

ABSTRACTS OF THE WEBINAR ON CUNICULTURE, WEBIASDESCU 2020
ONLINE MEETING, SPAIN, 11TH-24TH NOVEMBER AND 17TH DECEMBER, 2020

The first Webinar on Cuniculture, WebiAsescu 2020, organised by the Spanish Association of Cuniculture (ASESCU), was held online 11st and 24th November, and 17th December, 2020, co-organised with *Grupo Editorial Agrícola* and *Henar Comunicación Agroalimentaria*. This meeting was scheduled to replace the annual edition of the Cuniculture Symposium cancelled due to the COVID-19 pandemic. The webinar series was arranged in three editions, each consisting of two main talks and 5-6 oral communications. The first webinar focused on "Marketing of rabbit meat and new consumer trends" and included two main talks: "How to improve the marketing of rabbit meat" (by María Luz de Santos, from Intercun) and "Analysis of the status and future perspectives of rabbit meat production and industry in Spain" (by Luis Montero, from the Polytechnic University of Valencia). The second webinar was related to "Pathology: coronavirus and control of myxomatosis and viral haemorrhagic disease" and included two main talks: "Coronavirus and rabbit farming" (by Francisco Parra, from University of Oviedo) and "Myxomatosis and viral haemorrhagic disease: key aspects of its control" (by Juan M. Rosell, from Cunivetservice). This third webinar was devoted to "Present and future of the sector: Legislation, certification and animal welfare" and two main talks were given: "EFSA conclusions and recommendations: Health and welfare of rabbits on farms" (by Angela Trocino, from the University of Padova) and "Indicators of animal welfare in rabbits. How to do a full assessment" (by Antoni Dalmau, from IRTA). Moreover, a total of 16 oral communications were presented by research teams from Spain, Algeria, Mexico, France and the United Kingdom. Each webinar was attended by more than 300 participants from several European, American and African countries. Abstracts of the contributions presented are reported below.

MAIN PAPERS

**ANALYSIS OF THE STATUS AND FUTURE
PERSPECTIVES OF RABBIT MEAT PRODUCTION
AND INDUSTRY IN SPAIN**

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Spanish cuniculture has not been characterised by approaching integration processes as in other meat sectors. The main aim of the study is to identify the relationships between the two main actors in the sector, farmers and slaughterhouses, in order to propose organisational trends in the future. Databases of the Ministry of Agriculture, Fisheries and Food were used to carry out a geographical analysis of the data. The analysis shows a concentration of rabbit farms around the slaughterhouses, which leads to the conclusion that most producers depend on a single slaughterhouse as a customer, which limits

their commercial options. To improve this situation, new organisational trends are proposed, such as farmers joining strategies with slaughterhouses or integrating with them to coordinate production.

**INTRODUCTION TO AN ANIMAL WELFARE
ASSESSMENT PROTOCOL FOR DOES, BUCKS, AND
GROWING AND KIT RABBITS**

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Animal welfare assessment protocols allow us to understand the level of welfare and identify the main parameters to improve on farms. Accordingly, farmers have the option of using these tools for implementing corrective measures. Rabbits are the third species in number of heads reared for meat production in the world. However, in comparison to other species, very few studies have focused on their welfare. The European projects Welfare

Quality and Awin developed a multidimensional approach for the development of animal welfare assessment protocols containing an important number of animal-based measures. Nevertheless, rabbits were not addressed in these projects. The aim of the present communication is to present two animal welfare assessment protocols inspired by the Welfare Quality for adults (bucks, does and kit rabbits) and growing rabbits. The protocol is divided into four principles. In adult animals, the Good Feeding principle includes eight parameters (one animal-based); Good Housing includes 15 parameters (six animal-based), Good Health includes 26 parameters (16 animal-based) and Appropriate Behaviour contains nine parameters (four animal-based). In growing rabbits Good Feeding includes six parameters (one animal-based); Good housing includes eight parameters (two animal-based), Good Health includes 18 parameters (13 animal-based) and Appropriate Behaviour contains four parameters (three animal-based).

of unmedicated feed with 20% of grape pomace could represent a viable alternative which does not deteriorate meat quality.

