not named in their ingredients’ list. The caveat is that the publications also showed that hydrolysed protein formulations were not immune to this issue, even if the degree of “contamination” was less than novel protein diets (Ricci et al., 2018). It should be noted that not all hydrolysed diets were tested, and since the publication, greater quality assurance procedures would be present in the manufacturing facility. This helps highlight and emphasises that (1) veterinarians must critically evaluate all the dietary options available and demand from the manufacturer additional information as needed, and (2) dispensing any specific formulation must be done on an individual patient-by-patient basis, and in this example, this would be critical if a diet is chosen as part of a diagnosis and / or support of an adverse food reaction, the protein source must be novel for *that* patient. Further information on any diet’s formulation can be requested by contacting the manufacturer, most reputable companies have helplines, and by law their contact details must be on the packaging.

Future Thoughts, the Intestinal Microbiome: Veterinary and Functional Diets

While the choice of one diet over another, veterinary dietetic or functional, is guided by a logical process, with the underlying pathology a major driver of the decision, one unifying approach for future formulations is the gut microbiome. The central role of this microbiome in health and disease is being unravelled and represents an exciting area of research; “*the gut microbiome contributes with metabolic functions, protects against pathogens, educates the immune system, and, through these basic functions, affects directly or indirectly most of our physiologic functions*” (Pilla and Suchodolski, 2020). There is also a bi-directional metabolic pathway recognised between various organ systems and the gut microbiome

(Chen et al., 2019), with the Gut-Brain (Mansfield, 2019) and Gut-Kidney axis (Chen et al., 2019) being two key pathways. Maintaining a healthy gut microbiome is one central part to the health of these axes, and is impacted by age, diet, and many other environmental factors. However, any alterations these factors cause is not comparable to those alterations found in diseased animals, with gastrointestinal dysfunctions most obviously associated with gut dysbiosis. Dysbiosis represents changes in composition and structure of the gut microbiome community, which may dictate the physiological phenotype (health or disease). Therefore, placing a healthy gut microbiome at the centre of any nutritional formulation, no matter the intended support of the dietary matrix, is a sensible approach to whole-body health.

Establishing a healthy microbiome in the neonate, maintaining its health throughout the ageing process, and re-establishing the microbiome during dysbiosis, are all important strategies in which nutrition can play a central role (Salazar et al., 2014; Pilla and Suchodolski, 2020). A comprehensive approach to the microbiome is important and should not be limited to just supporting the microbiota: the microbiome is “part of the whole” (part of the whole gastrointestinal system) and its nourishment should also include the mucosal barrier and gut-associated lymphoid tissue (GALT) (Suchodolski, 2021). Prebiotics, postbiotics, fermentable fibres, botanical phytonutrients (antioxidant polyphenols), multivitamins are all dietary strategies for supporting a healthy gut microbiome and intestinal health. Their dietary inclusion can take place alongside the use of probiotics and FMT (Wernimont, 2019; Pilla and Suchodolski, 2020).

One key consideration for maintaining a healthy gut microbiome, is during and following, the use of antimicrobials. While there is increased emphasis on antimicrobial stewardship, it is inevitable that for some pets, antibiotics are prescribed. One recent study has investigated the impact on the gut microbiome due to administration with metronidazole in healthy dogs (Pilla et al., 2020). Antimicrobials can be used empirically for treatment of both acute and chronic gastrointestinal disease. However, it is known antimicrobials can disrupt the intestinal microbiome for a prolonged period. In humans, 30% of bacterial taxa were affected up to 6 months after their administration. In healthy dogs, tylosin administration altered the jejunal microbiome, with some bacterial groups being decreased for more than 14 days. The Pilla et al., 2020 study administered metronidazole at 15 mg/kg *per os* every 12 hours for 2 weeks. It was shown that metronidazole administration significantly increased the dysbiosis index, an index based on eight bacterial groups (AlShawaqfeh et al., 2014). The administration of metronidazole significantly changed the richness of the microbiome and its composition, including a decrease in key bacteria, such as Fusobacteria and *Clostridium hiranonis*, that did not fully resolve 4 weeks after discontinuation of the antimicrobial administration, resulting in the higher dysbiosis index seen. The results highlight the need to be especially (1) more cautious in the approach of prescribing metronidazole to dogs (Pilla et al., 2020), but also to (2) feed a dietary matrix that supports a healthy gut microbiome for all dogs receiving antimicrobial therapy, as well as (3)

feeding to support a healthy gut microbiome in all companion animals, regardless of their health status.

CONCLUSIONS

Veterinarians have a wide range of choices available for the nutritional support of their patients, with the accessibility to veterinary dietetic and functional feeds. Though an established approach to the patient and their case history, the best choice for nutritional support can be made. Involving the client in the decision process will aid their understanding and compliance towards the choice, especially important if life-long feeding of a specific diet is needed. Functional feeds can offer flexibility for the patient and client, especially early on in cases where there is an increased disease risk or susceptibility that can be supported nutritionally, ahead of moving onto a veterinary dietetic feed. Regular monitoring by the veterinarian and the clinic towards the patient's response to nutritional support, with the option to change the diet, will help ensure optimal patient management.

REFERENCES

1. AlShawaqfeh MK, Wajid B, Minamoto Y, Markel M, Lidbury JA, Steiner JM, et al, 2017, A dysbiosis index to assess microbial changes in fecal samples of dogs with chronic inflammatory enteropathy. *FEMS Microbiology Ecology*, 93, fix136.
2. Arihara K, 2014, Functional foods, In: Dikeman M, Devine C, editors, *Encyclopedia of Meat Sciences* (Second Edition), Elsevier Ltd, 32-6.
3. Bradley R, Tagkopoulos I, Kim M, Kokkinos Y, Panagiotakos T, Kennedy J, et al, 2019, Predicting early risk of chronic kidney disease in cats using routine clinical laboratory tests and machine learning, *J Vet Intern Med*, 1–13.
4. Chen Y-Y, Chen D-Q, Chen L, Liu J-R, Vaziri ND, Guo Y, Zhao Y-Y, 2019, Microbiome–metabolome reveals the contribution of gut–kidney axis on kidney disease, *J Trans Med*, 17, 1, 1 – 11.
5. Di Cerbo A, Morales-Medinab JC, Palmieric B, Pezzutod F, Coccoe R, Flores G, et al, 2017, Functional foods in pet nutrition: Focus on dogs and cats, *Res Vet Sci*, 112, 161–6.
6. Dudeja P, Gupta RK, 2016, Nutraceuticals, In: Gupta RK, Minhas D and Minhas S, editors, *Food Safety in the 21st Century, Public Health Perspective*, Elsevier Ltd, chapter 40, 491-6.
7. Elliott J, Rawlings M, Markwell PJ, Barber PJ, 2000, Survival of cats with naturally occurring chronic renal failure: effect of dietary management, *JSAP*, 41, 235-42.
8. Hand MS, Thatcher CD, Remillard RL, Roudebush P, Novotny BJ, editors, 2015, *Small Animal Clinical Nutrition*, Fifth Edition, Topeka, Kansas: Mark Morris Institute.
9. Hedhammar A, 2010, Breed, Sex and Age as Risk Factors for Various Diseases in Dogs, In: 35th World Small Animal Veterinary Association World Congress Proceedings, Geneva, Switzerland
10. IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, Maine 04092 United States <https://www.idexx.co.uk/en-gb/>
11. IRIS, International Renal Interest Society, <http://iris-kidney.com/>
12. Kirk CA, November 2006, Dietary Management and Nutrition, In: Kirk CA, editor, *Vet Clin Small Ani*, Volume 36, Issue 6, Elsevier Ltd, 1183-1410.
13. Mansfield C, 2019, The gut-brain axis, *Hill's Global Symposium 2019*, Proceedings.

