

A BONE OF CONTENTION: RAW MEAT DIETS FOR PETS

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INTRODUCTION

Raw meat diets for dogs and cats are an increasingly important alternative pet food option. Although most pet dogs and cats are fed conventional cooked dry kibble diets, increasingly pet owners are looking to different food options, including raw meat diets, as at least a component part of their pet's diet. It is difficult to know exactly how many dogs and cats are fed a raw meat diet, however in the UK, the PDSA PAW report estimated that approximately 7% of dogs were fed a raw diet (5% commercial, pre-prepared raw diets, 2% home-prepared raw diets), equating to nearly 800,000 dogs ¹.

WHAT ARE RAW MEAT DIETS?

Raw meat diets are pet foods comprising uncooked, untreated animal tissue, and include muscle, bone, skin and internal organs/offal (including abdominal viscera such as tripe). Animal material which can be made into pet food can be slaughterhouse material and game which is passed fit for human consumption but unwanted for commercial reasons and fish byproducts from factories and ships which prepare fish for human consumption. Material from animals which passed the antemortem inspection, that is unfit for human consumption, may also be included (e.g. a liver with fluke)².

Pet owners may choose to purchase 'ready-made' pre-prepared diets, or make up their own diets at home, or a combination of both. The vast majority of pre-prepared diets are supplied frozen.

Commercially available diets must undergo sampling testing to ensure that they are not contaminated with potentially dangerous foodborne pathogens. In the UK, this testing is overseen by Defra/Animal and Plant Health Agency (APHA), and samples must be tested for *Enterobacteriaceae* (including *E. coli*) and *Salmonella* spp. Samples will fail if they contain >5000 colonies per gram of *Enterobacteriaceae*, or if any *Salmonella* is detected.

WHY DO PET OWNERS CHOOSE THESE DIETS?

Pet food choice is an area of caregiving where owners have complete control over their pet's health and wellbeing. Therefore, the decision of what to feed their pet is often multifactorial, and owners often take great care over this choice.

Studies have shown that there are many reasons why an owner may choose to feed a raw diet, and frequently there is a combination of reasons. Owners may choose a raw diet as they feel it is more 'natural', 'species appropriate' or akin to the diet of wild dogs and wolves. Other reasons include the belief that raw diets provide health benefits (such as improved skin and coat health or improved faecal consistency) or disease prevention attributes. Furthermore, raw diets may be chosen due to a lack of trust conventional kibble companies, because owners feel they have more control over the ingredients in their dog's diet, or because they feel the diet is more nutritious and does not include 'additives' or 'fillers'. Finally, owners may choose a raw diet as they believe it is less 'processed' or artificial, mirroring trends in human nutrition away from 'ultra-processed' foodstuffs ³⁻⁷.

Unlike pet owners who choose a conventional kibble diet, pet owners who feed a raw meat diet are less likely to consult a veterinary professional about diet and nutritional choices, and more likely to trust the advice of friends or family, breeders, or importantly, social media and online resources^{4,8}.

Interestingly, pet owners who choose to feed a raw diet overwhelmingly believe in the positive attributes of the food choice, and do not perceive any risk of the diet to their pet, to themselves, or to in-contact pets or people, and strongly believe that conventional kibble-based diets are risky to their pets^{4,7}. Furthermore, often owners who do understand some bacterial risks associated with raw meat believe that these risks can be mitigated by good food hygiene practices at home. However, these practices frequently vary, are often inconsistently applied, and inappropriate practices such as rinsing of raw meat and not using separate utensils are reported⁹. This suggests that messaging surrounding appropriate practices may not be reaching the intended audience or are confusing or misconstrued.

WHAT ARE THE RISKS?

There is a growing body of evidence surrounding the risks associated with feeding a raw meat diet, particularly surrounding the microbiological risks and nutritional concerns. Dogs and their owners have very close relationships. Dogs often share the home with their owner, may be allowed on to soft furnishings such as beds or sofas, and may lick owner's hands or faces. Therefore, the risk of bacterial transmission is high.

Nutritional risks

There are concerns surrounding the nutritional adequacy of many raw meat diets, and these diets may be lacking in key minerals such as phosphorus, zinc, calcium and potassium, as well as key amino acids such as taurine. Commercial raw meat diets may meet FEDIAF nutritional standards by analysis, but products may have undergone limited (or no) testing or feeding trials. These concerns are heightened for home-prepared raw meat diets, which are most likely to be incomplete. This is of particular concern for growing animals.

