Reduced food intake is an important clinical sign that can result from a myriad of chronic diseases (eg, CKD, congestive heart failure, cancer, or liver disease) as well as acute illness or injury. Reduced food intake can lead to insufficient intake of calories and other nutrients, weight loss, muscle loss (cachexia), and, ultimately, poor outcomes.\(^1,2\) In addition, reduced or altered food intake is obvious to pet owners and is an important factor when owners assess a companion animal’s quality of life.\(^3,4\)

It is important for veterinary health-care teams to be aware of and to take steps to manage reduced food intake to improve outcomes and quality of life for companion animals, especially those with chronic illness. However, regulation of appetite and food intake is not completely understood, and terms relating to this problem are confusing and inconsistently applied (eg, anorexia, inappetence, hyporexia, or poor appetite). These challenges can make it difficult to document the prevalence and severity of a problem and to measure efficacy of diets, appetite stimulants, or other treatments. On the basis of these more objective criteria, changes in appetite status can be inferred because animals that are less interested in food can generally be assumed to eat less and to lose weight. However, subtle changes in desire for food may not be detected. For example, an animal that is less interested in food or has altered food preferences because of disease may have a decrease in appetite but no change in food intake.

Despite the fact these challenges exist, it remains important to address the issue of vague and inconsistent terms related to appetite in companion animals. Therefore, the authors propose that the following terms be consistently used to facilitate application for publications and clinical practice (Figure 1):
Adequate food intake—Adequate food intake is demonstrated by an animal voluntarily consuming a sufficient number of calories to maintain body weight (if at ideal body condition), gain weight (if underweight), or avoid unintentional weight loss (if overweight). In hospitalized or sick animals, a starting point for the number of calories required can be estimated by use of equations for calculating RER. The following equation can be used for animals of any weight: RER = (30•[body weight in kg]) + 70. For animals that weigh between 3 and 25 kg (6.6 and 55 lb), RER also can be estimated by use of the following linear equation: RER = (30•[body weight in kg]) + 70. In healthy animals, the number of calories required can be estimated by multiplying RER by various factors, depending on age, neuter status, and activity of the animal. However, the number of calories required to maintain body weight can differ widely among animals.

- Hyporexia—Previously, hyporexia has been used to describe a partial reduction in appetite, as opposed to complete loss of appetite.\(^{12,13}\) The authors propose that hyporexia be used as a quantitative, objective term that describes inadequate food intake to maintain body weight (if at ideal weight) or inadequate food intake to gain weight (if underweight). By use of this definition, hyporexia can be determined by obtaining an animal’s diet history, current and typical body weight, BCS, and MCS; assessing food and calorie intake; and calculating the RER. Severity of hyporexia can be described by quantifying intake in terms of a percentage of RER, although it is important to be aware that RER may not be adequate to maintain body weight in all animals, especially those that are not hospitalized or that are more active. Nonetheless, because maintenance energy requirements are variable, the authors recommend the use of percentage of RER as a starting point for determining whether an animal has hyporexia, with follow-up monitoring of body weight to ensure the animal has adequate food intake to achieve or maintain ideal body weight.

- Anorexia—Complete absence of voluntary food intake that suggests a complete loss of appetite.

- Dysrexia—The authors propose the use of the term dysrexia to describe abnormal patterns of food intake, such as altered food preferences or cyclic appetites that can result from chronic diseases. For example, an animal with dysrexia may be willing to eat a particular diet for a few days, then lose interest and refuse to eat that diet for a period but be willing to eat another food during that period. An animal with dysrexia may have normal food intake or hyporexia. However, because animals with dysrexia are at risk of inadequate food intake, particular attention should be paid to body weight, BCS, MCS, and quantification of daily food and calorie intake.

Descriptive terms that focus on appetite (eg, inappetence, reduced appetite, or poor appetite) instead of food intake cannot be accurately assessed; therefore, the authors recommend avoiding their use. The terms aphagia and hypophagia have been used to indicate lack of food intake and reduced food intake, respectively. However, to avoid confusion with problems relating to swallowing (eg, dysphagia), the authors recommend that the terms aphagia and hypophagia not be used.