-
14. Pilla P, Suchodolski JS, 2020, The Role of the Canine Gut Microbiome and Metabolome in Health and Gastrointestinal Disease, *Front Vet. Sci*, 6, 498.
 15. Pilla R, Gaschen FP, Barr JW, Olson E, Honneffer J, Guard BC, et al, 2020, Effects of metronidazole on the fecal microbiome and metabolome in healthy dogs, *J Vet Intern Med*, 1–14.
 16. Publications Office of the European Union, 2020, EUR-Lex & Legal Information Unit, Commission Regulations (EU) 2020/354, PARTNUTs, <https://eur-lex.europa.eu/legal-content/EN/TX-T/?uri=CELEX%3A32020R0354>
 17. Publications Office of the European Union, 2009, EUR-Lex & Legal Information Unit, Commission Regulations (EU) 767/2009, <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX-%3A32009R0767>
 18. Raditic DM, Remillard RL, Tater KC, 2011, ELISA testing for common food antigens in four dry dog foods used in dietary elimination trials, *J Anim Phys Anim Nut*, 95, 90–7.
 19. RenalTech® / Renal Detect, Antech, <https://www.antechdiagnostics.com/laboratory-diagnostics/predictive-diagnostics/renaltech>
 20. Ricci R, Conficoni D, Morelli G, Losasso C, Alberghini L, Giaccone V, et al, 2018, Undeclared animal species in dry and wet novel and hydrolyzed protein diets for dogs and cats detected by microarray analysis, *BMC Vet Res*, 14, 209.
 21. Salazar N, Arboleya S, Valdés L, Stanton C, Ross P, Ruiz L, et al, 2014, The human intestinal microbiome at extreme ages of life. Dietary intervention as a way to counteract alterations, *Front Gen*, Vol 5, Article 406, 1-9.
 22. Suchodolski JS, 2021, Part of the whole: the role of the gut microbiome in host health, Nestle Purina Webinar, 20th October 2021.
 23. Taulavuori K, Julkunen-Tiitto R, Hyöky V, Taulavuori E, 2013, Blue moon for superfoods, *Natural Product Communications*, Vol. 8 (6), 791-4.
 24. Wernimont S, 2019, Harnessing the Power of Nutrition to Improve Gut Health in Adult Cats and Dogs, *Hill's Global Symposium 2019*, Proceedings.

KOJU DIJETU DA ODABEREM ZA OPTIMALNO LEČENJE PACIJENTA: FUNKCIONALNU ILI VETERINARSKU DIJETU?

David Morgan

Optimalna nega pacijenta često predstavlja multimodalni pristup koji kombinuje medicinski, hirurški i dijetarni pristup: na primer atopični dermatitis pasa, renalna insuficijencija mačaka, osteoartritis, hronične enteropatije, dijabetes melitus, srčana insuficijencija. Za neka stanja, ishrana može biti okosnica u lečenju: na primer prekomerna težina/gojaznost, urolitijaza, enteropatija koja reaguje na hranu, neželjene reakcije na hranu. Kao deo strategije lečenja, veterinari mogu da biraju između širokog spektra nutritivnih proizvoda, od hrane bez recepta i funkcionalne hrane, koje su dostupne u marketima i prodavnicama za kućne ljubimce, do veterinarske dijetetske hrane (na recept) koju izdaju veterinari. Ali koji je najbolji izbor? Da li je to jednostavno pitanje da se uvek odabere veterinarska dijeta? Ili možemo izabrati alternativu?

Izbor najbolje opcije ishrane zavisi od: (1) kliničkog pregleda i stadijuma / težine oboljenja, (2) želje klijenta, na primer, da li zaista žele da koriste veterinarsku dijetetsku hranu? (3) prihvatljivosti dijete, (4) troškova ishrane, koji su zasnovani na kratkoročnim ili dugoročnim životnim potrebama. Stoga, najbolji izbor možda u početku neće biti odmah očigledan.

Ključne reči: fleksibilnost, funkcionalna hrana, mikrobiom, veterinarska dijetetska hraniva

UVOD

Uobičajeno je da veterinari uključe specifičnu ishranu u protokol lečenja pacijenata. Prepoznato je da mnoge bolesti imaju koristi od multimodalnog pristupa, koji uključuje medicinske i/ili hirurške strategije, uz specifičnu nutritivnu podršku kroz ciljani izbor sastojaka i formulacije hrane. To znači da ishrana ima važnu centralnu ulogu u optimalnom tretmanu mnogih pacijenata, a efekti takvog prilaza su *daleko od pukog obezbeđivanja* osnovnih dnevnih kalorija i hranljivih materija (Kirk, 2006; Hand i sar., 2015).

Veterinarska ishrana specifična za određene bolesti počela je da se primenjuje davne 1928. godine kada je dr Mark L. Moris stariji osnovao Raritan bolnicu za životinje u Edisonu, Nju Džersi, SAD. Dr Moris je verovao da specijalizovana ishrana može imati pozitivan efekat na zdravlje kućnih ljubimaca. Zatim, 1939. godine, vlasnik psa vodiča gospodin Frank, zamolio je dr Morisa da pregleda nje-

govog psa Badija. Dr Moris je dijagnostikovao bubrežnu insuficijenciju i verovao je da Badiju može da se pomogne hranom koju je razvio - „dijetu za bubrege“ pod nazivom Raritan Ration B. Ova hrana je bila originalna preteča dobro poznatog Prescription Diet® k/d® Canine i predstavlja početak budućih formulacija veterinarske dijeta. Ako posmatramo period do 2022. godine vidimo da postoji širok izbor veterinarskih dijeta koje nutritivno podržavaju brojna stanja orgaznizma (Kancelarija za publikacije Evropske unije, 2020, Uredbe Komisije (EU) 2020/354) i pružaju kliničarima više mogućnosti za optimalni tretman pacijenata kroz sprovođenje multimodalne strategije kombinovanja konvencionalne terapije i ishrane. Konačno, ono što se obično naziva „veterinarska (na recept) dijeta“ se zvanično naziva „dijetetska hrana“ u propisima 2020/354 i ovi termini će se u ovom tekstu koristiti naizmenično kao i termini „dijeta(e)“ i „hraniva - hrana“.

Ovaj rad ima za cilj da razjasni koji su osnovni koraci potrebni da se napravi najbolji izbor nutritivne podrške za pacijente kao deo njihovog optimalnog tretmana. Ukoliko su čitaocima potrebne dodatne informacije i detalji oni se mogu naći u radovima Kirk (2006) i Hand i sar. (2015).

