NUTRITION

The Benefits and Risks of Chew Treats

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Veterinarians are frequently asked about chew treats for dogs. Clients want to provide chewing items for numerous reasons, such as to address oral/dental health, satisfy normal chewing behavior, and provide enrichment and entertainment, which may help alleviate anxiety, stress, or other behavioral issues. Some canine chew treats even have manufacturer claims that they enhance nutrition and health. Veterinary practitioners need to know if those chew treats are safe and if they really provide positive health benefits. This article reviews the potential benefits and risks of offering chew treats to dogs.

TYPES OF CHEWS

It is difficult to evaluate chews because they are poorly defined in the literature. For this article, the authors suggest the following classification for canine chew treats:

- Animal-derived products that have undergone minimal processing
  - Bones (e.g., marrow, long bone, other bones)
  - Other body parts (e.g., ears, trachea, lung, hooves, antlers, horns, bully sticks, tendons, masseter muscles, skin, hides)
- Animal-derived products that have undergone extensive processing
  - Rawhides
  - Compressed rawhides
  - Chews made from meat, bone meals, blood meals, etc.
- Non–animal-derived products
  - Consumable, plant-based ingredients
  - Nonconsumables (e.g., plastic, rubber)

Abstract

Clients often ask veterinarians whether chew treats are good for their dog, and the answer is neither yes nor no. Chew treats can be beneficial as well as harmful. Benefits include behavioral and environmental enrichment and improved dental health. Risks include oral/dental trauma, airway or gastrointestinal obstruction, additional calories, ingredient intolerance, and pathogen introduction. Veterinarians should weigh the risks and benefits for each individual patient and advise clients to purchase chew treats for dogs from reputable companies only.

Take-Home Points

- There are 3 types of chew treats: animal-derived products that have undergone minimal processing, animal-derived products that have undergone extensive processing, and non–animal-derived products.
- Rawhide chews may contain chemicals and other ingredients used in processing.
- Benefits of offering treats may include environmental/behavioral enrichment and improved oral/dental health.
- Risks of offering treats include oral/dental trauma, airway or gastrointestinal obstruction, additional calories, ingredient intolerance, and pathogen introduction.
- Veterinarians should base chew selection on the individual patient (e.g., size, diet, chewing behavior, ingredient intolerance), reputable manufacturer, and Veterinary Oral Health Council approval.
- Raw chews may pose infection risk for immunocompromised patients and for humans in the same household.

Animal-Derived Products That Have Undergone Minimal Processing

Minimally processed animal-derived canine chews include bones and other body parts from animals of various species. They can be sold loose, "in pieces" with or without any packaging. Raw chews are susceptible to contamination because they are not subjected to processing procedures (e.g., heating, sterilization) to eliminate potential pathogens. They also may lack a "use by" date and often fail to indicate storage time, which may increase the risk for spoilage or contamination with pathogenic microorganisms (e.g., bacteria, mold).

Animal-Derived Products That Have Undergone Extensive Processing

Extensively processed animal-derived canine chew products are made from animal-origin materials that are not intended for human consumption and are classified as animal by-products, which include meat and bone meals, fish meals, blood meals, blood products, animal fats, and other dog foods. Animal by-products as well as non–animal-derived products can be further processed for use in chew production. Processing usually includes 1 or more treatments, transformations, or processing steps to form the final product.

Among products classified as extensively processed animal-derived chews are rawhides (**BOX 1**). Rawhide chews are made from the chemically processed inner hide layer, most commonly from cows but also other animal species (e.g., pigs, sheep, even water buffalo). The digestibility of rawhide chews is often unknown or suspected to be poor, and rawhide chews are not considered a "food." To produce a rawhide chew, the hide may be processed in brine (salt), degreasers, detergents, sodium bicarbonate, hydrogen peroxide, lime, or other chemicals needed to remove hair or fat, kill pathogens, and improve the appearance. Cheaper ingredients or scrap rawhide may be used to add weight to the product. Artificial colors and flavors are often added to make the final product more palatable, and additives (e.g., glues to hold shape) may be used. Ingesting rawhides exposes the dog to these processing chemicals and other ingredients. Processing and storage standards may differ by country of origin (i.e., United States, China, Mexico, or South America). Rawhide products have been recalled due to the use of

