

# Salmonella and the Raw Diet

By Lesley New

BSc Nutrition and Food Sciences

Critical look at the literature:

The biggest barrier encountered when proposing feeding a raw diet are those concerning microbial risks. Individuals opposed to this feeding method state that there is evidence lacking to prove that dogs can deal with the resultant risk of the bacteria that may be associated with eating raw meat. A critical look at the literature is therefore necessary to evaluate if this concern is valid.

One popular study that most recently tackled this issue is a paper by Joffe assessing the risk of *salmonella* infection in dogs fed a BARF (Bones And Raw Food) diet (10). He proposes that dogs fed a raw meat diet are a “public health concern”. Looking objectively at his methods and results fail to prove this to be the case. His study used 10 client owned raw fed dogs and 10 client owned dogs fed a dry food diet as controls. One meal-sized food sample and one stool sample were collected from each dog and tested for *salmonella*. The owners were responsible for the collection of the samples and as is stated in the paper “were aware of the purpose of the study prior to collection” (10). This alone is questionable and can create bias. Controlled scientific studies should be set up so that they are blind to the participants in order to prevent their influence on the results. Nowhere in the paper does it mention control measures surrounding feeding (including, but not specific to sanitation), storage of food, collection procedures or sample handling (temperature regulation, time between collection and testing). There is also no information given with regards to the subjects (age, breed, and/or clinical history). Were any of these dogs previously treated for gastroenteritis? Are they predisposed to developing such conditions? Were the dogs tested for the presence of *salmonella* in their stool prior to the onset of the study? Were any other environmental exposures considered as the source of the *salmonella* (especially in the cultures that did not directly reflect the bacteria seen in the food)?

The results themselves seem suspect and conclusions that are drawn from them do not necessarily fit with the break down of the facts. In fact Joffe helps to prove that dogs can deal with *salmonella* in their system. He states that 80% of the raw food samples tested positive for *salmonella* (10). Of those eight dogs two of them showed *salmonella* in their stool, only one of which showed the same serovar that was present in the food (10). How can he then dismiss the suggestion that dogs fed infected food do not necessarily shed *salmonella* in their stool? Interestingly none of the dogs were reported to show clinical symptoms of Salmonellosis even though they were fed food that contained the bacterium. This is further supported by Ettinger and Feldman who state that “isolation from gastrointestinal tract or its secretions does not indicate that the organisms are causing clinical disease” (7).

Curiously none of the stool samples of the dog’s fed a dry diet showed positive results for *salmonella*. Given that 36% of healthy dogs carry *salmonella* in their digestive tract and may shed the bacterium (7, 9, 18) it seems suspect that the results fail to show even a small percentage of shedding in these dogs. Joffe also states that a dog’s mouth must be considered a source of infection. Curious, we had oral and anal swab tests conducted by an independent lab on some of our dogs that are fed exclusively raw diets. These dogs were purposely fed meat that had been left out at room temperature for several days before feeding. Results were negative for *salmonella* in all of the dogs, contraindicating his concern. Interestingly enough Joffe states that although his results, as produced, are “suggestive, they are not statistically significant owing to the small number of dogs studied” (10). This remark clearly opens the door to further study and warrants caution to those taking his conclusions as the final word.

Another important paper to consider in this argument is that by Day, James and Heather (6). Their purpose was to look at the response of dogs to *salmonella* presented in

their food, either existing naturally or added at predetermined dosages. All other aspects were controlled for to limit the possibility of outside sources of contamination, including disinfecting the cages and all food and water bowls daily. The first series of experiments involved feeding dry dog food that was determined to be naturally contaminated for a duration of 16 days and then again with another set of dogs for 50 days. Anal swabs were collected daily and examined for enteric bacteria. Of the dogs fed for 16 days no positive samples for *salmonella* were produced. With the longer feeding duration, however, a shedder state was produced but no evidence of clinical symptoms was reported (6). These results show that although contaminated food may produce a shedder state in some dogs, no signs of infection were actualized. In the second series the dogs were fed, along with their food, a large single dose of *salmonella*. The strain used was isolated from human patients showing clinical signs of Salmonellosis. Again none of these dogs developed clinical signs of infection and the shedding of the pathogen was very sporadic (6). It is important to note that the dogs involved in the testing were 3 months of age. This is significant because younger dogs appear to be more susceptible to infection than do mature dogs (15, 16), due in part to their developing immune systems. The results from this data show that dogs openly fed *salmonella* did not develop any clinical signs of infection, suggesting that their systems can handle continual exposure to the bacterium without displaying symptoms of illness.