Dijagnostičke mogućnosti za bolje optimalno postupanje sa pacijentima

Tokom poslednjih nekoliko decenija svedoci smo uključivanja novih i naprednih dijagnostičkih procedura u svakodnevni rad veterinarskih klinika kao što su CT, MRI, ultrazvuk, endoskopija, odnosno pojedine laboratorijske procedure (npr. SNAP fPL test, automatski analizatori [IDEXX]). Korišćenje novih tehnologija omogućava primenu strategija kontrole bolesti, posebno onih koje imaju visok mortalitet i prevalenciju. Nedavno je primena veštačke inteligencije pomogla da se izgradi algoritam (Bradley i sar., 2019) koji predviđa koje su mačke u riziku od razvoja hronične bolesti - insuficijencije bubrega (CKD) i to 2 godine pre nego što se ona pojavi (RenalTech® / Renal Detect, Antech). CKD kod mačaka je vodeći uzrok smrtnosti kod životinja starijih od 5 godina. Kod starijih mačaka utvrđena prevalencija ove bolesti se kreće od 8% do 31% (Bradley i sar., 2019). Rano otkrivanje CKD omogućava primenu strategija lečenja koje mogu pomoći u usporavanju progresije bolesti, pri čemu je jedna od ključnih strategija podrška u ishrani uz hranu koja je ograničena u sadržaju proteina i fosfora (International Renal Interest Societi [IRIS]). Konačno, cilj kod ovih pacijenata je poboljšanje kliničke slike i kvaliteta života, kao i izbegavanje situacija koje mogu da izazvu pogoršanje funkcije bubrega i akutno oštećenje bubrega, kao što je npr. primena NSAIL.

Dostupna napredna tehnologija i znanje omogućavaju ispitivanje i pregled prethodno nedostupnih regiona tela, kao što je mikrobiom creva i njegova centralna uloga u zdravlju celog tela, kao i nove mogućnosti lečenja kao što je transfer fekalnog mikrobioma (FMT) (Pilla i Suchodolski, 2020). U kombinaciji sa univerzitetskim institucijama, univerzitetskim osobljem i porastom ulaganja privatnog kapitala u specijalizovane veterinarske bolnice, veterinari nastavljaju da pomeraju granice mogućeg u smislu dijagnostike i optimalnih strategija u lečenju pacijenata.

Pored toga, klijenti imaju širi pristup osiguranju kućnih ljubimaca, fiksne mesečne planove zdravstvene zaštite i imaju veću svest o ljudskom zdravlju koje je preneto na njihove ljubimce (humanizacija kućnih ljubimaca), što znači da su klijenti takođe spremni da traže kompletne dijagnostičke procedure i preporuke za tretman svojih ljubimaca.

Konačno, uticaj vladinih mera za borbu protiv COVID-a podstakao je posedovanje kućnih ljubimaca, prvenstveno jer mnogi ljudi traže društvo dok su zatvoreni u svom domu. Klijenti su imali više raspoloživih prihoda i spremni su da troše više na svoje ljubimce.

Sa stanovišta ishrane, tokom poslednjih nekoliko decenija došlo je do ogromnog porasta u vrsti i dostupnosti veterinarskih dijetetskih formulacija, koje imaju za cilj da idu u korak sa napretkom u veterinarskoj dijagnostici i terapijskim opcijama. Mnoge komercijalne kompanije su uključene u ulaganje, kreiranje i proizvodnju ovih dijeta, pružajući veterinarskim klinikama širok izbor za svoje pacijente, uz mogućnost da klinika ostvaruje dodatni novčani prihod.

Tokom svih ovih godina, ishrana je ostala centralni i ključni deo menadžmenta lečenja pacijenata. Delimično, moramo obezbediti njihove dnevne kalorije, zajedno sa osnovnim hranljivim sastojcima koji podržavaju život. Ali tu se stvar ne završava. Danas se ulažu ogromna sredstva u razvoj novih i naprednih dijetetskih formulacija (BVM). Rezultati ispitivanja koji se odnose na ovo su objavljeni od strane istraživača i recenziranim časopisima.

Veterinarske i funkcionalne dijetete: dostupnost i regulativa

Veterinarska dijeta (dijetetska ishrana). Brzina razvoja nove dijagnostike i obimna istraživanja koja stoje iza dijetetskih formulacija usmerenih na podršku zdravlju pacijenata, stvorili su potrebu da se unese struktura u razvoj i promociju ishrane usmerene na potporu kućnih ljubimaca sa specifičnim oboljenjima. Da bi pomogla da se uvede u marketing i *fundamentalnu* formulaciju specifičnih veterinarskih dijeta, Evropska unija je uvela propise kako bi pomogla komercijalnim kompanijama, zajedno sa državnim regulatornim vlastima, u razvoju, marketingu i promociji dijetetskih formulacija stavljenih na tržište. Glavne uredbe su Uredbe Komisije (EU) 2020/354 (ranije Direktiva 2008/38/EC) koje postavljaju specifične kriterijume koje treba poštovati i primeniti na formulacije i ono što se pojavljuje na ambalaži u smislu deklariranih informacija analiza kao i označavanje i deskriptivni doslovni tekst koji se mora koristiti (Kancelarija za publikacije Evropske unije, 2020, Uredbe Komisije (EU) 2020/354). Deo B ovih propisa sadrži "Listu namenske upotrebe", tačnije listu posebne nutritivne namene, koja „ukazuje“ na patologiju koju dijeta ima za cilj da podrži. Ostatak dela B pruža potrebne dodatne kriterijume za ishranu, što će biti objašnjeno kasnije u ovom tekstu.

Ove Uredbe (EU) 2020/354, koje se često nazivaju PARNUT, pošto regulišu hranu namenjenu ODREĐENIM NUTRITIVNIM NAMENAMA, mogu se lako preuzeti ([https://eur-lex.europa.eu/legal-content/EN/TKST/?uri=CELEKS%](https://eur-lex.europa.eu/legal-content/EN/TKST/?uri=CELEKS%202020354)

3A32020R0354) i predstavljaju kratku lektiru, pružajući veterinarima veći kontekst u razumevanju razloga za kreiranje i marketing veterinarske dijetetske hrane. Pošto veterinarske dijetete predstavljaju „hranu za životinje“ koja će se plasirati na tržište, one su takođe obuhvaćene širim evropskim propisima (EC) br. 767/2009. Međutim, veterinarske dijetete treba u početku proceniti da li se u potpunosti pridržavaju propisa PARNUT-a pre nego što se pređe na opštije Uredbe (EZ) br. 767/2009. Prvo što treba uzeti u obzir je da li dijetetska formula ima posebnu nutritivnu namenu definisanu u delu B PARNUT-a, a koja takođe ispunjava sve druge navedene kriterijume. Ako ovo prvo razmatranje nije ispunjeno, proizvod se ne može staviti na tržište kao dijetetska hrana.

Uprkos centralnoj ulozi koju veterinarske dijetete mogu imati u „menadžmentu“ pacijenta, kao deo multimodalnog pristupa, ili kao jedini izbor za kliničku intervenciju, one se ne mogu posmatrati kao „tretman“ ili „lečenje“ na isti način kao registrovani veterinarski lek. Ovo može zvučati paradoksalno s obzirom da kod nekih bolesti kao što su urolitijaza, gojaznost ili kod pasa i mačaka sa ranim stadijumom hronične bolesti bubrega (stadijum 2) (<http://vvv.iris-kidnei.com/guidelines/staging.html>), intervencija u ishrani može se smatrati glavnim uporištem u radu sa pacijentima. Međutim, veterinarske dijetetske hrane nisu odobreni veterinarski lekovi, na isti način kao, na primer, antibiotici, antiinflamatorni lekovi i stoga se ne mogu smatrati istim, uprkos njihovoj očiglednoj „kliničkoj koristi“. Ishrana, bez obzira na njenu formulaciju i sadržaj sastojaka, mora se u osnovi posmatrati kao „podrška“ pacijentu. Dok se lista „Posebnih nutritivnih svrha“ koja se nalazi u propisima može smatrati listom „indikacija“, ne bi bilo mudro koristiti ovu terminologiju za dijetetsku hranu, već bi „indikacije“ trebalo da budu rezervisane za upotrebu odobrenih veterinarskih lekova. Konačno, državni organi uključeni u regulisanje veterinarskih lekova, mogu da nadgledaju formulaciju, pakovanje, prodaju, marketing i promociju (uključujući veb stranice kompanije, društvene medije) ovih dijetetskih hraniva namenjenih za izdavanje od strane veterinara (npr. Direkcija veterinarske službe Vlade Velike Britanije). Prekršaji evropskih i državnih propisa mogu biti sankcionisani od strane ovih organa, uz najgori scenario da kompanija mora opozvati svoju hranu iz prodaje na tržištu.

