https://doi.org/10.17221/188/2020-VETMED

Estimation of the prevalence of respiratory diseases in pigs in north-eastern Poland: Survey of pulmonary lesions in pigs at a slaughterhouse

Paulina Przyborowska-Zhalniarovich[2], Yauheni Zhalniarovich[2], Krzysztof Wasowicz[1]*

[1]*Department of Pathophysiology, Forensic Veterinary and Administration, Faculty of Veterinary Medicine, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland*
[2]*Department of Surgery and Radiology with Clinics, Faculty of Veterinary Medicine, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland*

**Corresponding author: zolnierowicz.eugeniusz@gmail.com*

Citation: Przyborowska-Zhalniarowicz P, Zhalniarovich Y, Wasowicz K (2021): Estimation of the prevalence of respiratory diseases in pigs in north-eastern Poland: Survey of pulmonary lesions in pigs at a slaughterhouse. Vet Med-Czech 66, 242–247.

Abstract: A total of 29 520 animals, from 164 batches of pigs belonging to an identical number of herds, were involved in the study. The considered population of pigs were limited to the region of north-eastern Poland involving six voivodeships. From each herd, samples of blood were collected to evaluate the antibody titres to *Mycoplasma hyopneumoniae*, porcine reproductive and respiratory syndrome virus, Aujeszky's disease virus and swine influenza virus. At an abattoir, the lung lesions of each batch were scored and the enzootic pneumonia-like lesion average value was calculated. Lesions, indicative of enzootic pneumonia, were found in 57.8% of the lungs. For all lungs, the enzootic pneumonia-like lesion average value was 1.74, ranging from 0.42 to 3.56 among the 164 batches. In the examined pig population, 57.8% were considered suffering from swine respiratory disease, the majority of the affected pigs came from the Podlaskie (21.7%) and Greater Poland (17.25%) voivodeships. In the most affected voivodeships, 88.37% and 85.16% of the farms were considered as disease-susceptible for Greater Poland and Podlaskie, respectively. The findings indicate that, in pigs in north-eastern Poland, the major pathogens causing pneumonia-like lesions are *Mycoplasma hyopneumoniae* (68.9%) and porcine reproductive and respiratory syndrome virus (44%).

Keywords: enzootic pneumonia; mycoplasmas; swine

To protect public health as well as animal health and welfare, the official inspection on products of animal origin intended for human consumption are essential. Check results undertaken regularly by meat inspectors in abattoirs take on a crucial meaning for the consumer as well as for farmers and veterinarians. Moreover, procedures are a valuable tool in evaluating and monitoring the risk factors and the effect of diseases (Merialdi et al. 2012; Steinmann et al. 2014).

In many countries, the recording of lung lesions in abattoirs is a common practice, thus, it has been widely used to estimate the severity and prevalence of respiratory diseases. At present, the swine/porcine respiratory disease complex (SRDC/PRDC) also referred as swine respiratory disease (SRD), is presumably the most significant health concern. In the swine industry, it is widespread in modern intensive pig farms worldwide and leads to serious economic losses. The presence of coinfections, and the man-

https://doi.org/10.17221/188/2020-VETMED

agement and housing conditions have an influence on the severity of respiratory diseases. Multiple infectious agents: viruses (porcine respiratory and reproductive syndrome virus – PRRSV, swine influenza virus – SIV, Aujeszky's disease virus), mycoplasmas (*Mycoplasma hyopneumoniae – M. hyopneumoniae*) and bacteria (*Pasteurella multocida – P. multocida*) are usually involved in SRD (Maes et al. 2001; Fraile et al. 2010; Meyns et al. 2011; Merialdi et al. 2012; Garcia-Morante et al. 2016).

Cranioventral pulmonary consolidations (CVPC) are the main pulmonary lesions found in abattoir inspections. Those pathological changes are also called enzootic pneumonia-like (EP-like) lesions as the crucial bacterial respiratory pathogen responsible for enzootic pneumonia disease and involved in such lung lesions is *M. hyopneumoniae* (Fraile et al. 2010; Meyns et al. 2011; Garcia-Morante et al. 2016).