FITTING DIGESTIBLE PROTEIN TO DIGESTIBLE ENERGY RATIO IN GROWING RABBITS SELECTED BY GROWTH RATE

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To evaluate the consequences of genetic selection programmes on the protein requirements of growing rabbits, two experimental diets, differing in their digestible protein (DP) to digestible energy (DE) ratio, were evaluated in rabbits selected by average daily gain during the growing period (line R). Diet B (low DP/DE) was formulated to obtain the current recommendations of DP/DE for fattening rabbits (10.7 g/MJ), while diet A (high DP/DE) had a higher ratio (12.2 g/MJ). A total of 180 weaned rabbits (28 d of age) were divided into two experimental groups (90 animals to each feed) and housed in individual cages until 63 d of age. Animals fed with diet A showed higher feed intake ($+14 \pm 2$ g dry matter/day; $P < 0.001$) and average daily gain ($+4.3 \pm 0.7$ g/day; $P < 0.001$) during the experimental period than animals fed with diet B. No significant differences in mortality and morbidity were observed between diets. Animals fed with diet A showed better feed conversion rate during the first week (-0.10 ± 0.03 ; $P < 0.05$), while those fed with diet B showed better results during the last two weeks (-0.17 ± 0.03 ; $P < 0.05$), suggesting that the proper DP/DE ratio changes with age. In conclusion, the use of a higher DP/DE ratio in the first weeks after weaning could help improve the performance of these animals, without compromising their digestive health.

COMMUNICATIONS

GRAPE POMACE SUPPLEMENTATION IN NON-MEDICATED DIETS FOR FATTENING RABBITS. EFFECT ON INSTRUMENTAL AND SENSORY QUALITY OF THE MEAT

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This study aimed to investigate the effect of the inclusion of grape pomace in fattening rabbit diets on the instrumental and sensory quality of the meat. Thirty-six New Zealand white rabbits were weaned at 35 d, allotted to two groups in cages with 6 animals each and fed *ad libitum* for 30 d, either commercial control pellets, medicated plus withdrawal (CO), or non-medicated pellets with 20% of added grape pomace (OV). Meat from OV group had a higher pH, and lower lightness and thawing losses compared to the control group. No significant differences were detected in the other CIELAB colour parameters (a^* and b^*), cooking losses and shear force (Warner-Bratzler) between the two treatments. A trained panel found subtle differences in liver odour and metallic flavour, which were more intense in the control group, but similar sensory characteristics in the rest of the attributes evaluated, including overall liking. In conclusion, the supplementation

INFLUENCE OF MANAGEMENT FACTORS ON THE COMPOSITION AND DIVERSITY OF CAECAL BACTERIAL COMMUNITIES OF A RABBIT PATERNAL LINE

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Aiming to study the effect of different management factors on rabbit caecal microbial composition and diversity, a 16S rDNA-based assessment through the MiSeq platform was performed. Caecal samples were collected from 425 rabbits raised in two different facilities, fed under two feeding regimes (*ad libitum* or restricted) with food supplemented or free of antibiotics. QIIME 1.9.0 software was used to process the 16S sequences to generate a table containing the counts of each OTU for each sample. The influence of the different management factors on microbial alpha diversity was assessed by computing Shannon and the number of observed OTUs indexes from the rarefied OTU table. A multivariate approach (sPLS-DA) was chosen to evaluate the influence of these factors on microbial composition. Our results revealed that the largest modification of rabbit caecal microbial diversity and composition is exerted by the breeding farm. The feeding regime and the presence of antibiotics do not modify the global diversity of the caecal microbial communities. However, these factors influence the abundance of some OTUs, as multivariate analyses evidenced a certain classification power on the different levels of the management factors studied.

