

# Carcass Quality and Hematological Alterations Associated with Lung Lesions in Slaughter Pigs

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## Abstract

The aim of this study was to examine effects of lung lesions on carcass quality and hematological parameters of slaughter pigs. The group of pigs with lung lesion score 2 had significantly lower live weight, hot carcass weight and cold carcass weight compared to the group of pigs with lung lesion score 0 ( $P<0.05$ ). The same group of pigs had significantly higher back fat thickness at two points, and consequently significantly lower meatiness ( $P<0.05$ ). No significant difference was found between groups for the carcass dressing ( $P>0.05$ ). The total number of red blood cells, concentrations of hemoglobin and hematocrit showed significantly lower mean values in the group of pigs with lung lesions score 2 ( $P<0.05$ ). Significantly higher mean value was also found in the group of pigs with lung lesion score 2 in the total white blood cell count, lymphocytes and neutrophils ( $P<0.05$ ). However, no significant differences were found between groups of pigs in the mean value of middle-sized cells, leukocytes fractions (lymphocytes, middle-sized cells, and neutrophils) and platelet count ( $P>0.05$ ). In conclusion, the results showed that lung lesions in fattening pigs had negative impact on carcass quality and hematological parameters.

**Keywords:** carcass quality parameters, fattening pigs, hematological parameters, lung lesions.

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## 1. Introduction

Respiratory diseases are the major problem in intensive pig production systems [1,2]. Pneumonia and pleurisy are the most common findings in pig lungs at slaughter line [3,4]. Due to the presence of lung lesions, each year a significant economic losses result from reduced growth rates and feed conversion efficiency, increased mortality, morbidity and treatment costs, condemnation of edible losses and carcasses at slaughter and lower carcass and meat quality [5]. Assessment of lung lesions at slaughter line is a useful tool to determine the importance of respiratory diseases on the farm of origin [3]. It has been found that

lungs of at least 30 fattening pigs need to be inspected to estimate reliably the prevalence and severity of respiratory lesions on a herd level [6]. Furthermore, it has been found that respiratory lesions in fattening pigs result in marked changes in hematological values [7]. Pigs with lung lesions had lower red blood count, hemoglobin and hematocrit. The leucograma in pigs with lung lesions is characterized by leucopenia, eosinopenia, lymphopenia and monocytopenia [7]. Therefore, the aim of this study was to determine effects of lung lesions on carcass quality and hematological parameters of slaughter pigs.

## 2. Materials and methods

The study was carried out during autumn of 2014 (October and November) on 30 fatteners per

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sampling day (120 in total, 68 barrows and 52 gilts, crossbreeds Yorkshire x Landrace, with the average live weight of  $112.3 \pm 8.95$  kg and 6 months old). The pigs were fattened on the same farm of origin under identical conditions. They were all exposed to the same condition of pre-slaughter handling and were killed at the same slaughterhouse.

**Lung lesions examination at slaughter line.** The lungs of 30 slaughtered pigs per sampling day were palpated and visually appraised for pneumonia and pleurisy according to the Welfare Quality® protocol [9].

**Carcass quality analyses.** The carcasses were weighed on a balance scale with an accuracy of 0.1 kg in order to obtain the hot carcass weight. The carcass was considered with the head, tail and feet. It was chilled in the refrigerator for 24 hours at  $\pm 2^\circ\text{C}$  temperature, and re-weighed to determine the weight of the cooled carcass. The dressing percentage was calculated as: (hot carcass weight  $\div$  live weight)  $\times$  100. The carcass back fat thickness was measured with a metal ruler (accuracy to 1.0 mm) at two points (between the 13th and 15th dorsal vertebrae and over M. gluteus medius). Meatiness (in percentages) was determined according to Serbian regulation [10,11] on the basis of hot carcass weight and the sum of carcass fat thickness at two points (on the back and at the sacrum).

**Blood measurements.** Blood samples were collected within 30 s during exsanguination after electrical stunning and sticking. They were kept refrigerated until processed immediately on arrival at the laboratory. The tubes (2 mL) containing ethylenediaminetetraacetic acid (EDTA) was used to measure hematological parameters including white blood cells, lymphocytes, middle-sized cells (monocytes, eosinophils and basophils), neutrophils, red blood cells, hemoglobin, hematocrit and platelet count. Blood was analyzed with an automatic counter (Abacus junior vet, Hematology Analyser, Diatron MI PLC, Hungary). Proportions of lymphocytes, middle-sized cells and neutrophils were calculated as a percentage of leukocyte concentration on the same device.

**Statistical analysis.** Statistical analysis of the results was conducted using software GraphPad Prism version 6.00 for Windows (GraphPad Software, San Diego California USA, [www.graphpad.com](http://www.graphpad.com)). Pig carcasses were

classified in two groups according to the presence of lung lesions: 1) group of carcasses without lung lesions (lung lesions score 0); and 2) group of carcasses with lung lesions score 2. Student t-test was used to examine the differences in live weight, hot carcass weight, cold carcass weight, carcass dressing, back fat thickness at two points and meatiness in relation to the lung lesions score. The same test was used to determine the differences in hematological parameters in relation to the lung lesions score. All carcass quality and hematological parameters were presented by descriptive statistical parameters (mean value and standard error). In all cases, significance was fixed at level  $P < 0.05$ .

