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EVALUATION OF *SALMONELLA* ROD INCIDENCE IN POULTRY IN THE LUBLIN PROVINCE OVER THE YEARS 2001–2005

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Abstract: The researches included geese, broiler chickens and reproductive laying hens. The occurrence of *Salmonella* rods assigned to the serovars in the bird flocks was assessed for the years 2001–2005. In geese, during 2001–2003, *S. typhimurium* was isolated most frequently, whereas in 2004 – *S. enteriditis* (42.8%). Throughout the research period, in the flocks of reproductive laying hens, the *S. enteriditis* proved the most commonly reported serovar (67.8%). Among broiler chickens in 2001, *S. typhimurium* prevailed by only a slight percentage (45.1%). In the bird flocks under investigation, the highest *Salmonella* rate was obtained from the dead embryos, followed by cloacal swabs, inner organs of birds and faeces, while the lowest was detected in the litter obtained from chick breeding boxes.

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INTRODUCTION

For many years, *Salmonella* rods have remained a significant public health problem causing food poisoning in humans. Poultry, poultry meat products and mainly eggs, representing an important source of the bacteria, constitute a major hazard for consumers' health [1, 7]. The contamination of slaughter chicken carcasses with *Salmonella* rods also has been shown. However, despite the presence of the pathogen in poultry meat and products, it does not constitute the main cause of food poisoning in humans because of the various appropriate thermal processes applied [2, 10, 11].

Food poisoning reported after the consumption of eggs is developed most often by the serovar *S. enteritidis* [4, 5, 18]. However, the presence of the clinical symptoms produced by these bacteria in the human organism is usually associated with the increase of bacteria count up to 1×10^5 [9]. Whereas, *Salmonella* proliferation in egg contents is commonly caused by inappropriate storage conditions of eggs or their further processing [8].

Gast [5] emphasizes the significance of *Salmonella* control strategy for bacteria detection and prophylaxis, as well as its efficiency to reduce the incidence of *Salmonella* infections in egg-laying hens and thus, in humans in several countries. According to Eblen *et al.*, [3], the percentage of *Salmonella* rods in the USA in 1997 and 1998 reached 13.7% in geese, whereas in turkeys 19.6%.

The reservoir of salmonellae includes domestic and free-range animals, poultry and wild birds, as well as cattle manure and soil. The *Salmonella* infections recognized in birds proved quite hard to cope with due to their long-term carrier state and spread of the organisms. Most frequently,

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salmonellosis in poultry is produced by the serovar *S. enteriditis* [1, 2, 6, 7, 11].

Hoszowski and Wasyl [6] believe that broiler hatchery contamination with *Salmonella* rods induces this pathogen occurrence in the poultry flocks. In Poland, *Salmonella* was detected in 63.4% of samples collected in the hatchery plants. This is also connected with the higher rates of contamination found in the commercial poultry flocks than those for breeding. However, Mollenhorst *et al.*, [13] proved that a breeding system, flock management practices and rearing conditions create the major risk factors of *S. enteriditis* infections in laying hens at various ages.

Taking into account the above-mentioned data, it seems advisable to assess *Salmonella* rod occurrence in poultry in the Lublin Province over the five years' period.

MATERIAL AND METHODS

Research was performed on the basis of the present author's studies and data supplied by the Laboratory of Veterinary Hygiene in Lublin. The incidence of *Salmonella* rod in geese, broiler chickens and reproductive laying hens in the Lublin Province was evaluated for the years 2001–2005, with a consideration of the percentage of each bacteria serovar. The research material consisted chiefly of faecal swabs collected 2–3 weeks prior to birds' slaughter. To obtain reliable results, 20 swabs were taken from each flock. The dead birds, including day-old chicks, were investigated by isolating bacteria from internal organs (heart and liver). The dead embryos were also investigates. Swabs were also collected from cloaca and the litter from the chick breeding boxes.

Salmonella rods were identified according to the Polish norm PN-EN ISO 6579 [15]. The collected material was inoculated on buffered peptone water, after which salmonellae were multiplied on the liquid medium Rappaport Vassiliadis (RV) and agar media BG and XLD. There were also assayed the biochemical characteristics of bacteria. Salmonellae were assigned to a serological type on the grounds of the glass slide agglutination method using diagnostic sera specific for the somatic antigens.

RESULTS

The research results obtained are presented in Table 1 and 2. The investigations covered 1,090 flocks of geese, 3,658 of broiler chickens and 1,064 of reproductive laying hens. Evaluation of *Salmonella* rods occurrence in the goose flocks revealed the highest rate of the infected birds in 2001 (8.1%), while the lowest (3.7%) in 2005. Over the years 2001–2003, the serovar *S. typhimurium* was identified most frequently, whereas in 2004 – *S. enteriditis* prevailed (42.8%). As for the broiler chicken flocks, the highest number of this pathogen-induced infection was traced in 2002 (9.7%) and the lowest in 2005 (5.6%). Only in 2001, a slightly higher percentage of *S. typhimurium* was noted (45.1%), while in some other years *S. enteritidis* predominated (Tab. 1). The highest rate of this in the serovar-positive flocks was recorded in 2004 (79.5%), whereas the third identified serovar proved to be *S. derby*. The infection rate of this last serological type reached 4.5% throughout the research period. In the laying hens, the highest percentage of *Salmonella* rods presence was established in 2003 (7.7%) and the lowest in 2005 (3.4%). During the five-year

Table 1. *Salmonella* serovars isolated from poultry studied.

