

## ORAL PRESENTATIONS

### EPIDEMIOLOGICAL ANALYSIS AND CLASSIFICATION OF THE HEALTH STATUS OF PIG HERDS – THE HERD HEALTH INDEX (HHI)

Dickhaus, C.-P., Meemken, D. and Blaha, T.

*University of Veterinary Medicine Hannover, Field Station for Epidemiology, Bakum, Germany*

#### SUMMARY

Quantifying the herd health of food producing animals is a major precondition for improving the husbandry systems towards better health and welfare conditions. For assessing the health status of fattening pig herds accurately, multiple recurrent clinical examinations during the entire fattening period seem to be irreplaceable. Since this is, however, impossible in the routine production, indirect measurements of the herd health are needed. Therefore, a Herd Health Index (HHI) based on retrospective data was developed. First results of testing the HHI as tool for quantifying the health of pigs from pig-fattening farms are presented.

**Keywords:** Benchmarking animal health and animal welfare, Animal Treatment Index (ATI), Herd Health Index (HHI)

#### OBJECTIVE

The Reg. (EC) No. 178/2002 demands for the inclusion of the primary production into the food safety system and asks for a risk-based approach to food safety. Regarding the fact that data on the health status of slaughter animals has to be a part of the food chain information, it is essential to be able to quantify the health of food animal herds.

The objective is to develop, evaluate and validate a robust tool for quantifying the health status of pig herds and batches of slaughter pigs to serve as decision making tool for the risk-based meat inspection, but also for other risk-based decisions such as targeted residue testing and benchmark systems for creating incentives for the improvement of animal health and welfare of food producing animals. The paper describes the development of a Herd Health Index (HHI) and its testing by comparing the HHI of 20 herds with an intensive repeated clinical examination of the 20 herds by one veterinarian.

#### MATERIAL AND METHODS

For this study, various data reflecting the health of fattening pigs (representing grow-finish to slaughter) from 20 farms of a cooperative were gathered at least 6 times per group during the whole grow-finish and finish period. This cooperative is situated in Northern Germany and is

composed of 440 pig-fattening farms, which get their piglets without exception from an associated piglet rearing cooperative, i.e. all farmers work with the same genetics. The slaughter pigs are slaughtered at the same abattoir which also belongs to the cooperative. This horizontally and vertically quite well coordinated structure provides the basis for a harmonised data recording. On this basis, a comparison of the results of an intensive clinical investigation to an indirect measuring of the health status using the Herd Health Index (HHI) was carried out.

### CLINICAL INVESTIGATIONS INDEX

All fattening-groups of pigs in the 20 study herds were clinically examined at least 6 times evenly distributed over the whole fattening-period by strictly one person (first author). Out of 15 measured health indicators the following 6 criteria turned out to be most suitable for a semi-quantitative estimation of the health of the examined pig groups:

- a) The incidence and duration of **respiratory diseases** (0 to 4 points),
- b) The incidence and duration of **diarrhoea** (0 to 2 points),
- c) The incidence and duration of **limb-lesions** (0 to 2 points),
- d) The incidence and duration of **skin-diseases** (0 to 2 points),
- e) The incidence and duration of **cannibalism** (0 to 2 points), and
- f) The **evenness of weight gain within the pig group** (0 to 2 points).

Each of the 6 examinations resulted in additive “health points”, which range from 0 to 14 points. In order to represent the animal health status during the whole fattening period, the 6 examinations were spread throughout the entire finishing period (2 in the first, two in the second and two in the last third of the fattening period). At the time of slaughtering the slaughter pig batches of a finishing group, the health points of the 6 examinations were combined to one cumulative “batch health point” (= the average of the six health points). The batch health points of one herd were again combined to a “herd health point”, which then was the criterion that was compared to the HHI of the herd in question. To use the herd health points for a classification system, the following classes were created: 0 to 3 health points is score 0, 4 to 6 is score 1, 7 to 10 is score 2, and > 10 health points is score 3.