BOX 1 Resources for Information on Rawhide Chews

- Purina — Rawhide for Dogs
  bit.ly/3R7MxqK
- WebMD — Rawhide: Good or Bad for Your Dog?
  bit.ly/3uoB2lL
- U.S. Food and Drug Administration (FDA) — No Bones About It: Bones Are Unsafe for Your Dog
  bit.ly/47NwST7
- Petfood Industry — Rawhide Recall Expanded to Private Label Dog Chews
  bit.ly/49GnzWR
- Petfood Industry — FDA: Don't Give Bones to Dogs
  bit.ly/47joudX
- Petfood Industry — FDA Warns That Bone Treats Related to 90 Dogs' Illnesses
  bit.ly/3sJ7COL

unapproved compounds (e.g., quaternary ammonium chloride in rawhide chews from other countries).

Other Extensively Processed Chews Including Non–Animal-Derived Products

Other than rawhides, other extensively processed canine chews may be made from non–animal-derived ingredients (typically plant-based foods) and may be consumable or nonconsumable. These may be marketed as "rawhide free," but selecting a quality product is difficult because these chews are poorly regulated. A recent study used routine morphologic-based histologic staining techniques to compare chew products to labeling claims.[1] Of the 10 products tested, 2 contained skin layers (consistent with rawhides) and were therefore deemed inconsistent with their labeling. The study also reported that 4 products contained bacterial and fungal organisms.[1]

Another study that analyzed the nutrient composition of treats, including various rawhides, chewable sticks, and dental care sticks, found variable nutritional content in terms of dry matter, crude protein, ash, hydroxyproline content, simple sugars, and starch.[2] Study results suggest that treat labeling should include more information about the ingredients used and that the varying nutrient and caloric density of treats should be considered when deciding if appropriate for a particular dog.

BENEFITS AND RISKS ASSOCIATED WITH CHEW TREATS

Possible Benefits

Many dog owners seek chew treats that can be used to distract and satisfy their dog but also to provide oral/dental health benefits.

Behavior

Chews may provide an outlet for chewing behaviors, especially for puppies while their permanent teeth are erupting. Chews are also used to provide entertainment or enrichment. Several studies have demonstrated how chews can offer enrichment and healthy stimulation for dogs.[3-5]

A survey-based exploratory study on chewing behaviors in dogs found that 94% of dog owners provided their dogs with edible chewing material, 83% provided their dogs with inedible chews, and 4% sought veterinary treatment due to a problem with chewing material.[3] Many owners reported offering chews associated with situations leading to negative emotions (e.g., leaving the dog alone, changes in routine). In another study, puppies offered rawhide chews as a means of enrichment spent considerable time interacting with the chews (average 64% of free time).[4] A study that evaluated 62 laboratory dogs at 3 research facilities reported that the study dogs offered calf horn chews spent significantly less time staying near the fence of the kennel and observing the outside area (defined as "inactivity") and a significant increase in "explorative behavior."[5]

Overall Health

Despite the potential risk for exposure to pathogenic bacteria with raw animal-derived chews, a study that examined the use of chews for puppies indicated that they may provide some enhanced protection against gastrointestinal (GI) disease later in life.[6] The researchers surveyed dog owners and found a correlation between decreased risk of developing chronic enteropathy later in life when raw bones and cartilage, as well as leftovers and table scraps, were offered as chews during puppyhood and adolescence. However, a notable study limitation was that the data were collected solely from owner-reported dietary and medical histories.

Dental Health

Dental care recommendations include regular tooth brushing as the most effective way to control tartar accumulation, improve oral health, and reduce breath odor; however, brushing may be difficult to implement for some dogs and owner compliance may be poor.[7] In a recent publication, surveyed dog owners indicated that they believed the most important factors influencing dental health were a "healthy diet" and "natural chews," as well as indicating that brushing teeth was less important or reported brushing as "unnatural."[7]

A study that evaluated offering raw femur bones to laboratory dogs documented markedly decreased dental calculus (35.5% reduction after 3 days and 70.6% after 12 days).[8] No complications (e.g., tooth fractures, pieces of bone stuck between teeth, intestinal obstructions) were observed during the study.