### 3. Results and discussion

From a total of 120 examined pig carcasses, lung lesions were scored in 45 pigs (37.50%). The signs of pneumonia were detected in 31.67% ( $n=38$ ), while pleurisy was observed in 16.67% ( $n=20$ ) of the examined lungs. Dalmau et al. [12] examined the same pathological findings according to the Welfare Quality® protocol [9] in 10 Spanish pig slaughterhouses. Their study showed that the percentage of pneumonia and pleurisy varied from 13.3% to 45% and from 0% to 10%, respectively. In the study of Fablet et al. [6], pneumonia was observed in 69.1% of the pigs, while pleurisy was recorded in 14.4% of the pigs. The effects of lung lesions on the carcass quality parameters are given in Table 1. In the present study, the group of pigs with lung lesions score 2 had significantly lower live weight, hot carcass weight and cold carcass weight compared to the group of pigs with lung lesion score 0 ( $P < 0.05$ ) (Table 1). In contrast, no significant difference was found between groups for the carcass dressing ( $P > 0.05$ ). Similarly to our results, Permentier et al. [13] found that mean carcass weight was significantly lower for the pigs belonging to batches with high lung lesions score than the pigs belonging to batches with low lung lesions score (85.7 kg vs. 83.0 kg). Muller et al. [14] reported a significantly negative correlation between lung lesions and carcass weight in slaughtered pigs. As observed in this study, the pigs belonging to the group with lung lesions score 2 had significantly higher fat thickness at two points (on the back and at the sacrum), and consequently significantly lower meatiness, than pigs belonging to the group

without lung lesions ( $P < 0.05$ ) (Table 1). Opposite to our results, Permentier et al. [13] did not found significant difference among the pigs belonging to batches with high lung lesions score compared to the pigs belonging to batches with low lung

lesions score for the meat lean content in carcasses (61.6% vs. 60.1%), as well as for the backfat (12.7 mm vs. 13.9 mm) and loin thickness (66.0 mm vs. 65.1 mm).

**Table 1.** Data on carcass measures (mean value and standard error) in relation to lung lesions score (n=120)

Variable	Lung lesions 2	Lung lesions 0	Significance
Number of pigs	45	75	
Live weight (kg)	112.3±1.33	115.8±0.37	*
Hot carcass weight (kg)	91.86±1.17	94.78±0.35	*
Cold carcass weight (kg)	88.29±1.13	92.55±0.35	*
Carcass dressing (%)	81.73±0.24	81.84±0.19	ns
FTB (mm)	27.00±0.86	13.52±0.42	*
FTS (mm)	64.38±0.91	21.95±0.77	*
Meatiness (%)	32.53±0.18	44.12±0.21	*

FTB – fat carcass thickness on the back; FTS – fat carcass thickness at the sacrum;  
\* –  $P < 0.05$ ; ns – no significance ( $P > 0.05$ )

Differences in hematological parameters in relation to lung lesions score are shown in Table 2. In the current study, the total number of red blood cells, concentrations of hemoglobin and hematocrit showed significantly lower mean values in the group of pigs with lung lesions score 2 ( $P < 0.05$ ) (Table 2), similarly to the findings of Makinde et al. [14] and Pepovich et al. [7]. Additionally, the results obtained in the present

trial correspond to the findings of Tazayan [8], which proves eritropeniya, decreased hemoglobin and hematocrit. Significantly higher mean value was also found in the group of pigs with lung lesions score 2 in the total white blood cell count, lymphocytes and neutrophils ( $P < 0.05$ ) (Table 2), which is in concordance with the results of previous studies [14-17].

**Table 2.** Differences in hematological parameters (mean value and standard error) in relation to lung lesions score (n=120)

Variable	Lung lesions 2	Lung lesions 0	Significance
Number of pigs	45	75	
Red blood cells ( $10^9 / L$ )	7.04±0.17	7.83±0.13	*
Hemoglobin (g / L)	131.5±2.35	142.9±2.01	*
Hematocrit (%)	38.65±0.48	40.74±0.46	*
White blood cells ( $10^9 / L$ )	25.96 ±0.75	18.49 ± 0.48	*
Lymphocytes ( $10^9 / L$ )	17.66 ± 0.55	11.84 ± 0.37	*
Middle-sized cells ( $10^9 / L$ )	0.19 ± 0.01	0.22 ± 0.04	ns
Neutrophils ( $10^9 / L$ )	8.11±0.70	6.43±0.42	*
Lymphocytes (%)	69.15±1.79	64.43 ± 1.81	ns
Middle-sized cells (%)	0.71±0.04	1.18±0.21	ns
Neutrophils (%)	30.15±1.80	33.47±1.61	ns
Platelet count ( $10^9 / L$ )	235.5 ±19.05	252.1±13.25	ns

\* –  $P < 0.05$ ; ns – no significance ( $P > 0.05$ )

On the contrary, Pepovich et al. [7] found that the leukocyte count and the percentage of the lymphocytes were reduced in the group of pigs with pneumonia compared to the group of pigs without lung lesions. However, no significant differences were found between two groups in mean value of middle-sized cells, leukocytes fractions (lymphocytes %, middle-sized cells %, neutrophils %) and platelet count ( $P > 0.05$ ) (Table

2). Šoltésová et al. [18] point out that hematological changes and carcass quality alterations associated with lung lesions may occur due to reduced feed intake during period of sickness and disturbed metabolism of nutrients (carbohydrates, fats, proteins, vitamins, minerals, etc.) required for growth and development. In animals with respiratory lesions, this is manifested by a subsequent decreased growth intensity,

reduced daily weight gain, prolonged fattening period and negative effect on carcass quality traits with substantial negative impact on farm production and economy [18].

#### 4. Conclusions

The results showed that lung lesions in fattening pigs had a significant impact on carcass quality traits, as well as on hematological parameters. Lung lesions had a negative effect on live weight, hot carcass weight, cold carcass weight, back fat thickness at two points and meatiness. Significant changes compared to fattening pigs without lung lesions were recorded in more than half of the analyzed hematological variables, including red blood cells, hemoglobin concentration, hematocrit, white blood cells, lymphocytes and neutrophils.

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