Poultry	Year	Number of poultry studied	Number of (%) floocks infected	*S. typhimurium* Num. (%)	*S. enteritidis* Num. (%)	*S. derby* Num. (%)	*S. anatum* Num. (%)	*S. dublin* Num. (%)	*S. hadar* Num. (%)
Geese	2001	236	19 (8.1)	11 (57.0)	3 (15.8)	–	–	–	–
	2002	251	10 (4.0)	6 (60.0)	2 (20.0)	–	–	2 (2.2)	–
	2003	260	12 (4.6)	7 (58.3)	4 (33.3)	–	1 (8.3)	–	–
	2004	180	7 (3.9)	1 (14.3)	3 (42.8)	1 (14.3)	–	–	–
	2005	163	6 (3.7)	2 (33.0)	2 (33.3)	–	–	–	1 (16.7)
Total (mean)		**1090**	**54 (4.9)**	**27 (44.8)**	**14 (29.0**	**1 (14.3)**	**1 (8.3)**	**2 (2.2)**	**1 (16.7)**
Broilers chicken	2001	827	51 (6.2)	23 (45.1)	21 (41.2)	2 (3.9)	–	2 (3.9)	–
	2002	910	88 (9.7)	27 (30.7)	56 (63.6)	3 (3.4)	–	–	–
	2003	741	48 (6.5)	12 (25.0)	28 (58.3)	–	–	–	–
	2004	612	44 (7.2)	7 (15.9)	35 (79.5)	–	–	–	–
	2005	568	32 (5.6)	10 (31.3)	18 (56.3)	2 (6.2)	–	–	1 (3.1)
Total (mean)		**3658**	**263 (7.0)**	**79 (29.6)**	**158 (59.8)**	**7 (4.5)**	**–**	**2 (3.9)**	**1 (3.1)**
Reproductive laying hens	2001	250	15 (6.0)	5 (33.3)	8 (53.3)	–	–	–	–
	2002	251	12 (4.8)	3 (25.0)	7 (58.3)	–	–	–	–
	2003	273	21 (7.7)	3 (14.3)	17 (80.9)	1 (4.8)	–	–	–
	2004	142	6 (4.2)	1 (16.7)	4 (66.6)	–	–	–	–
	2005	148	5 (3.4)	–	4 (80.0)	–	–	–	1 (20.0)
Total (mean)		**1064**	**59 (5.2)**	**12 (22.3)**	**40 (67.8)**	**1 (4.8)**	**–**	**–**	**1 (20.0)**

period evaluated, the highest number of *S. enteritidis* salmonellae (67.8%) was traced. This serovar predominated markedly, especially in 2003 (80.9%). The other serovars were recorded much more occasionally (Tab. 1).

The *Salmonella* presence was assayed in faeces, dead embryos, internal organs of birds, swabs taken from cloaca and the litter from chick breeding boxes (Tab. 2). During the investigations carried out on the goose flocks in the years 2001–2005, the highest rate of bacteria was isolated from the dead embryos (61.8%), lower from the cloacal swabs (21.0%), and the lowest from the litter from the chick boxes (1.5%). Similar results were obtained for the broiler chickens and reproductive layers. Assessment of the broiler chickens and laying hens infection with salmonellae also revealed the highest numbers of the microorganisms in the dead embryos – respectively 56.7% and 59.6%. The samples taken from cloacal swabs showed nearly the same percentage of bacteria, i.e. 22.6% and 22.4%. Some lower level of *Salmonella* was isolated from the internal organs (10.3% and 9.1%) and the lowest from the litter of chick breeding boxes (3.1% and 1.5%).

Table 2. Percentage of *Salmonella* content in samples studied.

