

EFFICACY OF A ROTATION PROGRAMME WITH THE ANTICOCCIDIALS CLOPIDOL/METHYLBENZOQUATE AND ROBENIDINE AND EVOLUTION OF COCCIDIAL INFECTION IN RABBITS BETWEEN 1982 AND 1990

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Introduction

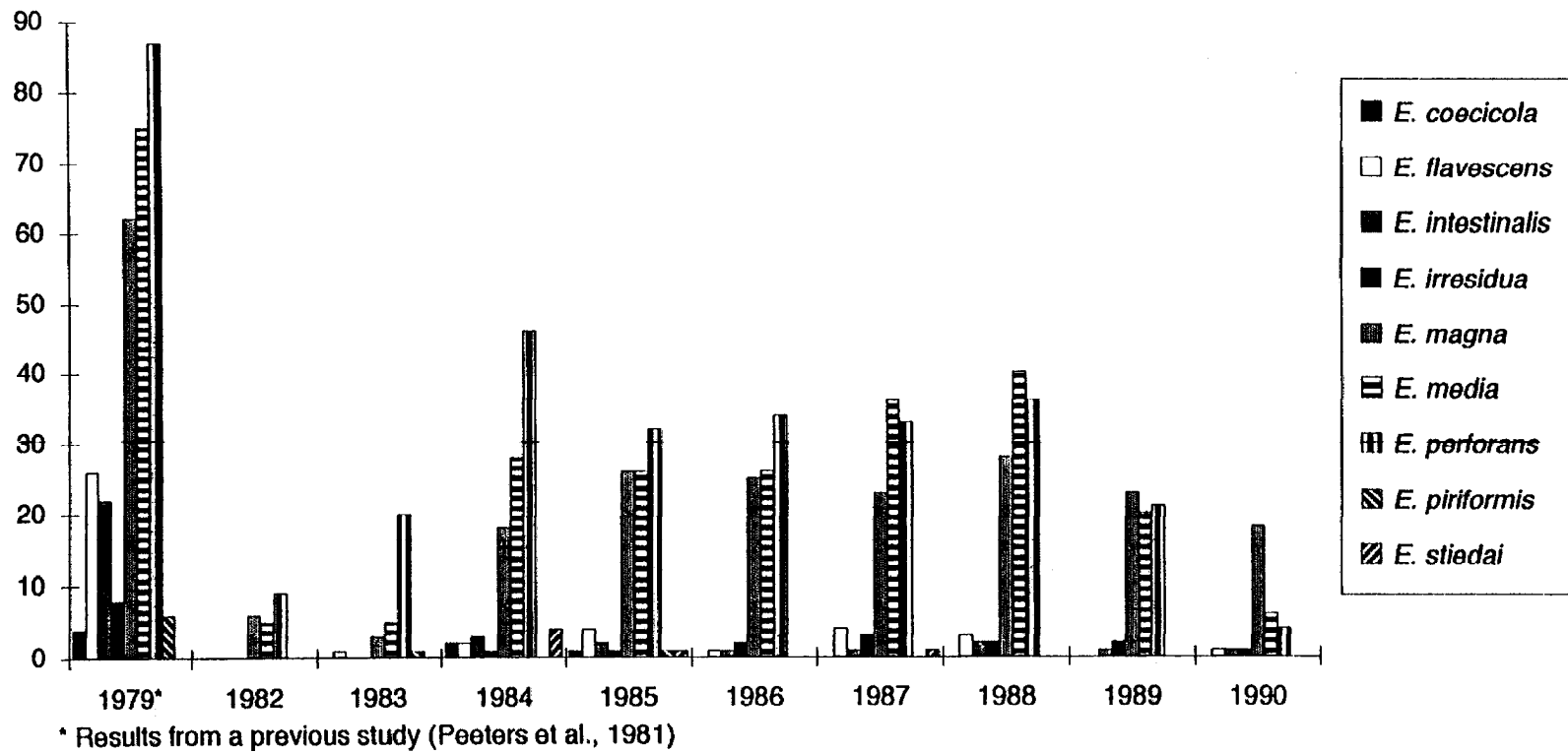
At least ten different species of *Eimeria* may occur in rabbits (Coudert, 1989). Nine of them have been detected in Belgium (Peeters et al., 1981) and the tenth species, *E. exigua*, is probably also present. Among the species affecting the gut *E. intestinalis* and *E. flavescens* cause high mortality, whereas the other species show moderate [*E. magna*, *E. media* (?) and *E. piriformis*] to low pathogenicity [*E. coecicola*, *E. exigua*, *E. irresidua*, *E. media* (?) and *E. perforans*]. The latter mainly cause growth depression and bad feed conversion. *E. stiedai* induces hepatic coccidiosis and may prejudice the marketing of the carcasses by causing white spots on the liver.

