

STUDY OF URGENT VISITS TO COMMERCIAL RABBIT FARMS IN SPAIN AND PORTUGAL DURING 1997-2007

Rosell J.M.^{*}, de la Fuente L.F.[†], Badiola J.I.[‡], Fernández de Luco D.[§], Casal J.^{‡#}, Saco M.[¶]

^{*}NANTA S.A. Ronda de Poniente 9. 28760 TRES CANTOS. Madrid. Spain.

[†]Depto. Producción Animal. Facultad de Veterinaria. C/ Profesor Pedro Cármenes s/n. 24071 LEÓN. Spain.

[‡]CReSA, IRTA, Edifici CReSA. Campus UAB. 08193 BELLATERRA. Barcelona. Spain.

[§]Depto. Histología y Anatomía Patológica. Facultad de Veterinaria. Av. Miguel Servet, 177. 50013 ZARAGOZA. Spain.

[#]Dept. Sanitat i Anatomia Animals. UAB. Edifici V. 08193 BELLATERRA. Barcelona. Spain.

[¶]Laboratori de Sanitat Ramadera. DAR. Via Circulació nord tram 6 -Zona Franca. 08040 BARCELONA. Spain.

ABSTRACT: This is a report on work carried out on 4307 visits to 868 commercial farms with domestic rabbits in Spain and Portugal from January 1997 to December 2007. Of the total visits, 2237 (52%) were emergencies on 660 farms. The median size of the farms ranged between 450 does in 1997 and 750 in 2007. This retrospective study measures the clinical disease occurrence using the Monthly Risk of urgent visits (MR), i.e. the percentage of visits made as a result of each clinical disease in comparison with the total number of urgent visits made each month. The main reasons for the emergencies were mucoid enteropathy (similar to Epizootic Rabbit Enteropathy), with a MR: 25.0%, enteritis-diarrhoea (24.1%), myxomatosis, (11.1%), reproductive troubles (8.6%), respiratory diseases (7.2%) and staphylococcosis (4.2%). Fifty-four percent of the urgent visits were due to diseases of the digestive system. Mucoid enteropathy was still one of the main diseases faced by the commercial rabbit industry during the study period. No significant yearly or monthly variations were observed in the analysis of the MR. A seasonal effect was only found in respiratory diseases during the summer (MR: 11.06±0.01) and myxomatosis in autumn (MR: 14.60±0.02), in comparison with spring (MR: 7.44±0.02). It is therefore concluded that farms should be permanently protected as they might be affected by any of these diseases at any time during the year.

Key Words: rabbit diseases, welfare, monitoring, surveillance, disease prevention.

INTRODUCTION

Rabbit production in Spain and Portugal has become more concentrated and intensified in recent years, and farms now house large numbers of animals that are exposed to sanitary problems. There is limited information in the field regarding intensive rabbit farms, the most common clinical disorders and their monitoring and surveillance (Christensen, 2001). Knowledge of these sanitary problems is of key interest for assessing animal welfare (Rosell and de la Fuente, 2009b), determining their relevance in Public Health and the financial damage they induce. As a whole these data could help in decision making and justifying investment in human or material resources used to study, control or eradicate them (Dijkhuizen *et al.*, 1997). The frequency of different sanitary problems in domestic rabbit farming in Spain and

Portugal has been discussed in a number of publications: Gracia *et al.*, (2004) describe cases sent to a diagnosis laboratory and Tantinyà *et al.*, (2000) and Rodríguez-Calleja *et al.*, (2006) describe findings in slaughterhouses and in meat, respectively. We believe that the perspective of veterinary practitioners may also be useful when quantifying the biggest sanitary problems on commercial farms, as pointed out by Wierup (2001).

Our aims were to (1) analyse urgent visits to intensive domestic rabbit farms over an 11-year period, (2) describe some epidemiological and clinical aspects related to monitoring of clinical diseases with the highest risk and (3) discuss actions related to surveillance, especially concerning clinically diagnosed zoonotic diseases.

MATERIALS AND METHODS

Study period and assessed farms

The retrospective study was conducted between January 1997 and December 2007. During this time we made 4307 visits to 868 farms located in Spain (812) and Portugal (56); 863 were meat production farms, 3 were farms with Rex rabbits and 2 produced pet rabbits. 839 of the 868 farms were closed-cycle, 20 were insemination centres and 9 housed weaned rabbits. The target rabbits were: males (or bucks, over 4.5 months old), females (or rabbit does, inseminated at least once), future breeders (between 2.5 and 4.5-5 months old), lactating rabbits (kits) and weaned rabbits (growing rabbits).

