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Research Article

Prevalence of *Bartonella henselae* in Pet and Stray Cats from the Aspect of Public Health: A Research Sample in the Concept of One Medicine - One Health [1] [2]

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Abstract

Cat Scratch Disease (CSD) is an important zoonosis seen in cats and a public health problem in all over the world. In this study, prospective cross-sectional serologic survey and examination of local health authority records for CSD, the seroprevalence of antibodies against *Bartonella henselae* in pet and stray cats, and its public health aspect were investigated. Total antibodies to *B. henselae* were evaluated by indirect fluorescent antibody test (IFAT) in serum samples taken from 93 pet cats and 93 stray cats from the Selcuk University Veterinary Faculty Animal Hospital and Konya Municipality Stray Animal Shelter. Percentages of pet cats and stray cats seropositive for antibodies against *Bartonella henselae* (26.88% and 41.94%, respectively) were significantly higher than percentages of pet cats. Total seroprevalence of *Bartonella henselae* was found to be 34.41% in the study. A total of 438 CSD cases were identified in the Konya region according to the data received from local health authority records in the previous 1.5 years (2011-2012). Stray cats have higher seroprevalences of antibodies against *Bartonella henselae*, but this likely was related to greater exposure to vectors of these organisms. In conclusion, it was observed that CSD is an important risk for public health in Konya region. Therefore in order to decrease CSD prevalence in this region and prevent transmission of the disease to humans, information, treatment and prevention studies must be carried out within the One Health concept.

Keywords: *Cat scratch disease, Zoonosis, Public health, Indoor cat, Stray cat*

Halk Sağlığı Açısından Pet ve Başıboş Kedilerde *Bartonella henselae* Prevelansı: Tek Tıp - Tek Sağlık Konseptinde Örnek Bir Çalışma

Özet

Kedi tırmık hastalığı (Cat Scratch Disease, CSD), kedilerde görülen ve bütün dünyada halk sağlığı problemi olan önemli bir zoonozdur. Bu çalışmada, prospektif kesitsel tarama ile pet ve başıboş kedilerdeki *Bartonella henselae* antikorlarının seroprevalansı ve bölge sağlık kuruluşlarının CSD kayıtları üzerinden hastalığın halk sağlığı açısından durumu araştırıldı. Total *B. henselae* antikorları, Selçuk Üniversitesi Veteriner Fakültesi Hayvan Hastanesi ve Konya Büyükşehir Belediyesi Geçici Hayvan Bakımevi'nden 93 pet ve 93 başıboş kediden alınan serum örneklerinde indirekt flörosan antikor testi (IFAT) ile değerlendirildi. *B. henselae* seropozitifliği pet ve başıboş kediler (sırasıyla, %26.88 ve %41.94) arasında yapılan karşılaştırmada, başıboş kedilerde belirgin şekilde yüksekti. Çalışmada, *B. henselae*' nın total seroprevalansı %34.41 olarak bulundu. Bölge sağlık örgütlerinin 1.5 yıllık (2011-2012) kayıtlarına göre Konya bölgesinde toplamda 438 CSD vakası görüldüğü tespit edildi. Başıboş kedilerde *B. henselae* seroprevalansının yüksek olması, başıboş kedilerin vektörlerle yoğun temasta olmalarına yorumlandı. Sonuç olarak, Konya bölgesinde CSD'nin halk sağlığı açısından önemli bir risk olduğu gözlendi. Bu çerçevede bölgedeki CSD prevalansını azaltmak ve insanlara geçişini önlemek için tek sağlık konsepti içerisinde bilgilendirme, tedavi ve koruma çalışmaları yapılması gerektiği sonucuna varıldı.