There are documented cases in the veterinary literature of nutritional disease occurring in dogs and cats because of improperly balanced or nutritionally inadequate raw diets. These include metabolic bone disease, including generalized osteopaenia and retinal degeneration in a kitten fed an exclusively raw chicken diet. Clinical signs were likely due to the inappropriately balanced diet and taurine deficiency, and full recovery was achieved following implementation of a complete diet formulated for kitten growth and taurine supplementation¹⁰. A further example is that of a puppy with severe osteopaenia which was fed an incomplete home-prepared diet of raw meat, homecooked cereals and vegetables. The puppy was found to have severe nutritional deficiencies, including hypovitaminosis A, hypovitaminosis D and hypocalcaemia, and was euthanased following deterioration in condition¹¹. These cases highlight how dietary inadequacies associated with poorly formulated raw meat diets can lead to severe clinical complications.

Bacterial risks

Raw meat diets globally have been demonstrated to be contaminated with bacteria with pathogenic and zoonotic potential, including bacteria with potential to cause very serious disease in humans and animals. These bacteria include *Salmonella enterica*, *Listeria* spp., *Campylobacter* spp., and Shiga-toxin producing *E. coli* (STEC)¹²⁻¹⁷. Importantly, many of the diets investigated were frozen products, indicating that the freezing process does not kill these potentially dangerous bacteria.

Cases of human disease linked to raw meat diets for pets are currently limited. Concomitant *Campylobacter* spp. infection in a raw fed dog and its owner has been reported¹⁸, and an outbreak of human STEC O157:H7 infection where one person died after developing haemolytic uraemic syndrome, was epidemiologically linked to the provision of raw tripe pet food¹⁹. A recent study identified dogs fed a raw diet to be a risk for *Salmonella enterica* transmission to humans²⁰. However, many raw-feeding owners surveyed as part of a large study investigating owner perception of disease associated with raw meat diets did not report any adverse events²¹.

There are, however, multiple cases of bacterial infection in pets linked to feeding a raw meat diet. These include Salmonellosis and *Mycobacterium bovis* infection in cats²²⁻²⁴, and Campylobacteriosis in dogs¹⁸. Raw chicken has also been identified as a risk factor for development of acute polyradiculoneuritis in dogs, potentially mediated by *Campylobacter* spp. infection²⁵.

A recent study in the UK by the Food Standards Agency aimed to determine the bacterial risk to pets and owners from raw meat diets²⁶. Overall, the level of risk to human health was deemed low, and the risk to pets was suggested to be low-medium. However, the level of uncertainty surrounding these risks was medium-high, indicated gaps in the evidence due to a lack of data. Furthermore, the 'severity of detriment' to humans if they were to contract an infection was deemed medium for *Campylobacter* spp. and high for *Salmonella* spp. and STEC. This indicates severe or potentially life-threatening disease.

Parasitic risks

Many parasites have been identified in samples of raw meat diets. These include protozoa such as *Neospora caninum*, *Sarcocystis* spp., *Toxoplasma gondii*, *Cryptosporidium parvum* and *Giardia* spp., and helminths including *Trichinella* spp., *Taenia* spp., and *Echinococcus* spp., including *E. granulosus*²⁷. Additionally, there has been a report of tongueworm (*Linguatula serrata*) infection in an untraveled dog in the UK, where this parasite is not endemic, attributed to provision of a raw diet²⁸. For many parasites, the risk of infection from raw meat diets may be low as the freeze-thaw process is likely effective to kill them. However, raw-fed cats have been demonstrated to shed increased seroprevalence of *T. gondii* and oocyst shedding²⁷.

Emerging risks

As well as the established concerns surrounding foodborne bacterial infections and raw meat diets, there are also some emerging concerns which may become of increased risk in future for both human and animal

health. Recently in the USA, there have been reports of cats contracting and dying as a result of highly pathogenic avian influenza H5N1 following consumption of contamination raw meat diets containing poultry²⁹. Additionally, there are emerging bacterial concerns, in particular, antimicrobial resistance. Raw meat diets have been demonstrated to be contaminated with antimicrobial-resistant *E. coli*^{14,30}, and provision of a raw meat diet has been identified as a risk factor shedding of antimicrobial-resistant *E. coli* by healthy dogs³¹.

