

Presence of *Salmonella* sp. in dog feces in the municipality of Lacerdópolis – Santa Catarina - Brazil

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Abstract

Salmonella spp. are Gram-negative bacilli from the family Enterobacteriaceae, they are widely distributed in nature and survive in the intestinal tract of birds, reptiles and mammals, as well as in humans. They are recognized as important zoonotic agents and for causing food borne illnesses around the world. The main infection route is fecal-oral and contaminated food and water are considered the main agents that bear this microorganism; however, contamination from contact with contaminated animals is also considerable. The present study had the objective of evaluating the presence of *Salmonella* sp. in feces of asymptomatic dogs in the Municipality of Lacerdópolis - Santa Catarina. Swabs were used to collect 40 feces samples. The protocol used for the analysis was based on the International Standard Organization ISO 6579:2002 and ISO 6579:2007 norms for the research of *Salmonella*, for which the methodology was adapted for fecal swab analysis. From the sample total, 15%, in other words, six animals were *Salmonella* sp. carriers, all male dogs of mixed breed that presented in relation to health care and wellness. Regarding these results, it is important to study these bacteria in pets and gain knowledge on its pathogenicity and on human contamination through contact with sick animals or asymptomatic carriers.

Keywords: Enterobacteriaceae. Zoonotic Agents. Asymptomatic Carriers.

Presença de Salmonella sp em fezes de cães no município De Lacerdópolis, Santa Catarina – Brasil

Resumo

Salmonella spp são bacilos Gram-negativos da família Enterobacteriaceae. Encontram-se amplamente distribuídos pela natureza, sobrevivendo no trato intestinal de diversos animais, incluindo o homem. São importantes agentes zoonóticos e causadores de doenças de origem alimentar. A principal rota de infecção é a fecal-oral, os alimentos e água contaminados são os principais agentes de veiculação do microrganismo, entretanto a contaminação através do contato com animais contaminados também é considerável. O presente estudo objetivou avaliar a presença de Salmonella sp em amostras de fezes de cães assintomáticos do município de

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Lacerdópolis, SC. Foram coletadas 40 amostras de fezes, utilizando-se de swabs. Protocolo utilizado para a análise foi baseado nas normas ISO 6579:2002 e ISO 6579:2007 para a pesquisa de *Salmonella*, sendo a metodologia adaptada para a análise de swab fecal. O pré-enriquecimento das amostras foi realizado em alíquotas de 10 mL do caldo de pré-enriquecimento. Do total de amostras, 15% (N=6), mostraram-se portadores de *Salmonella* sp, todos machos e de raça definida que apresentavam cuidados em relação à saúde e bem-estar. Assim, mostra-se a importância do estudo desta bactéria em animais de estimação, conhecendo-se a patogenicidade da mesma, e da contaminação do homem através do contato com animais doentes, ou portadores assintomáticos.

Palavras chave: Enterobacteriaceae, agentes zoonóticos, portadores assintomáticos.

1 INTRODUCTION

Salmonella is a microorganism that stands out as one of the main agents responsible for infectious disease, especially in the intestinal tract, causing a high rate of morbidity worldwide. The clinical manifestations are varied, such as nausea, abdominal pain, vomit and fever. The disease is commonly related to the ingestion of contaminated food or water (ABDELWAHEB, *et al.* 2008; PUI, *et al.*, 2011).

The diseases caused by *Salmonella* spp. can be divided into three groups: typhoid fever, caused by *Salmonella* Typhi; enteric fevers, caused by *Salmonella* Paratyphi (A, B and C); and enterocolitis, caused by the remaining *Salmonella* (JAY, 2005). In Brazil, salmoneloses stand out among the main food borne illnesses (AMSON, *et al.*, 2006; WELKER *et al.*, 2010).

The primary habitat of this microorganism is the intestinal tract; however, it may also be found in other organs. When present in the intestinal tract, it is excreted through the feces and can be transmitted to other locations by insects and other organisms. Thus, it is also found in water, especially polluted water. When people and other animals consume contaminated water or food, the microorganisms colonize the intestine and are again excreted through the feces, in a continuous cycle (JAY, 2005).

The main route of contamination by salmonellae is oral-fecal, from the ingestion of undercooked animal products or water contaminated by feces of infected animals, although it may also occur due to bad hygiene conditions and direct contact with sick or asymptomatic animals, mainly reptiles and pets (MEGID *et al.* 2001; DOUGHARI; OKAFOR, 2008).

Lately, an increase in the frequency of infections by *Salmonella* spp. in humans and other animals has been observed (DARGATZ *et al.*, 1998). Domestic animals, especially dogs, may represent important salmonela reservoirs, especially when they are asymptomatic. Salmonellosis in dogs is not very common, but may be aggressive depending on the number of infectious microorganisms and the immunological state of the animal, as well as other factors such as possible illnesses, in which case special attention is needed regarding zoonotic transmission through dogs. However, few studies are being conducted with this goal (MACIEL *et al.* 2004).