Types of visit

There were two types of visits: urgent and non-urgent. Urgent visits were made at the request of producers and occasionally of slaughterhouses; e.g. when there was a high number of condemnations of organs or whole carcasses. Non-urgent or routine visits were made on the initiative of the service company; during these visits sanitary or feeding programs were followed, but this has not been taken into account in the study.

Of the 4307 visits to the 868 farms, 2237 (52%) were urgent visits to 660 farms; 647 of these were closed-cycle, whereas 7 housed only bucks and 6 housed only weaned rabbits.

Work protocol

On each visit, data were collected on the farm, its clinical history, on the prevalence of some clinical diseases (coryza, mastitis, “sore hocks” and manges, amongst others), necropsies or sample collection. This first stage enabled us to decide whether we were dealing with an urgent or non-urgent case; this classification was always done by the same trained veterinarian. Monitoring or systematic collection of data on diseases (Salman, 2003), was carried out on the 4307 visits to 868 farms. Surveillance, which involved applying active control measures (diagnosis and, in particular, prevention and treatment), and follow-up, that is, observing recovery or relapse and recurrence, were an essential part of the 2237 urgent visits.

Diagnosis criteria used on the urgent visits

Each urgent visit was classified according to the clinical criterion with occasional assistance from microbiology, parasitology or histopathology laboratories. When two or more clinical diseases were detected at the same time on the farm, we only considered the most serious one. The threshold level of the clinical disease depended on its nature. Myxomatosis and viral haemorrhagic disease (RHD) were diagnosed when only a few affected animals, with clinical signs, were detected. The same occurred with

clinical salmonellosis. In the case of other clinical diseases, severity depended on incidence, prevalence or both, as will be indicated below. Mucoïd enteropathy (ME, according to Flatt, *et al.*, 1974; similar to Epizootic Rabbit Enteropathy/ERE, according to Licois *et al.*, 2005 and Pérez de Rozas *et al.*, 2005), was diagnosed based on the history of losses, clinical signs (anorexia, tympanism, borborigmus, grinding of teeth) and macroscopic lesions observed at necropsy (dilated stomach and intestine, impaction of the caecum or other segments of the intestine, presence of mucus), in several rabbits. ME was clinically diagnosed regardless of whether all age groups were affected or only a subpopulation on the farm; for example, only in females and kits 23 d after parturition, or only in weaned rabbits of 48 d. Enteritis-diarrhoea (ED) was presumptively diagnosed when ME was not present but inflammatory gross lesions compatible with enterobacteriosis, intestinal coccidiosis or clostridiosis, among others, were observed. When deemed necessary, we used etiological diagnosis. ED and ME occasionally occurred at the same time and the visit was classified as ED + ME. Salmonellosis was clinically differentiated from other gastroenteric disorders when besides ED in 5-15 d old kits, in weaned rabbits or both, we observed other gross pathological findings such as septicaemia, pneumonia (besides splenomegaly as the main necropsy finding), cachexia or reproductive troubles (sterility, subfertility, reabsorptions, metritis, abortions or stillbirths); in these cases we relied on diagnosis using culture, isolation and typing.

RHD was diagnosed according to the evolution of mortality, history of vaccinations, necropsy and laboratory analysis. In the case of myxomatosis and ringworm we used observation of clinical signs and laboratory analysis. We emphasize that this study is based on the examination of rabbit populations, and not just one animal. We classified infertility (the doe refused service or there were 2 to 3 unsuccessful AI, or a low gestation percentage < 60-70%, on farms using both mount and artificial insemination/AI), abortions (> 1%), obstetric disorders (e.g. uterine torsion, uterine prolapse), low prolificacy (a mean of < 8 liveborn), stillbirths (> 8%, on the parturition day) or small newborn as reproductive troubles. Morbidity as a result of coryza, clinical mastitis, sore hocks (or ulcerative pododermatitis) and manges were always determined in parous does; we measured prevalence and error using the population at risk and sample size used, according to Thrusfield *et al.* (2001). Our baseline prevalences were 25% for coryza, 5% for clinical mastitis, 10% ulcerative pododermatitis and 0% manges, for target populations, according to previous results (Rosell *et al.*, 2000a). Respiratory diseases included cases with > 30% prevalence of coryza, also pneumonia, external otitis, abscesses, torticollis and other disorders (abortions), as well as median monthly mortality risk > 4% and culling risk in breeding females > 8%.