CORRELATED RESPONSE IN REPRODUCTIVE TRAITS DURING LACTATION IN A LINE SELECTED FOR LITTER SIZE AT WEANING

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The genetic parameters of litter size at birth and at 7 and 31 (weaning) days of age were estimated in line Prat, selected for litter size at weaning for 35 generations. Mean values for litter size were 9.4 kits born alive (NBA), 8.9 alive at 7 d of age (N7), and 7.9 rabbits weaned (NW). The estimated heritabilities were 0.06 (NBA), 0.05 (N7), and 0.04 (NW). Genetic and phenotypic correlations between NW and the rest of the characters were at least 0.86 and 0.74, respectively. Genetic trends were 0.10 kits born alive, 0.09 alive at 7 d of life, and 0.08 kits weaned per generation. Results show that the improvement in NW is due to the improvement in NBA.

PITUITARY AND OVARIAN HORMONES IN PRIMIPAROUS RABBIT DOES: DOES LITTER SIZE AFFECT THEIR SECRETION?

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The aim of this study was to determine if litter size (LS) of primiparous rabbit does during their first lactation had any influence on the plasma concentration of Prolactin (PRL), LH (luteinizing hormone) and progesterone (P4), as well as on the main productive parameters of their second pregnancy. The pregnant does were divided after parturition into two different experimental groups according to a LS adjustment: Group TcA, with high LS (10-12 kits; n=21) and Group TcB, with low LS (7-9 kits; n=28). Blood samples were taken weekly throughout lactation starting on day 4 postpartum, until day 32 postpartum, before and after suckling. After weaning (day 32 post-partum) the does were re-inseminated, taking samples at 0 and 60 min after ovulation induction to determine the peak of LH and P4 concentrations. Does were also sampled on days 1 and 5 post-weaning. All hormones were determined by enzyme-immunoassay. After second parturition, some productive parameters were recorded: fertility, prolificacy, number of weaned, mortality and litter weight at weaning. Statistical analysis of the results revealed that LS did not significantly affect the hormonal plasma concentrations or productive performance of the females during second pregnancy.

PATHOGENS ASSOCIATED WITH DIGESTIVE DISORDERS IN COMMERCIAL RABBTRIES

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Digestive disorders are the main cause of economic losses in rabbit farms. This article provides a global and updated overview since 757 recent clinical cases were studied (95 from suckling rabbits, 117 from pre-weaning rabbits and 545 from fattening rabbits). Etiological diagnosis was carried out by bacteriological culture and a set of qPCR tests for detection of EPEC, *Clostridium spiroforme*, *C. perfringens*, rotavirus A, enterotoxigenic *Bacteroides*

fragilis and *Eimeria* spp. EPEC is the most prevalent agent in suckling rabbits. *C. spiroforme* and EPEC are the more frequently detected pathogens in pre-weaning rabbits, but enterotoxigenic *B. fragilis* appears as a new possible emergent pathogen. In fattening rabbits, diverse co-infections between *C. spiroforme*, *Eimeria* spp., EPEC and rotavirus A are much more frequent than those infections due to only one of them. Other pathogens detected in very few cases have been *Salmonella* sp. and *Enterococcus hirae*.

IS THE VACCINATION OF RABBITS AS COMPANION ANIMALS MANDATORY IN ANDALUSIA?

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In recent years, the keeping of rabbits as companion animals has increased. Diseases such as myxomatosis and viral haemorrhagic disease are of great importance in wild rabbit populations, in livestock farms and in companion animals, with special relevance from the point of view of animal welfare, health, economics and the environment. A review of all current regulations at European, Spanish and regional level that may be applicable is carried out. In the Autonomous Region of Andalusia (Spain), companion animals that do not belong to livestock farms have to meet the same identification, health and animal welfare requirements as animals of the same species used as food producing animals. Rabbits as pets must comply with a vaccination programme established and applied by a licensed veterinarian against myxomatosis and viral haemorrhagic disease.

