



Detection of illegal use of antibiotics in poultry by fluorescence microscopy

E. de Rijke, D. Samson, M. Groot, S. Sterk, L. van Raamsdonk and M. Nielen

Introduction

Tetracyclins are antibiotics registered for use in, amongst others, livestock. They can only be used therapeutically when prescribed by a veterinarian, and a withdrawal period has to be applied to prevent presence of antibiotics in meat for consumption.

However, tetracycline residues are regularly found in retail broiler meat. This can have several reasons; a too short withdrawal time, illegal use in sub-therapeutic dosages as growth promoter, or recirculation in the diet via the bedding.

The possibility to use fluorescence microscopy of the antibiotic oxytetracyclin (OTC) in cross-sections of tibia bone is studied to distinguish between untreated broiler chicken and several treatment strategies (Fig.1).

Antibiotics fluorescence in bone

The cross-sections of the tibia of untreated broilers show no fluorescence, while the tibia of treated broilers show clear fluorescent patterns (Fig. 2). A therapeutic treatment with a short withdrawal time results in fluorescent rings around the Haversian channels (2C). The longer the withdrawal time after treatment, the further the tetracyclins will diffuse and dilute in the bone (2A). The tibia of sub-therapeutically treated broilers show a diffuse, evenly distributed fluorescence pattern (2B/D). The patterns give a good indication of the use of this type of antibiotics.

Therapeutic use of tetracyclins is only allowed when the legally required withdrawal time is maintained to ensure that the residue levels in the meat are below the Maximum Residue Level (MRL). Control of the medicine administration of the farm and additional LC-MS/MS analysis can be used to detect allowed or illegal treatment. Analysis of the broiler meat showed that after sub-therapeutic treatment the MRL was exceeded, while the OTC levels in meat of therapeutically treated broilers (complying with the required withdrawal time) remained below MRL.

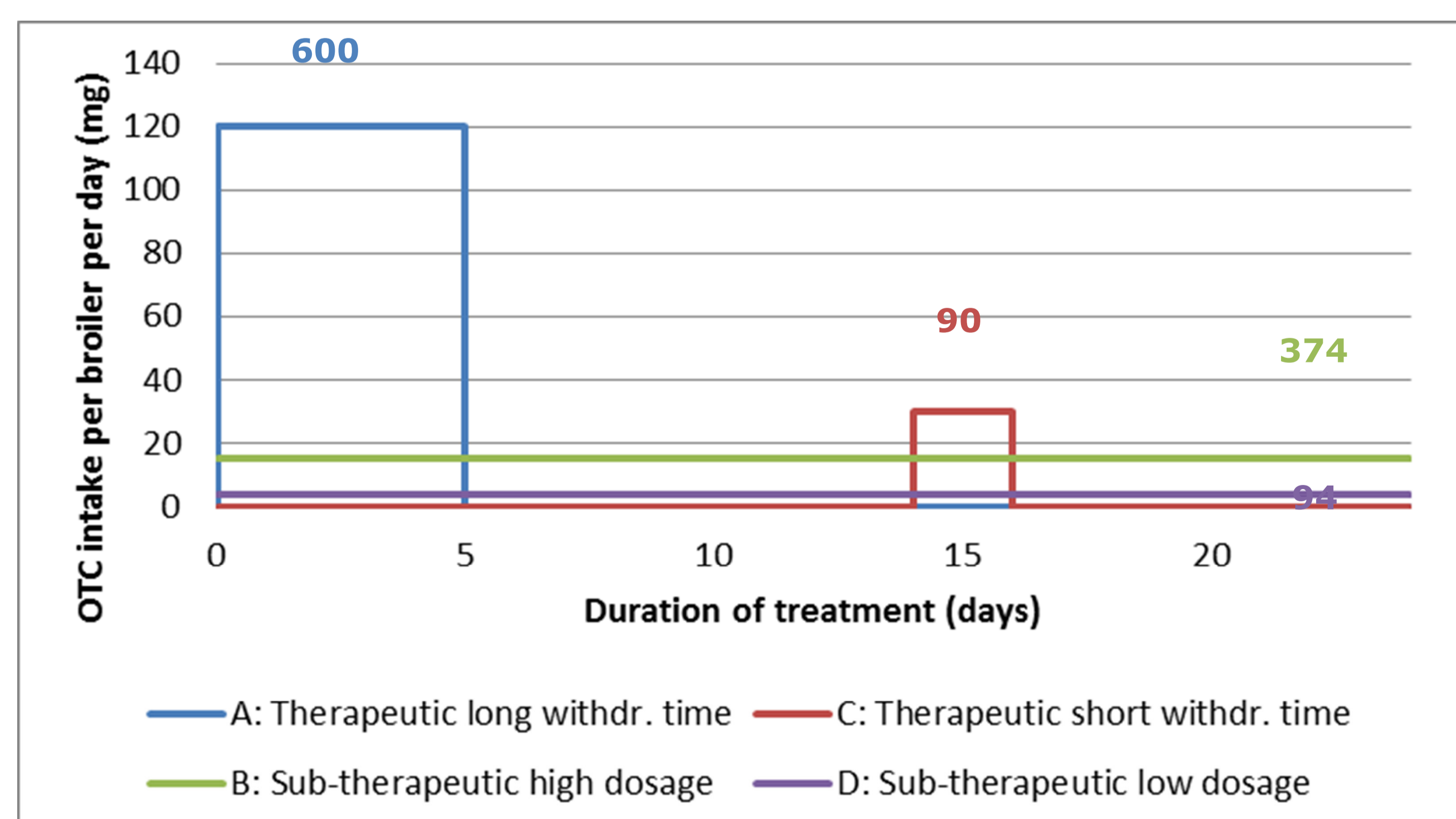


Figure 1. Oxytetracyclin intake per broiler for the different treatments. The total estimated intake during the full treatment is indicated above the graphs.