Although animals with acute and chronic illnesses commonly have problems with hyporexia, anorexia, or dysrexia, other animals may have excessive food intake. Excessive food intake can lead to obesity and other secondary health problems; however, these issues are outside the scope of this report.

**Mechanisms Controlling Food Intake**

Regulation of food intake is a complex, multifactorial, and redundant system developed to balance energy intake and energy expenditure to maintain an animal at a stable body weight. A detailed description of the regulation of food intake is beyond the scope of this report, but excellent reviews of that topic have been published.\(^{14,15}\) Major mechanisms for the regulation of food intake in humans and other animals have been determined (Figure 2). The hypothalamus is a major region of the brain involved with regulation of food intake; adipose tissue, the gastrointestinal tract, and nutrients also play an important role. In a weight-stable healthy person or companion animal, there is a balance between anorexigenic (eg, leptin, pro-opiomelanocortin, and cholecystokinin) and orexigenic (eg, ghrelin and neuropeptide Y) signals. After a meal is consumed, anorexigenic signals increase and contribute to satiety. However, as the amount of time after a meal increases, anorexigenic signals de-
Figure 2—Schematic depicting the major mechanisms for regulation of food intake in humans and companion animals. Arrows indicate the factor causes an increase (↑) or a decrease (↓) in food intake. *Would include a physical barrier such as an Elizabethan collar. †Includes pain related to eating (eg, dental disease or stomatitis) and generalized pain (eg, osteoarthritis). α-MSH = α-Melanocyte-stimulating hormone. AgRP = Agouti-related protein. CCK = Cholecystokinin. GLP-1 = Glucagon-like peptide-1. IL-1β = Interleukin-1β. NPY = Neuropeptide Y. POMC = Pro-opiomelanocortin. PYY = Peptide YY. TNF-α = Tumor necrosis factor-α.

crease and orexigenic signals increase, which results in a feeling of hunger and a drive for food intake. In healthy animals, this balance between anorexigenic and orexigenic signals can be shifted in favor of weight gain owing to factors such as overfeeding of highly palatable, calorie-dense foods. On the other hand, for many illnesses, the balance is shifted in favor of reduced food intake and weight loss. Many signals act to reduce food intake, but far fewer signals stimulate food intake. In addition to physiologic mechanisms, there are also a variety of psychological factors that impact food intake in humans. The role of these psychological factors in companion animals is less clear.

Pathophysiologic Processes for Dysregulation of Food Intake

The multifactorial regulation of energy balance and food intake can be disrupted by a variety of processes in ill and injured animals. In response to illness or injury, energy is mobilized from protein and, to a lesser degree, fat stores. These processes are important in the short term to provide energy needed to mount immune responses and repair wounds, but they also can lead to progressive depletion of lean body mass and energy stores in acute and chronic illnesses. 16–18

Many disease processes interfere with energy regulation. In healthy animals that ingest an insufficient number of calories to meet energy requirements, an increase in the production of orexigenic stimuli and a decrease in the production of anorexi-
Obtain a diet history

What is the animal’s current diet, including the main diet, treats, table foods, foods used when giving medications, and supplement-type products? Obtain information about the specific products and quantity consumed for each item. Diet history forms are available to help obtain this information.21

What is the animal’s current daily dietary intake? It should be noted that to assess dietary intake, one must quantify the amount offered and the amount eaten.

Evaluate adequacy of calorie intake

Body weight: Evaluate body weight trends. Has the animal’s weight decreased over time?

Body condition score: Evaluate the BCS by use of a standardized 9-point scale.22,23

- If underweight (BCS 1 to 3), is the animal failing to gain weight?
- If ideal BCS (BCS 4 to 5), is the animal losing weight?
- If overweight (BCS 6 to 9), is the animal having unintentional weight loss?