In relation to clinical staphylococcosis we considered cases with skin lesions (pustular dermatitis in kits, does or both; digital dermatitis and perivulvar abscesses in females or dorsal lumbar abscesses, especially in bucks), and pneumonia or multifocal abscesses in internal organs (mainly heart and lung). We classified an urgent visit as mastitis when prevalence (p) of the clinically diagnosed disorder was high (p>10%), but pustular dermatitis or other alterations associated with staphylococcosis were not present. Some cases of encephalitozoonosis were diagnosed by a histopathology laboratory, but on most of our visits we based a presumptive diagnosis on clinical signs: splay leg, low-growth rate and an increase of runt rabbits at weaning, e.g. 400 g body weight at 31-35 d old (Rosell, 2005) or an increase in runts and rabbits with splay leg when sold, e.g. 631 g body weight at 67 d old (Rosell, unpublished), without enteropathy or pneumopathy being detected, and also on *post mortem* macroscopic findings that were compatible with this disease: interstitial nephritis, splenomegaly, lymphadenopathy of the mesenteric lymph node and cachexia. Some cases did not show any predominant signs except for high mortality. For example, in the Sept/15/1997 case, classified as mortality of growing rabbits, we performed 10 necropsies; the apparent cause of death in 2 rabbits was pneumonia, ED in another 2, haemorrhagic septicaemia in 3 and ME in 3. Mortality of females was another cause for urgent visits and mortality of kits (i.e. with mixed signs, e.g. pneumoenteritis detected on the same visit). Psoroptic mange, sarcoptic mange, or both, were included in manges. Sore hocks refers to visits when the highest problem was sore hocks (p>15%). Toxicosis

included visits when the adverse effects of medication were recorded and miscellaneous when other causes with a low incidence were observed.

Statistical analysis

We estimated the highest risk of each sanitary problem or clinical diagnosis criteria used during the urgent visits based on the “Monthly risk of urgent visits” (MR%), that is, the percentage of visits made as a result of each disease, in comparison with the total number of urgent visits made each month. This variable was the unit of analysis. Statistical analysis was by SAS (2007), release 9.01, utilizing different procedures (UNIVARIATE and GLM) depending on the analyses we used. Statistical significance was indicated by a $P < 0.05$.

The statistical model used was $Y_{ij} = \mu + YE_i + MO_j + e_{ij}$,

where Y_{ij} is the dependent variable MR for the main disorder observed on each urgent visit, μ is the mean, YE_i is the year effect (1997-2007), MO_j is the month effect (12), and e_{ij} is the residual effect. A second statistical model, similar to the one described, was used replacing the month effect by the season effect S_j : winter (January, February and March), spring, summer and autumn. The study was based on visit-farm-level data, and clinical diseases, including one visit maximum per farm, month and different disorder.

RESULTS

Farms

Table 1 shows the sizes of the farms we visited. The median of the population sampled over the 11-year period ranged between 450 does in 1997, and 750 in 2007.

Husbandry on the doe farms changed during the study period. In 1997 artificial insemination (AI) was used on 11% of the 225 farms visited, in 2001 on 52% of 169 farms and in 2007 on 85% of 177 farms. On all of these farms, the rabbits were housed in cages without a raised platform.

Visits, monitoring and surveillance of diseases

The absolute frequency of visited rabbitries for each main disorder on each urgent visit was: mucoid enteropathy (701 visits and 258 farms), enteritis-diarrhoea (448 visits/230 farms), myxomatosis (237/136), reproductive troubles (158/103), respiratory problems (149/97), staphylococcosis (97/65), miscellaneous diseases (87/63), mortality of females (56/46), ringworm (47/42), mortality of growing rabbits (42/38), salmonellosis (51/34), toxicosis (32/29), mortality of kits (30/25), viral haemorrhagic disease (26/22), manges (26/21), mastitis (19/16), encephalitozoonosis (19/14), and sore hocks (12/10). Table 2 shows the statistics for the main disorder observed on each visit ($n = 132$ months), corresponding to the 2237 urgent visits to 660 doe farms during 1997-2007.

The highest MR corresponded to digestive disorders, ME (25.0%) or ED (24.1%). Cases of salmonellosis, verminosis (1 case), hepatic coccidiosis (3 cases), visceral cysticercosis (1 case), and Tyzzer’s disease

Table 1: Descriptive sizes of 839 doe farms dataset sampled in Spain and Portugal during 1997-2007.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
No. of farms	225	205	204	137	169	142	154	173	182	193	177
Median	450	460	550	625	600	665	600	600	749	715	750
Maximum	2200	3355	2700	2400	6000	6000	5000	6200	5500	4880	5250
Minimum	130	100	83	75	72	120	140	53	128	55	72

Table 2: Statistics of the Monthly Risk of urgent visits for the main disorders (%).