Therefore, regarding the risks that these important pathogens represent in people's health, research on asymptomatic incidence in pets, such as dogs, is extremely important for the creation of preventive measures to avoid contaminating the environment and, consequently, people who are in contact with these animals. The objective of this study was to determine the incidence of *Salmonella* in pet dogs in the municipality of Lacerdópolis, Santa Catarina, in Brazil.

2 MATERIALS AND METHODS

Fecal swab samples from 40 healthy domestic dogs (19 males and 21 females) were analyzed. The samples were collected randomly at the same time as the animal's data, such as sex, feeding habits, breed and place where it is mostly kept.

Swabs were used for sampling, which, after being dipped in the superior portion of the feces – that had no contact with the ground –, were placed in tubes containing the Cary Blair means of transportation. The sampling procedure followed the recommendations of the Central Laboratory of Public Health of Santa Catarina (LACEN, 2006) for the collection of fecal swabs in humans. The samples were identified only by the animals' identification number and taken to the laboratory for analysis.

We used analysis protocols described in ISO 6579:2002 and ISO 6579:2007 for the detection of *Salmonella*. The methodology was adapted for the analysis of fecal swabs. The swabs were dipped in 10 mL of pre-enrichment broth Buffered Peptone Water (OXOID, CM 509) and the samples were released to the broth by rotation movements. The remaining analyses followed the protocols described in the norms mentioned above.

3 RESULTS

When fecal samples from the 40 dogs were analyzed, the presence of *Salmonella* spp. was observed in six individuals, corresponding to of 15% of the studied population. Among the evaluated animals, 100% did not present any symptoms, making this data worrying, since, according to Maciel et al.(2004), dogs may represent important reservoirs for *Salmonella* spp., especially when asymptomatic (Table 1).

Among the 40 dogs, four belonged to the breeds Chow Chow, Rottweiler, Golden Retriever and Beagle, with one individual per breed. The breeds Yorkshire, Pinscher and German Shepherd were a total of 15% of the samples, with two individuals per breed. Poodles represented 7.5% of the dogs evaluated, in a total of three samples. Dogs with undefined breeds represented the majority of the sample, 67.5% of the total (Table 1).

Of the total of positive samples for *Salmonella*, about 83.3% belonged to dogs of a defined breed, one Beagle, one Poodle, one Pinscher, one Golden Retriever and one German Shepherd. Only one dog did not have a defined breed. Among them, 16.6% were fed exclusively with dog food, the rest were fed dog food and human food.

Among the positive samples for *Salmonella* spp. 100% were from males; however, we did not find studies in the literature that explained this. Only one sample came from a vermifuged dog.

Table 1 - Results of the research analysis of *Salmonella* in dogs from the municipality of Lacerdópolis, SC – Brazil – Physical Characteristics. (continua)

Dog	Sex	Breed	Size	Vermifuged	Symptomatic	Presence of <i>Salmonella</i>
1	Male	Poodle	Small	Yes	No	Yes
2	Female	IB	Small	No	No	No
3	Female	IB	Small	Yes	No	No
4	Female	Chow Chow	Medium	Yes	No	No
5	Female	German Shepherd	Medium	Yes	No	No
6	Male	IB	Medium	Yes	No	Yes
7	Female	IB	Small	Yes	No	No
8	Female	IB	Medium	Yes	No	No

(conclusão)

Dog	Sex	Breed	Size	Vermifuged	Symptomatic	Presence of <i>Salmonella</i>
9	Female	IB	Small	Yes	No	No
10	Female	Pinscher	Small	Yes	Yes	No
11	Male	IB	Medium	Yes	Yes	No
12	Male	IB	Medium	Yes	No	No
13	Male	IB	Medium	Yes	No	No
14	Female	IB	Medium	Yes	No	No
15	Female	IB	Small	Yes	No	No
16	Macho	Yorkshire	Small	Yes	Yes	No
17	Female	Poodle	Small	Yes	No	No
18	Male	IB	Small	Yes	No	No
19	Female	IB	Medium	Yes	No	No
20	Female	IB	Medium	Yes	No	No
21	Male	Poodle	Small	Yes	No	No
22	Male	Yorkshire	Small	Yes	No	No
23	Male	IB	Medium	Yes	Yes	No
24	Male	IB	Large	Yes	No	No
25	Female	IB	Medium	Yes	No	No
26	Male	German Shepherd	Large	Yes	No	Yes
27	Female	IB	Medium	Yes	No	No
28	Female	IB	Medium	Yes	No	No
29	Male	Pinscher	Small	Yes	No	Yes
30	Male	IB	Medium	Yes	Yes	No
31	Male	Beagle	Medium	Yes	No	Yes
32	Male	Golden Retriever	Medium	No	No	Yes
33	Male	IB	Large	No	No	No
34	Female	IB	Small	No	No	No
35	Female	Rottweiler	Large	No	Yes	No
36	Female	IB	Small	Yes	No	No
37	Female	IB	Medium	No	No	No
38	Male	IB	Medium	No	No	No
39	Male	IB	Medium	No	No	No
30	Female	IB	Small	No	No	No

Four animals, i.e. 66.6% of the carriers of the disease, had domicile behavior (Table 2), they were confined to yards and came in contact with few people. Only one animal had access to the interior of the residence and had contact with a higher number of people. Another animal, as well as the domicile behavior, had peridomestic behavior and therefore came in contact with other animals. However, all samples came from asymptomatic dogs.

