

**ABSTRACTS OF THE 41ST SYMPOSIUM ON CUNICULTURE, ASESCU
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The 41st Congress of the Spanish Association of Cuniculture (ASESCU) was held in Hondarribia (Guipúzcoa province) from 12th to 13th May 2016. This edition coincided with the 40th anniversary of ASESCU, which was founded in 1976. The main papers focussed on analysing the changes in rabbit feeding in the last decades and future prospects, on preparing the future reproductive rabbit, on Spanish consumer segmentation and characterization of rabbit meat consumption, and on the role of the Rabbit Meat Marketing Board (INTERCUN) in promoting consumption of rabbit meat in Spain. A specific session was devoted to explain the objectives and progress of the research projects supported by the partnership between the Spanish Institute of Agricultural Research (INIA) and INTERCUN. In addition, a round table was held on the present and future prospects of the rabbit farming in Spain. Moreover, a total of 24 communications were presented both in working sessions with oral communications and posters (nutrition, carcass and meat quality, pathology, ethology and welfare, and management and genetics). The meeting was attended by more than 185 participants, including researchers from Spain, Portugal, Italy, France, Brazil, Egypt, and Puerto Rico among other countries. Abstracts of the contributions presented are reported below.

**PREPARING THE FUTURE REPRODUCTIVE
RABBIT**

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The reproductive success is not only defined by the genetic potential that each individual inherit from its parents. Maternal and environmental effects that males and females encounter during their development also influence it. The uterine space, the gestation site and the number of littermates influence the pre-natal development, the birth weight and the offspring survival ability in early lactation. In a context where selection favors high litter sizes, and thus littermate competition, practices like cross-foster offspring to reduce litter size and promote weight homogeneity favors the correct development of future reproducing rabbit. Few works have been dedicated to study the effects of post-weaning phase on the future reproductive success. Here we point out the necessity of studies dedicated to unravel the consequences of current food restriction practices on the future reproductive life of

males and females. Much has been studied regarding the nutritional practices adopted from their selection as future breeders to the beginning of their reproduction, the called rearing period. Two nutritional strategies (quantitative or qualitative restriction) may be used during this phase to favor the correct body development of males and females, while avoiding over-fattening. Regarding male rearing period, their nutrition is straight related to the season. During fall is recommended to nourish young males with high-energy diets while during spring levels a lower energy content seem to be sufficient to cover their needs. Crude protein levels should be superior to 15% during this period. The most extended recommendation in young females is the feed restriction when high-energy diets are used until females reach 80% of their adult weight. We argue that a minimum physiological maturity must be reached before inseminate females for the first time. Wait for physiological maturity may improve health and welfare of rabbit females. The use of low-energy and high fiber diets as an alternative strategy is mentioned. This strategy are recommended to be applied no later than 70 d old, favoring thus the development of a higher feed intake capacity. This strategy also favors a smoother development of the body and has positive impacts on the long term.

SPANISH CONSUMER SEGMENTATION AND CHARACTERIZATION OF RABBIT MEAT CONSUMPTION

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Rabbit meat is an essential component in the Spanish gastronomic culture. Its use in many traditional recipes makes it a common ingredient, an aspect that provides a significant advantage over other more unusual or exceptional food. However, consumption of rabbit meat in Spain is in a delicate situation of stagnation, with unfavorable growth prospects. Numerous studies have analyzed the perception of the Spanish rabbit meat consumer, without reaching deep into aspects such as lifestyle or market segmentation, essential concepts if it would like to stand out in a saturated market of food proposals and characterized by an extremely dynamic society. Using data from a survey (with 3.53% error) we segmented the Spanish food market using a version of Food-Related Lifestyle (FRL), an instrument designed to segment the consumers according to their food related lifestyles. Factor analysis and cluster analysis yielded four segments, identified as (1) "Unconcerned", (2) "Cooks", (3) "Out-of-home consumers and convenience shoppers" and (4) "Rational purchaser with little interest in cooking". Finally we analyzed each segment by consumption of rabbit meat. The data obtained, from a marketing perspective, may be useful for the rabbit sector.

