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Antimicrobial use in Belgian broiler production

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ABSTRACT

The use of antimicrobials in production animals has become a worldwide concern in the face of rising resistance levels in commensal, pathogenic and zoonotic bacteria. In the years 2007 and 2008 antimicrobial consumption records were collected during two non consecutive production cycles in 32 randomly selected Belgian broiler farms. Antimicrobials were used in 48 of the 64 monitored production cycles, 7 farms did not use any antimicrobials in both production cycles, 2 farms only administered antimicrobials in one of the two production cycles, the other 23 farms applied antimicrobial treatment in both production cycles. For the quantification of antimicrobial drug use, the treatment incidences (TI) based on the defined daily doses (the dose as it should be applied: DDD) and used daily doses (the actual dose applied: UDD) were calculated. A mean antimicrobial treatment incidence per 1000 animals of 131.8 (standard deviation 126.8) animals treated daily with one DDD and 121.4 (SD 106.7) animals treated daily with one UDD was found. The most frequently used compounds were amoxicillin, tylosin and trimethoprim-sulphonamide with a mean TI_{UDD} of 37.9, 34.8, and 21.7, respectively. The ratio of the UDD/DDD gives an estimate on correctness of dosing. Tylosin was underdosed in most of the administrations whereas amoxicillin and trimethoprim-sulphonamide were slightly overdosed in the average flock.

1. Introduction

Although antimicrobial therapy is of essential importance in maintaining animal health, the use of antimicrobials in production animals has become a worldwide concern in the face of rising resistance levels potentially threatening treatment options in both veterinary and human medicines (Bywater, 2004; Prescott, 2008). In 2007, the World Health Organization recommended stopping intensive routine use of antimicrobials in production animals (Collignon et al., 2009). A first step in limiting routine use of antimicrobials has already been taken in 1999, when Europe scheduled a total ban of antimicrobial growth promoters by January 2006. After the ban, the fear in many countries was that therapeutic use would increase and in the end no real progress would be made in reducing antimicrobial consumption. In Sweden a temporarily increase of therapeutic use after the ban was indeed observed, but consumption levels have dropped again to the prior therapeutic level (Grave et al., 2004, 2006; Bengtsson and Wierup, 2006; Phillips, 2007). In Denmark (DANMAP, 2008) and the Netherlands (MARAN,

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2007) on the contrary, the ban has been followed by a steady increase in consumption of therapeutic veterinary antimicrobial agents.

Pig, veal, and poultry production are largely making use of antimicrobials for therapeutic, methaphylactic or prophylactic purposes as a result of their intensive production system that frequently requires the application of mass medication (Catry et al., 2006; Timmerman et al., 2006; Prescott, 2008). In addition, precise dosing, an important aspect of the prudent use of antimicrobials (Mevius et al., 1999), is often more difficult when applying mass medication. A crucial step in the control of emergence and dissemination of antimicrobial resistance is the registration of consumption of antimicrobials (Gyssens, 2001; Mevius et al., 1999). Recently European authorities have issued the obligation for member states to register and report their national veterinary antimicrobial consumption (Anonymous, 2010). Some countries, like Denmark, Sweden, Norway, the Netherlands, Germany and the UK already have an established antimicrobial consumption monitoring program. Others, like Belgium, are currently developing a veterinary antimicrobial consumption monitoring system (www.belvetsac.ugent.be).

The aim of this study was to quantify the level of antimicrobial consumption in Belgian broilers. For this the amounts, indications for use and accuracy of dosing were registered during two non consecutive production cycles in 32 Belgian broiler farms. This study was conducted in parallel with a large scale study on the occurrence of antimicrobial resistance (Persoons et al., 2010).

2. Materials and methods

2.1. Sample design and sampling

From fifty randomly selected Belgian broiler farms holding at least 10,000 birds, 32 (64%) participated in a study on the prevalence of antimicrobial resistance in indicator bacteria (Persoons et al., 2010). The farms were selected from the official list of 730 matching broiler farms (sanitel) by allocating a random number to all of them and then selecting the fifty smallest numbers. Growers from four farms refused participating in the survey. Five could not be included because they had recently ceased activity or were planning to do so in the near future. The nine other growers could not be contacted after several attempts to do so. The farms were visited twice leaving one production cycle in between unsampled to exclude time or seasonal effects, and for the antimicrobial resistance survey to evaluate whether resistance tended to persist in time (Persoons et al., 2010). The downtime in between visits ranged from 44 to 58 days, with a median of 48 days. The visits all took place in the years 2007 and 2008 each time when the birds were in their fifth week of production, corresponding to the week prior to slaughter. At each visit, individual fecal swabs from 30 conveniently selected broiler chickens were collected from which *Escherichia coli* and *Enterococcus faecium* were isolated followed by antimicrobial susceptibility testing as described elsewhere (Persoons et al., 2010). Additionally, data on antimicrobial use in the two sampled production cycles were collected. No farmers declined to have these data recorded.

2.2. Data collection

The antimicrobial use was registered by means of a treatment registration card on which time and duration of administration, product administered, dosage, amount administered, administration route and the person applying the treatment were retrospectively recorded at the end of the two monitored production cycles. To check for the completeness of treatments entered on the card, the farm's official medication register was consulted. This register consists of all the veterinarian's prescriptions, needed for every antimicrobial treatment of the birds, and is regularly controlled by the Federal Agency for Safety of the Food Chain. No information on treatments applied in hatchery was available since this information is not routinely provided with the day old chicks. Therefore this could not be included.

Besides the amount of antimicrobial drugs administered, the indications for use were registered. These were categorized into the following 8 possible indications: *E. coli* sepsis, necrotic enteritis, dysbacteriosis (non-specific bacterial enteritis), respiratory problems, skin or feather diseases, feet problems or arthritis, coccidiosis and general prophylaxis.

2.3. Data analysis

All the data were entered in an Excel spreadsheet (Microsoft corporation, Redmond, Washington, USA). Volumes of antimicrobials administered were converted to mg of active substance per kg live weight. The frequency of use of the different compounds (active substances) used was calculated as the ratio of production cycles where the compound was used to the total number of cycles followed (64).

Quantification of drug use can be done in different ways, using financial or commercial units, or weight indicators (Chauvin et al., 2001). In this study, weight indicators were chosen. The defined daily dose (DDD) is defined as the nationally determined average maintenance dose per day and per kg chicken of a specific drug (Jensen et al., 2004). For poultry, the DDD (Grave et al., 2004) was estimated based on the dosages mentioned in the Belgian Compendium on Veterinary Medicines (Anonymous, 2008a,b) and on the drug's instruction leaflet.

The used daily dose (UDD) describes the amount of active substance actually administered to the animals in mg/kg. The UDD was calculated by dividing the amount of antimicrobial compound administered (mg) by the number of broilers times the average weight at treatment to define a standard treated bird (Timmerman et al., 2006). The UDD/DDD ratios were calculated as a way to assess the correctness of dosage. Ratios between 0.8 and 1.2 were considered as correct dosing (Timmerman et al., 2006). Values less than 0.8 and greater than 1.2 were considered to be underdosing and overdosing, respectively.

The frequency of treatments can be quantified by calculating treatment incidences (Grave et al., 1999). This