THE ZOONOTIC RISKS OF SLEEPING WITH PETS

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Abstract

Background: Pets are more and more becoming a part of the family and the interactions between pets and their owners are changing. This results in extended and more intimate contact of owners with pets, which could lead to higher zoonotic risks. This study investigated these risks and their prevalences.

Methods: A group of 28 healthy dogs and 22 healthy cats were monitored for the presence of the parasites *Cheyletiella*, *Ctenocephalides* spp., and *Toxocara* spp., the dermatophyte *Microsporum canis*, and the bacteria *Clostridium difficile, Salmonella* spp., *Campylobacter jejuni* and Enterobacteriaceae. The presence of these pathogens was investigated using samples from the fur, footpads and the animal bed. The Aerobic Colony Count of the fur was also determined. The owners filled in a questionnaire with questions regarding their own health, the health of their pets, the location were the pet was allowed to sleep, the diet and parasite control.

Results: In total 29 pets (58%) were sleeping on the bed and 15 pets (30%) in the bed (under the blankets). A total of 19 dogs (68%) and 7 cats (32%) were tested positive for Enterobacteriaceae on the fur or footpads. Fleas were found on 7 pets (14%). High levels of aerobic colonies were found, up to 216 colony forming units/cm^2. Other pathogens were not found in this study.

Conclusions: This study, as well as the literature on this subject, indicates that pets play an important risk in the transmission of different pathogens to the owner. Therefore, owners should be informed about these risks to interact with their pets in a more responsible way.

***Keywords*:** Zoonoses, bedroom, dog, cat, pets, fleas, Enterobacteriaceae

1. Introduction

In the Netherlands, there are around 33 million pets, of which 1,5 million dogs and 2,6 million cats [1]. These pets are increasingly becoming a part of the family, which results in owners treating their pets more like human beings than like animals. Dogs and cats are no longer considered an employee, keeping guard or catching mice and sleeping in the barn, but a family member [2]. They now live in our homes, sit on our laps and lick our faces. An increasing number of owners takes this "humanisation" or "anthropomorphism" as far as to allow their pets to sleep in their bed with them. In the Netherlands 45% of the dogs and 62% of the cats are allowed on the bed, 18% of the dogs and 30% of the cats even keep their owners company in their beds [3]. In the USA 21-33% of the dogs and 60% of the cats sleep on or in the bed, in the UK this is 14% of the dogs and 45% of the cats, whereas in France this is 30% of the dogs and 45% of the cats [4].

Though pets can be beneficial to their owners by giving psychological support and relieving stress [5], most of the owners do not realize that their pets, unlike their kids, do not take off their shoes when coming indoors or regularly take a shower. This results in the fact that pets might be infected with a variety of zoonotic pathogens to which the owner may be extra exposed when sharing their bed with them. Infections with these pathogens can result in serious illness of the owner, such as cat-scratch disease, pasteurellosis, *Capnocytophaga canimorsus* septicaemia, or cryptosporidiosis [4], or even owners infected with the plaque [6,7]. Aside from these zoonotic risks, the risks of bites, scratches and rabies are also increased [4], as well as infection transmitted neither via direct or indirect contact, such as tick-transmitted diseases, e.g. Lyme disease [8].

Of course, owners who do not sleep with their pets are exposed to the pathogens their pets might carry along with them as well, just by allowing them in their home and petting them. But sharing a bed with a pet means a higher exposure rate and therefore setting owners at higher risks of contracting a zoonotic disease, because risks are calculated by multiplying the hazard with the impact and exposure. Hazards are characterized by prevalence figures in reservoir, virulence for humans, transmission routes and survival of the agent in the environment. The impact shows how serious a disease is, calculated in disability-adjusted life years (DALY's) and economic consequences, and the

exposure assessment concludes who is exposed, for how long, how often and how much pathogen is needed to induce infection [9].

According to this literature, owners who have extended and intimate contact with their pets are at a higher risk to contract a zoonotic disease than those who do not. Since it is unclear to which pathogens owners of healthy dogs and cats are exposed and how often this appears, this orientating pilot study will determine these facts to estimate the risks of sleeping with pets in bed.

2. Materials and Methods

2.1. Animals: Clinically healthy dogs and cats were randomly recruited among students, employees, family and friends in the region of Utrecht, the Netherlands. Animals from different living situations participated, varying from dorm rooms to family houses, and living with one student to full families. The study was conducted during the months February and March 2017.