Another study evaluated dental calculus and risk for oral injury among twelve 4-year-old adult beagle dogs offered either autoclaved beef cortical bone or spongy bone.[9] The study had a 2 × 5 factorial design consisting of the 2 treatments and 5 intervals, with 3 males and 3 females each, resulting in 6 replicates (the minimum recommended by the Association of American Feed Control Officials [AAFCO]). Researchers reported that despite the hardness of the bones, they noted no tooth root or enamel fractures and no esophageal or intestinal obstructions associated with bone ingestion. However, when the dogs were offered spongy bone, they noted gingival lesions in 4 dogs and bone remnants between teeth in 2 dogs. Despite those minor injuries, almost 90% of dental calculus was removed. That study concluded that offering those type of bone chews could extend dental cleaning intervals.

The study of the 62 laboratory dogs offered calf horns also reported positive effects on tartar/plaque reduction and fecal consistency.[5] Another study that compared brushing with use of dental chews found that chews reduced the bacterial load on the tongue and within the oral cavity and reduced breath odors, similar to the effects of dental brushing.[10]

A recent review of 9 studies on nonrawhide dental chew products reported that reaching definitive conclusions is difficult due to significant study design weaknesses (e.g., differing shapes and ingredients of tested chews, failure to identify pre-existing dental care routine or base diet in histories, failure to randomize study subjects, inconsistent assessment of calculus evaluation, limited duration of chew use, potential bias due to company funding).[11] Evaluation of dental chew effectiveness needs more independently funded studies with better study design.

Risks

Pet owners may offer chew treats for their nutritional or functional benefits. However, in 2017, the U.S. Food and Drug Administration (FDA) posted warnings about feeding bones to dogs as they may cause GI obstruction, choking, cuts and wounds in the mouth or on the tonsils, vomiting, diarrhea, bleeding from the rectum, and/or even death.

Oral Trauma/Dental Injuries

Bones or hard chews may inflict oral or dental injury or, if swallowed, cause intestinal obstruction (esophageal, jejunal). Traumatic dental fractures are very common in veterinary practice; reported prevalence is up to 26%[12] and may be caused by chewing on hard objects, such as bones or hard chews.

The World Small Animal Veterinary Association as well as the British Veterinary Dental Association has noted risks of dental abrasions, dental attrition, and tooth fractures from chewing very hard dental treats or animal-derived chew products.[13]

Older studies have noted that chews may reduce dental tartar or calculus; however, they do not address periodontal disease and may cause dental injury. In 1 study, 41% percent of wild dogs eating a natural diet showed evidence of periodontal disease, 83% had tooth wear, and 48% had fractured teeth.[14] In another study, 61% of feral cats had periodontal disease but only 9% had tooth calculus accumulation.[15]

Airway Obstruction

Another risk inherent with any chew or treat is airway obstruction/choking, especially if large pieces are ingested. Selection of chews should be based on body weight and chewing behavior of the dog. Some dogs are "gulpers" and will ingest chews rapidly, increasing their risk for airway obstruction. Packages for chews often state a warning for pet owners to supervise the pet when offering a chew and to remove smaller pieces (**FIGURE 1**).

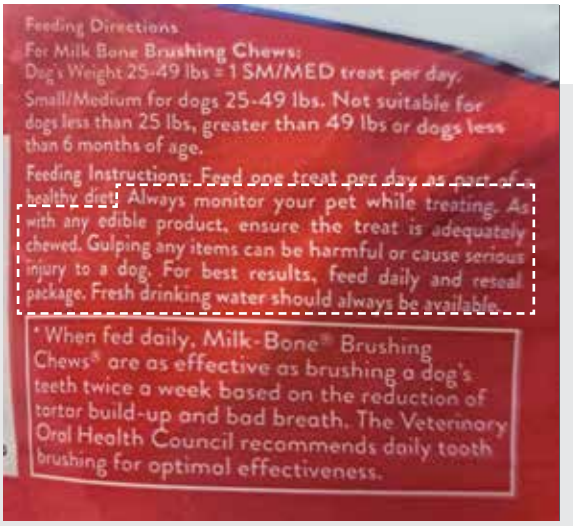

FIGURE 1 Sample feeding instructions and cautionary statements **(dashed box)** on a chew treat's packaging.