Funkcionalna ishrana (hrana): novija pojava dijetete za kućne ljubimce bila je ugrađivanje funkcionalnih sastojaka (npr. specifične hrane za životinje i/ili aditiva) u kompletnu ishranu (Di Cerbo i sar., 2017). Dok formulacije funkcionalne dijetete nisu kreirane da tačno odražavaju veterinarsku dijetetsku hranu, postojeće neizbežno i promenljivo preklapanje u njihovom izboru sastojaka, uključujući nutritivne proizvode, nivo prisutnih ključnih hranljivih materija (npr. proteina, masti, ugljenih hidrata, specifičnih vitamina, aditiva) i proizvodnih procesa (npr. svarljivost ključnih hranljivih materija).

Pored toga, funkcionalna ishrana nije formulisana i reklamirana kao veterinarska dijetetska hrana, i samim tim ne prati PARNUT. Ona podleže Evropskoj regulativi (EC) br. 767/2009, koja pokriva stavljanje tipične hrane za životinje na tržište: npr. potpunu i uravnoteženu ishranu pasa ili mačaka (Kancelarija za publi-

kacije Evropske unije, 2009, Komisija Uredba (EZ) br. 767/2009). Stoga, potencijalni opseg različitih formulacija funkcionalne hrane može biti prilično širok u poređenju sa veterinarskom dijetetskom hranom, pri čemu je ova druga „ograničena“ odobrenom listom posebne nutritivne namene koja se nalazi u PARNUT-u.

Termin „funkcionalna hrana“ osmišljen je u Japanu ranih 1980-ih (Arihara, 2014). Termin opisuje prerađenu hranu koja pokazuje dobrobit u cilju prevencije bolesti i/ili unapređenje zdravlja pored svoje (osnovne) nutritivne vrednosti. Što se tiče kućnih ljubimaca, nemamo dogovorenu definiciju funkcionalne hrane, stoga je najbolja opcija da se usvoji ono što se koristi za ljudsku ishranu: „*Funkcionalna hrana se može definisati kao dijetetski proizvodi koji, osim što obezbeđuju hranljive materije i energiju, blagotvorno moduliraju jednu ili više ciljanih funkcija u telu, pojačavanjem određenog fiziološkog odgovora i/ili smanjenjem rizika od bolesti*“. Funkcionalna hrana se može dalje definisati izborom sastojaka i/ili aditiva: „Funkcionalni sastojak je bioaktivno jedinjenje (npr. omega-3 masne kiseline, vitaminski antioksidansi, prebiotici, botanički fitonutrijenti, minerali) koje se može koristiti u proizvodnji funkcionalnih prehrambenih proizvoda. Ova bioaktivna jedinjenja se mogu dobiti iz različitih izvora kao što su primarni proizvodi, mikroorganizmi i neorganske sirovine“. U ljudskoj ishrani, funkcionalna hrana se preklapa sa nutraceuticima, medicinskom hranom, probioticima, dizajnerskom hranom, farmaceutskom hranom i „vitafood“-om (Arihara, 2014).

Ovih dana terminologija o ishrani sa kojom se suočavaju vlasnici kućnih ljubimaca je izuzetno obimna, i može biti veoma zbunjujuće razdvojiti sve i stvoriti sebi jasnu sliku. Što se tiče nutricionističkih proizvoda, ponovo možemo pogledati definiciju iz ljudske ishrane: „*Nutraceutik*“ je supstanca koja se može smatrati hranom ili delom hrane koja pruža medicinske ili zdravstvene beneficije, uključujući prevenciju i lečenje bolesti. Proizvodi od različitih izolovanih hranljivih materija, dijetetskih suplemenata, kao i dijetu od genetski modifikovane „dizajnerske“ hrane, biljnih proizvoda i prerađene hrane (žitarice, supe, pića) mogu biti uključeni pod okrilje *nutrijenata* (Dudeja i Gupta, 2016). Još jednom, mora se obratiti pažnja kada se koriste termini „prevencija“ i „lečenje“ kada su povezani sa bolešću jer se smatraju medicinskim tvrdnjama (na snazi Regulativom EU br. 767/2009) i trebalo bi da budu rezervisani za odobrene veterinarske lekove, a ne za bilo koju vrstu ishrane kućnih životinja. Konačno, imamo izraz „superhrana“: „Izraz „superhrana“ se odnosi na hranu koja je korisna za ljudsko zdravlje zbog visokog nivoa hranljivih materija i/ili bioaktivnih fitohemikalija kao što su antioksidansi“ i često se smatra pojedinačnim sastojkom bogatim određenim jedinjenjima, na primer antioksidansima, vlaknima ili masnim kiselinama (Taulavuori i sar., 2013). Međutim, termin „superhrana“ se dvosmisleno koristi u popularnim medijima i često se plasira sa pogrešnim zdravstvenim tvrdnjama o prevenciji i lečenju bolesti. Nedostatak dogovorenog konsenzusa i regulatorne kontrole dovodi do varijacija u definiciji funkcionalne hrane i superhrane i neizbežno je da postoji preklapanje potencijalnih sastojaka i formulacija. Radi jednostavnosti i jasnoće, fokus ovog rada će biti na veterinarskoj dijetetskoj i funkcionalnoj ishrani.

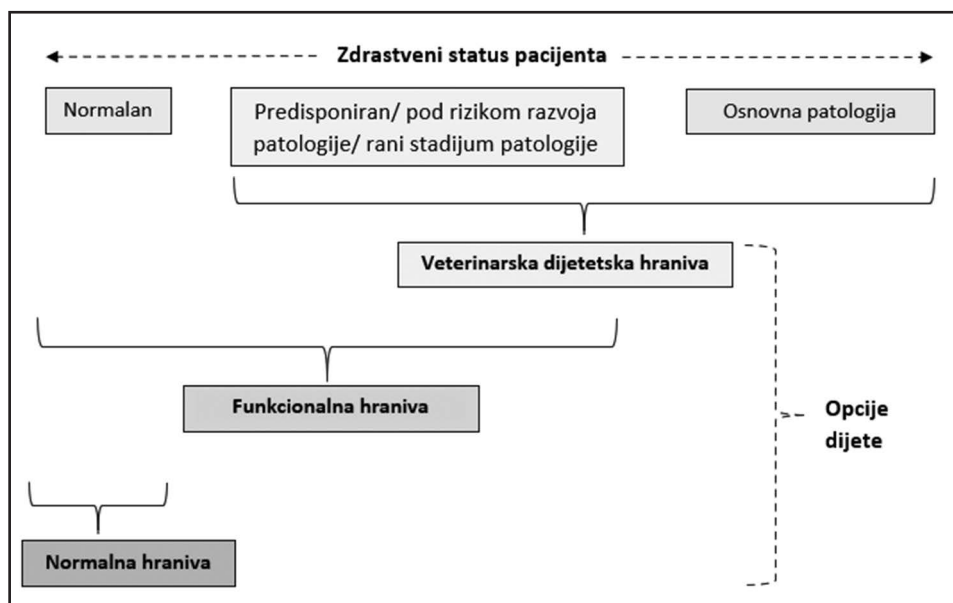
Koji je najbolji izbor za pacijenta: veterinarska ili funkcionalna dijeta?