2.2. Investigated pathogens: The presence of the parasites *Cheyletiella,* fleas (*Ctenocephalides* spp.) and *Toxocara* spp., the dermatophyte *Microsporum canis*, and the bacteria *Clostridium difficile*, *Salmonella* spp., *Campylobacter jejuni* and Enterobacteriaceae in general was investigated. These pathogens are easily detectable and may act as sentinel pathogens. All of the pathogens are proven to be zoonotic and are present in European domestic dogs and cats [10,11].

2.3. Questionnaire: All owners were questioned about their own health and the health of their pets, the location where the pet was allowed to sleep, the diet fed, and parasite control (Table 1).

Personal data owner: gender, age
Personal data pet: species, gender, age
Location were the pet is allowed to sleep: outside bedroom/bedroom floor/bedroom/on the bed/in the bed
Reason for (not) allowing the pet to sleep in bed
House type
Outdoor policy: in-/outdoors, with/without leash
Presence of disease symptoms in pet
Presence of (zoonotic) disease symptoms of the owner
Raw meat diet: yes/no, if yes: frequency
Catching prey animals: yes/no, if yes: frequency
Endo/ectoparasite prevention, washing: frequency

Table 1: Questionnaire

2.4. Sample collection:

Fur: A latex glove was put on and moistened with 1 ml of a 0,1% polysorbate 80, peptone-saline solution and used to stroke the animal back and forth once over its head and back, and back and forth over both flanks, trying to touch also the deeper layers of the hair and the skin. The glove was taken off inside out and filled with 10 ml of the 0,1% polysorbate 80, peptone-saline solution and tied up. The back of the animal was combed with a chloride-disinfected flea comb, until 15 or more hairs were collected. These were applied on the Dermatophytest® (Virbac) with chloride-disinfected tweezers.

Footpads: A foot print of the animal's front leg was taken by pressing the footpad softly on a Violet Red Bile Glucose (VRBG) agar plate for 1 second.

Animal bed: The sleeping-place of the animal was sampled by shaking or beating the cushions or blankets above a plastic-coated piece of paper. The obtained material was collected into a petri dish.

All samples were stored at 4°C and embedded within 24 hours.

2.5. Bacterial investigation: The latex glove was thoroughly shaken and kneaded, after which the content was applied to 3M™ Petrifilms™: 1 ml on an Enterobacteriaceae (EB) Petrifilm™ and 1 ml on three aerobic count (AC) Petrifilms™ each, of respectively the content of the glove and 10 times and 100 times dilutions. The EB Petrifilm was incubated for 24 hours at 37°C, the AC Petrifilms were incubated three days at 30°C. After this period, the number of colonies - on the EB plate only Enterobacteriaceae colonies - were counted.

Afterwards, the undeluded AC Petrifilm was swabbed. The swab was stored in Cobas buffer until it was researched using polymerase chain reaction (PCR) for the presence of *Clostridium difficile*, *Salmonella* spp. and *Campylobacter jejuni* (Gastro Bacterial Lightmix kit by TIP Molbiol, Clostridium RIDAGENE Clostridium difficile & Toxain A/B kit, Salmonella ltr target, Campylobacter 16s. Protocol and analysis according to Lightcycler 480II). Besides this, eight randomly picked glove samples were plated on blood agar TSA-S plates and *Campylobacter* bloodfree selective medium + CCDA selective supplement SR0155E plates, incubated for four days respectively at 37°C for the blood agar and 42°C, micro aerofilic, for the *Campylobacter* plates. The colonies growing on the blood plates were tested using a MALDI Biotyper®.

The VRBG agar plate with the footprint was incubated for 24 hours at 37°C, after which the number of Enterobacteriaceae colonies was counted.

2.6. Fungal culture: The Dermatophytest® was used according to the manufacturer's instructions and was checked every other day for change of colour, indicating dermatophyte growth.

2.7. Parasite investigation: The petri dish with material from the animal's sleeping-place was first examined using a stereo microscope with 10-50x magnification for flea stages and *Cheyletiella* mites (and eggs). Then, the material was investigated with a flotation concentration method, using a mini FLOTAC®, for *Toxocara* spp. eggs.

2.8. Statistical evaluation: The statistical analysis was performed using SPSS Statistics 24. Means and percentages were calculated and significant correlation ($p<0,05$) was tested using the independent sample T-test.

3. Results

3.1. Animals: A total of 50 animals, 22 cats and 28 dogs, were investigated. The mean age of the 14 female and 8 male cats was 6,7 years old (1 to 17 years). The 11 female and 17 male dogs had a mean age of 4,8 year old (1 to 12 years).