Finally, there are emerging bacterial species of concern in companion animals, such as the so-called 'ESKAPE' organisms (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Enterobacter* spp). These bacteria are of serious concern in human medicine, particular in hospital-acquired infections, due their highly antimicrobial resistant nature. However, they are of emerging concern in companion animal medicine too- a recent study from the UK identified Gram-negative ESKAPE organisms as the most prevalent antimicrobial-resistant bacteria isolated from small animal and equine hospitals³², and they have been implicated in infections in dogs and cats. Recent research from the UK has isolated these bacteria from samples of raw meat diets for dogs³³.

ARE THERE ANY BENEFITS?

Although there are many health benefits reported by advocates of raw feeding, currently the scientific evidence for them is limited. Greater palatability, and the pet's enjoyment of their food, is a reason sometimes given for choosing a raw diet. Dogs fed a raw meat diet tend to ingest more protein and fat, and less fibre, than dogs fed conventional cooked kibble. A high fat content, as often found in raw meat diets, is highly palatable. Gut health is another reported benefit; raw meat diets have been demonstrated to have good digestibility, and dogs fed them may have a lower faecal output than those fed a non-raw diet³⁴. Dogs fed a raw meat diet have differences in their gut microbiomes compared to dogs fed a cooked diet, however, more research is required to understand this further^{35,36}. One study identified that feeding a raw diet may have a beneficial effect on gut inflammatory markers locally, however, no difference in systemic inflammatory markers was found in dogs fed raw or cooked diets³⁶. Further reported benefits are improved skin and dental health. A large survey-based study of raw-feeding dog owners suggested that provision of a raw diet to puppies may protect against development of atopy in later life³⁷. Whilst one small study indicated that chewing raw bones may be beneficial for reducing dental calculus in dogs³⁸, there remains a shortage of evidence surrounding the effects of raw feeding on dog and cat dental health. Therefore, while there may be some beneficial effects of feeding a raw diet to pet health, there are many gaps in the literature, and further research is required.

CONCLUSIONS

The decision of what to feed a pet is very important to pet owners, is often multifactorial, and can evoke strong emotions. As veterinary professionals, we must remember that whatever type of food is chosen, the owner has usually picked this as they think it is genuinely the right thing to do for their pet.

Raw feeding continues to be popular. However, there are now well-documented public and animal health risks associated with this diet choice. Further research is required into the transmission and risks of bacterial disease to humans and animals from raw diets. Nevertheless, there is likely an increased risk from these diets to the most vulnerable in society, such as the elderly, very young and immunocompromised.

There is a continued need for conversation and engagement between veterinary professionals, medics, pet food companies, policy makers and pet owners to try to mitigate these risks, as well as continued efforts to improve education and awareness.

Word Count: 2033

REFERENCES

1. PDSA. *PDSA Animal Wellbeing PAW Report 2022: The Essential Insight into the Wellbeing of UK Pets.*; 2022. <https://www.pdsa.org.uk/media/4371/paw-2018-full-web-ready.pdf>
2. Defra/APHA. Using animal by-products to make pet food. Published 2019. <https://www.gov.uk/guidance/using-animal-by-products-to-make-pet-food>.
3. Bulochova V, Evans EW. Raw Meat-Based Pet Feeding and Food Safety: Netnography Study of Pet Owner Comments and Review of Manufacturers' Information Provision. *J Food Prot.*