Sa tako širokim izborom dostupnih dijetetskih formulacija, kako veterinarskih tako i funkcionalnih, mora postojati logičan prilaz donošenju odluke. Krajnji cilj mora biti da se obezbedi konstantna optimalna briga o pacijentu tokom perioda lečenja, a koji može biti kratkoročni (npr. dani, 1-2 nedelje), dugoročni (npr. 3-4 nedelje, meseci) ili na neodređeno (doživotno). Razumevanje prisutne patologije i njenog potencijalnog odgovora na dijetetsku intervenciju biće centralno u našem procesu donošenja odluka. Anamneza pruža ključne podatke o starosti, rasi i polu (sterilisani ili ne) psa ili mačke i prihvatanjem ili odbacivanjem određenih dijagnoza uz sakupljene podatke može se početi sa pravljenjem liste mogućih problema (Hedhammar, 2010).

Anamneza pacijenta pruža detaljnije informacije, pomažući da se finalizira lista problema i diferencijalne dijagnoze. Kada se postavi konačna dijagnoza, može se napraviti najprikladniji pristup lečenju. Ako je promena pacijentove ishrane deo multimodalnog pristupa, ili glavnog pristupa za lečenje ili dalju dijagnostiku, npr. neželjena reakcija na hranu (Hand i sar., 2015), važno je uskladiti se i postići dogovor sa klijentom u vezi konačne odluke o daljem tretmana. Ovo pomaže da se vlasnik uveri i razume zašto je napravljen određen izbor i doneta data odluka. Samo ukoliko je vlasnik dobro razumeo, on će pomoći i pridržavaće se pravila hranjenja. Kao deo ovog sporazuma, želje klijenta treba da budu shvaćene i uključene u diskusiju, na primer, da li im se sviđa ideja o hranjenju veterinarskom hranom? Da li postoji potencijalni problem oko prihvatljivosti hrane, da li će ukus biti problem (npr. smanjen apetit kod mačaka sa hroničnom bolešću bubrega u kasnoj fazi)? Pružanje indikacija dnevnih troškova hranjenja, na osnovu kratkoročnih ili dugoročnih/doživotnih zahteva, pomoći će u upravljanju očekivanjima klijenta i pomoći da se izbegnu nesporazumi.

Ako osnovna patologija nedvosmisleno navodi da je najbolji izbor specifična dijetetska formulacija, kao što je dijetetska ishrana sa ograničenim unosom proteina i fosfora „dijeta za bubrege“ za mačku sa stadijumom 2, 3 ili 4 hronične bolesti bubrega (Elliott i sar., 2000; Hand i sar., 2015), klijent treba da bude informisan o prednostima ishrane u pomaganju pozitivnom podržavanju svakodnevnog stanja i napredovanja ljubimca. Ako je preporuka za doživotno hranjenje jer je stanje progresivno i/ili ireverzibilno (npr. hronična bolest bubrega/insuficijencija kod mačaka, osteoartritis, hronična srčana insuficijencija), tada klijent mora da bude obavešten o potencijalnom gubitku koristi za zdravlje životinje ukoliko se predložena dijeta ne sprovodi.

Najbolji izbor dijete će objediniti status, anamnezu, dijagnozu, medicinski nadžment i zahteve klijenta. Iz ovog procesa se može doneti odluka o ishrani koja može da pomogne pacijentu, pored bilo kakvog medicinskog tretmana (slika 1).



Slika 1. Postoji velika fleksibilnost dostupna veterinarima i njihovim klijentima za najbolji izbor nutritivne podrške za svog ljubimca, bilo da su zdravi ili kada su izloženi riziku od patologije ili kada su razvili patologiju. Mora se pažljivo proceniti pacijent, i kroz otvorenu diskusiju sa klijentom, može se izabrati hrana. Neophodno je stalno praćenje pacijenata da bi se procenilo da li je potrebna bilo kakva modifikacija režima hranjenja.

Obrazloženje dijetetskih opcija

Veterinarske formulacije

Uredbe PARNUT Komisije (EU) 2020/354 predviđaju dvadeset i jednu "posebnu nutritivnu svrhu" za pse i mačke. Većina se odnosi na obe vrste, npr. „Smanjenje prekomerne telesne težine“, ali neke su specifične za vrstu, npr. „Smanjenje bakra u jetri“ samo za pse i „Smanjenje nivoa joda u hrani u slučaju hipertireoze“ samo za mačke. Deo B propisa daje Listu namenske upotrebe i u šest kolona izlaže zahteve i/ili preporuke koje komercijalna preduzeća treba da unesu u formulaciju proizvoda i deklaraciju na ambalaži. Tabela 1 sumira tri "Posebne nutritivne svrhe i zahteve" potrebne za stavljanje ovih proizvoda na tržište. Treba napomenuti da kolona 5 označava „preporučeno vremensko trajanje“ tokom kojeg proizvod treba da se daje. Ako se pominje ograničeni period hranjenja, kolona 6 pruža dalje smernice koje treba da budu navedene na pakovanju i daje veterinaru mogućnost da produži hranjenje: npr. „Preporučuje se da se pre upotrebe i pre produžavanja upotrebe potraži savet od veterinara“. Zbog specifičnih osnovnih nutritivnih zahteva navedenih u koloni 2, veterinarske dijetete su pažljivo formulisane oko nekih ključnih zahteva, a procedure obezbeđenja kvaliteta, koje prate tačnost konačne analize, su rigorozne. Zahtevane deklaracije će zapravo biti obu-

Tabela 1. Izabrani podaci za tri ključne posebne nutritivne svrhe. Informacije su preuzete iz Dela B, Liste namenskih upotreba, Uredbe Komisije (EU) 2020/354 (PARNUT). Pogledajte zvanični fajl za potpuno objašnjenje i listu.

