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DEVELOPMENT OF AUTOMATED MEASURES OF INDICATORS OF WELL-BEING AND HEALTH OF POULTRY: SPECIAL CASE OF AVIAN INFECTIOUS BRONCHITIS

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Context: Guaranteeing consumers a production process that respects animal welfare is one of the civil societal demands, especially for fast-growing poultry production (1). EBENE® method, developed by ITAVI, coupled with the new image and accoustic technologies must allow for finer and additional analysis than those carried out by man, and even better to manage health of poultry. From the video-surveillance methods/tools are proposed to measure general variations in chickens activity but none of them can be used to measure the animal welfare principles proposed by the OIE. **One objective of the project eBroilerTrack is to demonstrate the feasibility to associate group-wide sound measurements signing the welfare and health poultry status in the course of a respiratory pathologies**. The final aim of this work is to develop an early warming system of infectious diseases, for poultry breeders.

Experimental design:

We studied the impact of Infectious Bronchitis (IBR) on two avian lines: the PA12 SPF and a commercial ROSS 308. For each line, the protocol was as follows:
- D0: Hatching,
- D1: Transfer of all animals in room facilities,
- D21: Blood sampling on dry tube of all animals (IBR serology),
- D28: Naso-ocular inoculation Placebo or IBR of animals,
- D32: Swabbing of animals
- D35: Autopsies of animals (Histology, serology and PCR for detection of virus).
Precise zootechnical (weight and clinical signs) and welfare (EBENE® method) follow-up and measurement of vocalizations due to the infection.
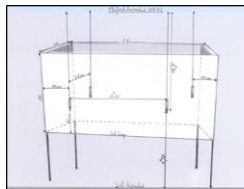

Figure 1:
The scheme and the photography illustrate the experimental housing of the chicks and the microphone placement for vocalizations recordings.
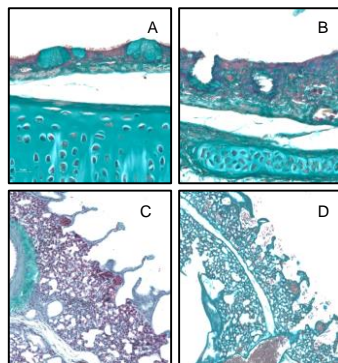
Results:

Figure 2: *Histological analysis of respiratory tissues of ROSS 308 chickens before and after infection. A (control) - B (infected): Trachea and C (control) - D (infected): Lung. Masson's Trichrome (MT) staining.*

Histology (Figures 2A to 2D)
Thickening of the tracheal and bronchial epithelium has been observed and associated with cellular infiltration (after IBR virus infection). Infection leads to emptying of the open caliciform mucus cells and deciliation of the trachea. All these tissue changes may lead to a change in the sounds emitted by the birds, such as burping or coughing.

Vocalization (Figures 3A and 3B)
Chicken rales, coughs and sneezes were identified by experts. From these labelled samples, characteristics are extracted to develop a detection algorithm. The detection is mainly based on night samples, where anomalous sounds are easily identifiable.
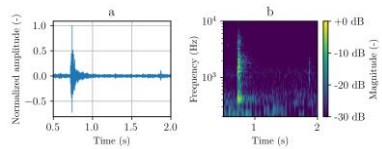

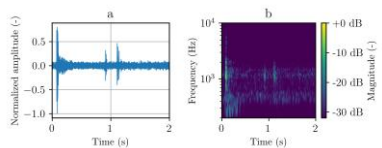**Figure 3A:** *Sneeze at D + 3 (PA 12), a. temporal representation, b. spectrogram.*

Figure 3B: *Sneeze followed by a rale at D + 3 (ROSS 308), a. temporal representation, b. spectrogram.*

Conclusion: **These results were able to better characterize the pathophysiology of IBR from zootechnical, behavioural, acoustic and histological points of view. The acoustic approach is innovative and has made possible the development of new algorithms and sound analysis to differentiate healthy from diseased group of chickens. Those results will aim to develop a useful tool for poultry farmers for early prediction information of a potential infection.**