Original paper

CONTROL OF THE RESPIRATORY DISEASES IN A PIG HERD USING DATA OF THE RESPIRATORY ORGANS EXAMINATION OF FATTENING PIGS AT A SLAUGHTERHOUSE

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Abstract

In everyday farming practice, assessment of economical impact of respiratory diseases at herd level relies on the following information: data records on the diseases within the herd, productivity and slaughterhouse records. The data available from the slaughterhouse encompass the number and percentage of low weight pigs, number of diseased animals, the severity of lesions observed at slaughter as well as the amount of discarded organs and carcasses. The aim of this investigation is to improve the assessment of health status of pigs at herd level and design programs for the control of respiratory syndrome in swine based on the analysis of the data collected at slaughter line. In the slaughterhouse, the thoracic cavity organs from 105 fatlings that have reached the slaughter body mass, 20 underweight fatlings and 20 underdeveloped piglets were examined. The weight of both half-carcasses was measured. Tissue samples of altered organs (lungs, mediastinal lympho nodes, tonsils) were collected and subjected to bacteriological analysis. The average weight of both half-carcasses was 81.54kg in fatteners with full slaughter body mass, and 58.29kg and 14.95kg in low-weight fatlings and piglets, respectively. Changes affecting 10% of lung tissue were established in 9 animals, 11-20% in 10 and 21-32% in 10 fatlings. Pathological process is characterized by hepatization of lung tissue, inflammation of the pleura or, even more frequently, adhesions between the visceral and parietal pleura and pericardium. In underweight fatlings, the rates of lung changes were <20% in 5, 11-30% in 3, <40% in 4, and >40% in 6 animals. Applying bacteriological testing, the following microorganisms were isolated: *Haemophilus parasuis*, *Arcanobacterium pyogenes*, and *Pasteurella multocida*. The examination performed at the slaughter line strongly suggested the necessity of designing a new, updated vaccination program taking into consideration the causative agents and vaccination schedule.

Key words: *control, fatteners respiratory organs, slaughterhouse*

Introduction

A number of researches demonstrated that respiratory diseases of swine result in substantial decrease in production performance and increase of production costs in pig industry (Van Alstine, 2012). Economical losses are mainly associated with increased consumption of drugs

and labor, veterinary services, decreased feed conversion, increased mortality rate, body weight loss and prolonged fattening period (Dosen et al., 2008; Hurnik et al, 1994). The analysis of economical effects of an outbreak of *Actinobacillus pleuropneumoniae* infection diagnosed on pig farms in the United States (US) in 1995 revealed a total economical loss of 32 million US dollars (Willard, 2005). Some estimations reported in the US indicated that reproductive problems, increased mortality rate and decreased growth and performance rate induced by Porcine reproductive and respiratory syndrome virus (PRRSV) infection are responsible for economic losses of some 66.75 million US dollars in breeding herds and some 493.57 million US dollars on fattening pig farms in the U.S. (Neumann et al., 2005). Although the specific economic effect of mycoplasmal pneumonia can be difficult to ascertain, a review of a number of studies of herds with enzootic pneumonia demonstrated 17% decrease in daily weight gain and a 14% decrease in feed efficiency. In addition, it has been estimated that for every 10% of the lung with pneumonia, the mean daily gain is reduced by 37 grams (Leneveu et al., 2005).

In everyday farming practice, assessment of economical impact of respiratory diseases at herd level relies on the following information: data records on the diseases within the herd (occurrence of clinical form of respiratory disease and/or other diseases, mortality rate, autopsy results, material costs of applied therapy and prophylactic strategies), productivity data (current weight gain, number of days until slaughter, conversion) and slaughterhouse records (the percentage of low-weight pigs, number of diseased animals, severity of lesions observed at slaughter and amount of discarded organs and carcasses) (Dailidavičienė et al., 2008; Došen et al., 2008; Došen et al., 2013). The inspection at slaughter might be a useful tool for monitoring the health status of animals and data source for further epidemiological studies (Došen et al., 2011). In many countries, health recording protocols for collecting relevant data at the slaughterhouses were developed (Christensen et al., 1999; Sorensen et al., 2006). Comprehensive post-mortem examination in the slaughterhouse enables identification of certain pathological changes in clinically healthy pigs. Such pathologies are associated with decreased production performances and indicate potential health problems on these farms (Sorensen et al., 2006; Van Alstine, 2012).

The aim of this research was to improve the assessment of health status of pigs at herd level and to design programs for the control of respiratory syndrome in swine based on the analysis of the data collected at slaughter line.

Materials and methods

The material for this research derived from swine farm, where certain disorders and health respiratory problems in fatteners were detected. The applied research methods included gross pathological examination and standard bacteriological examination for detection of the presence of aerobic and anaerobic bacteria in the organs and tissue samples derived from slaugtered pigs.

