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Risk factors for the spread of parasitic zoonoses among dog owners and their families in rural areas

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Abstract

Introduction. Close animal-human contacts are risky for people, especially in cases of any negligence towards proper veterinary care, deworming procedures, as well as human and dog hygiene. Among possible risks there are parasite zoonoses threats.

Material and methods. The study involved 176 dog owners from rural regions in Lublin province. The original Parasitic Zoonoses Transmission Risk Score (PZTRS) method was used to determine the risk for humans, a method based on the analysis of such criteria as animal-human coexistence conditions and dog hygiene, as well as dewormings negligence. The resulting score ranges from 0–8, where. '0' is a perfect score, '8' is the lowest and means high health risks for humans.

Results. Obtained PZTRS values were in the 1-6 range. Median as well as modal values were equal to 4, which means the presence of significant risk of parasitic zoonoses transmission to dog owners and members of their families.

Conclusions. In Polish rural areas, negligence of dog owners' duties, including improper hygiene and dewormings, as well as risky conditions of human-dog coexistence, increase the potential risk of zoonotic parasite diseases spreading. Nowadays, veterinary practices and media have the important responsibility of educating dog owners about the potential risk of zoonotic parasites.

Key words

rural regions, dogs, dog owners, parasitic zoonoses, risk factors, negligence, hygiene, deworming

INTRODUCTION

There are large numbers of zoonotic diseases that can potentially affect people and they pose a continuing public health problem, even in developed countries. Among them there are parasitic diseases.

In Poland, the real threat to humans is posed mainly by the following parasites: protozoa (especially- *Lamblia intestinalis* and *Toxoplasma gondii*), nematodes (*Trichinalla spiralis*, *Toxocara canis,* as well as *Toxocara cati*), cestodes (*Echinococcus granulosus, Dipylidium caninum, Taenia saginata, Taenia solium*), arthropods (*Sarcoptes scabiei* and *Pulex irritans* being a vector for *Dipylidium caninum*) [1, 2, 3]. Some of them are directly transmitted from animals to people, others require an intermediate host. Many parasites are transmitted through dogs, so that dogs that have become inseparable companions in people's lives can pose a potential hazard to human health [4]. Dogs may become mechanical and biological vectors as they roll in noxious substances, eat faeces and contaminated soil, as well as lick contaminated fur or paws [4,5].

In our country, in most cases, human parasite infestations are asymptomatic. But this does not mean that the problem of parasitic zoonoses is trivial. Zoonoses are even life-threatening medical problems to babies and young children, pregnant woman and their foetuses, undernourished patients, as well as to immuno-compromised individuals (people after transplants, treated because of autoimmune diseases, as well as people with AIDS – Acquired Immune Deficiency Syndrome) [4, 6, 7, 8, 9, 10, 11]. Because of the growing number of pets (including dogs) and the fact that cultural transformations allow owners to stay in close contact with such animals (such as letting dogs sleep in the owners' bed), as well as because of the increment in the number of immuno-compromised persons, zoonoses have gained increasing attention. Such attention concerns implementations of new diagnostic methods and understanding the epidemiological aspects of such diseases.

Poor sanitary habits, making light of pets' diseases, unsatisfactory veterinary care, lack of proper care of dogs, and allowing them to interact with wild animals and stray animals, their faeces and contaminated soil as well as too close dog-human contacts, may increase the risk of transmission

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above-mentioned diseases. To precisely determine the real scale of such types of negligence and dog breeding mistakes it is necessary to take the proper action against the spreading of zoonoses.

The aim of this study was to determine the scale of dog care negligence and breeding mistakes favouring the spread of parasitic zoonotic diseases in rural areas of selected districts in Lublin Province.