Coccidiosis is omnipresent in rabbit units and may cause considerable economic losses. Although massive intestinal coccidiosis associated with high mortality and severe growth depression have disappeared from commercial rabbit production, subclinical infections are still responsible for bad feed conversion. Moreover, all species favour colibacillosis by increasing caecal pH (Licois & Guillot, 1980) and thus favour the development of the enteritis complex (Whitney, 1970, Prescott, 1978, Sincovics 1984, Peeters, 1991). Therefore anticoccidial drugs have to be incorporated systematically in rabbit feeds.

Until 1988 only two anticoccidials were allowed in the European Economic Community (EEC) : clopidol (Coyden®) and robenidine (Cycostat®). Robenidine was used first in Belgium in 1982 and is nowadays the most largely used anticoccidial in Europe. During the IVth WRSA congress in Budapest in 1988 we showed that four years of intensive use of robenidine led to the disappearance of *E. intestinalis* and *E. flavescens* from most commercial rabbitries. *E. perforans*, *E. magna* and *E. media* became the species nearly exclusively found (Peeters et al., 1988). The first species showing chemo-resistance to robenidine was *E. magna* (Peeters et al., 1987). Numerous cases now exist in France (Coudert, 1989). Robenidine resistant strains represent of course a problem for the rabbit industry.

Since 1988 the EEC has allowed the use of clopidol/methylbenzoquate (Lerbek®) in rabbit feeds. This drug has been used in Belgium since June 1989 in a rotation programme with robenidine, mainly in commercial rabbitries showing problems with robenidine resistant strains. The aim of this paper is to establish the influence of this rotation programme on the percentage occurrence of *Eimeria spp.* in commercial rabbitries in comparison with fancy rabbitries using robenidine as only anticoccidial. In the mean time the evolution of coccidial infection between 1982 and 1990 will be reported as well.

Fig. 1. Percentage occurrence of Eimeria spp. in diarrhoeic commercial rabbits in Belgium