NUTRITION

EFFECT OF DIETARY SOLUBLE FIBRE INCREASE ON SPERM PARAMETERS IN ADULT AND YOUNG RABBITS

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In this work we have used 2 diets that differed in their main energy source (CS: cereal starch; FS: soluble fibre) to evaluate its possible effect on growth and intake, as well as on their semen traits in males from a paternal line used to artificial insemination. To this end, 72 adult males

of 14 mo of age (24 CS and 48 FS) and 53 young males of 3.5 mo of age (27 CS and 26 FS) were controlled during 5 and 7 months, respectively (preliminary results of a one-year trial). The daily feed intake of males with CS diet was higher for both ages (+14.0 and +15.8 g/d for adults and youngers, respectively; $P < 0.05$) due to an increased feed intake during the first control. Semen parameters were unaffected by the feed or male age. Only the percentage of sperm with abnormalities was significant lower with CS diet in young males (-3.54 points of percentage; $P < 0.05$).

PLASMA UREA NITROGEN AS AN INDICATOR OF AMINO ACID IMBALANCE IN RABBIT FEEDS: DAILY EVOLUTION

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In recent decades, the protein content of growing rabbit feeds has been reduced to decrease the risk of digestive disorders, minimize N excretion to environment and optimize diets. Under these conditions, a correct feed amino acid formulation is crucial. This study evaluates the level of plasma urea nitrogen (PUN) as a possible indicator of amino acids deficit in growing rabbits. Two diets were formulated with 8.1 and 4.4 g of lysine per kg of dry matter, within the recommendations (P8.1) and below them (P4.4), respectively. Twenty rabbits were used in a design with changes, controlling feed intake and drawing blood at 8:00, 12:00, 16:00, 20:00, 0:00 and 4:00 of days 57 and 59 of life to have the daily evolution of PUN every 4 h. Changes in the level of PUN were associated to the previous intake, being both maximum at 20:00 (15.9 mg/dL and 10.9 g/d) and minimum at 8:00 (13.4 mg/dL and 4.8 g/d). Rabbits fed with P4.4 had significantly lower feed intake (-21.4±4.6 g/d; $P < 0.01$) and higher PUN (+2.13±26 mg/dL; $P < 0.001$) than those fed with P8.1. With balanced feed P8.1, PUN level showed very similar evolution to that observed for feed intake, the more intake the more PUN. However, with feed P4.4 (clearly unbalanced in lysine), PUN values were always high and there are no great differences throughout the day. PUN difference between diets was the highest at 8:00 (+3.81 mg/dL), so it might be a good moment to evaluate the possible amino acids deficiencies in diets for growing rabbits.

EFFECT OF WHITE-ROT FUNGI BIOLOGICAL TREATMENT ON COWPEA STRAW (*VIGNA UNGUICULATA*) IN RABBIT FEEDING

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Recent studies suggest the ability of white-rot fungi in reducing lignin concentration of various by-products, and thus to value them nutritionally. In this context, the aim of this study was to evaluate the effect of five species of fungi - *Ganoderma lucidum*, *Lentinula edodes*, *Pleurotus citrinopileatus*, *Pleurotus eryngii* and *Phlebia rufas* – in the chemical composition and *in vitro* digestibility of cowpea straw (*Vigna unguiculata*) for use in rabbits feed. In addition, we evaluated 2 incubation periods of each mold (22 and 45 d). The results indicate that the fungus *Pleurotus citrinopileatus* promoted a higher nutritional value of the straw, with a significant reduction ($P<0.05$) of lignin content (–46.1%) and an increase ($P<0.05$) *in vitro* digestibility (+30.4%). However, there was a decrease in the content of hemicellulose and cellulose in the fungal colonization. It was also verified that a 22-d period of incubation is sufficient to observe an improvement in the nutritional value of this byproduct.