MATERIAL AND METHODS

The study involved 176 dog owners, possessing a total of 257 dogs, from the rural areas of Bełżyce, Chodel, Opole Lubelskie and Poniatowa districts in Lublin province, Poland. They represented both the purebred and not purebred dog owners who possessed dogs for pleasure and companionship (pets), as well as for farming purposes (guarding the farm and/or helping with grazing animals). Selection of the owners was random and included individuals who because of their health status were patients of the outpatient clinics in Poniatowa, Lublin province.

A special original questionnaire was applied with questions concerning details of residence, education and professional status of the dog owners, aspects of dog-breeding, such as hygiene (frequency of bathing), veterinary care, possession of a veterinary health certificate, frequency of de-worming procedures, and aspects of animal-human coexistence, as well as freedom of movement of the dogs around the house and the surrounding area. Most of the questions referred to the conditions of dogs and humans coexistence posing a risk of spreading zoonoses [12]. The survey was carried out during the period: January 2011 – May 2011, and was based on survey feedback issued during a visit in the outpatient clinics and received during subsequent visits to clinics.

To evaluate the risk of parasitic zoonoses transmission from dogs to humans, the original Parasitic Zoonoses Transmission Risk Score (PZTRS) method was used. PZTRS is determined by evaluating 5 simple criteria for aspects of dog breeding and conditions for dog-human coexistence on a scale from 0-2, then summing up the 5 values thus obtained. The criteria and scoring rules are as follows:

- Dog access to places for children's fun and recreation: yes – unrestricted or access limited only to places for fun, but without any supervision by adults – score of 2, yes – access only to places for fun but with supervision by adults –score of 1, no – score 0.
- Sleeping places for dog: bed (with a human) or undefined place – score 2, dog beds or dens inside living quarters – score 1, outside living quarters – score 0.
- Bathing frequency: never, only when the dog has fleas, once during the dog's life – score 2, once a quarter (3 months) or less frequently – score 1, more frequently than once a quarter – score 0.
- Deworming procedure frequency: never, less frequently than once a year or only during vaccinations – score 2, once a year – score 1, more frequently than once a year – score 0.

Interpretation of scores: '0' is a perfect score, '8' is the lowest.

RESULTS

The obtained data are presented below in Tables 1-7.

Children are particularly vulnerable to the transmission of zoonoses due to their natural tendencies to unhealthy behaviours, especially during play. Dogs, their excrements and pelage may be vectors of many zoonoses and pose a potential threat to children.

The unrestricted movement of dogs around in unfenced areas increases the risk of contact with a source of parasitic infections. Unlimited access of these dogs to people, including their places of eating, fun and sleeping, may create opportunities for zoonotic transmission. The most dangerous coincidence of 2 options concern:

- unrestricted movement of dogs (Tab. 1; row 'No restrictions') and their access to places for children's fun and recreation (column 'unrestricted'") or only to places for fun (with or without supervision by adults): 5+ 4+12 cases (21 cases, i.e. 11.9%);
- free movement restricted to an unfenced outdoor area (Tab. 1; row 'Unfenced outdoor area') and possible access to places for children's fun and recreation (column 'unrestricted') or only to places for fun (with or without supervision by adults): 2+0+7 cases (9 cases, i.e. 5.1%).

Such options concern conditions of dog-human coexistence which are noticeable in 17% (11.9%+5.1%) of all dog owners' households in rural regions. Only 69 (39.2%) of owners referred to the most safe dog-people-environment relations:

- dogs not allowed to move freely outside the living quarters (free movement restricted to living quarters): 35 respondents (19.9%);

Table 1. Possible occasional dog's' access to children's fun and recreation places.