Moreover, concerning the production traits, it was proven that pigs with severe lesions in the lungs had the lowest liveweight, meatiness and hot carcass weight, the highest pH value 45 min after slaughtering (pH_{45}) and the highest occurrence of dark, firm, dry (DFD) and pale, soft, exudative (PSE) meat. The significant downgrade in the carcass value and the major deterioration in meat quality were caused by presence of lung lesions (Karabasil et al. 2017).

To date, numerous contemporary studies have described the prevalence of respiratory diseases and lung lesions at slaughter in the recordings in different countries; however, such phenomena in Poland have not yet been assessed.

The aims of the present study were to investigate the prevalence of lung lesions at abattoirs in north-eastern Poland and to identify the major factors potentially associated with the severity of lesions in the finishing pig population.

MATERIAL AND METHODS

A total of 164 batches of pigs from 164 different farms were screened. A batch was defined as a group of 180 pigs belonging to the same farm that were killed on the same day at the abattoir. Blood samples from a random sample of ten pigs from each batch were collected at slaughter. Antibody titres to *Mycoplasma hyopneumoniae*, Aujeszky's disease virus, porcine reproductive and respiratory syndrome virus and swine influenza virus were tested (IDEEX). Broncho pneumonic lesions, an EP-like lesion – purple to grey pulmonary consolidation areas, predominantly located bilaterally in the cranioventral areas (Maes et al. 2001) were scored at the slaughterhouse. All the pigs were examined by the first author. The scoring system used to quantify the EP-like lung lesions was Madec's grid, where each lobe was evaluated according to the classification shown in Table 1 (Madec and Kobisch 1982; Morisson et al. 1985). An EP-like lesion average value (sum of the single lung EP-like lung score/number of scored lungs) was then calculated for all the lungs. Then, the EP-like lesion average value of each farm was calculated as the mean score of all the evaluated lungs.

Table 1. Enzootic pneumonia-like lesion scoring system (Madec and Kobisch 1982)

Enzootic pneumonia-like lesions (per lobe)	Score
No lesions	0
Lesion affecting < 25% of the lobe surface	1
Lesion affecting 25–49% of the surface	2
Lesion affecting 50–74% of the surface	3
Lesion affecting > 75% of the surface	4

The examined pigs were divided into disease-susceptible and disease-resistant groups based on their EP-like lesion average value. In the pig population, the EP-like lesion average value score of 1 indicates that the animal did not suffer from SRD (disease-resistant group) and the farm is disease resistant. While the EP-like lesion average value score of > 2 indicates that the pig suffered from SRD (disease-susceptible group) and the farm is disease susceptible.

RESULTS AND DISCUSSION

The pig population distribution in each geographical region is presented in Table 2. A total of 29 520 pigs from 164 different farms were examined. A total of 29 520 lungs were evaluated. The average number of lungs scored per batch was 180 (min. 77 – max. 190). The serological findings are summarised in Table 3 and Table 4. At slaughter, 92% of the herds were seropositive to *M. hyopneumoniae*. All the herds seropositive to PRRSV were also seropositive to *M. hyopneumoniae*. Antibodies against swine influenza virus H1N1 were detected in forty herds, while 12/40 (30%)

https://doi.org/10.17221/188/2020-VETMED

Table 2. Geographical distribution of the pig farms screened for cranio-ventral pulmonary consolidation by region

Polish voivodeships	Pig population (%)	Number of batches taken	Total number of lungs	Number of disease-susceptible farms	Number of disease-resistant farms
Podlaskie	26.22	43	7 740	38	7
Warmian-Masurian	11.59	19	3 420	14	7
Pomeranian	20.73	34	6 120	19	15
Kuyavian-Pomeranian	5.49	9	1 620	6	4
Masovia	19.51	32	5 760	13	12
Greater Poland	16.46	27	4 860	23	6
Total	100.00	164	29 520	113	51

Table 3. Serological results for 164 pig herds

	Number of seropositive herds	% of herds with pneumonia-like gross lesions
Mhyo	151	68.9
PRRSV	121	44
SIV (H1N1)	40	24.3
Auy	0	0