3.2. Questionnaire: Table 2 shows that 20 dogs (71%) and 14 cats (64%) were allowed in the bedroom and 15 dogs (54%) and 14 cats (64%) were allowed to sleep on the bed. In total, 7 dogs (25%) and 8 cats (36%) were allowed to sleep in the bed of their owners. The reasons owners gave for allowing pets in their bedroom or bed were mostly cosiness (44%), out of habit (24%), or being unable to keep the pet out (24%). The motivation of owners who did not allow their pets in their bedroom or bed, was mainly for hygienic reasons (81%). Hygiene was mentioned by 42% of all owners, including the owners who did allow their pets in their bed/bedroom.

	Dogs	Cats	Total
Floor without bedrooms	28 (100%)	22 (100%)	50 (100%)
Floor with bedrooms	23 (82%)	17 (77%)	40 (80%)
In the bedroom	20 (71%)	14 (64%)	34 (68%)
On the bed	15 (54%)	14 (64%)	29 (58%)
In the bed (under the blankets)	7 (25%)	8 (36%)	15 (30%)

Table 2: Places where pets are allowed to sleep

The answers also showed that 8 pets (16%) catches prey or are fed raw meat at least once a week, respectively 2 dogs (4%) and 6 cats (12%).

Furthermore, it showed that most owners were not familiar with the advised frequency of deworming and flea prevention. Only 19 of all dogs and cats (38%) were dewormed at least 4 times a year. Flea prevention took place in most cases, though most owners did not know how often this was needed either. In 6 of the cases (12%), the owners declared not to use any flea prevention.

3.3. Bacterial investigation: The aerobic colonies per cm^2 sampled fur area are calculated by dividing the number of aerobic colonies found in the fur sample by the estimated surface sampled (1600 cm^2 for cats, 2500 cm^2 for dogs) and shown in Figure 1. The mean aerobic colony count (ACC) is 22,5 cfu/cm^2 for cats (0,5 to 90) and 27,6 cfu/cm^2 for dogs (0,3 to 216).

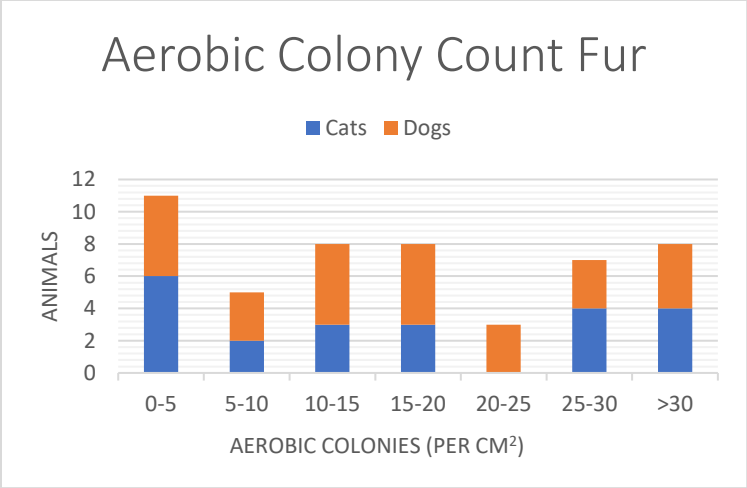

Figure 1: Aerobic count of the fur samples

The fur of 1 dog (4%) and 1 cat (5%) tested positive of Enterobacteriaceae, as did the footpads of 18 dogs (64%) and 6 cats (27%) (Table 3). Multiple Enterobacteriaceae colonies (1 to 7) were found on these footpads.

In none of the fur samples *Clostridium difficile*, *Salmonella* spp. or *Campylobacter jejuni* was found. The samples plated on the *Campylobacter* and blood agar plates did not show any pathogenic bacteria.

3.4. Fungal culture: *Microsporum canis* was not found on the fur of any of the animals.

3.5. Parasite investigation: 7 animals (14%) were diagnosed with fleas, of which 2 dogs (7%) and 5 cats (23%). *Cheyletiella* and *Toxocara* spp. were not found.

	Dogs	Cats	Total
Enterobacteriaceae on fur	1 (4%)	1 (5%)	2 (4%)
Enterobacteriaceae on footpads	18 (64%)	6 (27%)	24 (48%)
Total Enterobacteriaceae	19 (68%)	7 (32%)	26 (52%)
Fleas	2 (7%)	5 (23%)	7 (14%)

Table 3: Animals tested positive on pathogens

3.6. Risk factors: When all found pathogens are combined, it shows that 45% of the cats and 75% of the dogs were positive for one or more potential zoonotic pathogens. No significant correlation was found between the presence of pathogens and owner and animal characteristics, diet, location, parasite control or washing of the animal. Flea prevention appeared to negatively correlate with flea absence (p= 0,012).