Dog's living space. Free movement restricted to:	Possible occasional dog's access to children's fun and recreation places									
	Access limited to:								Total	
	Unrestricted		places for children's fun; no supervision by adults		places for children's fun; access supervised by adults		None			
	n	%	n	%	n	%	n	%	n	%
Living quarters	13	7.4	0	0	19	4.5	3	1.7	35	19.9
Living quarters and fenced outdoor area	5	2.8	0	0	11	6.3	3	1.7	19	10.8
Utility rooms and fenced outdoor area	4	2.3	0	0	14	8.0	3	1.7	21	11.9
Fenced outdoor area	10	5.7	5	2.8	17	9.7	17	9.7	49	27.8
Unfenced outdoor area	2	1.1	0	0	7	4.0	0	0	9	5.1
Dog lives chained up	6	3.4	0	0	5	2.8	8	4.5	19	10.8
No restrictions	5	2.8	4	2.3	12	6.8	3	1.7	24	13.6
Total	45	25.6	9	5.1	85	48.3	37	21.0	176	100

– lack of consent for the presence of dogs in places allotted for children's fun and recreation (Tab. 1, column 'None'; 37 respondents, i.e. 21% of respondents).

Both of the above-mentioned options, defined as mathematical function 'or', concerns 37+35-3=69 owners (39.2%) (Tab. 1).

The attitudes of owners towards their dogs' access to the immediate human environment also manifests itself in a more or less rigorous approach to the matter of designating dogs' sleeping places, and separating them from people's living space (Tab. 2).

It is obvious that the absolute separation of dogs and humans is the most hygienic option. Any presence of dogs in the immediate human environment, especially where the animals are also allowed to move freely over an unfenced area, may pose a risk to humans. Not one of respondents checked the most risky combination: sleeping with a dog which is allowed complete unrestricted freedom of movement (Tab. 2).

110 (62.5%) dog owners declared the separation of sleeping places for humans and dogs (dogs not allowed to sleep inside living quarters). 66 owners (37.5% of respondents) checked other answers that suggested more or less risky contacts (Tab. 2); this may be interpreted as approval for the possible contact of the dogs with every piece of furniture, domestic appliances, clothing, or even human bedding. 23 dog owners (13.1%) declared that their dogs were allowed to sleep in the living quarters in not defined sleeping places; 41 respondents (23.3%) declared allowing the presence of dog beds in living quarters, 2 owners (1.1%) declared the possibility of keeping a dog in a human bed during sleeping time (Tab. 2).

In spite of the fact that animals as well as people need hygienic procedures to enjoy good health, the idea of bathing dogs gives rise to controversy. Such a diversity of opinions is presented in Table 3.

It is obvious that dogs with freedom of free movement in unfenced areas may be potentially exposed to contacts with wild animals (direct or indirect contact – by faeces or contaminated soil) and need such special hygienic procedures as frequent bathing, especially when the dogs are allowed to stay in the living quarters. The most popular responses to the question concerning the frequency of bathing dogs were: 'irregularly or less frequently than every 3 months' – 64 owners (36.4% of those polled) checked this answer, and 'every 3 months or more frequently' – 57 of the polled (32.4%) (Tab. 3).

It may be worrying that 25 owners (13.6%) checked the option suggesting that they had never bathed their dogs, 17 owners (9.7%) declared bathing once during their dogs' life, while 5 owners (2.8%) of dogs with unlimited freedom of movement declared no bathing (Tab. 3; row 'No restrictions', column 'never'). 12 owners (6.8%) confessed that they bath their dogs only when their animals have fleas. Such answers were given both by owners of dogs allowed to move around in living quarters, as well as owners of dogs allowed to stay only outside dwelling spaces.

Deworming prevention is one of the most effective procedure preventing parasite transmissions. Its effectiveness depends on frequency, regularity and specificity of anti-parasitic means used (Tab. 4).

Only 46 owners (26.1% of those polled) declared de-worming procedure utilised more frequently than once a year. The majority of dog owners (i.e. the rest of those polled, i.e. 73.9% of 176 owners) checked answers suggesting negligence of the de-worming procedure (de-worming not carried out at all, carried out once a year when preparing for vaccination procedures, or carried out less frequently than once a year). 2 owners (1.1%) had never applied de-worming procedures, 7 (4.0%) applied de-worming procedures less frequently than

Table 2. Sleeping places for dogs.