EFFECT OF *BACILLUS AMYLOLIQUEFACIENS* AND SODIUM HEPTANOATE SUPPLEMENTATION ON GROWING RABBIT PERFORMANCE

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The aim of this study was to evaluate the effect of supplementing with *B. amyloliquefaciens* (Ecobiol) and sodium heptanoate (Hepton) on growth performance of growing rabbits. A control diet was formulated (17.3% crude protein and 36.2% neutral detergent fibre, on dry matter basis), and other 3 diets were obtained supplementing control diet with 500 and 1000 g *B. amyloliquefaciens*/t and 1000 g sodium heptanoate/t. Rabbits weaned at 25 d rabbits were used (67/diet). Rabbits fed BA2 diet tended to eat less than control group ($P=0.073$), and reduced feed intake by 6% compared to BA1 group ($P=0.036$) from 25 to 40 d of age, with no effect on growth rate or feed efficiency. From 40 to 63 d of age BA2 group ate 10% less than control group ($P=0.002$), with no effect on weight gain, resulting in a trend to improve feed efficiency ($P=0.063$). Rabbits from BA2 group also increased feed efficiency by 8%

compared with those of BA1 group in the 40-63 d period ($P=0.031$), without differences in feed intake or weight gain. Assessing the overall period, the increase the dose of *B. amyloliquefaciens* (BA2 vs. BA1) tended to decrease the feed intake ($P=0.069$) and feed efficiency increased by 6% ($P=0.006$). *B. amyloliquefaciens* supplementation, regardless of the dose used (BA2 or BA1), did not affect mortality in the overall period. During the 25-63 d period, supplementation with sodium heptanoate compared to the control group reduced feed intake 5% ($P=0.050$) and did not change the growth rate, leading to an increase of feed efficiency 7% ($P=0.003$). Compared to the average of BA1 and BA2 groups, rabbits fed sodium heptanoate showed greater weight gain (5%; $P=0.012$) and feed efficiency (4%; $P=0.024$), reaching a higher final weight ($P=0.012$).

EFFECT OF CELLOBIOSE SUPPLEMENTATION IN DRINKING WATER AND LEVEL OF DIETARY SOLUBLE FIBER ON GROWING RABBIT PERFORMANCE

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The aim of this work was to study the effect of supplementing doses of cellobiose lower than 7.5 g/L in drinking water of rabbits fed with 2 levels of soluble fiber on growth performance of growing rabbits. Three levels of cellobiose were used in drinking water, 0, 3.5 and 7.0 g/L NPC Cello-Oligo×2 levels of soluble fibre in the feed, LF: 8.2 vs. HF: 10.5% dry matter. Two hundred and forty rabbits weaned at 26 d of age were used (40/treatment) and 8 rabbits/treatment were slaughtered at 39 d of age and experimental diets changed to a common standard diet. Cellobiose was removed at 4 d of age. From 26 to 39 d of age, rabbits fed with the highest level of soluble fiber reduced feed intake by 6.4% compared to those fed the low level of soluble fiber ($P=0.002$), decreasing weight gain by 7.0% ($P=0.002$). Rabbits fed a low level of soluble fiber combined with 3.5 g cellobiose/L increased the weight gain and feed efficiency during this period compared to the average of the control group and the group given 7 g/L ($P_{BF(0+7 \text{ vs. } 3.5)}=0.004$ and 0.012, respectively), resulting in a better weight at 39 d of age ($P_{BF(0+7 \text{ vs. } 3.5)}=0.004$). Treatments had no effect on sucrose specific activity in the jejunum at 39 d of age. In the overall period, it was observed that increasing cellobiose concentration decreased linearly feed intake ($P=0.040$) and tended to improve feed efficiency ($P=0.10$). The BF-3.5 g cellobiose/L group gained more weight than those who received 0 or 7 g