4. Discussion

This study shows that many owners allow their pets into their bedrooms (68%) and even in their beds (30%). It is very likely that the real number of pets accessing their owners' bedrooms and beds is in fact even higher, since a lot of pets might do this without the permission or knowledge of their owners. These are higher numbers than in a former Dutch study, where 53% of the animals were allowed to sleep on the bed and 24% in the bed [3]. This is surprisingly since 42% of all the owners mentioned hygiene as a reason not to allow their pets in bed. Therefore, although a lot of the owners considered their pets as a hygiene threat, many owners did not act upon this. These results show a lack of knowledge about health risks associated with poor hygiene by many owners.

Most of owners did not know how to properly prevent themselves and their pets from common zoonotic parasites. Owners were asked to mention the frequency of deworming and flea prevention of their pets. This appeared to be a really hard question: many owners did not remember the last treatment, or whether they did it accordingly to the recommended frequency. Deworming is recommended in average four times a year [12], only 38% of all pets in this study did comply with this advice. The recommended frequency of flea prevention depends on the product used, but most owners did not know the recommended treatment frequency for their product. Moreover, 12% of the owners did not use any flea prevention. The negative correlation between the absence of fleas and the use of flea prevention found in this study might be caused by improper use of the preventive product.

Of the pets, 16% are fed raw meat or catch prey at least once a week. In both cases, the animal eats raw meat, which can be contaminated with zoonotic pathogens such as *Salmonella* spp. or *Escheria coli* [13]: *E. coli* O157:H7 as well as Extended-spectrum beta-lactamases (ESBL) producing *E. coli* [14]. Even *Clostridium perfrigens, Clostridium difficile, Staphylococcus aureus* and *Listeria* spp. (among which *Listeria monocytogenes)* have been identified in commercial raw pet diets [14,15], resulting in infection risks for the animal, who in turn can infect the owner. When a pet eats a meal infected with *Salmonella* spp., the pet may get infected and may shed *Salmonella* spp. in their feces, contaminating the environment (e.g. the house or bed of the owner). This can lead to infection in the owner [16]. Most pets become shedders without showing clinical signs, which makes them a hidden source of contamination [17]. This could also be the case for *Campylobacter* [18]. Another important risks of diets containing raw meat is the parasite *Toxoplasma gondii*, but so far no association of infection in humans with direct contact of infected cats has been described [19].

The number of aerobic colonies found on the fur of the animals can be compared to microbial guidelines for hospitals or kitchens. These standards are based on the fact that elevated Aerobic

Colony Counts (ACC) lead to higher chances for the presence of pathogens. Therefore, on surfaces where food is being prepared and the surfaces of a hospital that are frequently touched by hands (e.g. door handles, light switches and bed linen), the ACC should not exceed 5 cfu/cm^2 [20,21]. The mean ACC's found in this study of 22,5 cfu/cm^2 for cats and 27,6 cfu/cm^2 for dogs exceed this level with 4 to 5 times the maximum amount. The highest ACC's found are 90 cfu/cm^2 (18 times the maximum) for cats and even 216 cfu/cm^2 (43 times the maximum) for dogs. These numbers show the importance of proper hygiene when dealing with pets.

Besides the total number bacteria, the number of pathogenic bacteria is even more important. Enterobacteriaceae were found in 52% of the cases (68% of the dogs and 32% of the cats) on fur or footpads. These germs could easily be transmitted to the owners via direct contact (e.g. stroking, close contact) or indirect contact (e.g. walking over the sheets), possibly leading to *Salmonella* spp. or *E. coli* infections [11]. Besides the regular *E. coli* bacteria, *E.coli* bacteria producing extended-spectrum β-lactamases (ESBL)- or AmpC β-lactamase have also been isolated from healthy pets [22,23]. These bacteria are not only a risk of *E. coli* transmission, but since they are multi-drug resistant this also leads to limited therapeutic options [24]. Also *E. coli* O157:H7, a highly pathogenic serotype of *E. coli,* might be transmitted by asymptomatic dogs to humans, where it may cause bloody diarrheal syndrome [25,26].