Anahtar sözcükler: *Kedi tırmık hastalığı, Zoonoz, Halk sağlığı, Evcil kedi, Başıboş kedi*

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INTRODUCTION

One Health (also known as One Medicine) describes veterinarians and physicians working together to advance the health and well-being of both humans and animals. In a broader concept, it also includes collaboration with members of the public health community and, other health care professionals as well as biomedical research scientists. One of the primary goals of the One Health concept is to advance the understanding, prevention, and treatment of zoonotic disease [1]. CSD, known since the 1950s, is an important zoonosis, caused by *Bartonella henselae* [2-5]. Cats act as reservoirs in the transmission of *Bartonella henselae* to humans [2-4]. Spreading of *Bartonella henselae* from cats to humans is either directly by cat scratch and bite or indirectly by cat fleas and flea excrement [4-6]. Cat fleas harbour *Bartonella henselae* in their intestines, spread it in the environment via faeces and transmit the infection among cats. Settling of flea faeces between teeth during scratching or grooming with claws contaminated with flea faeces increase the possibility of transmitting the infection to humans through biting [4,7]. Ticks (Ixodesricinus) may act as a vector (trans-stadial transmission) in the transfer of *Bartonella henselae* among cats, humans, dogs and other mammal species [4]. In general, progressing asymptomatically in cats, CSD is a natural infection characterized by mild clinical symptoms in cat owners [8].

In humans, *Bartonella henselae* causes CSD [9], bacillary angiomatosis [6], bacteriaemia and extended fever [10], benign regional lymphadenopathy [11], and stomatitis [8]. Clinically, CSD progresses in typical and atypical forms. Its typical form is characterized by erythematous papules in the scratch or bite area and lymphadenitis in the nearest lymph node [11,12]. A painless erythematous papule or pustule with a diameter of 0.5-1 cm develops within 3-10 days in the scratched or bitten area. In 2-3 weeks, the papule or pustule usually heals without leaving a scar. Regional lymphadenitis follows more than 80% of the cases and 10% of these have a suppurative character. Within 1-7 weeks, the nearest lymph node enlarges, becomes sensitive and lymphadenitis develops. Lymphadenitis continues for 2-4 months or longer [11,13]. If the immune system of the host is sufficient it recovers on its own, however, if the immune system is compromised then generalized lymphadenopathy may develop. Potentially, this may lead to fatal disorders, particularly neuroretinitis, uveitis, endocarditis and neurological disorders in the atypical form [4]. Atypical manifestations may develop in 5% to 15% of humans with cat scratch disease; these may include Parinaud's oculoglandular syndrome, encephalitis, endocarditis, hemolytic anemia, hepatosplenomegaly, glomerulonephritis, pneumonia, relapsing bacteremia, and osteomyelitis [11].

The aim of this study is to serologically determine the prevalence of the important zoonosis *Bartonella henselae* in pet and stray cats in the Konya region and investigate its public health.

MATERIAL and METHODS

This study was approved by the Selcuk University Veterinary Faculty Local Ethics Committee (29.02.2012-2012/018).

Cats and Regional CSD Records

The animal material of this study consisted of 93 pet cats and 93 stray cats brought to the Selcuk University Veterinary Faculty Animal Hospital. In the context of this study, Local Health Authority records in the Konya region were examined and the number of patients visiting the 28 hospitals in the region with a complaint of cat bite/cat scratch was determined.

Sample Collection

Blood samples were collected from 93 stray cats and 93 pet cats by means of saphenous venipuncture. Samples in plain glass tubes were allowed to clot, and serum was obtained. Serum samples were frozen at –20°C until analyzed.

Testing Procedures

Presence of *Bartonella henselae* antibodies in the cat blood serum was established with a fluorescent microscope (Olympus BX50) using the IFAT (*Bartonella Henselae* IgG - IFA Vircell 200 test). Collected cat blood serum were defrosted at room temperature and diluted at a ratio of 1/64 with PBS prepared in the laboratory. 20 µl of the diluted serum was placed into wells in laboratory slides coated with antigens, the slides were placed into a laboratory incubator at 37°C with high humidity and incubated for 20 min. Following incubation, the slides were washed twice with PBS, 5 min apart, then washed with distilled water and left to dry. Into the wells on the dry slides, 20 µl cat conjugate diluted with 1/50 PBS was placed and the slides were incubated in an incubator with high humidity at 37°C for 20 min. After incubation the slides were washed and dried. VIRCELL mounting medium was put into the dry slide wells, covered with a cover slip and examined under a fluorescent microscope. Views were assessed in a darkened room under x 40 magnification with a fluorescent microscope. Observation of homogenous bacteria distribution giving out green-yellow fluorescence on a black background was considered to be positive *(Fig. 1)*.