Specifična nutritivna svrha	Osnovne nutritivne karakteristike	Vrsta ili kategorija životinje	Deklaracija na etiketi	Preporučeno vremensko trajanje	Ostale odredbe (nisu navedene sve odredbe)
1	2	3	4	5	6
Podrška bubrežne funkcije u uslovima hronične bubrežne insuficijencije	Visokokvalitetni proteini i fosfor ≤5g/kg kompletna hrana za životinje sa sadržajem vlage od 12% i sirovih proteina ≤220g/kg kompletne hrane za životinje sa sadržajem vlage od 12%	Psi	Izvor(i) proteina Kalcijum Fosfor Kalijum Esencijalne masne kiseline (ukoliko su dodate)	Na početku do 6 meseci	Preporučena svarljivost proteina: minimum 85%. Označite na etiketi: „Preporučuje se da se pre upotrebe i pre produžavanja perioda upotrebe zatraži savet od veterinara.“
	Visokokvalitetni proteini i fosfor ≤6,5g/kg kompletne hrane za životinje sa sadržajem vlage od 12% i sirovih proteina ≤320g/kg kompletne hrane za životinje sa sadržajem vlage od 12%	Mačke			Označite na etiketi: - „Preporučljivo je da se pre upotrebe i pre produženja perioda upotrebe zatraži savet veterinara.“ - „Svojstva nedovoljnog zasićenja urina za nastanak struvita i/ili zakiseljavanja urina.“ Deklaracija o usaglašenosti koja podržava svojstva ishrane prema nedostatku zasićenosti i/ili zakiseljavanju mora biti dostupna relevantnim nadležnim organima na zahtev.
Rastvaranje struvitnog kamenja	Nezasićena svojstva urina za struvit i/ili svojstva zakiseljavanja urina, magnezijum ≤1,8g/kg potpuna hrana sa sadržajem vlage od 12%	Psi i mačke	Kalcijum Fosfor Kalijum Magnezijum Hloridi Sumpor	5-12 sedmica	

nastavak Tabele 1.

Specifična nutritivna svrha	Osnovne nutritivne karakteristike	Vrsta ili kategorija životinje	Deklaracija na etiketi	Preporučeno vremensko trajanje	Ostale odredbe (nisu navedene sve odredbe)
1	2	3	4	5	6
Smanjenje prekomerne telesne težine	Metabolička energija <3060 kcal/kg kompletna hrana sa sadržajem vlage 12% Ili Metabolička energija <560 kcal/kg kompletna hrana sa sadržajem vlage do 85%	Psi	Energetska vrednost	Dok se ne postigne željena težina, ili nakon toga u cilju održavanja težine	Da bi se osiguralo da su minimalni zahtevi ispunjeni, nivo hranljivih materija u ishrani za smanjenje prekomerne telesne težine treba da se poveća u skladu sa tim kako bi se nadoknadio ograničen dnevni unos energije
	Metabolička energija <3190 kcal/kg kompletna hrana sa sadržajem vlage 12% Ili Metabolička energija <580 kcal/kg kompletna hrana sa sadržajem vlage do 85%	Cats			

hvaćene opštim propisima koji pokrivaju opštu hranu za životinje, odnosno član 17(2) i Aneks IV Uredbe (EZ) br. 767/2009. Pored toga, svi dodaci ili deklarirani aditivi su obuhvaćeni Uredbom (EC) br. 1831/2003. Ljudi koji su zaduženi za formulaciju hrane mogu uključiti određene sirovine (sastojke) i/ili aditive, koje nisu navedene u koloni 2, ako smatraju da će ovi dodaci biti korisni. Primer su omega-3 masne kiseline za „Podršku bubrežnoj funkciji u slučaju hronične bubrežne insuficijencije“, a njihovo dodavanje je sada pokriveno zahtevima navedenim u koloni 4, „Deklaracije za obeležavanje“ (tabela 1).

Jasno je da je izdavanje ove dijetetske veterinarske hrane i praćenje kliničkog odgovora pacijenata na medicinski tretman i odabranu nutritivnu podršku važna odgovornost veterinara i njegovog kliničkog tima.

Funkcionalne dijetete (hraniva)

„Nova hrana i komponente hrane su identifikovane kao „funkcionalne“ jer obezbeđuju zdravstveni benefit osim obezbeđivanja esencijalnih hranljivih materija, kao što su vitamini, minerali, voda, proteini, ugljeni hidrati i masti“ (Di Cerbo i sar., 2014). „Funkcionalna hrana pruža zdravstvene prednosti ako se redovno konzumira kao deo raznovrsne ishrane“, iako opsežne kliničke studije koje predstavljaju visoko rangiran EBVM, nažalost nedostaju za pse i mačke (Di Cerbo i sar., 2014). Uprkos tome, postoji raznovrstan raspon formulacija funkcionalnih dijeta koje su dostupne na tržištu (tabela 2). Jasno je da neke od osnovnih nutritivnih karakteristika pomenutih u koloni 2 PARNUT pravilnika (tabela 1) mogu biti uključene u funkcionalnu formulaciju. Međutim, bilo koja posebna nutritivna svrha navedena u koloni 1 PARNUT-a, ne može se pomenuti doslovno. Funkcionalna ishrana treba da bude potpuna hrana, obezbeđujući dnevni obrok psa ili mačke. Iako postoje funkcionalne poslastice / grickalice, koje su „komplementarna hrana“ (dovoljne za dnevni obrok samo ako se koriste u kombinaciji sa drugom hranom), fokus ovog teksta je potpuna hrana.

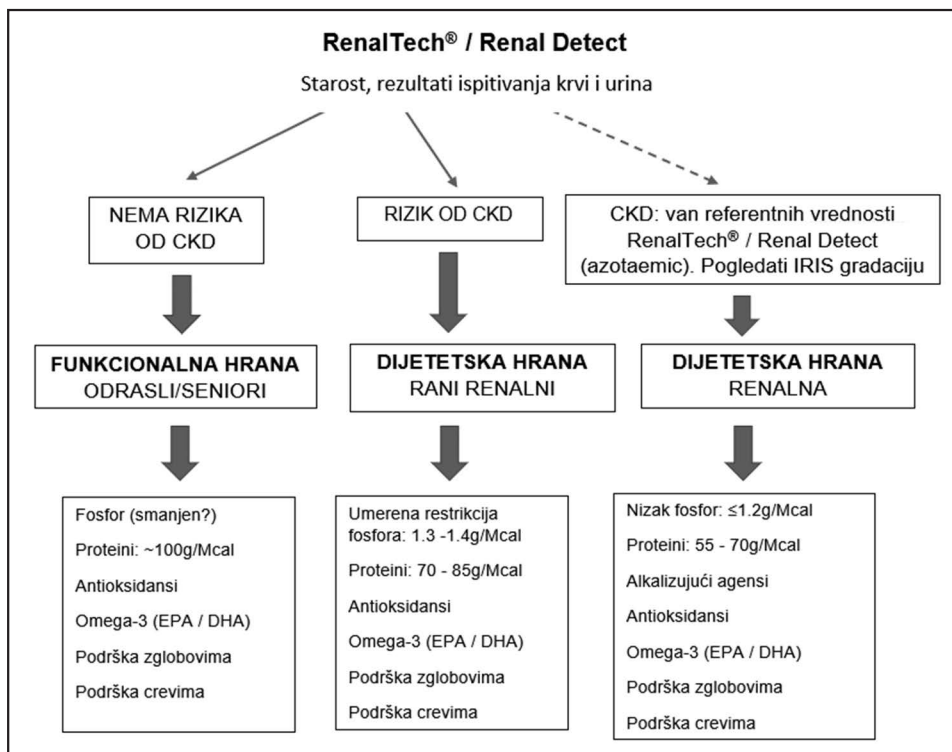
Funkcionalne dijetete pružaju veliku fleksibilnost u obezbeđivanju „dodatne“ nutritivne podrške kroz ugradnju specifičnih sastojaka/aditiva ili povećanje sadržaja ovih jedinjenja. Neka preklapanja sa dijetetskim formulacijama su neizbežna: konačna procentualna analiza, sadržaj energije, sastojci/aditivi ili svarljivost, sve su to oblasti potencijalne sličnosti između formula. Za veterinare i njihove pacijente, funkcionalna hrana (sastojci) i/ili aditivi ugrađeni u hranu mogu da obezbede nutritivnu matricu koja može pomoći u ispunjavanju određenih zahteva koji nisu obuhvaćeni „Posebnom nutritivnom svrhom“ ili premostiti jaz između obične hrane za životinje i dijetetske hrane, a na osnovu anamneze, dijagnoze i cilja optimalnog vođenja pacijenata. Ova opcija može pomoći u saglasnosti klijenta sa hranjenjem i potencijalno olakšati eventualni prelazak na dijetetsku hranu: npr. funkcionalna formula sa smanjenim sadržajem masti i kalorija za kućne ljubimce koji imaju prekomernu težinu ili su u opasnosti da postanu gojazni, a zatim ako se rezultat telesne kondicije ljubimca poveća, prelazak na dijetetsku formulu sa ograničenim unosom masti i kalorija.