- 2021;84(12):2099-2108. doi:10.4315/jfp-21-158
4. Morgan G, Williams N, Schmidt V, Cookson D, Symington C, Pinchbeck G. A Dog's Dinner: Factors affecting food choice and feeding practices for UK dog owners feeding raw meat- based or conventional cooked diets. *Prev Vet Med*. Published online August 9, 2022:105741. doi:10.1016/J.PREVETMED.2022.105741
5. Morelli G, Bastianello S, Catellani P, Ricci R. Raw meat-based diets for dogs: Survey of owners' motivations, attitudes and practices. *BMC Vet Res*. 2019;15(1):1-10. doi:10.1186/s12917-019-1824-x
6. Díaz-Regañón D, Llorca C, Sainz Á, et al. Exploring the popularity of raw meat-based diets for dogs and cats: A cross-sectional opinion survey in Spain. *Vet Rec*. 2025;(November 2024):1-10. doi:10.1002/vetr.5013
7. Empert-Gallegos A, Hill S, Yam PS. Insights into dog owner perspectives on risks, benefits, and nutritional value of raw diets compared to commercial cooked diets. *PeerJ*. 2020;8. doi:10.7717/peerj.10383
8. Morgan SK, Willis S, Shepherd ML. Survey of owner motivations and veterinary input of owners feeding diets containing raw animal products. *PeerJ*. 2017;2017(3):1-16. doi:10.7717/peerj.3031
9. Bulochova V, Evans EW. Exploring food safety perceptions and self-reported practices of pet owners providing raw meat-based diets to pets. *J Food Prot*. 2021;84(5):912-919. doi:10.4315/JFP-20-338
10. Lenox C, Becvarova I, Archipow W. Metabolic bone disease and central retinal degeneration in a kitten due to nutritional inadequacy of an all-meat raw diet. *J Feline Med Surg Open Reports*. 2015;1(1). doi:10.1177/2055116915579682
11. Hall G, Breheny C, Khan Z, Schwarz T, Mellanby RJ. Severe nutritional deficiencies and osteopenia in a dog fed a homemade raw diet. *Vet Rec Case Reports*. 2020;8(1). doi:10.1136/vetreccr-2019-001038
12. Nemser SM, Doran T, Grabenstein M, et al. Investigation of listeria, salmonella, and toxigenic escherichia coli in various pet foods. *Foodborne Pathog Dis*. 2014;11(9):706-709. doi:10.1089/fpd.2014.1748
13. Morelli G, Catellani P, Miotti Scapin R, et al. Evaluation of microbial contamination and effects of storage in raw meat-based dog foods purchased online. *J Anim Physiol Anim Nutr (Berl)*. 2020;104(2):690-697. doi:10.1111/jpn.13263
14. Morgan G, Pinchbeck G, Taymaz E, Chattaway MA, Schmidt V, Williams N. An investigation of the presence and antimicrobial susceptibility of Enterobacteriaceae in raw and cooked kibble diets for dogs in the United Kingdom. *Front Microbiol*. 2024;14. doi:10.3389/fmicb.2023.1301841
15. Treier A, Stephan R, Stevens MJA, Cernela N, Nüesch-inderbinen M. High occurrence of shiga toxin-producing escherichia coli in raw meat-based diets for companion animals—a public health issue. *Microorganisms*. 2021;9(8). doi:10.3390/microorganisms9081556
16. Hellgren J, Hästö LS, Wikström C, Fernström LL, Hansson I. Occurrence of Salmonella, Campylobacter, Clostridium and Enterobacteriaceae in raw meat-based diets for dogs. *Vet Rec*. 2019;184(14). doi:10.1136/vr.105199
17. Bojanić K, Midwinter AC, Marshall JC, Rogers LE, Biggs PJ, Acke E. Isolation of Campylobacter spp. from Client-Owned Dogs and Cats, and Retail Raw Meat Pet Food in the Manawatu, New Zealand. *Zoonoses Public Health*. 2017;64(6):438-449. doi:10.1111/zph.12323
18. Candellone A, Badino P, Girolami F, et al. Concomitant Campylobacteriosis in a Puppy and in Its Caregiver : A One Health Perspective Paradigm in Human-Pet Relationship. *Vet Sci*. 2023;10(4):1-12.
19. Kaindama L, Jenkins C, Aird H, Jorgensen F, Stoker K, Byrne L. A cluster of Shiga Toxin producing Escherichia coli O157:H7 highlights raw pet food as an emerging potential source of infection in humans. *Epidemiol Infect*. Published online 2020. doi:10.1017/S0950268821001072
20. Bernaquer I, Dumaresq J, Picard I, et al. Dogs fed raw meat-based diets are vectors of drug-resistant Salmonella infection in humans. *Commun Med*. 2025;5(1):11-13. doi:10.1038/s43856-025-00919-2
21. Anturaniemi J, Barrouin-Melo SM, Zaldivar-López S, Sinkko H, Hielm-Björkman A. Owners' perception of acquiring infections through raw pet food: A comprehensive internet-based survey. *Vet Rec*. 2019;185(21):658. doi:10.1136/vr.105122
22. Giacometti F, Magarotto J, Serraino A, Piva S. Highly suspected cases of salmonellosis in two cats fed with a commercial raw meat-based diet: Health risks to animals and zoonotic implications. *BMC*