Dog's living space. Free movement restricted to:	Sleeping place for the dog									
	Outside the living quarters		Inside living quarters						Total	
			In a dog bed		In a not defined place		With owners or their children			
	n	%	n	%	n	%	n	%	n	%
Living quarters	0	0	15	8.5	18	10.2	2	1.1	35	19.9
Living quarters and fenced outdoor area	6	3.4	8	4.5	5	2.8	0	0	19	10.8
Utility rooms and fenced outdoor area	21	11.9	0	0	0	0	0	0	21	11.9
Fenced outdoor area	49	27.8	0	0	0	0	0	0	49	27.8
Unfenced outdoor area	9	5.1	0	0	0	0	0	0	9	5.1
Dog lives chained up	19	10.8	0	0	0	0	0	0	19	10.8
No restrictions	6	3.4	18	10.2	0	0	0	0	24	13.6
Total	110	62.5	41	23.3	23	13.1	2	1.1	176	100

Table 3. Attitudes of owners towards bathing their dogs and restrictions concerning free movements of dogs.

Dog's living space. Free movement restricted to:	The frequency of bathing											
	Never		'It has happened only once'		Irregularly or less frequently than every 3 months		Every 3 months or more frequently		Only when the dog has fleas		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Living quarters	0	0.0	0	0.0	11	6.3	23	13.1	0	0.0	35	19.9
Living quarters and fenced outdoor area	0	0.0	0	0.0	9	5.1	8	4.5	3	1.7	19	10.8
Utility rooms and fenced outdoor area	0	0.0	2	1.0	7	4.0	11	6.3	0	0.0	21	11.9
Fenced outdoor area	9	5.1	10	5.7	24	13.6	3	1.7	3	1.7	49	27.8
Unfenced outdoor area	2	1.1	3	1.7	0	0.0	3	1.7	0	0.0	9	5.1
Dog lives chained up	8	4.5	2	1.1	6	3.4	0	0.0	3	1.7	19	10.8
No restrictions	5	2.8	0	0.0	7	4.0	9	5.1	3	1.7	24	13.6
Total	24	13.6	17	9.7	64	36.4	57	32.4	12	6.8	176	100

Table 4. Deworming prevention and treatment procedures applied to dogs with different restrictions for free movement.

Dog's living space. Free movement restricted to:	Deworming											
	Only when the dog is vaccinated		When the owner sees parasites		Once a year		More frequently than once a year		Less frequently than once a year		Never	
	n	%	N	%	n	%	n	%	n	%	n	%
Living quarters	4	2.3	0	0.0	4	2.3	25	14.2	2	1.1	0	0.0
Living quarters and fenced outdoor area	0	0.0	3	1.7	13	7.3	0	0.0	3	1.7	0	0.0
Utility rooms and fenced outdoor area	6	3.4	4	2.3	5	2.8	6	3.4	0	0.0	0	0.0
Fenced outdoor area	3	1.7	22	12.5	15	8.5	7	4.0	2	1.1	0	0.0
Unfenced outdoor area	4	2.3	0	0.0	3	1.7	0	0.0	0	0.0	2	1.1
Dog lives chained up	0	0.0	14	8.0	5	2.8	0	0.0	0	0.0	0	0.0
No restrictions	6	3.4	3	1.7	7	4.0	8	4.5	0	0.0	0	0.0
Total	23	13.1	46	26.1	52	29.5	46	26.1	7	4.0	2	1.1

once a year, 52 (29.5%) once a year, 46 owners (26.1%) only when any parasites were noticed (Tab. 4). It seems alarming that most of the dogs with full freedom of movement (no restrictions concerning movement, either outside and inside dwelling quarters (Tab. 4 – row 'No restrictions') – were de-wormed in an improper way (once a year, or even more rarely).

Proper veterinary care is one of the most important elements for the prevention of the spreading of parasitic zoonoses. Table 5 presents one possible measure for the quality of veterinary care and cooperation between veterinary doctor-dog owner – the possession by dog owners of a veterinary health certificate.