Statistical Analyses

Results of seroprevalences of antibodies against *Bartonella henselae* were compared between stray and pet cats. Statistical analyses of data obtained within this study were carried out using the X^2 test, values of $P<0.05$ were considered significant [14].

Fig 1. IFAT test, *Bartonella* positive reaction notice that apple green flourescence

Şekil 1. IFAT testi, *Bartonella* pozitif reaksiyon, elma yeşili floresan görünüm

Table 1. *Seroprevalence of Bartonella henselae determined by IFAT in domestic and stray cats*
Tablo 1. *Sahipli ve sahipsiz kedilerde IFAT yöntemiyle tespit edilen Bartonella henselae seroprevalansı*

Cats	N	IFAT (+)	IFAT (-)	Seroprevalence (%)
Domestic	93	25	68	26.88
Stray	93	39*	54	41.94
Totally	186	64	122	34.41

** X^2 value = 4.669, P<0.05*

RESULTS

Findings obtained in the light of the aims of the study carried out on pet and stray cats in the Konya region. In the scanning of 93 pet and 93 stray cats in the study region, 64 positive cats and 122 negative cats were identified. In the light of these findings, the seroprevalence of *Bartonella henselae* in the Konya region was found to be 34.41%. In the comparison regarding presence of *Bartonella henselae* in pet and stray cats, rate of positivity was found to be 26.88% in pet cats and 41.94% in stray cats *(Table 1)*. According to this, *Bartonella henselae* infection was seen to proceed at a significantly high level in stray cats.

In the context of this study, the number of patients admitted to the Infectious Diseases Department in a total of 28 hospitals in the Konya region, with a complaint of cat bite/cat scratch and pre-diagnosed with CSD, was seen to be 438 in the 1.5-year period between the dates this study was carried out (01/01/2011-30/06/2012).

DISCUSSION

Seroprevalence of antibodies against *Bartonella henselae* is ongoing in investigations carried out in many countries and its zoonotic potential is being evaluated. In France, in a study performed on 436 cats, bacteriaemia was identified in 72 cats and 179 cats were found to be seropositive regarding *Bartonella henselae* and/or *Bartonella clarridgeiae* [15]. It has been stated that, *Bartonella sp.* seroprevalence is higher in hot and humid climates [16]. In healthy pet cats, *Bartonella henselae* seroprevalence has been reported to be 17% in Thailand [17]; 9.6-19.6% in China [18]; 32% in Jordan [19]; 44.2% in Denmark [20]; and 54% in Indonesia/Jakarta [21]. In a pilot study carried out in healthy cats in Brasil, *Bartonella henselae* prevalence was found to be 47.5% and it was stressed that performing this study in the whole region to include larger populations of animals was very important for human and animal health [22]. In a study performed in the United States of America, where a total of 170 owned and stray cats, as well as cats from animal shelter were assessed, a *Bartonella henselae* seropositivity of 14.7% was determined and it was expressed that cat infections are an important source of zoonoses in humans [23]. In two separate studies carried out in the United Kingdom [24], and the United States [25], a relatively high seropositivity of 40.6% and 75% in pet cats and 41.8% and 93% in stray cats was reported, respectively. In the Czech Republic, while the total prevalence was 8% in a study including stray cats and cats in an animal shelter, bacteriaemia prevalence was determined to be 67% in stray cats and 5% in cats in the animal shelter [26].