The pathogenic bacteria *Clostridium difficile*, *Salmonella* spp. and *Campylobacter jejuni* were not found in this study. These may form a risk for the owners' health when having intimate contact with infected pets. *Clostridium difficile* has been found in the intestinal tract and faeces of dogs and cats and is considered to be a zoonotic pathogen [27,28]. Direct contact might be a possible transmission route [29]. In a Dutch study, faeces from 25% of diarrheic dogs and 18% of diarrheic cats tested positive on *C. difficile* [30], showing a high prevalence of this pathogen.

As previously mentioned, *Salmonella* spp. can lead to infection of the owner when the animal sheds *Salmonella* spp.. This can be caused when the animal is infected after ingesting contaminated food e.g. raw meat [16], or via the faecal-oral route (directly or indirectly) [31]. Moreover, *Salmonella* spp. has often been detected in soil samples, where it can survive for a year [32], which could lead to contamination of animal fur and footpads when direct contact with contaminated soil occurs. This could in turn easily lead to contamination of the home environment. This shows there are multiple routes for pets to infect their owners and though *Salmonella* spp. have not been found in this study, it still forms a considerable threat.

Campylobacter spp. are very common pathogens isolated from about half of investigated dogs and cats [33]. This bacterium can be transmitted to humans directly by the animals or indirectly via the environment [34]. One study found that dog owners, especially puppy owners, were at a significant higher risk to contract pet-associated *Campylobacter jejuni* or *C. coli* infection than non-dog owners [35].

In none of the cases *Microsporum canis* was found, though it is the most important and most often identified dermatophyte in ringworm cases for dogs and cats [36,37]. A study discovered that 17% of asymptomatic dogs and cats were positive for *M. canis* and showed that even asymptomatic dogs and cats might be a major source of pathogenic dermatophytes for humans [38].

Fleas were found in 14% of the cases in our study in a period (February and March) when the flea season has not started yet. Presumably, these numbers will be much higher in warmer seasons. In a study in the Netherlands 50% of the dogs and 52% of the cats with fleas were carrying zoonotic pathogens [39]. *Bartonella henselae* (cat-scratch disease), *Rickettsia typhi, R. felis* (flea-borne rickettsioses) and *Yersinia pestis* (plague) are the most important pathogens [40,41]. Since the fleas in the present study were demonstrated in sleeping-places of animals, the risk for the owner to get infected by (potentially infected) fleas is highly increased when the pet sleeps in the bed, because this leads to more exposure. Since fleas lay eggs mostly at night, the sleeping-place of infected animals will be the most dense inhabited places by fleas [42].

Other parasites were not found, but these are also common zoonotic pathogens. A report from in Italy showed that *Giardia duodenalis, Toxocara canis* and *T. cati* were often found in faecal samples from household dogs and cats, causing a zoonotic risk for their owners [43]. *Toxocara canis* has been reported as the cause of an estimated hundreds of cases of unilateral blindness in the USA, but the prevalence of *T. canis* has decreased due to proper anthelmintic product use, indicating its importance [44]. *Cheyletiella* mites, which belong to the most common fur mite infestations in dogs and cats, can infest the owner, causing pruritic papular lesions on the torso and arms [36,45].

In this study we did not investigate another important factor in the transmission of zoonotic pathogens: the oral flora of dogs and cats. The most common bacteria found in dog and cat bites, that are present in their oral flora, are the aerobic *Pasteurella multocida, Streptococcus* spp., *Staphylococcus* spp., *Neisseria* and *Corynebacterium* spp. and the anaerobic *Fusobacterium* spp., *Bacteroides fragilis, Porphyromonas* and *Prevotella* [46–49]. These pathogens are suspected to be transmitted to the owner via (in)direct contact, e.g. licking in the face or sleeping on the pillow, which could lead to serious infections [50].

Besides, half of the domestic cats are tested positive for *Bartonelle henselae*, the bacteria that may cause cat-scratch disease. It is also present in the dog population (10–35% seroprevalence) [51]. Humans can become infected with *B. henselae* by cats via scratching or biting, or via fleas, which is considered to be the most probable route of transmission [51,52]. Besides cat-scratch disease, *B. henselae* can also cause ocular complications like Perinaud oculoglandulair syndrome [53].

The bacteria *Helicobacter* spp. are also found in more than half of dogs and cats and may be transmitted to humans, resulting in gastric diseases. This transmission presumably occurs via direct contact [54].

5. Conclusion

The findings of this study indicate that pets play an important role in de transmission of many pathogens, forming a zoonotic risk for their owners. This is the case for all pet owners, but especially for those having extended exposure and intimate contact with their pets, like sharing a bed, since this highly elevates the exposure rate and thus the risks. Therefore, it is of great importance that owners know how to interact with their pets in a responsible way, especially young, old, pregnant or immunocompromised owners, who are at bigger risk of contracting infections. Owners should be informed about the zoonotic risks of intimate contact with pets and how to protect their pets and themselves.