	No.	Median	Mean	Standard deviation	Maximum	Coefficient of Variation
Mucoid enteropathy (ME)	132	20.0	25.0	13.9	75.0	67.6
Enteritis-diarrhoea (ED)	132	22.2	24.1	18.7	81.1	77.5
Myxomatosis	132	9.4	11.1	11.3	50.0	101.9
Reproductive troubles	132	8.0	8.6	8.5	33.3	99.7
Respiratory problems	132	5.4	7.2	9.4	50.0	130.1
Staphylococcosis	132	0.0	4.2	6.8	33.3	162.7
Other disorders	132	16.2	19.8	17.9	87.5	90.3

(1 case), brought the total to 1210 visits to 409 farms, that is, 54.1% of the urgent visits were due to diseases of the digestive system. Amongst serovarieties of *Salmonella* spp. identified in Spain, *Salmonella enterica* ser. Typhimurium, *Salmonella enterica* ser. Albert, *Salmonella enterica* ser. Enteritidis and *Salmonella arizonae* IIIa 48:Z4C were the most frequent microorganisms, based on 115 strains of *Salmonella* spp. isolated from rabbits (Saco, unpublished data).

The next most frequent clinically diagnosed diseases were myxomatosis (MR: 11.1%, clinical signs compatible with atypical and classical myxomatosis), reproductive troubles, excluding the cases with simultaneous appearance of myxomatosis (8.6%), respiratory diseases (7.2%) and staphylococcosis (4.2%). The CV for these diseases was unusually high, between 99.6 and 162.7, due to lower regularity between months. 32 visits were due to toxicosis. One case was due to clostridiosis by *C. septicum* (the Sept/30/2001 case, a farm with 2000 does, 40 of which had died within three days), as a result of bad practise in the application of hormones before AI. One case was due to dysbiosis (colibacillosis) caused by erroneous administration of amoxicillin in the drinking water. Another case was due to dysbiosis and mortality caused by ED in females after the administration of excess chlorine in the drinking water and 2 cases were due to the existence of abscesses in the shoulder region caused by subcutaneous injection of antimicrobials. The rest were cases of intoxication by topical exposure to insecticide in kits (over 1000 losses on a farm with 1800 females); excess sulphur in the nest boxes (to prevent ringworm), causing severe keratolytic effect and inanition or enteritis-diarrhoea and deaths in 10-20 d old kits. Visits were also made as a result of feed contaminated with excess calcium carbonate and narasin (anorexia, myopathies, cachexia and mortality in does), among others. Miscellaneous visits included, e.g. 1 case of chlamydiosis (confirmed by Stamp staining and ELISA test; León-Vizcaíno, personal communication), 1 of syphilis, 1 of a problem related to lack of ventilation, 2 cases of hyperthermic shock and 1 related to cold weather, 1 outbreak of pregnancy toxæmia, 2 cases of attacks by dogs, 2 cases of plagues of insects (*Periplaneta americana* and *Alphitobius diaperinus*, respectively), 2 cases of generalized subcutaneous oedemas in females, 1 case of Tyzzer's disease (confirmed by Whartin-Starry staining), 5 cases of dermatopathies (moist dermatitis and pseudomoniosis), 1 case of acute verminosis caused by *Passalurus ambiguus*, 3 cases of hepatic coccidiosis and 1 case of visceral cysticercosis, amongst others. 21 visits were made due to severe problems with low-growth rate in growing rabbits, 5 visits were due to low production in breeding does and 5 to poor body condition in females.

Time variation factors of MR

Table 3 shows the analysis of variance for the MR variables. The year and month variation factors were not significant for most of the sanitary problems. We underline the significance of the year factor for ED and other disorders. The effect of ED on the MR was caused by a decrease in the latter from 2005.

Table 3: ANOVA of the Monthly Risk of urgent visits for the main disorder.

	Model		Year factor		Month factor	
	F-Value	P-value	F-Value	P-value	F-Value	P-value
Mucoid enteropathy (ME)	1.08	0.38	1.40	0.19	0.79	0.65
Enteritis-diarrhoea (ED)	2.55	<0.001	4.17	<0.001	1.07	0.39
Myxomatosis	1.47	0.10	1.26	0.26	1.66	0.09
Reproductive troubles	1.50	0.09	1.10	0.36	1.86	0.05
Respiratory diseases	1.28	0.20	1.82	0.06	0.79	0.64
Staphylococcosis	1.02	0.44	0.87	0.55	1.15	0.32
Other disorders	3.85	<0.001	6.24	<0.001	1.67	0.09

The mean MR values for each Main Disorder in each month and year can be seen in Tables 4 and 5. The month factor was not significant. However, when the season factor was used as a variation factor instead of the month factor, visits due to respiratory diseases did have a significant effect ($P=0.04$); the effect of myxomatosis was almost significant ($P=0.06$). In summer MR was 11.06 ± 0.01 in comparison with the other seasons, which had MR values of 0.06 ± 0.01 . These differences can also be seen in Table 4 which shows monthly MR values. With regard to myxomatosis, significant differences were observed between the MR for autumn (14.60 ± 0.02) and spring (7.44 ± 0.02).