### THE COMPOSITION OF THE HERD HEALTH INDEX (HHI)

The following 4 parameters were gathered, rated, and combined to the HHI:

- 1) The **mortality rate**,
- 2) The **frequency of pathological findings in carcasses** of previous meat-inspections,
- 3) The **animal-treatment-index (ATI)**, and
- 4) The **duration of the fattening-period**.

#### 1) Mortality rate

If the mortality rate of a fattening group did not exceed 2% at the end of the fattening period this parameter was rated as mortality score 0. A frequency between 3% and 5% resulted in score 1, between 5% and 10% in score 2, and if the percentage of deceased pigs exceeded 10% the mortality score was 3.

## 2) Herd prevalence of pathological findings during previous meat-inspections

The frequency of gross pathological lesions found in carcasses and the organs of slaughter pigs of a herd is a quite objective indicator of the occurrence and severity of most diseases in pigs. Based on the Organ-Lesion-Index according to BLAHA (1994) the diagnostic findings of the meat-inspections of the slaughter pigs of each pig farm in the last six months were summarized in an index which varies from 0 to 10. Thereby the frequencies of pleurisy, pneumonia, liver-lesions and pericarditis per slaughter pig batch, and per herd (= cumulative index from consecutive batch) were rated and summarized in values from 0 to 10.

Organ-Lesion-Index according to BLAHA (1994)

<b>pleurisy</b>	frequency	<1%	1–10%	11–30%	>30%
	points	0	1	2	3
<b>pneumonia</b>	frequency	<1%	1–10%	11–30%	>30%
	points	0	1	2	3
<b>liver lesions</b>	frequency	<1%	1–10%	11–30%	>30%
	points	0	1	2	3
<b>pericarditis</b>	frequency	<1%	≥ 1%		
	points	0	1		

For calculating the HHI, a “Blaha-Index” less than 2 results in a lesion frequency score of 0, values from 3 to 5 were rated as score 1, points between 6 and 8 resulted in score 2, and a “Blaha-Index” higher than 8 leads to a lesion frequency score of 3.

## 3) Animal-Treatment-Index (ATI):

The Animal-Treatment-Index (Blaha et al., 2006) stands for the average frequency of medicating every pig in the group with antimicrobial substances, based upon the hypothesis that healthy pigs get less medication than pigs with a poor health and clinical illness. The formula is:

$$\text{ATI} = \frac{\text{No. of animals treated} \times \text{No. of treatment days}}{\text{Total} - \text{No. of animals in the herd or group}}$$

If the ATI does not exceed 10 days of medicating, this ends up in 0 points. An ATI between 11 and 20 days results in an ATI score of 1, ATI-values from 20 to 40 lead to an ATI score of 2. If a fattening group of pigs has been medicated with antimicrobial substances more than 40 days, the ATI score is 3.

## 4) Duration of the fattening period

On the study farms, all farmers start fattening piglets with a body weight between 27 and 31 kg and intend to send the slaughter pigs to abattoir with a body weight of 115kg to 121kg (= window of best price). If the time for fattening a batch of slaughter-pigs is less than 100 days this is calculated with score 0. A fattening duration period between 100 and 120 days results in score 1, a

duration from 121 to 150 days accounts for score 2, and if the fattening took more than 150 days this is taken into account with score 3.

**The HHI:** In the end the sum of the 4 single scores is added to the Herd-Health-Index (HHI) which can vary between 0 and 12 points. The HHI can be calculated for single batches, but also for herds for whatever period of time.

## RESULTS

Although the farmers in the investigated system use the same genetics, and are to follow the same guidelines for their herd health management, the single HHI's vary a lot. Some farmers fatten their pigs up to 120 kg within 91 days, without any losses and extremely little amounts of antibiotics. Other farmers loose 12,24% of their pigs, fattening their pigs takes more than 150 days and by treating them with antibiotics for more than 4 weeks. In most cases, the overall organ lesion frequency of slaughter batches from one farm is repeatedly the same over time, but there is no single parameter on its own which allows a reliable prediction about the health status of slaughter pig batches.