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Attachments

Attachment 1. Questionnaire

Geslacht: *man / vrouw*
Leeftijd: ……
Cijfers van uw postcode: …….. (geen letters en geen huisnummer, om anonimiteit te garanderen)

Vul de tabel in voor al uw honden en katten

	Diersoort	Leeftijd	Geslacht	Mag op de verdieping(en) waar geen slaapkamers zijn komen	Mag op de verdieping(en) waar wel slaapkamers zijn komen	Mag in de slaapkamer komen	Mag **op** bed komen	Mag **in** bed komen (onder de deken) **Zo ja, hoe vaak en hoe lang?**	Komt buiten
1	*Hond / Kat*		*M / V*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee* *Vrij / Aangelijnd*
2	*Hond / Kat*		*M / V*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee* *Vrij / Aangelijnd*
3	*Hond / Kat*		*M / V*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee* *Vrij / Aangelijnd*
4	*Hond / Kat*		*M / V*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee*	*Ja / Nee* *Vrij / Aangelijnd*

Hoe is uw woonsituatie? (Bijv. studentenkamer, 3-kamer appartement, gezinswoning)

……

Waarom slaapt u wel/niet samen met uw huisdier(en)?

……

……

Heeft u andere huisdieren dan honden en/of katten? Zo ja, wat voor diersoort en hoeveel?

……

Vertoont/vertonen één of meer van uw huisdier op het moment van monstername ziekteverschijnselen? Zo ja, welk dier (nummer uit bovenstaande tabel), en wat zijn de verschijnselen?

……

……

……

Voert u uw dier rauw vlees? Zo ja, hoe vaak? ……

Vangt uw huisdier prooidieren? Zo ja, hoe vaak? ……

Hoe vaak ontwormt u uw huisdier? ……

Hoe vaak behandelt u uw huisdier tegen vlooien? ……

Hoe vaak wast u uw huisdier? ……

Heeft u zelf last van één of meer van deze verschijnselen?
□ Jeuk
□ Diarree
□ Door schimmel veroorzaakte huidafwijkingen
□ Overige ziekteverschijnselen, namelijk ……

Attachment 2. Total results

2.1. Results samples

		Fungi	Parasites			Bacteria					
#	**Animal**	***Microsporum canis***	***Cheyletiella***	**Fleas**	***Toxocara* spp.**	***Clostridium difficle***	***Salmonella* spp.**	***Campylobacter jejuni***	**Enterobacteriaceae foot soles**	**Enterobacteriaceae fur (in 1 ml)**	**Aerobic count fur (in full sample)**
1	Cat	0	0	0	0	0	0	0	0	0	23000
2	Dog	0	0	0	0	0	0	0	0	0	23600
3	Cat	0	0	0	0	0	0	0	0	2	46000
4	Dog	0	0	0	0	0	0	0	2	0	179000
5	Dog	0	0	0	0	0	0	0	1	0	540000
6	Cat	0	0	0	0	0	0	0	1	0	17000
7	Cat	0	0	0	0	0	0	0	0	0	42000
8	Cat	0	0	0	0	0	0	0	6	0	131000
9	Cat	0	0	0	0	0	0	0	0	0	2200
10	Dog	0	0	0	0	0	0	0	3	0	66000
11	Cat	0	0	1	0	0	0	0	0	0	43000
12	Cat	0	0	0	0	0	0	0	0	0	12600
13	Cat	0	0	0	0	0	0	0	0	0	10400
14	Dog	0	0	0	0	0	0	0	2	0	42000
15	Cat	0	0	0	0	0	0	0	0	0	22600
16	Dog	0	0	0	0	0	0	0	1	0	32000
17	Dog	0	0	0	0	0	0	0	2	1	132000
18	Dog	0	0	0	0	0	0	0	3	0	48000
19	Dog	0	0	0	0	0	0	0	7	0	38000
20	Dog	0	0	0	0	0	0	0	2	0	34000
21	Dog	0	0	0	0	0	0	0	0	0	62000
22	Cat	0	0	0	0	0	0	0	0	0	30000
23	Cat	0	0	0	0	0	0	0	0	0	58000
24	Dog	0	0	0	0	0	0	0	0	0	2400
25	Cat	0	0	0	0	0	0	0	3	0	41000
26	Cat	0	0	1	0	0	0	0	0	0	29100
27	Cat	0	0	0	0	0	0	0	0	0	2170
28	Cat	0	0	0	0	0	0	0	0	0	144000