DISCUSSION

Farms

The sizes of the visited farms were similar by inspection to the segment of specialised farms. According to the 2003 National Rabbit Breeding Survey, published by the Ministerio de Medio Ambiente, Rural y Marino (MARM, 2005), there were 1204 doe farms with > 400 females. We therefore consider that the sanitary problems reported herein reflect the situation of intensive rabbit farming.

Monitoring and surveillance on urgent visits

The MR of urgent cases measures the importance of each sanitary problem and is useful for the monitoring and surveillance of different clinical disorders as it describes their relative occurrence. As expected, the highest risk of disorders in intensive rabbit production affects the digestive system, coinciding with results

Table 4: Mean Monthly Risk of urgent visits for each main disorder according to month (%).

	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mucoid enteropathy (ME)	26.8	16.1	33.6	23.6	30.0	24.3	26.6	26.6	23.0	26.0	23.5	19.9
Enteritis-diarrhoea (ED)	18.5	18.5	33.9	26.9	23.6	24.0	19.1	17.7	23.1	24.7	30.1	29.5
Myxomatosis	16.3	11.4	9.0	7.7	6.1	8.5	6.8	10.6	13.0	15.0	8.7	20.1
Reproductive troubles	7.8	12.7	2.7	8.8	9.8	9.4	10.9	6.6	4.4	15.0	7.1	7.9
Respiratory diseases	4.8	7.1	5.9	5.8	6.0	7.2	10.3	11.6	11.2	4.4	7.2	5.4
Staphylococcosis	8.0	3.1	3.4	1.5	5.0	6.2	7.1	3.0	4.1	5.0	2.5	0.9
Other disorders	17.7	31.1	11.5	25.6	19.5	20.5	19.2	23.9	21.2	9.9	20.8	16.4
No. of urgent visits	169	173	162	160	106	144	176	161	155	143	152	157

Table 5: Mean monthly risk of urgent visits for each main disorder, according to year (%).

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Global ¹
Mucoid enteropathy (ME)	29.1	34.5	32.5	25.2	18.5	18.8	21.7	21.7	20.2	23.3	30.8	25.0
Enteritis-diarrhoea (ED)	19.8	34.7	31.6	32.7	31.0	26.3	31.7	26.7	15.2	8.5	7.5	24.1
Myxomatosis	16.7	8.8	9.2	7.6	11.3	12.0	9.9	12.8	16.1	13.0	4.8	11.1
Reproductive troubles	7.1	8.0	6.6	8.6	8.7	11.4	14.2	8.9	5.8	5.9	9.1	8.6
Respiratory diseases	7.4	2.6	4.7	10.9	7.4	9.1	5.2	9.0	9.0	13.3	1.2	7.2
Staphylococcosis	6.1	3.5	1.0	3.7	5.1	5.8	5.4	4.4	4.7	0.8	5.4	4.2
Other disorders	14.0	8.2	14.5	11.3	17.9	16.6	11.9	17.4	29.1	35.3	41.3	19.8
No. of urgent visits	265	278	223	177	169	154	129	140	148	95	80	1858

¹ There were 2237 urgent visits, but they were only analyzed one visit per farm, month and different disorder (n=1858).

obtained in previous studies in Spain (Rosell *et al.*, 2000a). The low frequency of less common disorders is also in accordance with results obtained in preceding studies. The results of the ANOVA for the study of the time variation factors show very little annual and monthly variability, which favours the use of this variable in monitoring and surveillance. Only respiratory diseases showed a significant seasonal effect. The lack of significance for the month factor was due to high variability in MR for most of the disorders and perhaps also to the regularity with which diseases appear on intensive production farms. Production in a controlled environment reduces the seasonal relapse and its effect on associated clinical diseases, particularly during periods of substantial temperature change, i.e. spring and autumn, as pointed out by Nelson *et al.*, (2002). The high variability in MR can be seen in the high CV, which were 67.6 -77.5 for digestive disorders and 90.3-162.7 for the others, as expected for less frequent diseases.