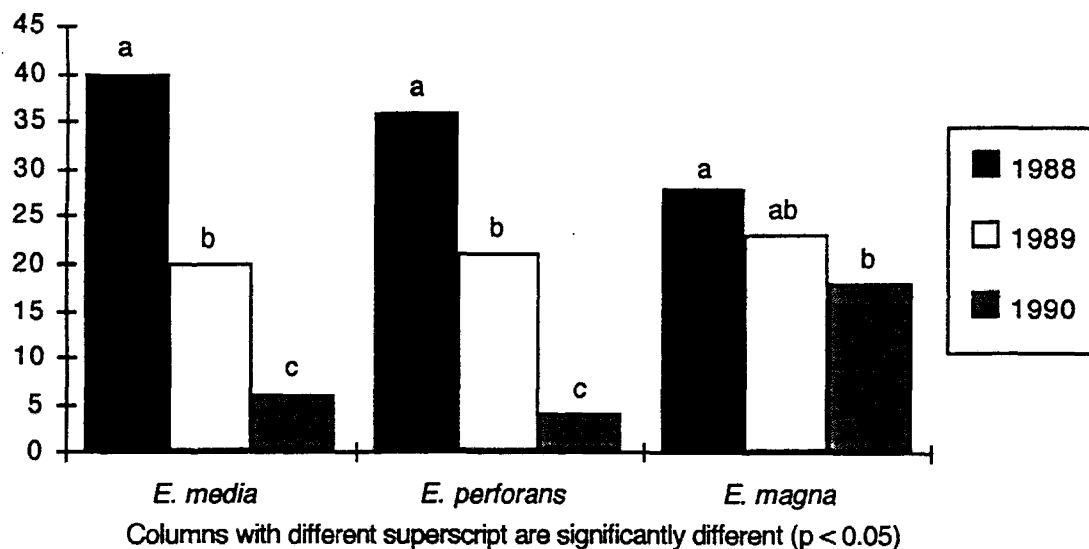


Materials and methods

Faecal samples. Between August 1982 and December 1990 a total of 1,896 caecal samples were collected in 61 commercial rabbitries from diarrheic rabbits. The rabbits were housed in wire cages which had droppings pits underneath and were fed *ad libitum* with a commercial pelleted ration containing 66 ppm of robenidine. Between 1985 and 1988 a lot of rabbit breeders added sulphadimidine-natrium to the drinking water the first week or weeks after weaning. In June 1989 increasing numbers of rabbit breeders switched to a rotation programme consisting of 3 months of feed supplementation with 220 ppm of clopidol/methylbenzoate followed by 6 to 9 months of supplementation with 66 ppm of robenidine. Moreover, another 1,026 caecal samples were collected from diarrheic rabbits sent by fancy and domestic breeders. The exact drug treatment and nutrition by these breeders were not known, but most of them kept rabbits on straw and gave a mixture of kitchen leftovers and green-stuffs to their animals, often supplemented by commercial pellets containing 66 ppm of robenidine.

Parasitology. Caecal samples were examined by the McMaster egg counting technique. Samples which were found to be negative were re-examined using the salt-flotation-concentration technique. A proportion of the screened fecal suspension was made up in 2.5 per cent potassium bichromate (w/v) and agitated in a water bath at 27°C in order to sporulate for subsequent differentiation in species as described before (Peeters et al., 1981). The frequency of the species present was determined on at least 100 sporulated oocysts.

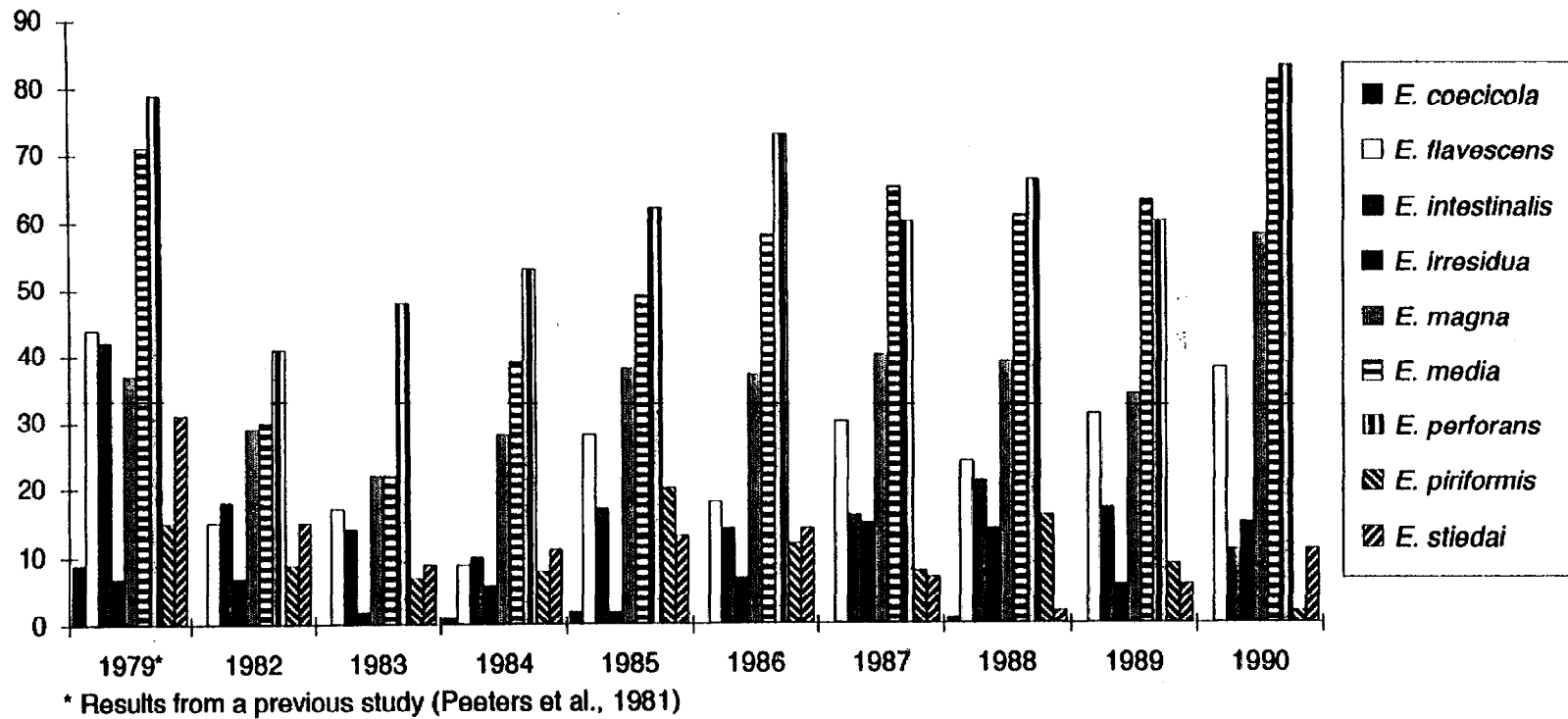
Fig. 2. Influence of clopidol-methylbenzoate/robenidine rotation on percentage occurrence of *Eimeria media*, *perforans* and *magna* in diarrheic commercial rabbits since 1989 in comparison with a continuous robenidine programme (1988)