All examined animals at the slaughterhouse originated from the same farm with the capacity of 14,000-15,000 fatlings. It should be noted that during the previous period, samples from dead fatlings were examined revealing presence of the viral genome Porcine circovirus (PCV) type 2 and PRRSV (Real Time RT-PCR). At the slaughterhouse, thoracic cavity organs from 105 fatteners that have reached the slaughter body mass, 20 underweight fatlings (the same

age as the previous category) and 20 underdeveloped piglets (age 70-80 days) were examined. The results of the examination and severity of the changes were recorded in forms prepared according to Christensen et al. (1999). The weight of both half-carcasses was measured. Moreover, the tissue samples of altered respiratory organs (lungs, mediastinal lympho node, tonsils) were collected and subjected to bacteriological examination.

Results and discussion

The half-carcass weight of healthy fatlings, underweight fatlings and underdeveloped piglets

The substantial variability in the carcass weight and leanness (share of muscle tissue) was established. The carcass weight of clinically healthy fatling ranged within a wide range of 67.95 kg to 101.4 kg. The carcass weight below 80 kg was established in 45 (44.55%) fatteners. The highest and the lowest leanness values being 64.9 kg and 49.2 kg, respectively, were established in the fatling group with carcass weight ranging between 80.1 and 90 kg.

Table 1. *Half-carcass weight of clinically healthy fatteners at slaughter line*

less than 70kg (67.95kg)	71-75 (72.13)	76-80 (77.81)	81-85 (82.45)	86-90 (87.43)	91-95 (92.62)	96-100 (96.2)	over 100 (101.4)
4 pcs*	12 pcs	29 pcs	26 pcs	18 pcs	10 pcs	1 pcs	1 pcs
The average half-carcass mass = 81.54kg							

* pieces

Table 2. *Half-carcass weight / leanness ratio of clinically healthy fatteners at slaughter line*

Less than 70 kg - 5 carcasses	Average leanness 54.8%		
	max. 56.9%	min. 50.5%	over 55% -3 carcasses
70.1 -75kg - 12 carcasses	Average leanness 54.53%		
	max. 61.9 %	min. 49.5%	over 55% - 3 carcasses
75.1- 80kg - 28 carcasses	Average leanness 52.36%		
	max. 61.6 %	min. 49.3%	over 55% - 7 carcasses
80.1-85kg - 26 carcasses	Average leanness 53.99%		
	max. 64.9 %	min. 49.2%	over 55% - 5 carcasses
85.1-90kg - 18 carcasses	Average leanness 54.92%		
	max. 60.9 %	min. 51.2%	over 55% - 7 carcasses
over 90kg - 12 carcasses	Average leanness 53.37%		
	max. 57.8 %	min. 51.2%	over 55% - 2 carcasses

The average carcass weight of underdeveloped fatlings was 58.2 kg, ranging from 43.6 kg to 69.6 kg. Although the fatteners were of the same age and originated from the same farm (facilities), their carcass weight was lower for 23.34 kg. The average carcass weight of piglets

aged 70-80 days was 13.23 kg. The piglets of the same age and body mass of 7.5 kg (weaned at age of 28 days) would weigh around 26 kg, provided that the daily weight gain was 400 g.

Table 3. *Half-carcass weight of underweight fatteners and underdeveloped piglets*

Category	Body mass (groups)	Number of fatlings	Individual carcass weight (kg)	Average carcass weight (kg)
Emergency slaughter	<50kg	6	43.4; 44.0; 46.6; 47.0; 49.2; 49.8	X=58.29
	50-60kg	3	56.4; 58.0; 58.0	
	61-70kg	11	61.0; 62.2; 62.8; 63.0; 63.8; 64.0; 64.8; 66.4; 67.0; 68.8; 69.6	
Piglets	13-13.9kg	9	13.2; 13.2; 13.2; 13.2; 13.2; 13.2; 13.3; 13.3. 13.3	X=13.23

Type of lesions in lung tissue, pleura and heart of clinically healthy fatlings

Low-grade lobular hepatization localized predominantly in the left and right apical lung was observed in 6 fatlings. In the two animals from the same population, localized pleuritis was observed. The changes were of very low grade, thus not quantified. In another 6 fatlings, lobular collapse of lung tissue was observed in the left and right diaphragm lobe. In 22 fatteners, localized pleuritis of both diaphragm lobes was noticed, whereby in 2 animals it was associated with adhesion complications and in 9 with abscesses. In 20 (19.05%) fatlings, the changes affected 11-40% of lung tissue. Most commonly, the entire cardiac lobes of the lung was affected.

Table 4. *Type of lesions in clinically healthy fatteners examined at slaughter line*

	Normal lung			Lung inflammation			Severe lung inflammation	
	Affected			Affected			Affected	
	0	Not measurable	1-10%	11-20%	21-30%	31-40%	41-50%	>50%
Pcs*	33	43	9	10	8	2	-	-
%	31.43	40.95	8.57	9.52	7.62	1.9	-	-
Total	80.95%			19.05%			-	

* pieces; - no detected

The majority of gross pathological changes were associated with localised chronic pleuritis (35.58%), *Pneumonia catarrhalis*, mycoplasmal infection (18.27%), *Pneumonia catarrhalis disseminata* (13.46%) as well as *Pleuropneumonia chronica / adhesiva* (7.69%). Interestingly, pericarditis (*Synechia pericardi)* was diagnosed in only one case (0.96%).