Gastrointestinal Injury

For a chew to safely pass through the GI tract, it must be partially or completely digested and must not form sharp edges after chewing. Laboratory methods have been developed to mimic the digestive process and assess rate of disappearance in the gastric and intestinal phases of digestion.[16] One study evaluated rates of disappearance of multiple treats and chews and found that in the gastric phase, digestibility of biscuit-type treats and dental chews was highest in both gastric and intestinal phases and that digestibility of bones was lowest.[16] The researchers also found that risk for obstruction was higher with bones but that bone edges typically became rounded via enzymatic digestion, thereby resulting in lower risk for GI injury or perforations.[16] Digestibility of other minimally processed animal-derived chews and rawhides was typically lower in the stomach and higher in the intestine.[16] To determine actual digestibility rates and overall safety of chews, studies will need to account for differences in processing applied to chews.

Additional Calorie Content

Minimally processed bones, other body parts, extensively processed rawhides, and compressed rawhides are not considered "food" by the FDA and are therefore poorly regulated. They are exempt from AAFCO registration and labeling requirements, and labels are not required to bear a calorie content statement or a guaranteed analysis. Regardless, chews are in fact ingested and may contribute significant protein and calories to a dog's diet.

Most dental chew products are considered treats, and veterinary nutritionists often recommend that to avoid unbalancing the total daily diet, treats should be limited to no more than 10% of the dog's daily caloric intake.[17] Rare chew treats may be formulated to be "complete and balanced" and meet the AAFCO recommendations for a dog's life stage (e.g., canine adult maintenance or growth).[18] Those chews may be a larger portion of the diet, accounting for its caloric contribution, and other foods should be adjusted appropriately to avoid overfeeding calories. Large chews

TABLE 1 Dental Chew Products Calories per Chew and % Daily Energy Requirement

PRODUCT	DOSE, 1 CHEW/BODY WEIGHT, POUNDS	KCAL	% DAILY ENERGY REQUIREMENT[a]
GREENIES (MARS, GREENIES.COM)			
Anytime	<5	15	8–28
Teenie	5–15	26	6–14
Petite	15–25	56	9–14
Original	26–50	90	9–14
Large	50–100	147	9–14
C.E.T CHEWS (VIRBAC, VIRBAC.COM)			
Extra small	<11	30	<9
Small	11–25	32	5–10
Medium	26–50	54	5–9
Large	>50	88	Up to 8
ORAVET (BOEHRINGER INGELHEIM, BI-ANIMALHEALTH.COM)			
Extra small	<10	26.8	<9
Small	10–24	47.7	8–16
Medium	25–50	80.5	8–13
Large/giant	>50	128.2	Up to 13
DENTALIFE (PURINA, PURINA.COM)			
Small/medium	15–20	63 q24–48h	12–15
Large	≥40	100 q24–48h	Up to 12
MILK BONE BRUSHING CHEWS (J.M. SMUCKER, MILKBONE.COM)			
Mini	5–25	30	5–17
Small/medium	25–49	65	6–11
Large	>50	100	Up to 10

[a]Calculated as 1.4 × (70 × BW(kg)$^{0.75}$) for range of body weights

may contribute significant calories to the daily diet if consumed. The authors evaluated some popular dental chews available online and found that many approach or exceed the 10% limit on calories for dogs of most sizes (TABLE 1).