cellobiose/L ($P_{BF(0+7 \text{ vs. } 3.5)}=0.019$). In contrast, AF rabbits receiving the intermediate cellobiose concentration gained less weight ($P_{AF(0+7 \text{ vs. } 3.5)}=0.035$). The level of soluble fiber did not affect mortality during the fattening period, but the increase of the concentration of cellobiose tended to reduce linearly mortality in BF group ($P_{BF(0 \text{ vs. } 3.5 \text{ vs. } 7)}=0.069$), while in AF group those receiving the intermediate cellobiose concentration the mortality tended to be lower ($P_{AF(0+7 \text{ vs. } 3.5)}=0.11$).

EFFECT OF SUPPLEMENTATION WITH ARGININE AND GLUTAMINE ON ILEAL AND FAECAL DIGESTIBILITY IN RABBITS AFTER WEANING

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The aim of this work was to study whether the dietary supplementation with arginine and glutamine and the eventual relationship between them influence ileal and faecal digestibility of weaned rabbits. A basal diet was formulated (C). Another 3 diets were obtained by adding 0.4% arginine (ARG), 0.4% glutamine (GLN) and a mixture of 0.4% arginine and 0.4% of glutamine (ARG+GLN) to the basal diet. An interaction ARG×GLN was observed for the faecal digestibility of GE y N ($P=0.008$ and $P=0.001$ respectively). Faecal digestibility improved with ARG or GLN supplementation compared to control diet, although when both amino-acids were supplemented together (ARG+GLN) it showed an intermediate value between control diet and those supplemented with ARG or GLN ($P<0.001$). Faecal digestibility of neutral detergent fibre was higher in diets supplemented with GLN ($P<0.001$). Treatments did not affect ileal dry matter and N digestibility ($P=0.44$). Glutamine supplementation tended to increase ileal apparent glutamic acid digestibility ($P=0.099$) respect to unsupplemented rabbits, while it did not affect the ileal apparent digestibility of the other amino acids ($P=0.13$). Supplementation with arginine+glutamine increased or tended to increase the ileal digestibility of most essential and not essential amino acids of the rabbits at 35 d of age ($P=0.096$) respect to the glutamine supplementation.

EFFECT OF PUERPERIUM DIET ON REPRODUCTIVE AND GROWTH PERFORMANCE OF RABBIT DOES AND KIDS SUBJECT TO SEMI-EXTENSIVE CYCLES

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The objective of the current study was to evaluate the effect of different doe feeds over the puerperium period on productive and reproductive parameters in semi-extensive production systems. Experimental diets consisted of a control (D1) diet formulated following the standard recommendations, then this diet was supplemented with extra levels of: amino acids (D2); or energy, mineral and vitamins (D3); or all these nutrient together (D4). As a result, D1 and D4 led the lowest and highest doe body weight, fat and energy body content ($P<0.01$). Dietary treatments in the puerperium period did not affect reproductive parameters or mortality. However, a significant effect of the puerperium diets was observed on litter weight and feed intake per cage. D4 diet had the highest litter weight and feed intake values, in both, at the end of puerperium period ($P<0.001$ and $P<0.05$, respectively) and at weaning ($P<0.001$ and $P<0.01$, respectively). An impairment of FCR was observed when D2 diet was used, being this effect evident for delivery-end of puerperium period and for the delivery-weaning period ($P<0.001$ and $P<0.01$, respectively). In summary, based on the data of the current study, it seems interesting to use doe feeds supplemented with amino acids, energy, minerals and vitamins during the puerperium period.