29	Cat	0	0	1	0	0	0	0	1	0	31000
30	Dog	0	0	0	0	0	0	0	0	0	820
31	Dog	0	0	0	0	0	0	0	1	0	32000
32	Cat	0	0	0	0	0	0	0	0	0	1280
33	Dog	0	0	1	0	0	0	0	0	0	1120
34	Dog	0	0	0	0	0	0	0	0	0	33000
35	Dog	0	0	0	0	0	0	0	0	0	38000
36	Dog	0	0	0	0	0	0	0	1	0	9900
37	Dog	0	0	0	0	0	0	0	2	0	25200
38	Cat	0	0	0	0	0	0	0	5	0	2470
39	Cat	0	0	1	0	0	0	0	1	0	810
40	Dog	0	0	1	0	0	0	0	0	0	44000
41	Cat	0	0	0	0	0	0	0	0	0	1900
42	Dog	0	0	0	0	0	0	0	0	0	19100
43	Dog	0	0	0	0	0	0	0	1	0	19000
44	Dog	0	0	0	0	0	0	0	2	0	74000
45	Dog	0	0	0	0	0	0	0	0	0	7000
46	Dog	0	0	0	0	0	0	0	4	0	75000
47	Dog	0	0	0	0	0	0	0	6	0	55000
48	Cat	0	0	1	0	0	0	0	0	0	102000
49	Dog	0	0	0	0	0	0	0	2	0	247000
50	Dog	0	0	0	0	0	0	0	3	0	52400

2.2. Results questionnaire

#	Animal	Gender Owner	Age Owner	Gender Animal	Age Animal	Outside?	Housing situation	Where allowed?	Reason
1	Cat	M	58	F	8	Yes	Family house	Floor without bedrooms	Hygiene
2	Dog	F	31	F		Yes	Family house	In bed. 1x/week, whole night	Habit
3	Cat	M	26	M		Balcony	Apartment	Bedroom floor	Hygiene, zoonoses
4	Dog	M	68	M	1	Yes	Family house	Bedroom	Hygiene
5	Dog (2)	M	27	M	2/3	Yes	Apartment	In bed	Habit, can open the door
6	Cat (2)	F	50	F	14/15	Yes, courtyard	Family house	In bed, sometimes	Habit
7	Cat	M	22	M	1	No	Dorm room	In bed, whole night	Animal likes it
8	Cat (2)	F	21	F		Yes	Family house	In bed, short	Cosy, can't stop it
9	Cat	F	25	M	2	Yes	Apartment	In bed, sometimes	Hygiene, hairs
10	Dog	F	22	F	8	Yes	Dorm room	In bed, 2x/week 10 min	When i'm not around
11	Cat	F	26	F	1	No	Studio	In bed, 5 min/day	Can't stop it
12	Cat (2)	F	48	F	1	Yes	Family house	On bed	Hygiene
13	Cat	F	51	F	8	Yes	Family house	On bed	Can't stop it
14	Dog (and cat)	F	40	M	8	Yes, on leash	Family house	Floor without bedrooms	Asthma
15	Cat (2)	F	49	F	4/9	Yes	Family house	In bed	Cosy
16	Dog (2)	F	20	M/F	1/8	Yes	Family house	Floor without bedrooms	Habit, hygiene
17	Dog	F	25	F	1	Yes	Dorm room	On bed	Loneliness
18	Dog (2)	F	60	F	1	Yes	Family house	Bedroom	No need
19	Dog	M	30	F	1	Yes	Apartment	Bedroom	It's not supposed to
20	Dog	F	29	F	7	Yes	Apartment	On bed	Annoying
21	Dog	F	48	M	4	Yes	Family house	On bed, short	Cosy, animal likes it
22	Cat (2)	M	38	M/F	5	Sometimes	Apartment	In bed, short	Habit
23	Cat (2)	M	65	M/F	14	Yes	Family house	Floor without bedrooms	Unpractical, hygiene
24	Dog	F	24	F	4	Yes	Studio	In bed	Cosy
25	Cat (2)	F	23	M	5/13	No	Dorm room	In bed, max 1 hour	Cosy
26	Cat (2)	M	49	M		Yes	Family house	Floor without bedrooms	Hygiene, fuss
27	Cat (2)	M	10	F	4/6	Yes	Family house	On bed	Can't stop it
28	Cat (2)	M	68	F	7	Yes	Family house	On bed	Can't stop it