Results

Commercial rabbitries. The first year of the incorporation of robenidine in rabbit feeds, only 6 % of caecal samples from diarrheic rabbits contained more than 100 oocysts per gramme (opg) and only three species were detected: *E. magna*, *E. media* and *E. perforans* (Fig. 1). This figure increased to 18 % in 1983 and 47 % in 1987. More and more species re-appeared and in 1985 all nine species of *Eimeria* were detected again. However, while most of these other species remained relatively rare (< 5 %), the percentage occurrence of *E. magna*, *E. media* and *E. perforans* rose

Fig. 3. Percentage occurrence of Eimeria spp. in diarrheic fancy and domestic rabbits in Belgium



progressively between 1982 and 1984. Between 1985 and 1988 the occurrence of *E. magna* and *E. perforans* remained stable, whereas a further rise of *E. media* was established with a peak incidence of 40 % in 1988. Medication with sulphadimidine-natrium by the drinking water resulted only in a temporary effect on oocyst numbers. Since the introduction of the rotation programme clopidol-methylbenzoquate/robenidine in 1989 a significant ($p < 0.01$) decrease of the incidence of *E. media* (40 % in 1988, 20 % in 1989 and 6 % in 1990) and of *E. perforans* (36 % in 1988, 21 % in 1989 and 4 % in 1990) has been noted (Fig. 2). Also the percentage occurrence of *E. magna* decreased from 28 % in 1988 to 18 % in 1990 ($p = 0.93$). Moreover, fecal samples contained less oocysts : 33 % of samples with more than 100 opg in 1989 against only 18 % in 1990 ($p < 0.01$).

Fancy and domestic rabbitries. In fancy and domestic rabbits the infection level was markedly higher : between 1982 and 1990, 34-64 % of samples from diarrheic rabbits contained 10^4 or more opg and all species of *Eimeria* were detected : *E. magna*, *E. media* and *E. perforans* were very common (22-73 %), *E. flavescens* and *E. intestinalis* were less common (10-28 %), whereas *E. coecicola*, *E. irresidua*, *E. piriformis* and *E. stiedai* were relatively rare (0-15 %) (Fig. 3). Although *E. flavescens* and *E. intestinalis* showed about the same percentage occurrence between 1979 and 1984, the incidence of *E. intestinalis* remained low (11-21 %) between 1984 and 1990, whereas the incidence of *E. flavescens* rose from 9 % in 1984 to 38 % in 1990.