EFFECT OF VACCINATION ON VIRAL LOAD AND PROTECTION AGAINST RHDV2

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Vaccination against Rabbit haemorrhagic disease (RHD) is the principal measure available for protection against this lethal virus, although limited scientific information is available. The aim of this study was to assess the clinical course, viral load and survival rate of animals vaccinated with ERAVAC® after experimental RHDV2 infection at 6 mo post-vaccination (mpv). To this end, 38 rabbits were randomly distributed between two groups; one was vaccinated with ERAVAC® and the other received PBS (control). Control and vaccinated rabbits were challenged

with a heterologous virulent RHDV2 strain at 6 mpv and clinically monitored for 7 d. Animals were necropsied and organs and faeces were sampled for detection of the viral load. The results showed that vaccination with ERAVAC® provides full protection against mortality after experimental challenge and prevents the spread of RHDV in faeces, as well as the persistence of the virus in major target organs, in RHDV2 infected adult rabbits at 6 mpv. This study contributed to describing the effect of the vaccine on RHDV2 transmission, as the main alternative for RHDV2 control on farms.

COMPARATIVE STUDY OF THE CASSETTE CHROMOSOME MEC (SSCMC) IN STAPHYLOCOCCUS AUREUS STRAINS ISOLATED FROM RABBITS

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The increase in antibiotic-resistant bacteria is a problem, and specifically in *Staphylococcus aureus* one of the most important resistances is to methicillin. This resistance is caused by acquisition of the mobile genetic element SCCmec (staphylococcal chromosomal cassette containing the mec gene). In this study, a selection of isolated strains of rabbits was carried out in order to sequence them and examine the SCCmec element in depth. Five different types of mec cassette (III, IVc, Vc, XI, new type) specific to each ST genotype were obtained. The types of cassettes IVc, Vc and XI found were similar to those described above. However, we found a new type of cassette in a strain type ST2855, and another type of cassette composed of this new SCCmec and part of the SCCmec type III element. In addition, within this element other resistance genes such as blaZ and genes for resistance to bleomycin and cadmium were found.

GROUP SIZE AND RELATIONSHIP EFFECT ON GROWTH AND STRESS PARAMETERS OF GROWING RABBITS

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The search for alternatives to antibiotic use in the fattening of meat rabbits is a need nowadays, as the abuse of antibiotics has caused the appearance of antimicrobial resistance. These alternatives can be related to feeding alternatives, but also to management techniques. In this work, 3 different management techniques have been assessed: feed (with and without antibiotic), cage size (8 animals and 32 animals) and relationships (siblings and no siblings in the same cage). Productive parameters (IC, GMD, IMD, motility, final weight) and haematological parameters (erythrocytes, haemoglobin, haematocrit, leukocytes, neutrophils, lymphocytes, lymphocytes-neutrophils ratio, platelets) were analysed. Feed had effect only on IC, GMD, IMD and mortality, and cage and group size also affected productive and haematological parameters, respectively.

PERINATAL FACTORS AFFECTING SURVIVAL OF KITS

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The aim of this study was to examine the effect of parity order, season, lactation status, quality of nest, sex and kindling on cage, cannibalism, and kit weight at birth on their survival in the early hours after delivery. A total of 1696 kits from 77 females of ITEL2006 synthetic line were used in this study. Kindling on cage effect and kit weight at birth were significant ($P \leq 0.001$), and cannibalism had a significant effect on the survival of kits ($P \leq 0.05$). However, lactation, sex ($P = 0.10$), parity, season, and nest quality ($P > 0.10$) had no effect on kit survival. When birthweight was 45 g, survival probability was 90%, and only 60% if they were born outside the nest. Cannibalism also reduced survival from 25 to 10% in kits with weights between 15 and 75 g. In conclusion, a high kit weight at birth increases their survival in unfavourable conditions of maternal behaviour.