29	Cat	M	50	M	17	Yes	Family house	On bed	Hygiene
30	Dog	F	49	M	12	Yes	Family house	Floor without bedrooms	Hygiene, ranking order
31	Dog (and 2 cats)	F	26	M	3	Yes	Family house	In bed	Cosy
32	Cat (2)	F	47	F	6	Yes	Family house	In bed, short, 3x/w	Habit, cosy
33	Dog	F	48	M	7	Yes, on leash	Family house	Bedroom	Hygiene
34	Dog	F	33	F	3	Yes	Apartment	On bed	Cosy
35	Dog	M	75	M		Yes, on leash	Family house	On bed	Relaxing
36	Dog	F	65	F	6	Yes	Family house	Bedroom	Hygiene
37	Dog	F	24	M	3	Yes	Studio	On bed	Relaxing, hygiene
38	Cat	F	48	F	12	Yes	Family house	On bed	Cosy
39	Cat	F	53	F	9	Yes	Family house	Bedroom	Hygiene
40	Dog	M	47	F	11	Yes	Family house	In bed	Cosy
41	Cat	F	22	F	6	Yes	Family house	Floor without bedrooms	Hygiene, no need
42	Dog	F	31	M	3	Yes	Apartment	Bedroom floor	Hygiene, to intimate
43	Dog	F	48	M		Yes, on leash	Apartment	In bed, 1x/w, 5 min	Inconvenient
44	Dog	F	70	M	10	Yes	Family house	On bed	Hygiene, no need
45	Dog (and 2 cats)	F	50	M		Yes, on leash	Family house	Floor without bedrooms	Hygiene
46	Dog (and cat)	F	58	M		Yes, on leash	Family house	Bedroom floor	Hygiene
47	Dog (2)	M	49	M		Yes, on leash	Family house	Bedroom	Hygiene
48	Cat (2)	F	51	M	3	Yes	Family house	Floor without bedrooms	Hygiene
49	Dog	F	22	M	1	Yes	Dorm room	On bed	Cosy, convenience
50	Dog (2)	F	45	M/F	9/10	Yes	Family house	Floor without bedrooms	Hygiene

#	Raw meat	Pray	Deworming (/year)	Flea prevention (/year)	Washing (/year)	Symptoms animal	Symptoms owner
1	x	x	3	When needed	0	x	x
2	x	x	2	1	12	x	x
3	x	x	1	1	0	x	x
4	x	x	4	3	0	x	x
5	2-3x/day	x	1	0	0	x	x
6	x	x	0,5	2	0	x	x
7	1x/week	x	2	0	0	x	x
8	x	1x/week	1	1	0	x	x
9	x	1x/month	4	4	0	x	x
10	x	2x/year	4	13	4	x	x
11	x	x	1	1	0	x	x
12	x	x	3	8	0	x	x
13	x		0	When needed	0	x	x
14	x	x	4	12	0	x	x
15	x	1x/week	When needed	When needed	0	x	x
16	x	x	3	1	4	x	x
17	x	x	4	0	6	x	Fungi
18	x	x	9	9	26	x	x
19	x	x	6	0	>52	x	x
20	x	x	4	4	52	x	x
21	x	x	2	4	4	x	x
22	x	x	6	2	0	x	Airways
23	x	Sometimes	3		0	x	x
24	Daily	x	When needed	52	4	x	x
25	x	x	0	0	0	x	x
26	x		1,5	2	0	x	x
27	x	Sometimes	4	Rarely	0	x	x
28	Rarely	1x/3week	1	6	0	x	x
29	Rarely	Sometimes	0	4	0	x	Itch
30	x	x	2	2	18	Ulcus (on medication)	x

31	x	x	4	4	12	x	x
32	x	x	2	In the summer	0	x	x
33	x	x	0	2	2	x	x
34	x	x	3	4	0	x	x
35	x	x	1	7	3	x	x
36	x	x		2	4	x	x
37	2x/week	x	4	6	In the summer	x	x
38	x	4x/year	12	12	0	x	x
39	Rarely	x	2	2	0	x	x
40	x	x	When needed			x	x
41	x	x	1	0	0	x	x
42	1x/week	x	4	4	4	x	x
43	x	x	1	2	12	x	x
44	x	x	0,5	1	9	x	x
45	x	x	4	In the summer	4	x	x
46	x	x	0	4	5	x	x
47	x	x	1	1	6	x	x
48	x	Rarely	2	2	3	x	x
49	x	x	4	4	4	x	x
50	2x/week	x	1	When needed	1	x	x