Table 5. Veterinary health certificate possession procedures applied to dogs with different restrictions of free movement.

Dog's living space. Free movement restricted to:	Veterinary health certificate possession					
	No		Yes		Total	
	n	%	n	%	n	%
Living quarters	10	5.7	25	14.2	35	19.9
Living quarters and fenced outdoor area	14	8.0	5	2.8	19	10.8
Utility rooms and fenced outdoor area	4	2.3	17	9.7	21	11.9
Fenced outdoor area	34	19.3	15	8.5	49	27.8
Unfenced outdoor area	5	2.8	4	2.3	9	5.1
Dog lives chained up	13	7.3	6	3.4	19	10.8
No restrictions	5	2.8	19	10.8	24	13.6
Total	85	48.3	91	51.7	176	100

Almost a half of the dog owners polled (85 owners, i.e. 48.3% of 176 owners) declared lack of a veterinary health certificates proving veterinary care of their dogs. This negligence was declared by 13 owners of chained dogs, and 72 (40.9% of those polled) owners of dogs that were able to be in contact with people and their close environment (dogs with more or less free movement, or even no restrictions of free movement (Tab. 5- all rows except for 'Dog lives chained up').

The data present in Tables 1-4 present the scale of important of dog-human coexistence and dog breeding negligence. All the data may influence (in a direct or indirect way) human health, including creating risks for zoonotic transmissions.

To evaluate such a risk, the original Parasitic Zoonoses Transmission Risk Score (PZTRS) method was used. The detailed data concerning such risk in rural regions in the context of dog breeding aspects (dogs' free movement restrictions) are shown in Table 6.

Table 6. Parasitic Zoonoses Transmission Risk Score (PZTRS) in context of restrictions concerning free movement of kept dogs.

Dog's living space reported by polled dog owners. Free movement restricted to:	No. of respondents whose human-dog coexistence conditions were assessed at 0-8 points on the 8-point scoring scale (PZTRS)								
Points	0	1	2	3	4	5	6	7	8
Living quarters	0	0	13	3	5	14	0	0	0
Living quarters and fenced outdoor area	0	0	0	6	7	6	0	0	0
Utility rooms and fenced outdoor area	0	0	6	0	6	12	0	0	0
Fenced outdoor area	0	6	5	0	8	2	0	0	0
Unfenced outdoor area	0	2	3	21	7	13	3	0	0
Dog lives chained up	0	0	0	4	3	0	2	0	0
No restrictions	0	0	0	0	16	0	3	0	0
Total	0	8	27	34	52	47	8	0	0

Table 6 also presents data expressing PZTRS scoring distribution, and thus the risk of parasites' transmission during contacts with dogs reared in different conditions (with different restrictions concerning free movement in both unfenced areas and in residential buildings). The obtained PZTRS values were in the 1-6 range.

Not one of the polled dog owners referred to breeding conditions that suggested the highest safety (0 points), nor to a very high or the highest risk of transmission of parasitic zoonoses (7 or 8 points) (Tab. 6). The detailed analysis of such data need determining the median and mean scoring values (Tab. 7).

Table 7. Parasitic Zoonoses Transmission Risk Score (PZTRS) in context of restrictions concerning free movement of kept dogs – scoring: modal, median and mean values.

Dog's living space described by polled dog owners. Free movement restricted to:	Human-dog coexistence conditions assessed on the 8-point scoring scale (PZTRS)		
	Modal value	Median value	Mean value
Living quarters	5	4	3.6
Living quarters and fenced outdoor area	4	4	4.0
Utility rooms and fenced outdoor area	5	5	4.0
Fenced outdoor area	4	2	2.8
Unfenced outdoor area	3	3	3.7
Dog lives chained up	3	4	4.0
No restrictions	4	4	4.3
Total	4	4	3.7

Taking into consideration the data describing PZTRS scoring in 176 households represented by the polled rural dwellers (Tab. 6; row 'Total'), both the median and modal as well as median values suggest improper human-dog conditions of coexistence and/or dog owners negligence posing a risk of parasitic zoonoses transmission from dogs to people (both median and modal values were equal to 4; mean value 3.7). Looking at the median as well as modal PZTRS scoring values, a very disadvantageous regularity can be noted: dogs with wide freedom of movement and those living close to people, in most cases, cause a potentially higher risk of parasitic zoonoses transmission than those kept outside houses (including those chained up – higher modal and/or median PZTRS values (Tab. 7).