Muscle condition score: Evaluate MCS by use of a standardized scale.24–26 One MCS26 used by some clinicians has numeric values (score ranges from 0 to 3, with 0 = severe muscle loss and 3 = normal muscle mass). However, because this numeric system can result in confusion, the authors recommend use of the MCS system developed through the World Small Animal Veterinary Association.24,25 For that MCS, an animal is described as having normal muscle mass or mild, moderate, or severe muscle loss.

- Has the animal’s MCS worsened over time?
- If the answer to any of the weight, BCS, and MCS questions is no, then calorie intake is adequate.
- If the answer to all of the weight, BCS, and MCS questions is yes, then calorie intake is inadequate.

Assign appropriate terms

If calorie intake is inadequate, is the animal eating any food?

- If the answer is yes, then the animal is hyporexic.
- Quantify the severity of hyporexia by calculating calorie intake as a percentage of RER.
- Note the duration of hyporexia, including the number of days prior to the initial examination.

- If the answer is no, then the animal is anorexic.
- Note the duration of anorexia, including the number of days prior to the initial examination.

Evaluate feeding patterns

Is the animal unwilling to eat an optimal diet?

• Does the animal require the addition of treats, toppings, or other flavor enhancers to the main diet so that it will eat?

• Does the animal lose interest in a diet after eating it for a few days?

• If the answer to any of these questions is yes, then the animal is dysrexic.
• Note the duration of dysrexia, including the number of days prior to the initial examination.

Results of these assessments should be recorded in the animal’s medical record to enable evaluation of patterns over time and to guide treatment.

Management of Inadequate Food Intake

The veterinary health-care team should consider several potential targets for intervention. Methods to encourage food intake have also been summarized elsewhere.12,13

Diagnosis and treatment

Identify and treat underlying medical conditions or issues that may be contributing to reduced food intake. This may include adjusting medications or treating underlying diseases, which can include the following:

• Oropharyngeal problems (eg, dental disease, stomatitis, or dysphagia).
• Sources of other pain (eg, osteoarthritis or recent injury or surgery).
• Medications (eg, chemotherapeutics, antimicrobials, diuretics, or narcotics).
• Gastrointestinal tract or hepatic disease (eg, neoplasia, inflammatory bowel disease, delayed gastric emptying, pancreatitis, hepatic lipodosis, or cholangiohepatitis).
• Other chronic or severe disease (eg, CKD, congestive heart failure, cancer, sepsis, or respiratory tract disease).
• Signs of nausea.
• Reduced or modified sense of taste or smell (secondary to neoplasia, chemotherapeutics, or upper respiratory tract infection).
• Dementia or cognitive dysfunction.

Modify environmental conditions to encourage food intake

Avoid associations between feeding and unpleasant procedures (eg, administration of medications or fluids). If possible, schedule treatments to be performed at other times and by other people.

Change the feeding bowl. Some materials (particularly plastic) can retain unpleasant odors. Some cats prefer a shallow dish that does not touch the whiskers during feeding. Some dogs prefer a dinner plate. Place food bowls away from areas used for urination or defecation and other locations where subtle odors may be present.

Feed in a different area of the home, such as in another room or even outdoors.

Remove barriers to eating, such as an Elizabethan collar (such animals must be supervised while eating to ensure they do not exacerbate the condition that required the use of the Elizabethan collar).
For companion animals that are social eaters, provide them with company during mealtimes. For animals that prefer solitary eating, provide a private area, such as another room.

Normalize the light-to-darkness cycles and timing when meals are provided to emulate the animal’s typical routine.

**Modify dietary factors to enhance palatability**

Temperature: Some animals prefer to eat room-temperature food, whereas warmed food is more palatable to other animals. Some dogs prefer food that has been chilled. If food is heated, it should be stirred well and the temperature tested before it is offered to ensure it is not too hot.

Texture: Differing textures of appropriate diets should be offered. These include dry food with various shapes and canned food with various textures (paté, chunky, or stew).

Aroma: Some animals prefer foods with strong aromas (eg, foods with fishy flavors).

Moisture: Offer canned food or add water to dry food.