- Vet Res.* 2017;13(1):1-6. doi:10.1186/s12917-017-1143-z
23. Stiver SL, Frazier KS, Mauel MJ, Styer EL. Septicemic salmonellosis in two cats fed a raw-meat diet. *J Am Anim Hosp Assoc.* 2003;39(6):538-542. doi:10.5326/0390538
24. O'Halloran C, Ioannidi O, Reed N, et al. Tuberculosis due to *Mycobacterium bovis* in pet cats associated with feeding a commercial raw food diet. *J Feline Med Surg.* 2019;21(8):667-681. doi:10.1177/1098612X19848455
25. Martinez-Anton L, Marenda M, Firestone SM, et al. Investigation of the Role of *Campylobacter* Infection in Suspected Acute Polyradiculoneuritis in Dogs. *J Vet Intern Med.* 2018;32(1):352-360. doi:10.1111/jvim.15030
26. Pegg AE, Jackson J, Evans C, Cohen V. An assessment of the risk of companion animals acquiring *Salmonella*, *Escherichia coli* spp., *Campylobacter* spp. and MRSA from contaminated raw pet food, and associated risks to pet owners from the use of these product in the home. *Food Stand Agency.* Published online 2024. doi:https://doi.org/10.46756/sci.fsa.nss574
27. Davies RH, Lawes JR, Wales AD. Raw diets for dogs and cats: a review, with particular reference to microbiological hazards. *J Small Anim Pract.* 2019;60(6):329-339. doi:10.1111/jsap.13000
28. Macrelli M, Mackintosh A. Tongue worm (*Linguatula serrata*) infection in a dog imported into the United Kingdom from Romania. *Vet Rec Case Reports.* 2022;10(2). doi:10.1002/vrc2.281
29. AVMA. Cat deaths linked to bird flu-contaminated raw pet food, sparking voluntary recall. AVMA News. Published 2025. <https://www.avma.org/news/cat-deaths-linked-bird-flu-contaminated-raw-pet-food-sparking-voluntary-recall>
30. Nüesch-Inderbinen M, Treier A, Zurfluh K, Stephan R. Raw meat-based diets for companion animals: A potential source of transmission of pathogenic and antimicrobial-resistant Enterobacteriaceae. *R Soc Open Sci.* 2019;6(10). doi:10.1098/rsos.191170
31. Morgan G, Williams N, Schmidt V, Pinchbeck G. Raw meat diets are a major risk factor for carriage of third-generation cephalosporin-resistant and multidrug-resistant *E. coli* by dogs in the UK. *Front Microbiol.* 2024;(September):1-15. doi:https://doi.org/10.3389/fmicb.2024.1460143
32. Zendri F, Isgren CM, Devaney J, Schmidt V, Rankin R, Timofte D. Resistome-based surveillance identifies ESKAPE pathogens as the predominant gram-negative organisms circulating in veterinary hospitals. *Front Microbiol.* 2023;14. doi:10.3389/fmicb.2023.1252216
33. Morgan G, Pinchbeck G, Timofte D, Williams N. Presence of Gram negative ESKAPE pathogens in commercially available raw meat diets for dogs in the UK (Abstract 964). *8th World One Heal Congr Abstr Book, 20-23 Sept 2024.* 2024;(September):247.
34. Geary EL, Oba PM, Templeman JR, Swanson KS. Apparent total tract nutrient digestibility of frozen raw, freeze-dried raw, fresh, and extruded dog foods and their effects on serum metabolites and fecal characteristics, metabolites, and microbiota of healthy adult dogs. *Transl Anim Sci.* 2024;8(November):1-19. doi:10.1093/tas/txae163
35. Sandri M, Dal Monego S, Conte G, Sgorlon S, Stefanon B. Raw meat based diet influences faecal microbiome and end products of fermentation in healthy dogs. *BMC Vet Res.* 2017;13(1):1-12. doi:10.1186/s12917-017-0981-z
36. Hiney K, Sypniewski L, DeSilva U, et al. Fecal microbiota composition, serum metabolomics, and markers of inflammation in dogs fed a raw meat-based diet compared to those on a kibble diet. *Front Vet Sci.* 2024;11(April):1-17. doi:10.3389/fvets.2024.1328513
37. Hemida MBM, Salin S, Vuori KA, et al. Puppyhood diet as a factor in the development of owner-reported allergy/atopy skin signs in adult dogs in Finland. *J Vet Intern Med.* 2021;35(5):2374-2383. doi:10.1111/jvim.16211
38. Marx FR, Machado GS, Pezzali JG, et al. Raw beef bones as chewing items to reduce dental calculus in Beagle dogs. *Aust Vet J.* 2016;94(1-2):18-23. doi:10.1111/avj.12394