Auy = Aujeszky's disease virus; Mhyo = *Mycoplasma hyopneumoniae*; PRRSV = porcine respiratory and reproductive syndrome virus; SIV (H1N1) = swine influenza virus

herds were also seropositive to PRRSV and *M. hyopneumoniae.* Broncho pneumonic lesions suggestive of enzootic pneumonia (EP-like) were detected in 17 063 (57.8%) of the lungs (Figure 1). In the region of north-eastern Poland, the highest frequency of lung lesions was found in the pig population from the Podlaskie (21.7%) and Greater Poland (17.25%) voivodeships. In the rest of the regions, the frequency was four times lower – under 5.55% (Figure 1). The EP-like lesion average value was 1.74 for all the lungs and 3.25 for the affected lungs. The EP-like lesion score in the batch of slaughtered pigs ranged from 0.42 to 3.56.

A total of 113 farms were considered as disease-susceptible (68.9%) while 51 farms were considered as disease-resistant (31.1%). The mean of EP-like lesion average value [mean ± standard deviation (SD)] in the disease-susceptible farms (3.25 ± 1.3) was numerically higher than that of the disease-resistant farms (1.12 ± 0.7).The potential major risk factors of lesions were associated with *M. hyopneumoniae* together with PRRSV and *M. hyopneumoniae* with SIV – fifty-two and twenty-eight herds, respectively. *M. hyopneumoniae* was potentially associated with pulmonary lesions in twenty-one herds. The combined infection of *M. hyopneumoniae*, PRRSV and SIV was a potential cause of pulmonary lesions in twelve herds. The most disease-susceptible farms were located in the Greater Poland (85.16%) and Podlaskie (88.37%) voivodeships (Figure 2).

Table 4. Description of the variables related to the lung lesions and infection variables that characterised the examined 164 herds

Variable	General sample 164 herds	
	mean	SD
Clinical signs of macroscopic lesions		
EP-like lesions median score in the batch of slaughter pigs	2.2	1.57
% of pigs with EP-like lesions	57.8	21.4
Infectious status of the batch		
% *M. hyopneumoniae* positive batch	92	–
% of batch with antibodies to PRRSV	74	–
% of batch with antibodies to SIV (H1N1)	24.2	–

To best of our knowledge, this is the first survey study of the risk factors associated with lung lesions in pigs slaughtered in Poland. The present study provides new insights into the severity and prevalence of pulmonary lesions of pigs in north-eastern Poland. Six voivodeships were taken under consideration: Podlaskie, Warmian-Masurian, Masovia, Pomeranian, Kuyavian-Pomeranian and Greater Poland. The most significant conclusion indicates that cranio-ventral pulmonary consolidations were frequently detected (57.8%) in the population of pigs in the screened region of Poland. Generally, in European countries, the prevalence of pulmonary lesions ranges from 19% to 79% in pigs, however, the large divergence in the range