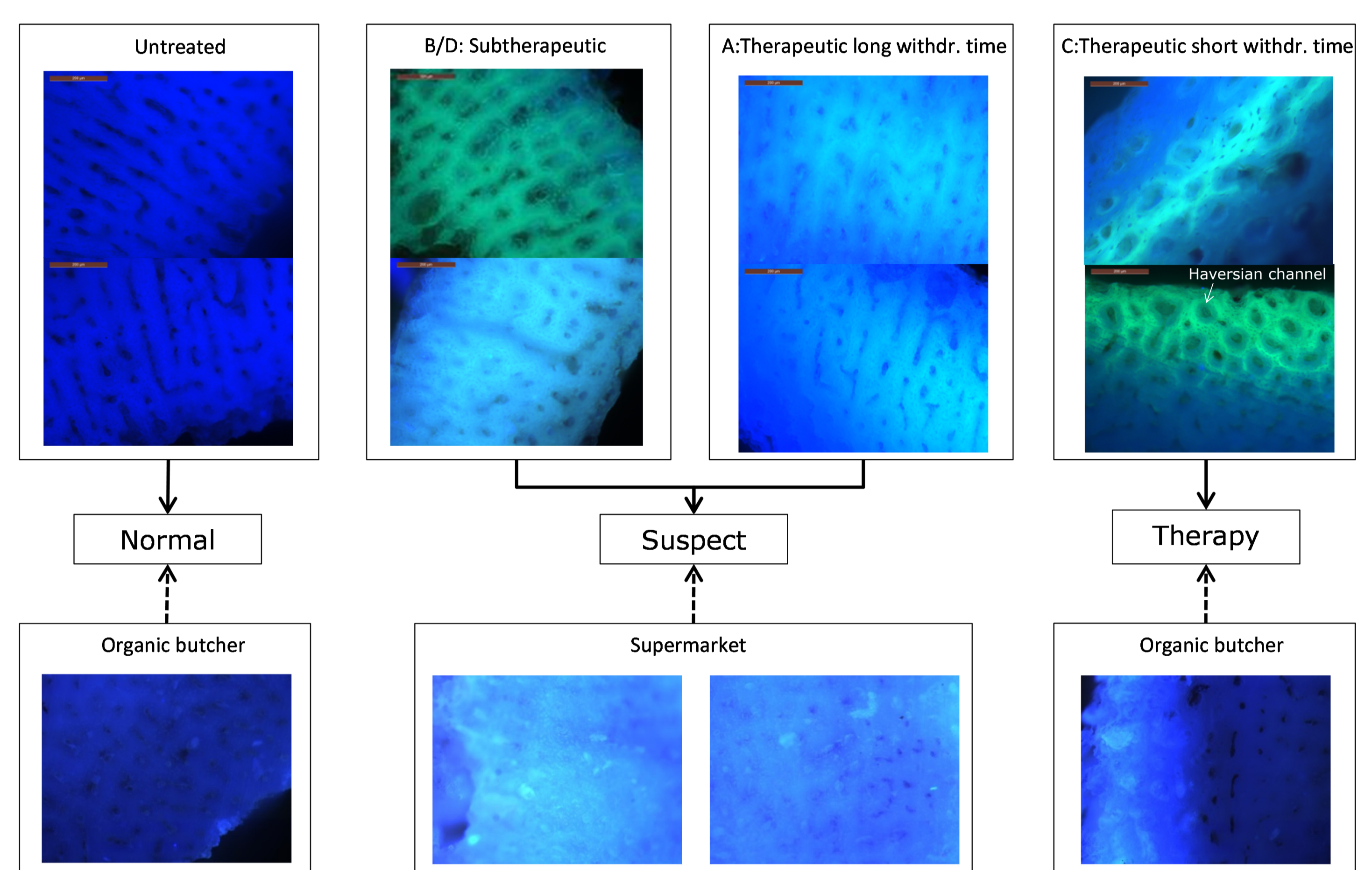
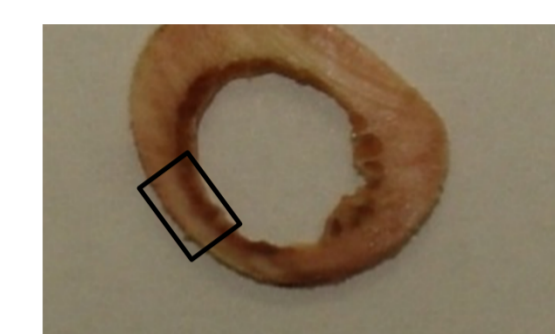


Figure 2. Fluorescence microscopy photos of the cross sections of tibias from broilers treated with different dosages of the antibiotic oxytetracyclin (see Fig. 1), and different drumsticks bought at the supermarket and organic butcher.

Application: Supermarket vs. organic butcher

To test the method with actual products, the tibia bones from drumsticks bought at an organic butcher and a supermarket were investigated (Fig. 2 lower part). The supermarket products show a diffuse fluorescence over the whole bone surface that can be caused by sub-therapeutic treatment. The profiles of the bone from the organic butcher show more resemblance either with the blank or with the profiles of the therapeutically treated broilers with a short withdrawal time.

Summary

- With the developed fluorescence microscopy method it is possible to retrospectively differentiate between untreated (no fluorescence) and with OTC treated (fluorescence) broiler chickens.
- This method can for example be applied to inform the consumer on (the history of) antibiotics use in retail broiler chickens to check for antibiotic-related fraud with organic broilers.
- In the near future this test may directly be applied at the slaughterhouse with a hand-held UV lamp and goggles.

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