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**The occurrence of salmonellosis as zoonotic diseases
in the area of activities
of the State Sanitary-Epidemiological Station in Zamosc**

Występowanie salmonelloz jako chorób odzwierzęcych w rejonie działania
Państwowej Stacji Sanitarno-Epidemiologicznej w Zamościu

Summary. The aim of the study was to characterize the occurrence of salmonellosis in the operation area of the State Sanitary-Epidemiological Station in Zamosc (PSSE) in 2013 and 2014. The scope of the research included the Zamosc city and county residents. The data came from the archives of the PSSE. All cases were documented. The main etiological agent of the disease was *Salmonella enteritidis*, which accounted for 88.8% of the total number of cases in 2013 and 87.5% in 2014, respectively. Most cases were reported in the youngest age group of cases (30.8%) in that time interval. It is important to note that in 2013 and 2014 the number of salmonellosis cases showed a downward trend from 18 to 8.

Słowa kluczowe: *Salmonella*, epidemiology, serotype, *Salmonella typhimurium*, *Salmonella enteritidis*, infection

INTRODUCTION

Food poisoning is a common cause of outbreak, which manifest as acute disorders of the gastrointestinal tract. These disorders occur most often after consuming the food containing ingredients harmful for health and human life. The World Health Organization (WHO) now recommends the name: foodborne and waterborne diseases [Dziubek 2005].

Epidemiological data have shown that the foodborne diseases, both in Poland and in other EU member states, were usually of bacterial origin, and their main cause was bacteria of *Salmonella* genus [Kępińska 2006]. In the last decade, the number of poisonings in countries with a high degree of life quality showed a downward trend, nevertheless infections caused by zoonotic intestinal rods of *Salmonella* are still the most common cause of foodborne poisoning.

Salmonellosis, compared to other zoonosis in humans, among all countries, are widespread in the Eastern Europe to the highest degree, therefore, due to its two-way action (farm, human), monitoring should be a priority of the disease.

The aim of the study was to characterize the occurrence of salmonellosis in the area of functioning of the State Sanitary-Epidemiological Station in Zamosc (PSSE) in 2013 and 2014.

MATERIAL AND METHODS

The study conducted in 2016 included an assessment of the epidemiological situation of salmonellosis in the area of PSSE in Zamosc operation in 2013 and 2014. Archived data from the forms on epidemiological investigations from PSSE laboratory were the basis of the study.

Classification of cases caused by the zoonotic types of *Salmonella* rods was carried out in accordance with applicable procedures and criteria established by the European Commission and criteria applicable in Poland for the purpose of epidemiological surveillance. A retrospective study covered data from the years 2013–2015 included in the archival documentation; only confirmed cases with recognized sources of infection were included. The characteristics of the assessment included the division of patients into gender and age groups: 0–4 years, 5–14 years, 15–19 years, 20–60 years and over 60 years of age. The study results are summarized in tabular form.

RESULTS AND DISCUSSION

The knowledge of the etiology of infection and identification of the pathogen play a crucial role in decision of the proper treatment. An appropriate identification of specific pathogens is only available in research laboratories [Gómez-Duarte *et al.* 2009].

During the research in 2013–2014, on the basis of the results for fecal samples analyzed in the laboratory of the State Sanitary-Epidemiological Station in Zamosc, 18 cases of salmonellosis in 2013 and 8 cases in 2014 were found (table 1).

Table 1 summarizes the results of *Salmonella* occurrence in particular months of the year. Most cases in the first year of observation were recorded in April and June, a single disease events occurred in January, March, and May, and two more cases were recorded in July and September. In the remaining months, there were no cases.

In the second year of the study (2014), the disease cases occurred in January, May, July, and August as well single ones in September and October. The confirmation of the trend existing for the last few years that majority of cases falls in the summer months, are also the results of own research, in which the share of cases usually occurs in June, April, and July.

Age plays an important role in the incidence of disease due to *Salmonella*. Long-term studies of different authors show that elderly people, usually above 60 years of age and children in the first group from 0 to 4 years, are the most vulnerable to this disease [Sadkowska-Todys and Czarkowski 2011, GIS 2011–2014, Staszewska-Kwak *et al.* 2004]. This is associated with the fact of impaired immunological barrier not fully devel-

oped at children, while weakened due to illnesses in older groups, and most of all the age. The results of the salmonellosis occurrence relative to the age groups are shown in table 2.