https://doi.org/10.17221/188/2020-VETMED

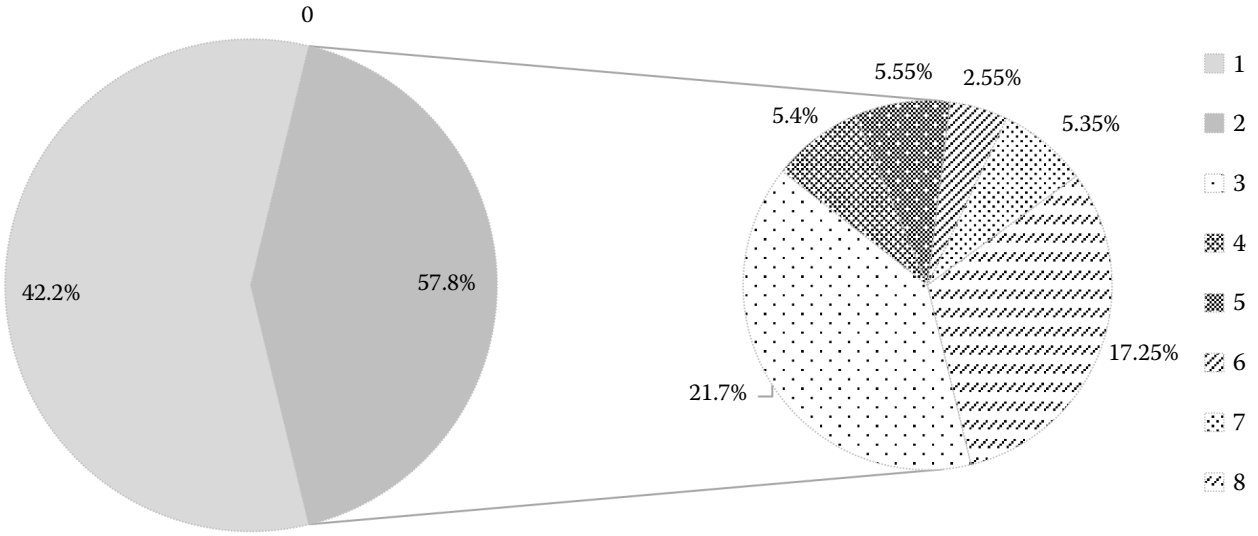

Figure 1. Pie chart involving the percentage of healthy (1) and affected (2) pigs in the investigated population. The small pie – the percentage of affected pigs in a certain voivodeship: (3) Podlaskie, (4) Warmian-Masurian, (5) Pomeranian, (6) Kuyavian-Pomeranian, (7) Masovia, (8) Greater Poland

Figure 2. Geographical distribution of the percentage of pig farms considered as disease-susceptible by region

depends on the country and the lung lesion scoring system that is used (Falk and Lium 1991; Lium and Falk 1991; Grest et al. 1997; Cleveland-Nielsen et al. 2002; Fraile et al. 2010; Meyns et al. 2011; Fablet et al. 2012; Merialdi et al. 2012). Depending on the voivodeship, the prevalence of pulmonary lesions

https://doi.org/10.17221/188/2020-VETMED

in the pig population ranged from 2.55% to 21.7%, thus, the divergence of the range was also significant (Figure 1). The highest prevalence of pulmonary lesions was noted in pigs from the Podlaskie and Greater Poland voivodeships, where the majority of Polish pig production occurs.

In the worldwide swine industry, respiratory diseases are still one of the most challenging problems, resulting from the interaction of infectious agents (mycoplasmas, viruses and bacteria), host factors and environmental conditions.

The most frequent findings in pig lungs at the abattoir are cranioventral pulmonary consolidation, categorised as enzootic pneumonia-like lesions, particularly caused by *M. hyopneumoniae*. Despite all the efforts performed to reduce economic losses caused by these pathogens, *M. hyopneumoniae* continues to be an important concern to worldwide swine herds (Zhang et al. 2018). The prevalence of *M. hyopneumoniae*, PRRSV and SIV infections was high in this research (Table 4), though similar to other reported European studies (Falk and Lium 1991; Lium and Falk 1991; Grest et al. 1997; Cleveland-Nielsen et al. 2002; Fraile et al. 2010; Meyns et al. 2011; Fablet et al. 2012; Merialdi et al. 2012). Considering the susceptibility to diseases on farms, the highest rate was noted in farms located in the Greater Poland (85.16%) and Podlaskie (88.37%) voivodeships (Figure 2).

In Poland, cranio-ventral pulmonary consolidations are frequent lung lesions in pigs at abattoirs, which suggests notable economic losses. Improvement in the management at the farm level together with measures focused on slaughter checks, may have a substantial impact in decreasing the occurrence of respiratory diseases.

The findings of this study indicate that the prevalence of pneumonia remains high in Poland and management factors are central to disease control.

Acknowledgement

The authors want to thank Dr. Jacek Zyzman and the rest of official veterinarian for their cooperation in the trial.

Conflict of interest

The authors declare no conflict of interest.

REFERENCES

Cleveland-Nielsen A, Nielsen EO, Ersboll AK. Chronic pleuritis in Danish slaughter pig herds. Prev Vet Med. 2002 Sep 30;55(2):121-35.