Year	Faeces	Dead embryos	Inner organs	Swabs from cloaca	Litter from chick breeding boxes
Geese					
2001	8.1	53.5	18.2	19.1	1.1
2002	6.5	63.2	8.7	21.6	–
2003	10.2	61.2	7.8	18.5	2.3
2004	8.4	59.6	5.2	25.7	1.1
2005	4.1	71.7	3.9	20.3	-
Mean	7.5	61.8	8.8	21.0	1.5
Chicken broilers					
2001	19.8	31.7	20.4	21.7	6.4
2002	3.8	72.1	8.2	15.9	–
2003	6.4	58.7	7.3	25.4	2.2
2004	5.1	61.9	6.8	24.7	1.5
2005	4.9	59.0	8.7	25.1	2.3
Mean	8.00	56.7	10.3	22.6	3.1
Reproductive laying hens					
2001	12.6	40.8	22.4	23.1	1.1
2002	5.1	68.2	6.5	20.2	–
2003	9.7	58.8	5.1	24.9	1.5
2004	3.2	66.6	6.1	21.8	2.3
2005	7.8	63.6	5.4	22.1	1.1
Mean	7.7	59.6	9.1	22.4	1.5

DISCUSSION

Salmonellosis in the poultry flocks has been the most frequently reported disease, yet over the decades a decline of this pathogen detectability has been noted. The studies conducted in the years 2001–2005 demonstrated a reduction of *Salmonella* induced poultry infections in all the poultry species investigated. According to Hoszowski and Wasyl [6], in 2004 in Poland the infected flock percentage for slaughter geese amounted to 5.9% and 1.6% for reproductive geese;

S. agona Num. (%)	*S. virhow* Num (%)	*S. saint–paul* Num. (%)	*S. thompson* Num. (%)	*S.* of group B	*S.* of group C	*S.* of group C_1	*S.* of group C_2	*S.* of group E
–	–	–	–	2 (10.5)	3 (15.8)	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
1 (14.3)	–	–	–	–	–	1 (14.3)	–	–
1 (14.3)	–	–	–	–	–	–	–	–
2 (15.5)	**–**	**–**	**–**	**2 (10.5)**	**3 (15.8)**	**1 (14.3)**	**–**	**–**
–	–	–	–	2 (3.9)	1 (2.0)	–	–	–
1 (1.1)	1 (1.1)	–	–	–	–	–	–	–
3 (6.2)	1 (2.1)	–	–	–	–	2 (4.2)	–	1 (2.1)
–	–	1 (2.3)	1 (2.3)	–	–	–	1 (2.3)	–
–	–	–	–	–	–	1 (3.1)	–	–
4 (3.6)	**2 (1.6)**	**1 (2.1)**	**1 (2.3)**	**2 (3.9)**	**1 (2.0)**	**3 (3.6)**	**1 (2.3)**	**1 (2.1)**
–	–	–	–	1 (6.7)	1 (6.7)	–	–	–
1 (8.3)	–	–	1 (8.3)	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	1 (16.7)	–	–	–	–
1 (8.3)	**–**	**–**	**1 (8.3)**	**2 (11.7)**	**1 (6.7)**	**–**	**–**	**–**

whereas, in the chicken broiler flocks, the percentage of *Salmonella*-positive flocks was 7.7% and in the laying hens – 5.3%.

Among the identified serovars, *S. typhimurium* predominated only in geese (in 27 flocks out of 54 infected). In these birds, though, in south-eastern Poland over the years 2001–2005 *S. enteritidis* [18] was diagnosed more frequently. In broiler chickens, the serovar *S. enteritidis* dominated, which is supported by Hoszowski and Wasyl [6] whose studies proved that this *Salmonella* serovar has been the most frequently reported both, Poland and the worldwide. These bacteria are chiefly transmitted by the eggs originating in the infected parent flocks and afterwards penetrate the hatched chicks. Strzałkowski *et al.* [17] who recovered the *Salmonella* rods from dead broiler chicks showed that serovar *S. enteritidis* (90.88%) also had the highest rate, followed by *S. choleraesuis* (7.56%) and *S. typhimurium* (1.56%). While Mituniewicz *et al.* [12], evaluating the *Salmonella* presence in the poultry flocks in the Warmińsko-mazurskie Province in the years 2001–2005, reported the highest incidence of *S. typhimurium*. Roy *et al.* [16], isolating the *Salmonella* rods from the poultry products, poultry and environmental samples, showed the presence of the following serovars: *heidelberg* (25.77%), *kentucky* (21.64%), *montevideo* (11.34%), *hadar* and *enteritidis* (5.15%), *infantis*, *typhimurium*, *ohio* and *thompson* (4.12%).

Investigations of the laying hens also showed predominance of *S. enteritidis* and *S. typhimurium* over the other serovars. Whereas Otomo *et al.* [14], evaluating the *Salmonella* incidence in the hen farms in northern Japan, detected the following serovars: *S. enteritidis*, *S. corvallis*, *S. typhimurium* and *S. infantis*.

The highest number of *Salmonella* rods was isolated from the dead embryos and cloacal swabs.

The poultry lines used currently are genetically selected for the highest performance and, as a consequence, are more susceptible to infections. This fact necessitates the implementation of the appropriate preventive measures, both specific and non-specific.

CONCLUSION

The numerous legal regulations have given high priority to prevention and control of *Salmonella* induced infections, yet this pathogen still remains a hazard for human and animal health. However, a recent decrease has been noted in the reported incidence of poultry infection due to salmonellae.

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