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ScienceDirect
Food Control 18 (2007) 1068–1076
FOOD CONTROL
www.elsevier.com/locate/foodcont

Veterinary drugs residue monitoring in Italian poultry: Current strategies and possible developments

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Received 7 December 2005; received in revised form 29 June 2006; accepted 3 July 2006

Abstract

Veterinary drugs residue monitoring is enforced in the EU according to requirements set down in EU Directive 96/23/EC and Commission Decision 97/747/EC; the number of samples to be collected yearly is essentially defined according to production data.

The present study aimed to quantitatively estimate the general contamination level of Italian poultry meat by some veterinary drug residues. A sampling plan was designed according to statistical considerations; study results were extrapolated to the general population by means of Bayesian analysis.

Only one positive sample, contaminated by sulfonamides, was detected; this low contamination level (0.33%) is very close to the percentage of violative samples detected by the Italian National Residue Plans (NRP) in the period 1995–2001 (<0.5%). This result, however, was achieved more effectively and at a lower cost than data obtained within NRP's design and requirements. The study indicated also that statistically based residue monitoring plans ensure better protection levels for consumers, than control systems designed simply as a proportion of production units.

Keywords: Veterinary drug residues; Quantitative data; Bayesian analysis

1. Introduction

The objectives of this study were to generate quantitative information to evaluate the presence of veterinary drug residues in broilers slaughtered in Northern Italy, to compare, where possible, these results with contamination data deriving from the Italian National Residues Plan (NRP) and on the basis of these results, to propose an approach to residue control, alternative to what prescribed by current European legislation (EC, 1996, 1997).

Poultry meat, rather than other commodities, such as eggs or beef, was chosen for a variety of reasons. Poultry meat is largely consumed in Italy, by consumers of every age, ranging from babies to the elderly (Turrini, Saba, Perrone, Cialfa, & D'Amicis, 2001); its consumption exceeded 1 million tons in 2003–2004 (the study years) and it is constantly increasing, in spite of animal health emergencies, like the avian influenza epidemics of the last years; finally, Italy is a strong producer of this commodity, being fully self-sufficient in this regard.

Italian poultry production is considerably vertically integrated, with closely connected farming, slaughtering and processing stages. Such integration implies that production forecasts, such as the planned slaughtering and processing of batches coming from different farms must be strictly complied with; one of the means to achieve this compliance is through the intensive use of veterinary drugs, both to control disease and promote growth. The regular and massive use of drugs in intensive farms was considered as a risk factor for direct contamination of poultry meat

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doi:10.1016/j.foodcont.2006.07.011

(Endtz et al., 1991; Kabir, Umoh, Audu-okoh, Umoh, & Kwaga, 2004; Mitema, Kikuvi, Wegener, & Stohr, 2001), due for instance to the possibility of incomplete observation of prescribed withdrawal times; abattoirs were the chosen check points.

Poultry production is not evenly distributed throughout Italy, being mainly clustered in the North-East; in addition, large poultry slaughtering plants processing most of the national poultry production, are few and located in some districts; one of these is the study site, the Forlì veterinary district, which accounts for over 30% of Italian poultry slaughtering and processing.

Sulfonamides, trimethoprim, tetracyclines, macrolides, quinolones and β-lactams were selected for investigation being the drugs most commonly used in Italian poultry farms.

These substances have been selected for residue investigations also due to other reasons, as, for instance, the high frequency of violations reported worldwide, especially for sulfonamides, which record the highest violation rate in the USA (Dey, Thaler, & Gwozdz, 2003); public health considerations were also taken into account (Bates, Joerdens, & Griffiths, 1994; Boisseau, 1993; Heitzman, 1993). Some of the drugs routinely employed in poultry farms, such as quinolones, are increasingly involved in antibiotic resistance phenomena, characterizing both animal and human isolates; this is particularly the case of *Campylobacter* spp. and enteroccal infections, whose resistant strains to quinolone and macrolides have increasingly been reported in the last 10–15 years (Endtz et al., 1991;Engberg, Aarestrup, Taylor, Gerner-Smidt, & Nachamkin, 2001; Jacobs-Reitema, Koenraad, Bolder, & Mulder, 1994; Shah, Schäfer, & Knothe, 1993).

Finally this study aimed to evaluate the feasibility and the possible advantages of a different sampling frame for NRP activities, as an alternative to the proportional sampling prescribed by EU Council Directive 96/23/EC and Commission Decision 97/747/EC. Residue control is a complex activity, trying to balance different issues, such as consumer protection, animal health and trade in an ever changing world; the present EU approach to residue monitoring and control has been characterized by significant inflexibility, with substances, species, commodities and sampling criteria established at the central (European Commission) level. In addition to these technical drawbacks, bureaucracy is further hindering the development of more agile control systems, tailored to the needs of individual Member States. NRPs must be formally approved by the EU Commission, before becoming enforceable in the national territories, and the legal iter for approval is quite lengthy and subject to many delays. It has happened that some national NRPs were approved during the second half of the year, with obvious disadvantages, the most severe ones being the lack of official control during the first six months of the year and a subsequent excessive pressure on routine labs in the second half of the year.

2. Materials and methods

2.1. Sampling

Since Italian meat poultry chain is strongly vertically integrated, with broilers reared and sent to slaughter as batches, the sampling unit chosen for this study was the batch. 299 batches were sampled, to detect at least 1% residue violation at a 95% confidence level.

Each batch was made up by birds of the same sex; the number of birds present in each batch ranged from 1.078 to 27.468, with a mean of 10.139, 19 broilers per batch. 112 batches (37.46%) were made up by males, 178 (59.53%) by females; gender was not specified in the remaining 10 batches.

Samples were collected at the abattoir from healthy birds, i.e. birds fit for slaughter and human consumption that passed veterinary inspection; both birds and batches were randomly chosen.

Tissues investigated were muscle (500 g) and liver (300–500 g); liver samples were obtained from a pool of 2–3 birds, the liver amount provided by a single bird being inadequate for laboratory analysis.

2.2. Substances investigated positive samples

Substances investigated were sulfonamides (sulfadimethoxine, sulfamethoxazole, sulfadiazine, sulfaquinoxaline, sulfamerazine, sulfamethazine, sulfametoxipyridazine and sulfathiazole), trimethoprim (alone or associated with sulfonamides), macrolides (tylosin and erythromycin), tetracyclines (oxy- and chlortetracycline), β-lactams (amoxicillin) and quinolones (enrofloxacin and flumequine). As far as comparison with official NRP data was concerned, only violative samples were taken into consideration. Violative samples were defined as those ones exceeding the substance MRL according to EU relevant legislation (EC, 1990). Samples where residues were actually detected, but contamination, as quantified by chemical analytical methods, did not exceed the established MRLs, are listed in Table 1. MRLs for the investigated substances are summarized in Table 2.

2.3. Analytical methods

Samples were analysed at the I.Z.S.A. & M.[1] Chemistry Laboratory. The laboratory is accredited for veterinary drug analysis and has documented quality control procedures.

All samples were typically screened with microbiological/plate tests. Quinolones (enrofloxacin and flumequine) were screened according to the analytical method developed by Ellbroek (1991). β-lactams (amoxicillin),

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