STUDY OF UTERINE CAPACITY IN TWO ALGERIAN RABBIT LINES

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The aim of this work was to study the uterine capacity in females from synthetic line SS and local population LP. In total, 27 ovariectomised females from SS and 25 from LP were used. Does were slaughtered on d 25 of third gestation. Ovulation rate, number of embryos and alive foetuses, and embryonic, foetal and prenatal survival were collected. Ovulation rate and the number of implanted embryos were significantly higher in does from SS group than in those from LP group (+2.87 ova and +2.51 embryos, respectively, $P < 0.001$). No differences were found for number of implanted and live foetuses on 25 d of gestation between groups when ovulation rate was included as covariable in model. Does from SS group had a similar embryonic, foetal and prenatal survival, compared to those from LP group. In conclusion, synthetic line SS and local population LP had a similar uterine capacity.

INITIATION OF A SELECTION PROGRAMME OF A MATERNAL RABBIT LINE

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The ITEL2006 line has been selected for both litter size at birth and weight at 75 d for 3 generations. Subsequently, the line has been maintained in discrete generations without selection. Recently, new selection strategies for litter size are being studied. The aim of this study is the reproductive characterisation of base population of the maternal line. A total of 273 parities from 101 females were measured. Litter size at birth, number born alive, number of dead and weaned number were reordered. The model included farm, season (summer and winter), physiological status (nulliparous, lactating and non-lactating) and doe

permanent effects. Bayesian methodology was used. Litter size at birth, the number of kits born alive and at weaning were lower in summer than in winter (-2.0, -2.0 and -1.0 kits, respectively). Nulliparous and lactating does at mating showed more total kits born (+0.8, +0.5 kits) and born alive (+1.3, +0.8 kits) than non-lactating does. The number of weaned was similar for all physiological states. In conclusion, both season and physiological status at mating affect litter size. These results imply that litter size will have to be corrected for these effects for the application of a genetic improvement programme.

EFFECT OF FEED RESTRICTION AS AN ALTERNATIVE TO THE USE OF ANTIBIOTICS IN NON-CONTROLLED ENVIRONMENT FARMS

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The effect of feed restriction and antimicrobials on production performance during fattening was studied in 987 young rabbits reared at eight rabbits per cage in a non-controlled environment farm. Between 35 (weaning) and 63 d of age, animals were fed as follows: *ad libitum* feeding with medicated feed (AdLibMed); *ad libitum* feeding with no medicated feed (AdLibNoMed); restricted feeding with medicated feed (RestrMed); or restricted feeding with no medicated feed (RestrNoMed). All animals were fed *ad libitum* with no medicated feed between 63 and 70 d of age. The level of feed offered under restriction was theoretically 80% of the feed intake observed in groups fed *ad libitum*, but variations in environmental temperature during the trial led to a final effective level of 84%. Overall mortality was low (3.88% to 9.30%). Group AdLibNoMed had lower average daily gain and not significant but relevantly higher mortality than group AdLibMed. Group RestrNoMed did not have a lower mortality rate than group AdLibNoMed. Results indicate that feed restriction might not be the best alternative to producing without antibiotics when feed intake is highly conditioned to environmental changes and mortality is low.

FACTORS THAT INFLUENCE THE ECONOMIC AND FINANCIAL VIABILITY OF RABBIT FARMING IN THE STATE OF MEXICO, MEXICO

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This study aimed to analyse the factors influencing the costs and income of rabbit production, with emphasis on the adoption of Good Rabbit Practices (GRP). For the analysis, the producer panels technique was used and descriptive information was obtained from three Representative Production Units (RPU) of 20, 40 and 80 reproductive rabbit does. Questionnaires were applied to 30 rabbit farmers to determine the Good Practices Adoption Index (GPAI). In the RPU analysed, feed is the main cost item in production (65 to 83%); the medium-scale RPU (40 reproductive rabbit does) is the most profitable. All three RPU are financially and economically viable. The general GPAI is low (0.45), and rabbit farmers adopt GP that facilitate production, feeding, durability of housing materials and equipment. There are significant differences ($P < 0.05$) in the average GPAI of group I (0.22), in relation to group II (0.45) and III (0.68). In conclusion, the cost of feed is the main factor that directly influences the profitability of farms. Rabbit farmers adopt GRP that have a direct influence on production costs.