Table 2 - Results of the research analysis of *Salmonella* in dogs from the municipality of Lacerdópolis, SC – Brazil – Ethological Characteristics. (continua)

Dog	Food	Human Contact	Place where animals were kept	Presence of <i>Salmonella</i>
1	Dog Food	Yes	House/Yard	Yes
2	Dog /Human Food	No	Confined/Yard	No
3	Dog /Human Food	No	Confined/Yard	No
4	Dog Food	Little	Confined/Yard	No
5	Dog /Human Food	No	Confined/Yard	No
6	Dog /Human Food	No	Confined/Yard	Yes

Dog	Food	Human Contact	Place where animals were kept	Presence of <i>Salmonella</i>
7	Dog Food	Little	Confined/Yard	No
8	Dog /Human Food	Little	Confined/Yard	No
9	Dog /Human Food	Yes	Confined/House	No
10	Dog /Human Food	Yes	Confined/Apartment	No
11	Dog /Human Food	Little	House/Yard	No
12	Dog /Human Food	Yes	House/Yard	No
13	Dog /Human Food	Yes	Confined/Apartment	No
14	Dog /Human Food	Yes	Confined/Yard	No
15	Dog /Human Food	Yes	House/Yard	No
16	Dog Food	Yes	Confined/House	No
17	Dog Food	Yes	House/Yard	No
18	Dog Food	Yes	House/Yard	No
19	Dog /Human Food	Little	Confined/Yard	No
20	Dog /Human Food	Little	Confined/Yard	No
21	Dog Food	Yes	Confined/Apartment	No
22	Dog Food	Yes	Confined/House	No
23	Dog /Human Food	Yes	Confined/House	No
24	Dog /Human Food	No	House/Yard	No
25	Dog /Human Food	No	Yard/Street	No
26	Dog Food	Little	Confined/Yard	Yes
27	Dog /Human Food	Little	Confined/Yard	No
28	Dog /Human Food	No	Confined/Yard	No
29	Dog /Human Food	No	Confined/Yard	Yes
30	Dog /Human Food	Little	Confined/Yard	No
31	Dog /Human Food	No	Yard/Street	Yes
32	Dog /Human Food	No	Confined/Yard	Yes
33	Dog /Human Food	No	Confined/Yard	No
34	Dog /Human Food	Little	Confined/Yard	No
35	Dog /Human Food	Little	Confined/Yard	No
36	Dog /Human Food	Yes	House/Yard	No
37	Dog /Human Food	No	Confined/Yard	No
38	Dog /Human Food	No	Confined/Yard	No
39	Dog /Human Food	No	Confined/Yard	No
40	Dog /Human Food	No	Confined/Yard	No

4 DISCUSSION

Salmonella is an enterobacterium that is typical in warm-blooded animals. Infections caused by these bacteria can be identified in fecal microbiota in pets with enteric and extra-enteric clinical manifestation as well as in asymptomatic animals (RIBEIRO et al, 2010).

According to a study conducted in the city of Salvador (Bahia, Brazil), 39.65% of evaluated dogs were asymptomatic carriers of *Salmonella*, which constitutes a serious public health issue (CALDAS, 1979). Maciel et al. (2004) recorded the occurrence of 9.47% of positive cases of *Salmonella* spp. from a total of 190 samples from dogs in the city of Ilhéus (Bahia, Brazil).

According to Megid *et al.* (2001), the most common transmission method of *Salmonella* is through contaminated food and water. Two animals were only fed dog food, which is curious data, since dog food contains protein of animal origin in its formula (viscera powder). Costa (2008) states in his study that the meat powder, used in food for domestic animals, is a result of processing residues that are not used for consumption (such as remains of meat, entrails, organs, bones, etc.).

Megid *et al.* (2001) report in their study that the animals confined in kennels presented a higher risk of infection and that infected dogs are more prone to develop the disease, especially when they are debilitated.

Thus, it is important to emphasize the caution necessary to manipulate the animals' feces and to disinfect where they defecate. According to Greene (2006), one of the factors that contribute to the occurrence of *Salmonella* is associated to the accumulation of waste and poor hygiene of the environment where the dogs live. Also, special attention must be paid to the contact that children have with animals, especially since they have little notion of hygiene.

5 CONCLUSION

According to the results obtained, this study demonstrated the importance of domestic animals (dogs) as eventual carriers of *Salmonella*, especially when they do not present symptoms.

From a total of 40 feces sampled from healthy animals, six positive samples for *Salmonella* were identified, 15% of the studied population, which reveals a worrisome fact in view of the pathogenicity of the bacteria and the contamination of humans through contact with these animals.

Another point of interest is the fact that most asymptomatic dogs are of a defined breed, which suggests more care is given to these animals, and the fact that all of them were fed with industrialized dog food, which should theoretically decrease the chances of contamination, deserves further studies.

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