Freshness: If there is uneaten food from a previous meal, it should be thrown away and replaced with fresh food.

Palatability enhancers: Sources of fat (eg, butter) can be added in small amounts, provided the fat is not contraindicated for the animal or its condition. Homemade chicken, fish, or beef broth also can be used (do not use commercial broths because even low-sodium commercial broths have a high sodium content). For dogs, sweet foods (eg, sugar, honey, maple syrup, applesauce, or fruit yogurt) can be added to the main diet, provided the sweet food is not contraindicated for the animal or its condition.

Nutritionally balanced home-cooked diet: Some animals may find home-cooked foods to be more palatable than commercial diets. Consultation with a board-certified veterinary nutritionist is recommended because nearly all empirical recipes or recipes from books or websites are nutritionally unbalanced.

**Avoid food aversion**

A food aversion is a form of conditioning in which animals or humans avoid consumption of a food that previously has been paired with transient illness. Animals affected by vomiting or signs of nausea, neoplasia, some medications, or some illnesses can develop robust and long-standing food aversions. This phenomenon can be particularly problematic in patients in which long-term feeding of therapeutic diets may be recommended and there are a limited number of appropriate diets available (eg, an animal with CKD that requires a low-phosphorus diet). Prevention of food aversions may be helpful to minimize anorexia, hyporexia, and dysrexia. To reduce the risk of food aversion, it may be helpful to avoid changing diets for an animal that is acutely ill or hospitalized; dietary modifications can be instituted once the animal’s condition has improved or it is ready to be discharged from the hospital. Placement of a feeding tube can be considered for animals at high risk for development of a food aversion.

**Consider use of appetite stimulants**

Several drugs have been investigated as appetite stimulants for veterinary patients. A review of the use of appetite stimulants in cats was recently published. Although currently available medications may be helpful for certain animals, their efficacy can be unpredictable and they may prove inadequate to sufficiently increase food intake of a hyporexic or anorexic animal to meet energy requirements. Overreliance on appetite stimulants may lead to a delay in addressing the underlying problem or application of more aggressive nutritional intervention and thus cause additional days of hyporexia or anorexia. Appetite stimulants may be considered as adjunctive treatments, especially during treatment of underlying diseases. However, for patients with prolonged insufficient food intake or more severe disease, placement of a feeding tube or use of parenteral nutrition (if enteral nutrition is not possible) should be considered.

Mirtazapine is a tetracyclic antidepressant used in humans, but it has primarily been used in veterinary patients for its antiemetic and appetite-stimulating effects. In a masked, placebo-controlled crossover clinical trial, mirtazapine increased body weight, improved appetite score, and reduced vomiting in cats with CKD. A recommended regimen for oral administration is 1.88 mg/cat every 24 to 48 hours, as needed, to achieve adequate food intake to meet energy requirements. Although the pharmacokinetics of mirtazapine in dogs has been investigated, clinical studies are lacking. One recommended daily oral dosing regimen for dogs is 3.75 to 30 mg (3.75 mg for dogs weighing [7 kg ≤ 15.4 lb], 7.5 mg for dogs weighing 8 to 15 kg [17.6 to 33 lb], 15 mg for dogs weighing 16 to 30 kg [35.2 to 66 lb], and 30 mg for dogs weighing > 30 kg [≥ 66 lb])34,36; however, the efficacy of mirtazapine in dogs remains to be proven. Because mirtazapine is metabolized in the liver and cleared by the kidneys, the dosing frequency should be reduced for animals with hepatic or renal disease.