Tabela 2. Primeri nekih funkcionalnih dijetetskih formulacija za pse: imajte na umu, lista nije konačna, ima za cilj da istakne potencijalni raspon dostupnih izbora.

Kategorija funkcionalne dijetete	Primeri dijetarnih formulacijafunkcionalna hrana i/ili dodatak aditiva
Kastrirani psi i mačke / Light	Nizak / umeren sadržaj masti, visok sadržaj proteina L-karnitin
Smiruje & Relax	alfa-casozepin L-triptofan
Senior	Umerene masti, umereno-visoki proteini Nizak fosfor (?) Ekstra antioksidansi, vitamini (Vit E), fitonutrijenti (biljni) Probiotici, Prebiotici Glukozamin & hondroitin sulfat Trigliceridi srednjeg lancemedium-chain triglycerides omega-3 masne kiseline (EPA, DHA)
Koža & Krzno	Visokokvalitetni proteini Omega 3 masne kiseline, Omega 6 masne kiseline
Zglobovi	Glukozamin & hondroitin sulfat Kurkuma, zelene dagnje Omega-3 masne kiseline
Hipoalergijska	Novi protein, visoko svarljivi Jedan novi protein, jedan ugljeni hidrat
Podrška varenju	Probiotici, Prebiotici, Postbiotici Fermentabilna vlakna Nizak do umeren sadržaj masti, umeren sadržaj proteina, visoko svarljiva
Dijeta za zalučenje	Omega-3 (EPA and DHA) Visoko svarljiva
Oralna nega	Smeđe morske alge (<i>Ascophyllum nodosum</i>) Polifosfati

Još jedan praktičan primer je skrining mačaka starijih od 7 godina na CKD pomoću RenalTech® / Renal Detect (Antech) tehnologije koja može predvideti mačke u riziku od razvoja CKD u narednoj godini. Mačke koje nisu u neposrednom riziku, ali mogu biti predisponirane za razvoj CKD kasnije, mogu preći na hranu za zrele / starije, a za mačke za koje se otkrije da su već „u opasnosti“, mogu preći na veterinarsku dijetetsku hranu, kao što je rana bubrežna formula (slika 2). One mačke koje su već iznad IRIS praga (International Renal Interest Societi [IRIS]), mogu se prevesti na ograničeniju formulu za bubrege (slika 2), zajedno sa drugim preporučenim medicinskim modalitetima terapije.

Iako su sve dijetetske formulacije, veterinarsko dijetetske i funkcionalne, kao i njihov marketing, strogo regulisane utvrđenim zakonima, postoje neke situacije kojih veterinari moraju biti svesni, a koje mogu pomoći u konačnom odabiru proizvoda. Jedan primer su dijetete koje se prodaju kao „hipoalergene“, koje ciljaju na sumnjive neželjene reakcije na hranu / osetljivu kožu / osetljivu probavu. Klijenti



Slika 2. Skrining mačaka starijih od 7 godina na rizik od razvoja hronične bolesti bubrega (CKD) korišćenjem RenalTech® / Renal Detect i na osnovu rezultata starosti, krvi i urina (RenalTech® / Renal Detect, Antech). Ako mačka nije u neposrednom riziku od razvoja CKD, može se dati funkcionalna hrana. Mačke za koje je utvrđeno da su u riziku ili su već u stadijumu CKD koji zahteva specifičnu dijetalnu intervenciju (na osnovu IRIS stadija), mogu se hraniti ranom bubrežnom ili renalnom veterinarskom dijetetskom hranom.

često postavljaju sami „dijagnozu“ bez posete veterinaru, što podstiče kupovinu takve dijetete u supermarketu ili prodavnici za kućne ljubimace. Iako su ove vrste dijetete komercijalno popularne, terminologija „hipoalergena“ nema zvaničnu definiciju i stoga dovodi do mnogih varijacija u izvoru proteina (vrstama) i broju korišćenih proteina. Takođe vidimo „nove proteinske“, „jednoproteinske“ i „ograničene antigenske“ dijetete koje su dostupne za primenu prilikom neželjenih reakcija na hranu. Problemi koji se moraju uzeti u obzir su da se u nekim slučajevima odbačena(e) vrsta(e) proteina mogu koristiti u uobičajenim hranivima, što znači da nisu „novina“. Pored toga, publikacije su pokazale da hrana koja je označena da sadrže ograničen ili „novi“ izvor proteina može biti „unakrsno kontaminirana“ nedeklarisanim proteinima (Ricci i sar., 2018; Raditic, Remillard i Tater, 2011). Ova „kontaminacija“ može da se desi tokom procesa proizvodnje ako mašine i oprema nisu temeljno očišćeni između proizvodnih ciklusa sa drugim recepturama, ili ako je došlo do nepravilnog skladištenja i transporta ključnih sirovina. To znači da hipoalergene / nove proteinske dijetete mogu sadržati dodatne vrste proteina, iako u

tragovima, a koje nisu navedene na listi sastojaka. Istraživanja su takođe istakla da formulacije hidrolizovanih proteina nisu imune na ovaj problem, čak i ako je stepen „kontaminacije“ bio manji od novih proteinskih dijeta (Ricci i sar., 2018). Treba napomenuti da nisu testirane sve hidrolizovane dijetete, a u međuvremenu, od objavljivanja navedenih istraživanja, u proizvodnim pogonima su možda uvedene savremene mere obezbeđenja kvaliteta. Ovo pomaže da se istakne sledeće: (1) veterinari moraju da kritički procene sve dostupne opcije ishrane i da po potrebi zahtevaju od proizvođača dodatne informacije, i (2) izdavanje bilo koje specifične formulacije mora se vršiti na individualnoj osnovi od pacijenta do pacijenta. U ovom primeru bilo bi važno naglasiti sledeće: ako je dijete izabrana kao deo dijagnoze i/ili podrške neželjenoj reakciji na hranu, izvor proteina mora biti nov za tog pacijenta. Dodatne informacije o formulaciji bilo koje dijetete mogu se zatražiti kontaktiranjem proizvođača (većina renomiranih kompanija ima telefone za pomoć), a po zakonu njihovi kontakt podaci moraju biti na pakovanju.