Tables 2 and 3 demonstrate as examples the relation between HHI and clinical findings.

**Table 2.** Herd health criteria and the HHI of Farm A

Batch-No.	1	2	3	4	5	6	7	8	9	10
Mortality (%)	6,25 → 2	6,25	6,25	6,25	12,24	12,24	12,24	12,24	12,24	12,24
Score		→ 2	→ 2	→ 2	→ 3	→ 3	→ 3	→ 3	→ 3	→ 3
Blaha-Index	6	6	6	6	6	6	6	6	6	6
Score	→ 2	→ 2	→ 2	→ 2	→ 2	→ 2	→ 2	→ 2	→ 2	→ 2
ATI (d/pig)	52,05 → 3	52,05	52,05	52,05	45,15	45,15	45,15 %	45,15	45,15	45,15
Score		→ 3	→ 3	→ 3	→ 3	→ 3	→ 3	→ 3	→ 3	→ 3
Duration of fattening (d)	138	146	154	163	100	112	121	129	142	149
Score	→ 2	→ 2	→ 3	→ 3	→ 1	→ 1	→ 2	→ 2	→ 2	→ 2
<b>HHI</b>	<b>9</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>9</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>
<b>Clinical examination score</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>

The HHI of Farm A (average of batches 1 to 10) = 10. The average clinical examination score of Farm A = 2

**Table 3.** Herd health criteria and the HHI of Farm B

Batch-No.	1	2	3	4	5	6	7	8	9
Mortality (%)	0	0	0	0	0	2,11	2,11	2,11	2,11
Score	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0
BLAHA-Index	1	1	1	1	1	2	4	4	4
Score	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0	→ 1	→ 1	→ 1
ATI	0	0	0	0	0	0,01	0,01	0,01	0,01
Score	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0	→ 0
Duration of fattening (d)	91	97	102	118	124	95	102	111	125
Score	→ 0	→ 0	→ 1	→ 1	→ 2	→ 0	→ 1	→ 1	→ 2
<b>HHI</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>Clinical examination score</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

The HHI of Farm B (average of batches 1 to 10) = 1. The average clinical examination score of Farm B = 0

Table 4 demonstrates the composition of the HHI's of all study farms. The scores of the Farms C to T were calculated as shown for Farms A and be (cf. Table 2 and 3)

**Table 4.** The Herd-Health-Index (HHI) compared to the clinical findings of all 20 study farms

farm	mortality score	ATI	Blaha-Index score	duration of fattening score	HHI	clinical examination score
A	3	3	2	2	<b>10</b>	2
B	0	0	0	1	<b>1</b>	0
C	1	0	1	2	<b>4</b>	1
D	0	1	0	1	<b>2</b>	0
E	1	1	1	2	<b>5</b>	1
F	2	0	1	1	<b>4</b>	1
G	2	1	1	2	<b>6</b>	0
H	0	1	1	2	<b>4</b>	1
I	0	1	1	2	<b>4</b>	0
J	1	1	1	3	<b>6</b>	0
K	1	1	1	1	<b>4</b>	0
L	0	0	1	1	<b>2</b>	1
M	1	1	1	2	<b>5</b>	1
N	1	0	0	1	<b>2</b>	0
O	1	2	1	2	<b>8</b>	2
P	1	0	1	1	<b>3</b>	0
Q	1	1	0	1	<b>3</b>	1
R	1	1	1	1	<b>4</b>	1
S	2	0	2	2	<b>6</b>	1

## DISCUSSION AND CONCLUSION

The chosen criteria for indirectly measuring the health of pig groups (slaughter batches, finishing groups and/or herds) seem to provide a rather accurate reflection of the health history of pigs sent to slaughter. Calculating a Herd Health Index supports greatly the estimation of the herd health of slaughter pigs, which can be used for the risk-based meat inspection, for benchmarking the herd health status of herds supplying the same slaughter house (as tool for the improvement of animal health and animal welfare), and for other risk-based decisions such as targeted residue testing. In further investigations the HHI should be validated in other production systems.

## REFERENCES

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