



Antibiotic Treatment Promotes Tetracycline Resistance in *Chlamydia*-infected Swiss Fattening Pigs

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Key words

Chlamydia suis, pig, antibiotic treatment, tetracycline resistance, selective pressure, Switzerland

Aim of the study

The aim of this study was to determine the selective pressure due to prophylactic antibiotic group treatment on the presence of tetracycline-resistant *Chlamydia* (*C.*) *suis* strains in Swiss fattening pigs.

Material and methods

158 samples identified as *C. suis* from 21 conjunctival and 137 fecal swabs belonging to 24 farms of the sample collection obtained by Hoffmann et al. 2015 were further processed for isolation. The 24 farms were divided into three groups: A) farms without antibiotic treatment (n = 16), farms with prophylactic oral antibiotic treatment of the whole herd consisting of B) trimethoprim, sulfadimidin and sulfathiazole (TSS, n = 3), and C) chlortetracycline with or without tylosin and sulfadimidin (CTS, n = 5). 59 successfully isolated strains and their corresponding clinical samples were tested for the presence or absence of the tetracycline resistance class C gene [*tet*(C)] by conventional PCR and further investigated for their antibiotic susceptibility *in vitro*. The phenotype of investigated strains was either classified as tetracycline sensitive (MIC ≤ 2 µg/ml), intermediate (2 µg/ml < MIC < 4 µg/ml) or resistant (MIC ≥ 4 µg/ml) depending on the MIC concentration. Results of groups and individual pigs were correlated with prior antibiotic treatment and compared between the first and second sampling (beginning/end of fattening period).

Results and significance

112 out of 158 swabs produced *C. suis*-positive isolates resulting in a success rate of 70.89% with a striking difference between the low success rate in conjunctival swabs with only one isolate out of 21 samples (4.76%), and fecal swabs where the success rate was high (81.02%). These results correlated with the bacterial load that was generally higher in fecal swabs. Viable *C. suis* organisms were mainly shedded by the fecal but not by the conjunctival route. By PCR, 32 isolated strains were positive for *tet*(C), while 27 strains were negative. By the antibiotic susceptibility assay, 31 of the 59 investigated strains were phenotypically sensitive (52.5%), six strains were considered intermediate (10.2%), while 22 were tetracycline resistant (37.3%). While all phenotypically resistant strains were also positive by the *tet*(C) PCR (22/22) as expected, strains that were either classified as sensitive or intermediate could be both positive or negative for *tet*(C). It has been shown recently that the presence of *tet*(C) does not necessarily mean that the strain is phenotypically resistant (Donati et al., 2016). In fact, while 26 out of 31 phenotypically sensitive strains tested *tet*(C)-negative as expected, only one out of six intermediate strains were negative for *tet*(C). Farms where pigs were treated with tetracycline derivatives (CTS, group C) harbored the most phenotypically resistant *C. suis* strains with 18 out of 26 isolated samples (64.3%), particularly if the samples were collected at the end of the fattening period (83.3%). Farms using no antimicrobial treatment during the fattening period (Group A) did not harbor any resistant strains. Interestingly, from farms that treated their animals with TSS (Group B), a highly diverse population of different strains was isolated. Out of 15 tested *in vitro*, four were phenotypically resistant, nine were sensitive and two intermediate. Within group C (CTS), there was an increase of resistant strains after the 2nd sampling. In summary, we show that the number of tetracycline resistant (*tet*^R) *C. suis* strains in pigs treated with tetracycline tended to be high or even increased between the beginning and end of the fattening period, whereas farms where no antibiotic treatment was applied only yielded tetracycline sensitive (*tet*^S) *C. suis* strains, providing evidence for selective pressure.



Tiergesundheit, Zoonosen

Monitoring Surveillance

Publications, posters and presentations

Donati, M.; Balboni, A.; Laroucau, K.; Aaziz, R.; Vorimore, F.; Borel, N.; Morandi, F.; Vecchio Nepita, E.; Di Francesco, A. Tetracycline susceptibility in *Chlamydia suis* pig isolates. PLoS One. 2016 Feb 25;11(2):e0149914.

Wanninger, S.; Hoffmann, K.; Donati, M.; Di Francesco, A.; Borel, N. Tetracycline resistant *Chlamydia suis* in Swiss fattening pigs. 3rd European Meeting on Animal Chlamydioses and Zoonotic Implications, Paris, France, 2015 (presentation).

Wanninger, S.; Hoffmann, K.; Donati, M.; Di Francesco, A.; Hässig, M.; Borel, N. Tetracycline resistant *Chlamydia suis* in Swiss fattening pigs. 14th German Chlamydia Workshop, Freiburg, Germany, 2016 (presentation).

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