The lowest mean value (2.8) concerned dogs isolated from people as well as from wild animals (free movement restricted only to a fenced outdoor area). In such cases, the median was equal to 2 (also the lowest one), modal value 4. The highest mean value (4.7) concerned dogs with no restrictions on free movement.

DISCUSSION

The spread of several zoonoses transmitted by dogs may be limited by applying relatively simple procedures related to breeding conditions, as well as to human and animal hygiene. Many of them do not require considerable financial outlays, but only relevant knowledge and maintaining proper standards of human-animal coexistence conditions. The most important rules for such coexistence may be summarized as:
- maintaining proper hygiene of dogs;
- appropriate treatment of sick animals;
- avoiding contacts with wild animals and stray dogs (including contacts with faeces and contaminated soil);
- being proactive in de-worming puppies and adult dogs;
- maintaining the rules of human hygiene (washing hands, keeping quarters clean, disinfection of floors).

Each of these preventive rules appears to be important and self-evident, but unfortunately, practice shows that recommendations are often not realized. Establishing the facts, determining the scale of such negligence, as well as reasons for such improprieties, is a prerequisite for effective measures to reduce the number of parasitic infestations in humans.

Non-adherence by dog owners to the rules for proper animal-human coexistence may be caused by the lack of knowledge and superstitions concerning hygiene procedures, among them controversies concerning the bathing of dogs. Opinions presented by dog owners and published on the Internet (dog owners and lovers websites) represent a range of views from denial of the necessity of bathing, to recommendations to apply such a hygiene procedure several times a week (Tab. 3). Negligence in bathing dogs that are allowed to run freely through a neighbourhood as well as inside the house may be dangerous for the owners and their children, especially in cases of close animal-human contacts. Free movement of dogs is one of the most obvious ways of parasitic diseases transmission, enabling the dogs to be in contact with the reservoir of many parasites (wild animals, ownerless dogs and their faeces, as well as contaminated soil) [13,14]. Any negligence in the maintenance of a dog's hygiene increases the danger of the appearance of zoonoses, especially when human-animal physical contacts are close, or dogs are allowed in living quarters.

The obtained data suggest that only 9/24 of the dog owners polled who allowed their dogs unlimited movement (Tab. 3 – row 'No restrictions') and 3/9 of those who allowed dogs free movement around unfenced areas (Tab. 3 – row 'unfenced outdoor areas') bathed their dogs once a quarter or more frequently.

Faecal tests and the de-worming of pets are tasks which should be obvious to all pets owners. In many developed countries, it is recommended that faecal tests should be carried out at least 2-4 times a year. For example, the American Association of Veterinary Parasitologists (AAVP), the Centres for Disease Control and Prevention (CDC), and the Companion Animal Parasite Council (CAPC) recommend regular deworming. In the USA there are two suggested ways of action:
- giving a dog a year-round heartworm preventive/intestinal parasite combination product, and performing faecal tests 1-2 times per year (plus eventually appropriate therapy);
- performing faecal test 2-4 times a year and (eventually) using an adequate de-worming product.

In Poland, prophylactic adult dogs dewormings are preferred [15,16], usually carried out 3-4 times a year, and faecal tests carried out once a year. De-worming is recommended for all dogs, even those with negative faecal test results. A positive test result is an indication to perform curative de-worming instead of prophylactic de-worming (results of tests help with making the proper choice of means of deworming).