While *Bartonella henselae* seroprevalence of 44.2% was determined, bacteremia prevalence was not statistically different between shelter/stray cats (13/49, 26.5%) and pet cats (8/44, 18.2%) in Denmark [20]. In Algeria, *Bartonella henselae* seroprevalence was found to be 17% in stray cats [27]. In a study carried out in Turkey, *Bartonella henselae* seroprevalence in cats in the Ankara region was found to be 18.8% [28]. In a study carried out in six different regions in Turkey, the total seroprevalent cat ratio was 28.9%. With varying seropositivity rates in Bursa (41.3%), Adana (33.9%), Burdur (32.3%), Aydin (27.5%), Kayseri (17.9%) and Istanbul (12.5%), it was stated that *Bartonella henselae* is a significant pathogen in Turkey [29]. In the present study, *Bartonella henselae* seroprevalence in owned cats and stray cats was determined to be 26.88% and 41.94%, respectively. Seropositivity rate in stray cats was found to be at a statistically significant high level (X^2 value = 4.669, $P<0.05$). The total seroprevalence level (34.41%) determined in this study is approximately within international (8-93%) and national (12.5-41.3) data range. These results clearly state that owned cats and stray cats are both reservoirs of *Bartonella henselae* infection. When hospital data examined in the context of this study is taken into account, it is seen that the number of patients pre-diagnosed with CSD (n: 438) in the investigation area is at a significantly high level. These results indicate that, in diseases with zoonotic potential such as this disease and similar ones, studies within the one medicine-one health concept must be carried out and preventative measures taken.

CSD is an important zoonosis seen in cats, which may spread to humans. In immune-competent patients, while *Bartonella henselae* leads to the acute infection known as CSD, it may cause widespread clinical diseases, such as bacillary angiomatosis, encephalopathy, peliosis hepatitis, splenitis, osteomyelitis and bacteriaemia in immune-compromised patients [2-4,11,30,31]. Treatment of Bartonellosis is carried out in the light of personnel experience, expert opinion and microbiological sensitivity data depending on the infection agent, clinical disease duration and immunological status of the patient [4,30,32]. Efforts to standardize antibiotic dose and duration treatment regimens, based upon both in vitro antibiotic susceptibility testing and patient outcome assessments are critically needed to effectively manage patients with neurobartonellosis and to elucidate the mechanisms by which chronic interplay between the host and bacteria ultimately leads to neurological manifestations [31]. In addition, antibiotics used in these treatments have been reported to be ineffective in the rate of recovery or success at any significant level [32]. In China, *Bartonella sp.* seroprevalence was found to be significantly high in people bitten by dogs and dog bite was reported to pose a risk with regards to *Bartonella* infection [33]. In a study carried out in Italy, contact with a cat was reported in 61 of 74 patients diagnosed with CSD and cat-related trauma in 49 patients. In a screening including 27 cats, some of which were owned by these patients and others not (domestic and stray), 9 of the 11 cats belonging to CSD patients and 2 of the 16 remaining cats were identified as being *Bartonella henselae* seropositive. In a general screening carried out in the region, *Bartonella henselae* seropositivity rate was found to be 23.1% [34]. These data indicate that preventative measures need to be taken for protection against and control of CSD. It is recommended that at-risk individuals should take certain precautions when coming into contact with cats; such as, adopting cats older than 1-year, avoiding adopting cats from animal shelters or crowded cat homes, health and flea control carried out by veterinarians, avoiding cat bite and scratches, cleaning bite and scratch wounds with soap and water and seeking medical advice, protection from flea infestations and other possible vectors and keeping cats indoors to prevent zoonotic risks [4]. In the present study, the number of patients with pre-diagnosed CSD in a total of 28 hospitals in the Konya region was seen to be 438 in the 1.5-year period. In the light of these studies for prevention of Bartonellosis, we believe that veterinary surgeons must collaborate with human medicine in their common field of studies within the frame of the one health concept. It will be advantageous to develop the one-health concept with studies such as; information given on subjects concerning human health despite being unrelated directly to pets and other animals, activating local and regional health units, encouraging the collaboration of veterinary surgeons and medical doctors in the management of immune-compromised people and pets, student exchange programs between veterinary and medical students and assessment of human- animal relationships in veterinary clinical procedures [1].

In conclusion, data from the present study illustrates that *Bartonella henselae* infection is an important zoonosis and a public health problem in the Konya region as well as all over the world. In this context, veterinary and medical health workers, particularly at-risk people, must be informed on the subject of CSD and a common working ground established.

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