One study analyzed the caloric content of bully sticks and found caloric density to be approximately 3.01 kcal/g or 88 kcal/treat or 15 kcal/inch. Thus, a 22.7-kg (50-lb) dog that consumes a large (8-inch) bully stick will consume approximately 120 kcal/chew. The daily energy requirement (DER) for this dog is approximately 1020 kcal/day (DER = [70 × BW(kg)$^{0.75}$] × 1.4). The chew would be 11.8% of this dog's caloric intake, thereby exceeding the recommended treat limit of no more than 10% of calories per day (102 kcal/day). When dog owners were surveyed as to the caloric content of various chew treats (including bully sticks), 50% of respondents underestimated the number of calories.[19]

Intolerance

For dogs with food sensitivities exhibited as GI or dermatologic disease, chews will expose the dog to additional animal proteins and may not comply with requirements for a limited-ingredient diet or hypoallergenic food trial. Pet owners may fail to recognize chews as being contraindicated in their dog's diet.

Pathogens

Similar to raw dog foods that undergo poor quality control, minimally processed animal-derived dog chews may carry bacterial pathogens and other infectious organisms that may cause illness in dogs and humans.[20] Such risks may similarly apply to raw chews, with regard to both the dog consuming the treat and the humans in the environment. Considering that dogs commonly carry chews around the household, risk for environmental contamination is greater for chews than for raw food confined to a food dish.

Although clients may seek to feed more "natural" bones as chews, to reduce risks for pathogen exposure, the authors recommend avoiding offering unsterilized or raw materials to immunocompromised patients or those with multiple medical challenges as well as to patients that live in homes with immunocompromised adults or small children. Caution is thus warranted when purchasing, handling, and feeding raw chews.

BOX 2 VOHC Requirements for Manufacturers

- Assurance that no major safety issues—such as toxicity, esophageal or intestinal obstruction or perforation, gross nutritional imbalance, or trauma to oral tissues such as fracture of teeth or laceration or penetration of oral mucosa—were identified during testing or since the product was first marketed.
- Assurance that all FDA or AAFCO regulatory requirements have been met in product manufacture and sale.
- Annual reporting of any complaints or regulatory actions relating to the safety issues noted above.

AAFCO = Association of American Feed Control Officials; FDA = Food and Drug Administration; VOHC = Veterinary Oral Health Council

SELECTING DENTAL CHEW PRODUCTS

To provide an objective assessment of dental product efficacy, the Veterinary Oral Health Council (VOHC) was formed and developed a protocol for testing effectiveness of plaque and calculus retardants in dogs. Note that the VOHC system is limited only to dental efficacy review and is not a regulatory body. The VOHC only authorizes the use of a registered seal on products intended to help retard plaque and tartar on the teeth of animals for which clinical trial results are voluntarily submitted (BOX 2). The VOHC makes no guarantees associated with safety of the product use. Veterinarians should still examine the appropriateness of a particular VOHC-approved dental chew and consider the total caloric effect to ensure that the chew does not contribute excessive calories.

SUMMARY

Offering chews responsibly requires matching the chew with the individual patient (BOX 3). Veterinarians should recommend commercial chew products from reputable companies that display calorie content, full ingredient listings, and a guaranteed analysis providing nutritional data as a minimal requirement to understand the nutritional effects of the chew. Selecting chews appropriate for the dog will help keep chews within the dog's treat allowance as well as ensure safe use of the chew. Veterinarians should discuss with clients the importance of monitoring the dog while it

BOX 3 Proper Feeding of Chews

- Select chew products from reputable companies.
- Be sure the product displays a guaranteed analysis with a calorie statement. Check whether the chew product has a nutritional adequacy statement and for which life stage.
- Match chew size to the patient, and consider the caloric effect of the chew in that patient's diet.
- Instruct clients to carefully monitor their dog with the chew at all times and to remove the chew if it is small enough to pose a risk of choking or for gastrointestinal obstruction if swallowed.
- Do not use raw bones or raw nonbone chews in households with immunocompromised family members.

has the chew. Knowing a dog's individual behavior and personality type is valuable because aggressive chewers are at increased risk for oral/dental injury or may be more likely to ingest large pieces of chews, which can cause choking or obstructions. TVP

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