Monitoring and surveillance of each main disorder

The frequency of visits due to ME did not decrease throughout the 11-year retrospective study period. The impact of ME on mortality and sanitary cost is still high (Rosell and Fluvià, 2008). In our opinion, this disease requires the greatest attention from all perspectives (producers, veterinarians, feed manufacturers, diagnosis laboratories, the pharmaceutical industry, research centres, Public Administrations). With regard to ED, we would like to point out the difficulty of controlling some cases of colibacillosis and clostridiosis, due to multi-drug resistance (Gracia *et al.*, 2004); but also the good results obtained (not presented) with autovaccines in cases of enterobacteriosis (salmonellosis and colibacillosis), such as that proposed by Stakenborg *et al.* (2006), which are currently being studied in Spain and Portugal. Also, on visits due to ED in 1997-2007 we requested coprological analyses that showed *Eimeria* spp. as being important agents in gastroenteric disorders in rabbits, ED or ME (not presented). In confirmed cases of salmonellosis we put a previously used plan of eradication (Saco *et al.*, 1997) into action, based on hygiene (culling, disinfection), immunoprophylaxis (autovaccine) and treatment. Taking the relevance of these diseases into account (EC, 2003), a bacteriological survey in rabbitries to detect healthy carriers might be useful, similar to that done by Agnoletti *et al.* (1999).

The low occurrence of Tyzzer's disease (1 rabbitry) is similar to our experience in 1983-1996: two cases confirmed by laboratory diagnosis; this is in accordance with a study carried out by French clinicians (Le Normand *et al.*, 2005). Further analyses in specialised laboratories would provide greater knowledge of the aetiology of cases of ED. During 1986-1990 there were 158 cases of myxomatosis on 532 farms (30%), whereas in the current data base, the MR was 11.1% (Rosell *et al.*, 1992b). Our observations show that the degree of protection on farms using immunoprophylaxis and biosecurity measures is higher than in the past (not presented). In any case, these results are not representative of the real incidence of

myxomatosis on the 868 farms during the 132 mo study period, but rather of the risk of urgent visits. Fewer visits were made as a result of RHD than in 1988-1996: 63 visits in 9 years in comparison with 26 in this 11-year period; continuous protection by vaccination of breeders is more common than before (not presented). We draw attention to the Jan/09/2007 case of RHD on a farm with 600 producing does, 200 of which had died due to this disease; we saw 24 d old affected kits with a confirmed diagnosis. Following Argüello's criterion (personal communication), the kits were vaccinated at 18 d old and the result was successful. We also know that outbreaks caused by current field strains of calicivirus might be prevented by standard vaccines available in Europe, according to OIE, (2006).

Outbreaks of respiratory diseases also required considerable clinical attention during 1997-2007 (MR: 7.2%), but were relegated from 1997 by the re-emergence of ME (not presented before 1997). These diseases are endemic on some farms and still cause low production and high mortality risks (Rosell and de la Fuente, 2009a). Respiratory diseases had a higher MR of urgent visits in summer (July, August and September). This effect coincides with the results of previous studies (Rosell, *et al.*, 1992a), in which we measured the prevalence of coryza on farms rather than visits due to respiratory diseases. In our opinion, high temperatures and low humidity in summer enable this greater prevalence. We believe that the use of immunoprophylaxis to protect production farms and in particular selection breeder centres is necessary; this should be our objective in a new approach to the problem.

As for ringworm on affected intensive production farms, the number of sick animals was sufficient to make a clinical diagnosis. As current control measures are the same for *Microsporum canis* and *Trichophyton mentagrophytes*, the most common agent according to Cabañes (2000), we did not differentiate between the two diseases, though a laboratory differential diagnosis would be necessary from the Public Health perspective (Torres-Rodríguez *et al.*, 1992), in spite of the laboratory constraints (Coelho *et al.*, 2008). Few visits were made on account of ringworm: only 5% of the emergencies. However, this does not mean that the problem is uncommon; in a previous study we found 60% mean prevalence (affected farms with clinical signs) of ringworm on 1100 farms examined between 1983 and 1996; in the study the problem had a favourable evolution (by inspection), the number of farms with affected animals decreased from 76% at the start of the study to 44% in 1996 (Rosell *et al.*, 2000b). With regard to surveillance, we may therefore affirm that some of the control measures proposed to farmers were included on visits that were not considered urgent and, obviously, on the 47 visits made on account of ringworm. Something similar occurred in the case of staphylococcosis, with a MR of 4.2%; when this problem was pandemic in Europe in the 1980s (Hermans *et al.*, 2003), we observed clinical signs (at least in litters with suckling rabbits affected by pustular dermatitis) in 63% of a sample of 212 farms. Today, the use of effective preventive measures: antiseptics in nests and metaphylactic measures applied to breeding does at parturition, as well as carrying out trials using autovaccines, has changed the situation noticeably. Nevertheless, further bacteriological sampling would be useful, as suggested by Segura *et al.* (2007).