A look at earlier studies done in the area may also help to give credence to the argument that a dogs system can handle exposure to enteric bacteria. The results in Kintner's study lean towards this hypothesis. Early work done at the Ohio State University with 71 dogs showed that 18% of the dogs tested for *salmonella* were positive (12). Further studies were conducted in an attempt to infect several of the dogs with *Salmonella typhimurium* and *Salmonella enteritidis*. The dogs were dosed with *Salmonella* either through their food or via a stomach tube and monitored for signs of infection. In all of the dogs organisms were recovered in their feces but were negative three to eight days later. None of the animals showed a clinical state of infection or any evidence of ill effect (12). Two of the dogs were then given *S. typhimurium* intravenously and subsequently developed Salmonellosis, however both recovered without treatment in 4-5 days (12). These findings are important because although Salmonellosis was evident in these two dogs it was only after the dose was given directly into the bloodstream. In order for *salmonella* to cause a systemic infection fed via the oral route the bacterium must adapt to the acidic environment it encounters in the stomach and then resist being killed by the white blood cells of the immune system (18). In this study the only findings of infection occurred after administering a dose through a route which has limited significance once taken out of the laboratory.

#### Incidence and Prevalence:

Many critics believe that dogs fed a raw diet are a reservoir for transmitting *salmonella* to humans. For this reason it is important to consider the prevalence in dogs and how this relates to humans. Information from the BC Center for Disease Control for 2001 shows that 80% of the positive results for *salmonella* were from humans sources (3). The remaining 20% were isolated from non-human sources, which could include many potential origins (contaminated food, environment, reptiles, dogs and/or cats). This limits the significance of cases that were of the direct result of contact with dogs alone. Statistics from the CDC show that in 2001 the total number of isolations of *salmonella* from domestic animals and environmental sources (both clinical and non-clinical presentations) was approximately 7.9% (5). It is important to note that this also included environmental sources of *salmonella* as well as other domestic animals such as cats. Therefore the percentage of isolations from dogs alone would be a fraction of this percentage, leaving a marginal window of cases where infections could be passed to humans.

After examining canine zoonoses and their risk to man Baxter and Leck state that direct canine-human transmission has occurred in relatively few cases (2). They further

state that in reports from the UK dogs account for only about 1% of animal isolations of *salmonella* and speculate that they may be involved in a similar number of human cases (2), although no definitive data to theorize such conclusions is given. Pelzer states that although *salmonella* has been isolated from dogs, it is difficult to assess the risk of humans acquiring infection because the infective dose is difficult to define, and in most cases the number of organisms isolated from the animals is not given (17). In cases where the same serotype is isolated from both humans and animals in the home the “question arises as to whether one or the other was the culprit or whether both were victims of a common source” (11). A study by Galton et al did not find significant evidence to conclude that *salmonella* infections in dogs were a source of infection in man (8). The paper further states that infections from their study were in part “either derived from common sources, spread from animal to man or possibly the reverse” (8). Mackel et al suggested that instances of infection also relate to the numerous reservoirs of *Salmonella* in both human and animal environments (14). While dogs could be considered a potential source of infection (1, 16) evidence has yet to prove that they are a definitive source of infection or a “public health concern” (10). To further elicit this point a look at a study conducted by Caraway et al is warranted (4). The study involved sentry dogs that were shedding *salmonella* in their stool with unknown origin for the point of infection. While the source of the infection was not isolated the paper did show, after testing the handlers, that even though *salmonella* was found to be carried by over 78% of the dogs the bacterium had not been passed to any of the handlers (4). As stated by Ettinger and Feldman “most cases of human enteric disease caused by these bacteria are not associated with pet exposure” (7).

#### Relationship to raw feeding:

As can be seen in the studies examined dogs exposed to *salmonella* in their food did not develop clinical Salmonellosis. According to Pelzer CDC reports in the UK from 1973-1984 state that the number of organisms in contaminated meat is low (1/100g), a rate of contamination that, for most people, is below the infective dose (17). Considering that dogs are more resistant to infection than humans, proper handling and storage of raw meat products should minimize the risk. In some of the studies the bacteria could be found in the stool of some dogs after exposure, however since 36% of healthy dogs carry *salmonella* in their digestive tracts (7, 9, 18) these findings were not surprising. Due to this fact an important issue that must be remembered when discussing *salmonella* risk in dogs, regardless of diet, is hygiene (7,13). The source of the pathogen is generally proved to be feces (15, 17, 18), therefore the risk of transmission can be minimized or eliminated by maintaining certain levels of sanitation and hygiene. Additional measures should be taken in dogs fed a raw diet to ensure sufficient levels of safety. This includes properly cleaning all feeding bowls, contact surfaces and utensils using hot soapy water and limiting the time spent above refrigeration temperature (5°C) during storage and feeding.

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