Negligence in deworming dogs in Poland (Tab. 4) may arise through ignorance or carelessness, but sometimes may also be the result of financial troubles. The polled dog owners were inhabitants of one of the poorest regions of Poland – in 2008 it had the highest proportion of families living in poverty (in Lublin Province the percentage of unemployed was equal to 15.3, while in Poland such percentage was close to 10.6 [17]). In 2009, the average monthly income per one person in the Lublin Province was equal to 826 PLN (currency – Polish Zloty) [18], while the average monthly income in Poland was almost 35% higher and amounted to 1,114.49 PLN [18,19].

In Poland, the de-worming procedures requires veterinary consultations and the use drugs that may be available only on prescription. The typical deworming procedure necessitates spending 10-15 PLN, but sometimes the de-worming cost can exceed 60 PLN (cost of both de-worming drugs and veterinary consultation; it also depends on the body mass of the dog and scope of action of drugs used). Such expenses are especially significant for those country dwellers who have barely enough money to subsist [20] and/or possess several dogs.

Close animal-human contacts are risky for people. Sleeping with a dog is an element of the new culture that is more friendly to animals, in particular to pets (this is exemplified in pictures, films, and even songs, e.g. Jethro Tull – *Sleeping With The Dog).* Such close relationships are approved by many psychologists, especially when people feel alone in a more and more industrialized world. In the Netherlands, for example, 60% of pets visit the bedroom; 45–60% of them are allowed on the bed, and 18–30% of dogs sleep in the bed with their owner [21]. The risk for a human increases in cases of neglect of proper hygiene, for example, in the Netherlands, just 15% of dog owners wash

their hands after contact with the animals [21], as well as in cases of neglect in the proper care of dogs, especially when the dogs are allowed to move around in unfenced areas and the neighbourhood. In such cases, the risk of contacts with wild and ownerless animals which are potential sources of parasitic infestations increases. The risk of transmission of zoonoses increases in cases of allowing dogs to sleep with family members, or play with young children (who are not accustomed to maintaining hygienic standards) [22]. Taking into consideration the results of the performed questionnaire survey, such an increased risk concerned only 2 of the polled dog owners, i.e. 1.1% of respondents (Tab.2). Comparing such data to those from the Netherlands [21], the problem does not seem to be essential in rural areas in Poland. It is a matter of concern that many owners allow their dogs free access both to unfenced areas and dwelling places. In such cases, there are possible contacts of the dog's fur with furniture, clothing and carpets, which make possible contamination of the house environment with infectious forms of parasites (e.g. eggs of roundworm (*Toxocara canis)*, hookworm *(Diphyllobothrium species*), *Echinococcus granulosus,* as well as mature parasites such as itch mite (*Sarcoptes scabiei*) and *Cheyletiella mites*.

It is a fact that in rural regions animal hygiene leaves a lot to be desired (bathing – Table 3) and there is negligence in maintaining de-wormings which are really essential (Tab. 4), therefore, the actual state of human-dogs coexistence rules must be improved to ensure greater safety for dog owners and their families. Such aid should be realized by improving veterinary care (the active part of veterinary doctors in de-worming procedures), as well as better education (a role for the mass media and school education, as well as local veterinary and sanitary services).

Looking at data presented in Table 5 and the conclusion that almost a half of the polled dog owners (85 owners, i.e. 48.3%) declared lack of possession of veterinary health certificates proving veterinary care of their dogs, the important conclusion must be drawn: that dog owner-veterinary doctor cooperation must be improved immediately.

CONCLUSIONS

In Poland, negligence in hygiene and veterinary dog care increases the potential risk of spreading zoonotic parasite diseases.

In rural areas, such negligence concern veterinary care, de-wormings, dog hygiene, and allowing the free movement of dogs, both in unfenced areas and living quarters.

Nowadays, veterinary practices and the media have the important responsibility of educating dog owners about the potential risk of zoonotic parasites.

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