CONCLUSIONS

We have written this paper in the belief that the information collected on 2237 urgent visits to 660 intensive farms could be useful as a reflection of the situation in Medicine and Rabbit Production. The sample of farms visited throughout 1997-2007 corresponds to the segment of specialised commercial farms. The Monthly Risk of urgent visits measures the occurrence of each clinical disease and is useful for the monitoring and surveillance of different disorders. Although the information on sanitary status is not thorough, it does shed light on the most frequent pathological processes. ME (similar to ERE) is one of the most financially important diseases faced by the rabbit industry. This study of 11 years of work demonstrates the need to protect farms against the analysed diseases, as they might appear at any time during the year. The existence of diseases that affect Public Health requires practising veterinarians to

become involved in the monitoring and surveillance of rabbit diseases, to take part in training programs and make routine visits to inform farmers of strategies to control these diseases. This overview provides useful criteria on the current situation and is a basis for future comparisons. However, the back-up of clinical diagnosis based on bacteriological sampling on farms, in AI centres and slaughter plants will supply more in-depth knowledge of disease occurrence, provide credible information and maintain consumer confidence.

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REFERENCES

- Agnoletti F., Lenarduzzi M., Ricci A., Marotta A. 1999. Isolation of *Salmonella* spp. from Italian commercial rabbitries. In *Proc.: 2nd International Conference on rabbit production in hot climates. Adana (Turkey), September 7th-9th, 1998*. Testik A., Baselga M. (Ed.) *Cahiers Options Méditerranéennes CIHEAM-IAMZ 41* 189-193.
- Cabañes F.J. 2000. Dermatophytes in domestic animals. In: *Kushwaha R.K.S., Guarro J. (Ed.) Biology of Dermatophytes and other Keratinophilic Fungi. Chapter 13. Revista Iberoamericana de Micología* 104-108.
- Christensen J. 2001. Epidemiological concepts regarding disease monitoring and surveillance. *Acta Veterinaria Scandinavica Suppl.* 94, 11-16.
- Coelho A.C., Pinto M.L., Coelho A.M., Fontes M.C., Mourão J.L., Pinheiro V., Rodrigues J. 2008. Laboratory limits on Dermatophyte diagnosis in rabbits with clinical lesions. In *Proc.: 9th World Rabbit Congress, 10-13 June, 2008. Verona, Italy*.
- Dijkhuizen A.A., Huirne R.B.M., Morris R.S. 1997. Economic decision making in animal health management. In *Dijkhuizen, A.A., Morris, R.S. (Ed.) Animal Health Economics. Principles and applications. Post Graduate Foundation in Veterinary Science. University of Sidney, Australia*, 13-23.
- EC. European Communities. 2003. Regulation (EC) No 2160/2003 of the European Parliament and of the Council of 17 November 2003, on the control of Salmonella and other specific food-borne zoonotic agents. *Official Journal of the European Union* 12.12.2003, L 325/1-15.
- Flatt R.E., Weisbroth S. H., Kraus A. L. 1974. Mucoid enteropathy. In: *Metabolic, Traumatic, Mycotic, and Miscellaneous Diseases of Rabbits, chapter 17*. In: *The Biology of the Laboratory Rabbit. 1st Ed. Academic Press, New York, U.S.A.*, 437-440.
- Gracia E., Baselga R., Fernández A., Albizu I., Villa A. 2004. Etiología de las diarreas en conejos. *Boletín de Cunicultura* 131: 20-26.
- Hermans K., Devriese L.A., Haesebrouck F. 2003. Rabbit staphylococcosis: difficult solutions for serious problems. *Vet. Microbiol.*, 91: 57-65.
- Le Normand B., Licois D., Niepceon S., Chatelier S. 2005. Description d'un cas de maladie de Tyzzer en élevage intensif de lapins de chair. In: *Bolet G. (Ed), Proc. 11^{èmes} Journées de la Recherche cunicole*, 29-30 nov. Paris, ITAVI édit. 241-243.
- Licois D., Wyers M., Coudert P. 2005. Epizootic Rabbit Enteropathy: experimental transmission and clinical characterization. *Vet. Res.* 36: 601-613.
- Ministerio de Medio Ambiente, y Medio Rural y Marino (MARM) (formerly Ministerio de Agricultura, Pesca y Alimentación/MAPA). 2005. Encuesta Nacional de Cunicultura 2003. Available at: <http://www.mapa.es/estadistica/pags/cunicultura/memoria2003.pdf>. Accessed July 2008.
- Nelson R.J., Demas G.E., Klein S.L., Kriegfeld L.J. 2002. Seasonal fluctuations in disease prevalence. Chapter 3. In: *Seasonal patterns of stress, immune function, & disease. Cambridge University Press, Cambridge, UK*, 58-88.
- OIE (Office International des Épizooties). 2006. Annual Reports of OIE Reference Laboratories and Collaborating Centres 2006. Available at: http://www.oie.int/downld/LABREF/Ref_Lab_06.pdf.
- Pérez de Rozas A.M., Carabano R., Garcia J., Rosell J.M., Diaz J.V., Pascual J.J., Badiola J.I. 2005. Etiopatogenia de la Enteropatía Epizootica del conejo. *Boletín de Cunicultura* 139: 39-49.
- Rodríguez-Calleja J.M., García López I., García-López M.L., Santos J.A., Otero A. 2006. Rabbit meat as a source of bacterial foodborne pathogens. *J. Food Protect.* 69: 1106-12.
- Rosell J.M. 2005. The suckling rabbit: Health, care, and survival. A field study in Spain and Portugal during 2003-2004. In: *Daader, A. (Ed.), Proc. of the 4th International Conference on Rabbit Production in Hot Climates. Sharm el-Sheik (Egypt), February 24th-27th, 2005*.
- Rosell J.M., Fluvia M. 2008. Análisis técnico-económico de explotaciones cunicolas. *Cunicultura*, 192: 9-13.
- Rosell J.M., de la Fuente L.F. 2009a. Culling and mortality in breeding rabbits. *Prev. Vet. Med.*, 88: 120-127.
- Rosell J.M., de la Fuente L.F. 2009b. Effect of footrests on the incidence of ulcerative pododermatitis in domestic rabbit does. *Anim. Welfare*, 18: 199-204.
- Rosell J.M., Badiola J.I., de la Fuente, L.F., Cármenes P., Badiola J.I. 1992a. Rhinitis of the domestic rabbit. An epidemiological survey during the period 1986-1991. I. Influence of the year, season and type of rabbitry. *J. Appl. Rabbit Res.* 15: 1375-1381.
- Rosell J.M., Badiola-Sáiz J.I., de la Fuente L.F. 1992b. Infezioni virali del coniglio in Spagna. *Riv. di Conigliicoltura*, 7/8, 45-50.
- Rosell J.M., de la Fuente L.F., Cuervo L. 2000a. Diagnóstico (Diagnostics). In: *Rosell J.M. (Ed.), Enfermedades del Conejo (Diseases of the rabbit). Chapter V, Volume I. Mundi - Prensa Libros S.A., Madrid, Spain*, 257-311.
- Rosell J.M., Dronadra M.A., de la Fuente L.F. 2000b. Dermatología (Dermatology). In: *Rosell J.M. (Ed.), Enfermedades del Conejo. Chapter XIX, Volume II. Mundi - Prensa Libros S.A., Madrid, Spain*, 355-398.
- Saco M., Badiola Sáiz J.I., Rosell J.M. 1997. Salmonellosis in a commercial rabbitry. A five-year survey from the laboratory and the field perspective. In: *Proc.: Symposium Salmonella and Salmonellosis '97. Ploufragan, France. May 20-22nd, 1997*. 387-389.
- Salman M.D. 2003. Surveillance and monitoring systems for animal health programs and disease surveys. Chapter 1. In: *Animal disease surveillance and survey systems. Methods and applications. 1st Ed. Salman M.D. (Ed.). Iowa State Press, Ames, IA, USA*, 3-13.