Table 1. Occurrence of salmonellosis in the area of PSSE in Zamosc functioning in 2013–2014

Tabela 1. Występowanie slamonelloz na terenie PSSE w Zamościu w latach 2013–2014

Year Rok	Month/ Miesiąc												Total Razem
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2013	1	0	1	4	1	7	2	0	2	0	0	0	18
2014	1	0	0	0	1	0	2	2	1	1	0	0	8
n	2	0	1	4	2	7	4	2	3	1	0	0	26
%	7.7	0	3.8	15.4	7.7	26.9	15.4	7.7	11.6	3.8	0	0	100

Table 2. Salmonellosis occurrence relative to the age groups in 2013–2014

Tabela 2. Występowanie salmonelloz z uwzględnieniem grup wiekowych w latach 2013–2014

Patient's age Wiek pacjenta w latach	2013		2014		Total Razem	
	n	%	n	%	n	%
0–4	8	44.4	0	0	8	30.8
5–14	3	16.7	2	25	5	19.2
15–19	2	11.1	1	12.5	3	11.5
20–60	5	27.8	2	25	7	27.0
>60	0	0	3	37.5	3	11.5
Total Razem	18	100	8	100	26	100

Most cases (as much as 44.4%) were recorded at patients from the youngest age range, then at people of 20 to 60 years of age (27.8%) in 2013. In 2014, despite the small number of cases, their vast majority occurred at patients over 60 years of age (table 1). Among the identified cases during these two years of study, the same number of cases (13) in men and women were found (table 3).

The course of disease caused by *Salmonella* rods depends on the overall nutritional status and comorbidities. The lack of available professional care and antibiotics in some parts of the country means that infections can pose a serious threat to life [Paul 2013]. Higher risk occurs in children up to 7 years of age, especially due to typhoid fever, while paratyphoid fever, which has a milder course, makes the risk lower [Toporowska-Kowalska *et al.* 2007, Paul 2013]. It happens that the infection may also have a chronic

course and dyspeptic symptoms may persist for several months [Toporowska-Kowalska *et al.* 2007]. The source of infection with *Salmonella* for human is usually food contaminated with diseased animals' feces as well as food products and water. In a study conducted in Poland under the official food and poisoning control performed in 2004–2007, *Salmonella* bacterium strains were isolated from confectionery, poultry products and convenience foods, but also from pasta, fish or groats [Mąka *et al.* 2010]. In 2014, 8392 cases of illness caused by *Salmonella* were confirmed (including 8197 of food poisonings). This is more than in the previous year, when the number was 7578 cases (including 7407 of food poisonings). The increase in the number of cases was, as in previous years, seasonal nature or was a continuation of the long-term trends earlier observed [GIS 2015, Sadkowska-Todys and Czarkowski 2015]. In Poland and other European Union countries, there is a tendency to the appearance of *Salmonella* strains with unusual antigenic properties increasing pathogenicity or drug resistance [Ścieżyńska *et al.* 2012]. According to data from 2008, most of salmonellosis cases were found in Germany, the UK and the Czech Republic, whereas the smallest in Malta [Osek and Wiczorek 2010].

Table 3. Salmonellosis occurrence relative to the genders in 2013–2014
Tabela 3. Występowanie salmonelloz z uwzględnieniem płci w latach 2013–2014

Gender Płeć	2013		2014		Total Razem	
	n	%	n	%	n	%
Women Kobiety	8	61.5	5	38.5	13	100
Men Mężczyźni	10	77.0	3	23.0	13	100

The epidemiological information shows that among all Polish provinces, the majority of cases in 2014 were recorded in Mazovian province (1573), then in the Malopolska province (845). In Lublin province, 602 cases were recorded, which ranked it at the 6th position in the country. The incidence rate per 100 thousand population was 28.0; 336 people were hospitalized.

The largest number of cases in 2015 was also reported in Mazovian province (1394), followed by 1 000 cases in Malopolska province. The lowest number of incidences was recorded in Lubuskie province. Lublin province was ranked at 8th place in terms of the number of cases: 535 case were documented; incidence rate per 100 thousand residents was lower than in the previous year and amounted to 25.0, while 408 patients were hospitalized [GIS 2014–2015].

The incidence of disease and its course is largely dependent on the serotype of *Salmonella* strain. Differentiation of *Salmonella* spp. strains within species and subspecies is based mainly on the analysis of biochemical features and antigenic structure, which allows the division into 46 serotype groups [Boyd *et al.* 1996, Brenner *et al.* 2000, Hoszowski and Wasyl 2000]. All *Salmonella* serotypes are considered to be potentially

