ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN-POLONIA
VOL. LIII, 18 SECTIO DD 1998

Katedra Prewencji i Klinika Chorób Ptaków, Katedra Epizootiologii i Klinika Chorób Zakaźnych
Wydziału Medycyny Weterynaryjnej AR w Lublinie

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Birds as one of elements in transmission of zooanthroponoses Part I. Salmonella infections *

Ptaki jako jedno z ogniw w łańcuchu chorób odzwierzęcych.
I. Salmonelloza

Problems of diseases transmitted from animals to man have been minimized in Poland after World War II because of a great improvement in epidemiological and epizootic situation of the country. As a result of profound changes in the model of animal production have returned certain threats, for example tuberculosis, appeared new ways for transmission of infectious agents (for example salmonelloses), and emerged completely new diseases such as spongiform encephalopathy in cattle.

Birds play a valid role in transfer of zooanthroponoses. Poultry can transmit *Salmonellae* and *Campylobacter*, decorative birds can serve as a source of protozoan diseases, chlamydia infections, many bacterial diseases. The role of birds in these threats is well documented, and therefore prevention measures to control human infections have been easily introduced. The role of free-living birds, living in a close contact with men such as sparrows, pigeons or hunting birds, as vectors of diseases transmitted to man is not well defined. Birds like rodents are common carriers of *Salmonellae.*

A lot of *Salmonella* serotypes can infect birds. Since the second half of the 80's *S. enteritidis* dominates in birds. The role of this bacterium in initiating diseases of birds was not well documented since its isolation by Gartner by the end of the 19th century up to the 80's of the 20th century. Now its is well known that *S. enteritidis* dominates not only in infectious processes and morbidity of birds but

Studies supported by the Committee of Scientific Investigations (092/P06/96/10)

also in epidemics of *Salmonella* infection in human beings. *S. enteritidis* caused outbreaks in Argentina, Canada, USA, Great Britain and in most member countries of the European Community (26). Knowledge on *S. enteritidis* outbreaks in Poland is relatively low. The published data have regional or fragmentary character. A monograph on *Salmonella* infections in Poland should contain data both from medical research and veterinary studies. Moreover, it should concern infections and diseases caused possibly by a great number of different *Salmonella* types and application of the modern methods of investigations.

The number of infections and food intoxications of humans caused by *Salmonellae* of animal origin, mainly *S. enteritidis* in the last years has greatly increased in the world. In Poland this number has increased many times (13, 18, 20, 27). One of the reasons of this increase are infected birds. Therefore, in birds in many countries there was initiated control of *Salmonella* infections. It is realized by a strict sanitary control of farms and control of poultry meat and especially eggs and (2, 26).

The main source of infection of humans is the consumption of *S. enteritidis* contamined food of poultry origin. In the last decade the percentage of slaughter poultry infected by *Salmonellae* systematically increases. Poultry can infect from different sources. Most often they infect from the environment and by fodder. Often the source of infection are contaminated eggs. They may be infected by *Salmonellae* in the reproductive tract of hens or during unsanitary harvest or unproper preservation.

According to Spillmann and Ehrsam (cit. 22) the environment is the main source of *Salmonella* infection for slaughter poultry. The environment participates in 51% of bacterial transmissions. The role of vertical transmission of infection is lower. Infections of poults in parental flocs reach 11% . Infections of poults in incubators are very low, approx 2%. Comparable data are obtained in Poland. R u d y (22) found that in Poland 25% poultry houses is contaminated by *Salmonellae*. The significant role in transmission of *Salmonella* infections in poultry farms have rodents living on the farm and on the field and occasionally visiting farms. At a very low morbidity they often transmit and disseminate *Salmonellae*. Rodents are mostly infected by *S. enteritidis*. The threat of *Salmonellae* dissemination has increased because this bacterium may intensively multiply in the alimentary tract of rodents. They often are asymptomatic carriers of *Salmonellae* and may disseminate bacteria into the environment. One g of feces of asymptomatic carrier contains even 1 mld of bacterial cells (20). This great number of bacteria in feces contaminates environment (water, soil, lakes) and poultry houses. Contamined environment serves as a source of infection for birds, free-living and domestic animals, and for human beings. In bacteria contamined slaughter houses and food