- SAS. 2007. SAS/STAT User's Guide (Release 9.01). *SAS Inst. Inc., Cary NC, USA.*
- Segura P., Martínez J., Peris B., Viana D., Penadés J.R., Corpa J.M. 2007. Staphylococcal infections in rabbit does on two industrial farms. *Vet. Rec.*, 160: 869-873.
- Stakenborg T., Vandekerchove D., Mariën J., Laevens H., Imberechts H., Peeters J.E. 2006. Protection of rabbits against *Escherichia coli* (EPEC) using an intimin null mutant. *BMC Veterinary Journal*, 2: 22-31. doi:10.1186/1746-6148-2-22
- Tantinyà M., Rosell J.M., Facchin E. 2000. Salud Pública (Public Health). In: *Rosell J.M. (Ed.), Enfermedades del Conejo. Chapter IX, Volume I. Mundi - Prensa Libros S.A., Madrid, Spain, 465-513.*
- Thrusfield M., Ortega C., de Blas, I., Noordhuizen J.P., Frankena K. 2001. Win Episcope 2.0: improved epidemiological software for veterinary medicine. *Vet. Rec.*, 148: 567-572.
- Torres-Rodríguez J.M., Dronda M.A., Rosell J., Madrenys N. 1992. Incidence of dermatophytoses in rabbit farms in Catalonia, Spain, and its repercussion on human health. *Eur. J. Epidemiol.* 8: 326-329.
- Wierup M. 2001. Why do we record disease? *Acta Vet. Scand., Suppl.* 94, 7-9.
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