Cyproheptadine is an antihistamine that inhibits serotonergic receptors of the hypothalamus, which leads to some appetite-stimulant effects in cats (with minimal evidence for beneficial effects in dogs). The recommended oral dose for cats is 1 to 2 mg every 12 to 24 hours. Because of its variable bioavailability and mean half-life of 12 hours, cyproheptadine may require ≥ 2.5 days to reach steady-state concentrations. Similar to mirtazapine, cyproheptadine is metabolized in the liver and cleared by the kidneys, and the dosing frequency should be reduced for animals with hepatic or renal disease. Administration of
cyproheptadine is not recommended for cats with hepatic lipidosis because of reports of idiopathic hepatotoxicosis and hepatic failure.40

Maropitant is a selective neurokinin-1-receptor antagonist that has antiemetic effects in cats41 and dogs.42,43 A study44 of maropitant administration for 2 weeks to cats with CKD resulted in a significant decrease in vomiting but did not result in a significant change in appetite score or body weight. Although it is important to treat signs of nausea when they are present, there does not appear to be a strong effect of maropitant on food intake.

Newer drugs that more specifically target appetite may be beneficial for animals with inadequate food intake. Capromorelin, a selective ghrelin-receptor agonist, increased food intake and body weight in healthy dogs45 and was recently approved for use as an appetite stimulant in dogs by the US FDA. Investigators of a prospective, randomized, masked, placebo-controlled, multisite study46 of 244 client-owned dogs with reduced appetite detected significant increases in owner-assessed appetite after 4 days of capromorelin administration, compared with results for administration of a placebo. Results of a safety study47 of capromorelin in cats were recently reported. Although only reported as preliminary results, a multisite pilot field study48 of approximately 40 cats with CKD indicated significant increases in body weight after capromorelin administration for 90 days, compared with results for a placebo.

Although other drugs (eg, diazepam, oxazepam, and propofol) have been used for pharmacological stimulation of appetite, they are not currently recommended for such use because of adverse effects or lack of data on pharmacokinetics and efficacy.31 Additional studies on pharmacological stimulation of appetite and other methods of increasing food intake in dogs and cats are warranted.

Consider providing enteral or parenteral nutrition

If animals are unwilling or unable to consume a sufficient number of calories to achieve or maintain an ideal body weight (or are unwilling to eat enough of an optimal diet to obtain a sufficient number of calories), use of a feeding tube is indicated to provide enteral nutrition. If enteral nutrition is contraindicated, parenteral nutrition should be considered. Proactive intervention should be strongly considered for animals that are anorexic, hyporexic, or dysrexic, rather than waiting until malnutrition develops. Some animals are at high risk for malnutrition and secondary sequelae of inadequate food intake; for these animals, more aggressive nutritional intervention with placement of a feeding tube or parenteral nutrition should be considered. Criteria for these high-risk animals include the following:

- Animal is hyporexic or anorexic for more than 3 to 5 days.
- Animal has a low BCS or MCS and is unwilling or unable to consume a sufficient number of calories (or enough of an optimal diet to provide a sufficient number of calories) to achieve and maintain an ideal BCS.
- Animal has dysrexia and is unwilling to eat a diet appropriate for its medical condition (eg, an animal with stage 3 or 4 CKD that is unwilling to eat a therapeutic renal diet).
- Animal has severe underlying disease (eg, sepsis or severe pancreatitis).
- Animal is expected to have prolonged low voluntary food intake for more than 3 to 5 days because of its condition (eg, hepatic lipidosis or head trauma).

Future Research

Future studies to elucidate mechanisms of energy regulation will help to identify potential targets for therapeutic intervention in animals with hyporexia, anorexia, and dysrexia. Additional studies with the uniform application of terms will improve understanding of the prevalence and severity of appetite problems in animals with acute and chronic diseases.

Clinical Summary

Inadequate food intake is a common clinical problem in animals, with major adverse effects. Application of consistent terms (eg, hyporexia, anorexia, and dysrexia) and assessment of the situation with respect to adequate caloric intake will facilitate accurate patient assessment and treatment as well as assist future research on the consequences and treatment of this important clinical problem. Veterinary health-care teams should ensure that diet history, body weight, BCS, MCS, and a diet plan are evaluated and discussed at every patient visit. These steps will help clinicians to detect changes in food intake and facilitate proactive problem solving and nutrition intervention.

Acknowledgments

Dr. Freeman serves on a scientific advisory council of and has performed consultations for Aratana Therapeutics.

Footnotes


References