factories are directly contamined poultry meat and other food products. Due to anatomical structure, delicate and folded skin, slaughter birds are more often infected by *Salmonella* during slaughter than other animal species (8). Strict hygienic conditions can easily eliminate or highly restrict secondary bacterial contaminations. But elimination of *Salmonella* from the environment is very difficult, if not at all, possible.

More than 30 *Salmonella* serotypes have been isolated from free-living birds during the last century. Among them were the urban pigeon (*Columbia livia f. domestica*) (4, 27), gull sp. (*Larus ridibundus, L.argentatus* and *L. marinus*) (16, 19, 21, 23), coot (*Fulica atra*), greylag goose (*Anser anser*) (16), pheasant (*Phasianum colchicum*) (7, 9) starling (*Sturnus vulgaris*) (23), bullfinch (*Pyrrhula pyrrhula*) (11), greenfinch (*Carduelis chloris*) (11, 12), house sparrow (*Passer domesticus*) (7, 12, 13, 23), rook (*Corvus frugilegus*) (27), savis wabler (*Locustella luscinoides*) (27) and sparrow hawk (*Accipiter nisus*) (11).

Among *Salmonella spp.* dominated *S. typhimurium, S. enteritidis, S. anatum, S. panama, S. derby, S. st. paul.* All of them have been isolated from birds from different ecological niches and of different alimentary preferences. Examinations of free-living birds in Norway and Finland revealed *S. typhimurium* in seed eaters (bullfinch, greenfinch) and birds of prey (sparrow hawks) (11). One can assume that *S. typhimurium* is a constant component of food chain of birds irrespective of their food preferences.

Many studies have been devoted to the role of pigeons, sparrosw and gulls as vectors in dissemination of pathogenic microorganisms. These species of birds live in a close contact with humans and domesticated animals, mainly horses dogs, cats and decorative birds.

In the last decade attention has also been paid to the role of urban pigeons in epidemiology of human salmonellosis in great cities (4, 10, 16, 19, 21, 27). As studies on species composition and number of birds in large cities showed, the urban pigeon (*Columbia livia f. domestica*) together with the house sparrow (*P. domesticus*) form the largest part of avifauna both in West Europe (5) and in Poland (6, 15). In Warsaw the urban pigeons and sparrows during breeding season form 56% and in winter 76% of the whole population of free-living birds. These two species also dominate in avifauna of Olsztyn (6). The pigeons dominate in parks, old cities, downtowns and new quarters in cities whereas sparrows dominate in suburbs and industrial zones (6, 15). Carrier state of *Salmonella*, mainly *S. typhimurium*, is noted relatively common in the urban pigeons. It is very interesting that urban pigeons carry *Salmonellae* twice more often than breeding pigeons (4). P i n o w s k i et al., (18) in studies on morbidity of sparrows in Warsaw and suburbs in 1988-1990 has isolated *Salmonellae* from 6.6% of sparrows and 3.3% mazures. K r u s z e w i c z (13)

has isolated *Salmonellae* from sparrow poults from the nests situated close to school and grocery. These buildings are frequently visited by humans.