Šta u budućnosti – intestinalni mikrobiom: veterinarske i funkcionalne dijetete

Dok je izbor jedne dijetete u odnosu na drugu vođen logičnim procesom, gde je osnovna patologija glavni pokretač odluke, jedan objedinjujući pristup budućim formulacijama je mikrobiom creva. Centralna uloga mikrobioma u zdravlju i bolesti predstavlja značajnu oblast istraživanja; „Mikrobiom creva doprinosi metaboličkim funkcijama, štiti od patogena, obrazuje imunski sistem i preko ovih osnovnih funkcija utiče, direktno ili indirektno, na većinu naših fizioloških funkcija“ (Pilla i Suchodolski, 2020). Takođe, prepoznati su i dvosmerni metabolički putevi između različitih sistema organa i crevnog mikrobioma (Chen i sar., 2019), kao npr. „creva-mozak“ (Mansfield, 2019) ili „creva-bubreg“ (Chen i sar., 2019).

Uspostavljanje zdravog mikrobioma creva je centralni deo zdravlja, a na njega utiču starost, ishrana i mnogi drugi faktori životne sredine. Međutim, bilo koje promene koje ovi faktori izazivaju nisu uporedive sa promenama koje se nalaze kod obolelih životinja sa gastrointestinalnim disfunkcijama koje su najočiglednije povezane sa disbiozom creva. Disbioza predstavlja promene u sastavu i strukturi zajednice crevnog mikrobioma, koje mogu diktirati fiziološki fenotip (zdravlje ili bolest). Stoga stavljanje zdravog mikrobioma creva u centar bilo koje nutritivne formulacije, bez obzira na predviđenu podršku matrice ishrane, je razuman pristup zdravlju celokupnog tela.

Uspostavljanje zdravog mikrobioma kod novorođenčeta, održavanje njegovog zdravlja tokom procesa starenja i ponovno uspostavljanje mikrobioma tokom disbioze, sve su to važne strategije u kojima ishrana može da igra centralnu ulogu (Salazar i sar., 2014; Pilla i Suchodolski, 2020). Sveobuhvatan pristup mikrobiomu je važan i ne bi trebalo da bude ograničen samo na podršku mikrobioma: mikrobiom je „deo celine“ (deo celog gastrointestinalnog sistema) i njegova ishrana takođe treba da uključuje mukoznu barijeru i limfoidne žlezde povezane sa crevi-

ma (GALT) (Suhodolski, 2021). Prebiotici, postbiotici, rastvorljiva vlakna, botanički fitonutrijenti (antioksidativni polifenoli), multivitamini su sve dijetetske strategije za podršku zdravog mikrobioma creva i zdravlju creva. Njihovo uključivanje u ishranu može se odvijati zajedno sa upotrebom probiotika i FMT-a (Vernimont, 2019; Pilla i Suchodolski, 2020).

Značajan period za održavanje zdravog mikrobioma creva je tokom i nakon upotrebe antimikrobnih sredstava. Iako je povećan naglasak na pravilnu upotrebu antimikrobnih sredstava, neizbežno je da se nekim kućnim ljubimcima prepisuju antibiotici. Jedna nedavna studija je istraživala uticaj na mikrobiom creva usled primene metronidazola kod zdravih pasa (Pilla i sar., 2020). Antimikrobni lekovi se mogu empirijski koristiti za lečenje i akutnih i hroničnih gastrointestinalnih bolesti. Međutim, poznato je da antimikrobni lekovi mogu poremetiti crevni mikrobiom na duži period. Kod ljudi, 30% bakterijskih taksona je bilo pogođeno do 6 meseci nakon njihove primene. Kod zdravih pasa, primena tilozina je promenila mikrobiom jejunuma, pri čemu su neke bakterijske grupe bile znatno smanjene tokom više od 14 dana.

Pilla i sar. (2020) ispitivali su upotrebu metronidazola u dozi od 15 mg/kg *per os* svakih 12 sati tokom 2 nedelje. Pokazalo se da primena metronidazola značajno povećava indeks disbioze, koji je zasnovan na osam bakterijskih grupa (AlShavakfeh et al., 2014). Primena metronidazola značajno je promenila bogatstvo mikrobioma i njegov sastav, uključujući smanjenje ključnih bakterija kao što su *Fusobacteria* i *Clostridium hiranonis*, koje se nisu u potpunosti rešile 4 nedelje nakon prestanka primene antimikrobnih lekova, što je rezultiralo višim indeksom disbioze. Ovi rezultati ističu potrebu da se bude posebno: (1) oprezniji u preskripciji metronidazola psima (Pilla et al., 2020), ali i da se (2) uvede ishrana koja podržava zdrav mikrobiom creva za sve pse koji primaju antimikrobnu terapiju, kao i (3) da je neophodno održavanje zdravog mikrobioma creva kod svih životinja kućnih ljubimaca, bez obzira na njihov zdravstveni status.

ZAKLJUČCI

Veterinari imaju na raspolaganju širok spektar izbora za nutritivnu podršku svojim pacijenata, uz dostupnost veterinarske dijetetske i funkcionalne hrane. Uključivanje klijenta u proces odlučivanja će pomoći njegovom razumevanju i pridržavanju izbora, što je posebno važno ako je potrebno doživotno pridržavanje određene dijetete. Funkcionalna hrana može ponuditi fleksibilnost za pacijenta i klijenta, posebno u ranim fazama u slučajevima kada postoji povećan rizik od bolesti ili osetljivost koja se može podržati nutritivno, pre prelaska na veterinarsku dijetetsku hranu. Redovno praćenje pacijenta od strane veterinara u vezi sa odgovorom na nutritivnu podršku, uz mogućnost promene ishrane, pomoći će da se obezbedi optimalan tretman pacijenta.

**Organizaciju XLIII simpozijuma za inovacije znanja veterinara,
finansijski su podržale sledeće organizacije i preduzeća:**

Pokrovitelj

Ministarstvo poljoprivrede šumarstva i vodoprivrede – Uprava za veterinu
uz podršku Veterinarske komore Srbije

Veliki sponzori:

Ave & Vetmedic
Aevum pet care
Kinološki savez Srbije
Veterinarski institut dr Vaso Butozan

Sponzori:

VSI Kraljevo
VSI Jagodina
Naučni institut za veterinarstvo Srbije
Institut za higijenu u tehnologiju mesa
Marlofarma
Promedia
Vivogen
VS Bujanovac
Veterinarski zavod Subotica
Hrana produkt
Superlab
VSI Šabac
Naučni institut za veterinarstvo Novi Sad
UVPS
VSI Niš
Krka Farma
Fishcorp 2000 feed
Evrolek
Zoolek
Biochem Balkan
VSI Subotica
VSI Sombor
VS Mladenovac
Naturavitalis
VSI Pančevo
VSI Zaječar
Lusa vet
Royal Vet
VSI Požarevac
Primavet

CIP - Каталогизација у публикацији - Народна библиотека Србије, Београд
636.09(082)

СЕМИНАР за иновације знања ветеринара (43 ; 2022 ; Београд)
Zbornik predavanja XLIII Seminara za inovacije znanja veterinara,
Beograd, [25.02.2022.] / [urednik Dragan Gvozdić]. - Beograd : Fakultet
veterinarske medicine, Centar za izdavačku delatnost i promet učila,
2022
(Beograd : Naučna KMD). - [7], 205 str. : ilustr. ; 24 cm

Na vrhu nasl. str.: Univerzitet u Beogradu. - Tiraž 450. - Str. [3]:
Predgovor / Milorad Mirilović, Danijela Kirovski. - Bibliografija uz
svaki rad. - Summeries. - Registar.

ISBN 978-86-80446-46-2

а) Ветерина - Зборници

COBISS.SR-ID 58357769