Discussion

A 1979 study of healthy looking commercial rabbits receiving pelleted rations with 82.5 ppm sulphaquinoxaline/pyrimethamine as anticoccidial drug revealed the omnipresence of *Eimeria spp.* despite the presence of the drug : 85 % of samples contained more than 10^2 opg, of which 41 % with more than 10^4 opg (Peeters et al., 1981). All species were found. Similar results were obtained in Britain (Catchpole and Norton, 1979) and in France (Zundel et al., 1980).

Since 1982 robenidine has been incorporated in rabbit feeds in the EEC. This was associated with a spectacular modification of the coccidiosis pattern in commercial rabbitries (Fig. 1). Most of the species disappeared completely and only very low levels of coccidia were detected. Also in fancy and domestic rabbitries depression of coccidiosis was noticeable. This confirmed previous laboratory studies with robenidine (Coudert, 1978).

Although the incidence of most species, especially the killer species *E. flavescens* and *E. intestinalis*, remained low during 8 years of continuous use of robenidine in commercial rabbits units, the incidence of *E. magna*, *E. media* and *E. perforans* increased significantly between 1982 and 1984. Especially the rise of *E. magna* was of particular concern as this species may cause considerable economic losses by growth depression and bad feed conversion. Therefore rabbit breeders added sulphadimidine-natrium to the drinking water of weaning rabbits between 1985 and 1988. Yet, only little influence on coccidial infection rate was observed.

Since 1989 quite a lot of commercial rabbit breeders have adopted a rotation programme consisting of 3 months of clopidol/methylbenzoquate followed by 6 to 9 months of robenidine. This resulted mainly in 1990 in a spectacular clean-up of commercial rabbitries, back to the favourable situation of 1982 when robenidine was first introduced (Fig. 2). In fancy and domestic rabbitries using a continuous robenidine programme no such effect was established (Fig. 3). Rotation mainly reduced the percentage occurrence of *E. media* and *E. perforans*. *E. magna* was affected to a lesser extent, which is in agreement with earlier results with clopidol/methylbenzoquate in experimentally and naturally infected rabbits (Peeters & Halen, 1980, Peeters et al., 1983).

In conclusion : clopidol/methylbenzoquate is able to eliminate robenidine resistant strains from contaminated rabbitries, which restores the full activity of robenidine.

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Summary

Cecal samples were collected from 1,896 diarrheic rabbits issued from 61 commercial rabbitries and screened for coccidiosis. Another 1,026 cecal samples were collected from diarrheic fancy and domestic rabbits. In 1982, the year of introduction of the anticoccidial robenidine in pelleted rabbit feeds, a dramatic decrease of coccidial infection ratio was detected in commercial rabbitries and to a lesser degree in fancy rabbitries. The highly pathogenic species *E. flavescens* and *E. intestinalis* disappeared completely from most commercial units and *Eimeria magna*, *E. media* and *E. perforans* became the species nearly exclusively found. After 3 years of continuous use of robenidine most of the species reappeared, but at very low levels (< 5 %). The percentage occurrence of *E. magna*, *E. media* and *E. perforans* on the contrary rose progressively to 26, 26 and 32 % resp. in 1985 due to drug resistance. The incidence of *E. magna* and *E. perforans* became then stabilized, whereas the occurrence of *E. media* rose further to 40 % in 1988. The instauration of a rotation programme with 3 months of 220 ppm clopidol/methylbenzoate and 66 ppm of robenidine during 6 to 9 months has been able to eliminate robenidine resistant strains from contaminated rabbitries since 1989, which restored the activity of robenidine. In 1990 the incidence of *E. magna*, *E. media* and *E. perforans* in diarrheic commercial rabbits dropped again to 18, 6 and 4 % respectively.