It is worth noting that urban ecosystems are not stable, they currently change. Easy access to food accelerates migration of new species of birds to great cities. A very good example of this situation are gulls: *L. ridibundus* and *L. argentatus*. *L. ridibundus* lives in great colonies in unshaven water reservoirs but it preys on suburbs. As a migratory bird it contaminates a migration tract with pathogenic microorganisms in spring and autumn. Not long ago *L. argentatus* was occasionally present in Poland. In the 60's first hatching of *L. argentatus* were noted in Pomerania, but from 70's it has been found on lowlands, mainly on grounds situated along great rivers (25) and in city agglomerations (3). In West Europe nests of this bird are often on buildings in downtowns, at the seaside and also far away from the sea (3). In USA (23) *L. argentatus* every day flies on a distance of almost one hundred km from hatching colonies to food reservoirs in suburbs. The long distance fly enables the transfer of *Salmonellae* to hatching places (23). It was found that 2.5% of birds in a colony carried *Salmonellae* (23). Therefore many authors point to gulls as vectors of *Salmonellae* and their main disseminator (16, 23, 27). Mikulaskova (16) states that the gulls play the active role in pollution of the environment by *Salmonellae*. Examining carrier state of *Salmonella* in 756 birds of 57 species she isolated 32 strains of *S. typhimurium*, 6 *S. enteritidis*, 1 *S. panama* and 1 strain of *S. anatum*. 38 strains have been isolated from *L. ridibundus*, the rest from *Anser anser* and *Fulica atra*.

In Scandinavian countries much attention has been paid to carry state of *Salmonellae* by wild-living birds (10, 11, 19, 21). Examinations of Kapperud and Rosef (10) in Oslo also point to the gulls living both in rural and urban areas as the main carriers of *Salmonellae*. In rural area *Salmonellae* have been isolated also from *L.marinus*. In Helsinki (Finland) 16% of the examined gulls and 3% of sparrows have been infected (19). In Germany the case of intoxication of humans after eating of smoked herrings that had been infected by gulls was reported in the 60's.

In Poland only sporadic studies have beene made on carrier of *Salmonellae* by free-living birds. Zaleski and Jakubowska (27) in the middle of the 70's have examined 384 specimens of feces from 44 species of wild-living birds. In four cases (approx. 1% of specimens) *Salmonella spp.* was isolated.

The wild-living birds such as pigeons, gulls and sparrows that have contact with human seats form a very important element in the so-called epidemiological and epizootic means of transfer of pathogens. These species of birds can transmit *Salmonellae* into humans and poultry. And again, food and food products both from home breed poultry and from great breeding centers, are a great threat for humans

as a source of *Salmonella* infection. Probably these epidemiological mechanisms form a background for an increased number of alimentary *Salmonella* infections in human beings.

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STRESZCZENIE

W ostatnich latach globalne zakażenia i zatrucia pokarmowe u ludzi spowodowane przez salmonelle pochodzenia odzwierzęcego osiągnęły wartość 80-90%. Podobną sytuację obserwuje się również w Polsce. Ważnym ogniwem w łańcuchu zakażeń odzwierzęcych są ptaki. Dotyczy to drobiu (salmonelloza, kampylobakterioza) oraz ptaków ozdobnych (choroby pierwotniacze, chlamydiozy, niektóre choroby bakteryjne).

Nosicielstwo salmonelli u ptaków wolno żyjących ma charakter niemal powszechny. Od różnych gatunków ptaków wolno żyjących w ciągu ostatnich kilkudziesięciu lat wyizolowano ponad 30 serotypów *Salmonella*. Drobnoustrój ten znalazł trwałe miejsce w łańcuchu pokarmowym ptaków, niezależnie od ich preferencji pokarmowych. Ptaki dziko żyjące w otoczeniu siedzib ludzkich, takie jak gołębie, mewy, czy wróble, a także inne gatunki są ważnym elementem w łańcuchu epizootycznym i epidemiologicznym salmonellozy. Przenosić one mogą pałeczki *Salmonella* na człowieka oraz na ptactwo domowe. Z kolei ptactwo domowe zarówno z hodowli przyogrodowych, jak też z ferm wielkotowarowych, głównie poprzez żywność opuszczającą zakłady przetwórstwa spożywczego, stanowi realne zagrożenie dla zdrowia człowieka.