pathogenic to humans and/or animals. Depending on the serotype and *Salmonella* spp. strain, variations in pathogenicity and specificity of infection towards different species of organisms are recorded [Sanchez-Vargas *et al.* 2011]. *Enteritidis* and *typhimurium* are the most common serotypes causing salmonellosis in the EU. The severity of illness in the EU countries has also been seen in the period from June to October [Osek and Wieczorek 2010]. It is caused by various serotypes (varieties secreted on the basis of their recognition by specific antibodies) of *Salmonella* sp. bacteria. Serotype *S. enteritidis* is most often isolated from hens and chickens, as well as from people; in turn, *S. typhimurium* from waterfowl such as ducks and geese, as well as pigeons. *Salmonella* sp. bacteria are characterized by high resistance to environmental conditions. They survive up to four months in the water [Toporowska-Kowalska *et al.* 2007], and they grow within broad temperature range (5-46 °C). These bacteria are very resistant to drying and freezing [Sanchez-Vargas *et al.* 2011]. These features of *Salmonella* sp. determine the high rate of salmonellosis incidence, which in 2006 was 35 per 100 thousand inhabitants (13 362 cases in Poland), and in 2005, it was even higher i.e. 42 per 100 thousand inhabitants (16 006 cases) [Czerwiński *et al.* 2008].

Table 4. The percentages of *Salmonella* cases taking into account the serotypes in 2013–2014
Tabela 4. Wartości procentowe przypadków występowania *Salmonelli* z uwzględnieniem serotypów w latach 2013–2014

Serotype of <i>Salmonella</i> Serotyp <i>Salmonelli</i>	2013	2014
	%	%
<i>S. typhimurium</i>	5.6	0
<i>S. virchow</i>	5.6	0
<i>S. enteritidis</i>	88.8	87.5
<i>S. infantis</i>	0	12.5
Total Razem	100	100

The most common causes of infection are serotypes of *Salmonella enteritidis* and *Salmonella typhimurium*. Some of the *Salmonella* serotypes are adapted to a single host, for example *S. dublin* to cattle, *S. choleraesuis* to pigs, *S. gallinarum* and *S. pullorum* to poultry, which does not mean a lack of their pathogenicity to other species, including humans. Others, mainly *Salmonella enteritidis* and *Salmonella typhimurium*, are isolated from a variety of animals and a man [Kłapeć and Stroczyńska-Sikorska 2011].

Our study showed that, among the existing serotypes, the most common were *Salmonella enteritidis* (88.8%), *S. virchow* and *S. typhimurium* (5.6% each), and *S. infantis* (only 12%). Results from the operation area of PSSE in Zamosc for 2013 and 2014 are summarized in table 4.

The trend of serotypes occurrence reported in the present study confirmed the nationwide and worldwide tendencies: the most common cause of illness was *Salmonella enteritidis*.

Table 5. The incidence of infection with *Salmonella enteritidis* rods in 2013–2014
Tabela 5. Zapadalność na zakażenia pałeczką *Salmonella enteritidis* w latach 2013–2014

Incidence Zapadalność		Zamosc city Miasto Zamość	Zamosc county Powiat zamojski	Total Razem
2013		2	13	15
2014		1	6	7
Total Razem	n	3	19	22
	%	13.6	86.4	100

The fundamental element of salmonellosis risk reduction is rapid recognition and prevention. It is urgent to find a way of spreading the germ, halt its spread by introduction of a sanitary rigor at all stages of raw materials processing and products. The basic element in the implementation of these activities is to monitor the presence of *Salmonella* [Tietze *et al.* 2007]. Hence, performing the research in this area within the area of PSSE in Zamosc operation is by all means justified.

CONCLUSIONS

1. The occurrence of salmonellosis in the area of functioning of the State Sanitary and Epidemiological Station in Zamosc in 2013 and 2014 showed a downward trend.
2. Most cases were reported in the youngest age group, children from 0 to 4 years old.
3. The main etiological agent of the disease was *Salmonella enteritidis*, which comprised 88.8% of cases during the study period.

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Streszczenie. Celem pracy była charakterystyka występowania salmonelloz na terenie działania Państwowej Stacji Sanitarno- Epidemiologicznej (PSSE) w Zamościu w latach 2013–2014. Zakres badań obejmował miasto Zamość i mieszkańców powiatu zamojskiego. Dane pochodziły z archiwum Stacji. Wszystkie przypadki były udokumentowane. Głównym czynnikiem etiologicznym schorzenia była *Salmonella enteritidis*, która stanowiła 88,8% w ogólnej liczbie zachorowań w 2013 r. i 87,5% w 2014. Najwięcej zachorowań odnotowano w najmłodszej grupie wiekowej: 30,8% przypadków w badanym przedziale czasowym. Warto podkreślić, że w latach 2013 i 2014 liczba zachorowań na salmonellozy w rejonie działania PSSE Zamość wykazywała tendencję malejącą.

Słowa kluczowe: *Salmonella*, epidemiologia, serowar, *Salmonella typhimurium*, *Salmonella enteritidis*, zakażenie