Fablet C, Marois-Crehan C, Simon G, Grasland B, Jestin A, Kobisch M, Madec F, Rose N. Infectious agents associated with respiratory diseases in 125 farrow-to-finish pig herds: A cross-sectional study. Vet Microbiol. 2012 May 25;157(1-2):152-63.

Falk K, Lium BM. An abattoir survey of pneumonia and pleuritis in slaughter weight swine from 9 selected herds. III. Serological findings and their relationship to pathomorphological and microbiological findings. Acta Vet Scand. 1991;32(1):79-88.

Fraile L, Alegre A, Lopez-Jimenez R, Nofrarias M, Segales J. Risk factors associated with pleuritis and cranio-ventral pulmonary consolidation in slaughter-aged pigs. Vet J. 2010 Jun;184(3):326-33.

Garcia-Morante B, Segales J, Fraile L, Perez de Rozas A, Maiti H, Coll T, Sibila M. Assessment of Mycoplasma hyopneumoniae-induced pneumonia using different lung lesion scoring systems: A comparative review. J Comp Pathol. 2016 Feb-Apr;154(2-3):125-34.

Grest P, Keller H, Sydler T, Pospischil A. The prevalence of lung lesions in pigs at slaughter in Switzerland. Schweiz Arch Tierheilkd. 1997;139(11):500-6.

Hannan PC, Bhogal BS, Fish JP. Tylosin tartrate and tiamutilin effects on experimental piglet pneumonia induced with pneumonic pig lung homogenate containing mycoplasmas, bacteria and viruses. Res Vet Sci. 1982 Jul; 33(1):76-88.

Karabasil N, Cobanovic N, Vucicevic I, Stajkovic S, Becskei Z, Forgach P, Aleksic-Kovacevic S. Association of the severity of lung lesions with carcass and meat quality in slaughter pigs. Acta Vet Hung. 2017 Sep;65(3):354-65.

Lium BM, Falk K. An abattoir survey of pneumonia and pleuritis in slaughter weight swine from 9 selected herds. I. Prevalence and morphological description of gross lung lesions. Acta Vet Scand. 1991;32(1):55-65.

Madec F, Kobisch M. Bilan lesionnel des poumons de porcs charcutiers a l'abattoir [Gross lung lesions of pigs at slaughter]. J Rech Porc Fr. 1982;14:405-12. French.

Maes D, Chiers K, Haesebrouck F, Laevens H, Verdonck M, de Kruif A. Herd factors associated with the seroprevalences of Actinobacillus pleuropneumoniae serovars 2, 3 and 9 in slaughter pigs from farrow-to-finish pig herds. Vet Res. 2001 Sep-Oct;32(5):409-19.

Merialdi G, Dottori M, Bonilauri P, Luppi A, Gozio S, Pozzi P, Spaggiari B, Martelli P. Survey of pleuritis and pulmonary lesions in pigs at abattoir with a focus on the

https://doi.org/10.17221/188/2020-VETMED

extent of the condition and herd risk factors. Vet J. 2012 Jul;193(1):234-9.

Meyns T, Van Steelant J, Rolly E, Dewulf J, Haesebrouck F, Maes D. A cross-sectional study of risk factors associated with pulmonary lesions in pigs at slaughter. Vet J. 2011 Mar;187(3):388-92.

Morrison RB, Hilley HD, Leman AD. Comparison of methods for assessing the prevalence and extent of pneumonia in market weight swine. Can Vet J. 1985 Dec;26(12): 381-4.

Steinmann T, Blaha T, Meemken D. A simplified evaluation system of surface-related lung lesions of pigs for official meat inspection under industrial slaughter conditions in Germany. BMC Vet Res. 2014 Apr 27;10: [12].

Zhang M, Huang T, Huang X, Tong X, Chen J, Yang B, Xiao S, Guo Y, Ai H, Huang L. New insights into host adaptation to swine respiratory disease revealed by genetic differentiation and RNA sequencing analyses. Evol Appl. 2018 Dec 3;12(3):535-48.

Received: September 18, 2020
Accepted: February 22, 2021