In the period from October 2003 to March 2004, number of 110, 865 pigs originating from 1,196 pig farms were examined at slaughterhouses in France. Vaccination against *Mycoplasma hyopneumoniae* has been performed at the majority of farms (899 herds) throughout a period of more than one year. The findings revealed the average rates of pneumonia, pleuritis and abscess being 27.6%, 14.4% and 2.3%, respectively. In almost 10% of the herds, pneumonia was diagnosed in more than 30% of animals. In vaccinated herds, the

rate of observed lesions was lower than that in non-vaccinated ones (Leneveu et al., 2005). In Lithuania, the examination of respiratory organs at slaughter revealed "enzootic pneumonia" in 46.14% of examined animals. Pleuritis, alone or associated with lung inflammation, was established in 29.55% of examined cases (Dailidavičienė et al., 2008). In our research, the bacteriological analysis of lung tissue, mediastinal lympho nodes and heart revealed the presence of *Bacillus sp*., *Streptococcus alfa hem*., *E. coli*, *Haemophilus parasuis.*

Primary causative agents of respiratory diseases are PRRSV, PCV-2, Swine influenca virus and infections caused by *M. hyopneumoniae*, *Actynobacillus pleuropneumoniae*, *Bordetella bronchiseptica*, *Haemophilus parasuis* and sometimes *Aujeszky's disease virus* (Došen et al., 2013; Prodanov-Radulović et al., 2011; Van Alstine, 2012). The secondary important infectious agents include *Pasteurella multocida*, *Streptococcus suis* and *Actinobacillus suis* (Došen et al., 2008; Neumann et al., 2005). Regrettably, the majority of infections implicate more than one causative agent. If the bacterial infection is associated with the viral one, the disease takes an acute course spreading rapidly between the housing facilities and is associated with higher morbidity and mortality rates. Subsequently, the epidemic takes a chronic course characterized by sporadic manifestations such as coughing, sneezing, anorexia and fever. The frequency and severity of the epidemic outbreak is strongly dependent on the location of the farm, bio-safety measures, farm management, vaccination program, as well as on the type and species of the agent (Hurnik et al., 1994).

Swine production management is of great influence on the occurrence of respiratory diseases on the farm. The most common infection routes include purchasing of infected pigs or semen for artificial insemination originating from another swine farm (Christensen, 1999; Došen et al., 2011; Prodanov-Radulović et al., 2011). Purchasing fattening pigs from different sources (farms), farms with floor-system production and vicinity of other pig-farms is a potential risk factors for the occurrence of respiratory diseases (Sorensen et al., 2006; Prodanov-Radulović et al., 2011). Large number of pigs on the farm and high-density of the animals also play a role in the outbreak of the disease (Stark, 2000). Besides, air quality, temperature, nutrition and hygiene regimen are important factors in the development and course of the disease (Hurnik et al., 1994; Sorensen et al., 2006).

Type of lesions in lung tissue, pleura and heart in underdeveloped fatlings and piglets

Lung changes affecting 13-78% of lung tissue were observed in all fatteners. All lung lobes were affected, and pleuritis was established in 50% of cases. In eight fatlings, the changes affected over 40% of lung tissue.

Table 5. *Type of lesions in underdeveloped fatteners and piglets*

Group	Normal lung		Lung inflammation			Severe lung inflammation	
	0 affected	1-10% affected	11-20% affected	21-30% affected	31-40% affected	41-50% affected	>50% affected
			5/25%	3/15%	4/20%	2/10%	6/30%
Total	20 (40%) fatlings						

In the examined samples, the following microorganisms were isolated: *H. parasuis* (4 samples), *Arcanobacterium pyogenes* and *P. multocida* (2 samples), *A. pyogenes* and *H. parasuis* (2 samples), *Pasteurella multocida* and *H. parasuis* (2 samples), and *A. pyogenes*, *H. parasuis* and *P. multocida* (1 sample). In the examined piglets, lobular collapse of lung tissue (4), emphysema (2), interstitial edema (2), fibrinous pneumonia and hepatization (2) and lung tissue hepatization were diagnosed.

Conclusion

High rate of changes in respiratory organs of clinically healthy fatteners was evident. It substantially affects the fluctuation in body weight, leanness and carcass quality. In spite of prophylactic measures and persistent therapy, a number of fatteners are underdeveloped. The apparent high-grade changes in thoracic cavity organs of examined pigs raise the issue of economical feasibility of their raising. Moreover, such fatlings are potential carriers of infectious agents. The examination performed at the slaughter line strongly suggested the necessity of designing a new, updated vaccination program taking into consideration the causative agents and vaccination schedule.

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