CARCASS AND MEAT QUALITY

THE EFFECT OF TRANSPORT CONDITIONS ON MEAT QUALITY OF GROWING RABBITS

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To evaluate the effect of transport, lairage, and cage position within the truck on carcass and meat quality, 160 rabbits aged 84 d were controlled. The increase of transport time from 1 to 3 h increased dressing out percentage (60.7 vs. 61.5%; $P<0.05$) and *longissimus lumborum* pH (5.64 vs. 5.73; $P<0.01$) and decreased the lightness index (49.8 vs. 47.6; $P<0.01$). The increase of lairage until 3 h increased pH (5.64 vs. 5.74; $P<0.10$) and decreased cooking losses (30.9 vs. 29.1%) and shear force of *l. lumborum* (5.39 vs. 4.13 kg/g) ($P<0.001$).

The cage position within the truck affected dressing percentage lower in top cages compared to bottom cages (60.5 vs. 61.7%; $P < 0.01$), whereas the cage exposition to air (external and internal cages) had only minor effects on meat colour.

EFFECT OF LEVEL OF SOLUBLE FIBRE AND OMEGA-6/OMEGA-3 RATIO ON BODY AND CARCASS CHEMICAL COMPOSITION IN GROWING RABBITS

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The aim of this work was to study whether the relationship between soluble fiber and the n-6/n-3 ratio affects the body and carcass chemical composition. Four diets were designed (LF_Ln-3, LF_Hn-3, HF_Ln-3 and HF_Hn-3), with 2 soluble fibre levels (7.8 vs. 14.4% dry matter[DM]; LF and HF) and two n-6/n-3 ratios (3.5 vs. 13.4; Ln-3 and Hn-3). Forty rabbits/diet weaned at 26 d of age were used (460 ± 79.8 g) to determine body and carcass composition by bioelectrical impedance at 27, 39, 62 and 69 d of age. Kits from LF_Hn-3 and HF_Ln-3 diets, tended to weigh more and had more body energy ($P = 0.078$ and 0.094). Carcass protein percentage decreased 1.16% in young rabbits from LF_Hn-3 diet ($P = 0.035$) compared to LF_Ln-3 and HF_Hn3 treatments. Body weight at 62 d tended to be higher with higher levels of n-3 ($P = 0.073$), decreasing by 1.2% ($P = 0.049$) body protein percentage and increasing by 2.7% ($P = 0.031$) fat percentage. All these variables were similar at 69 d. Body energy at 62 d tended to increase in young rabbits fed with LF_Hn-3 (2380 vs. 2353 kJ/100 g DM; $P = 0.064$), while at 69 days tended to increase in LF_Hn-3 and HF_Ln-3 treatments (2493 vs. 2463 kJ/100g DM; $P = 0.064$). Carcass fat percentage at 39 d of age in rabbits fed LF_Hn-3 treatment tended to decrease with respect those fed with the diet LF_Ln-3 ($P = 0.074$), whereas at 69 d rabbits from BF_An-3 treatment, tended to increase their body fat percentage compared with those fed LF_Ln-3 diet ($P = 0.074$).

PATHOLOGY

ANTIMICROBIAL SENSITIVITY OF STAPHYLOCOCCUS AUREUS IN RABBITS AGAINST TIAMULIN, TILMICOSIN, ENROFLOXACIN AND TETRACYCLINE

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Staphylococcus aureus is an important cause of bacterial infections in rabbit. Staphylococcosis control is mainly done by antibiotic treatment; however its effectiveness is limited by antibiotic resistant strains and the lack of reference values for *in vitro* sensitivity tests. In this study, *in vitro* antibiotic sensitivity to tiamulin, tilmicosin, tetracycline and enrofloxacin of *S. aureus* strains from staphylococcal process in rabbits was evaluated. Antibiotics concentrations obtained in tissue after oral treatments was also determined. All *S. aureus* strains tested have a minimum inhibitory concentration (MIC) of tetracycline, enrofloxacin and tilmicosin higher than the antibiotic tissue concentrations reached after treatment; suggesting that these antibiotics are not effective against rabbit staphylococcosis. After tiamulin treatment, the antibiotic concentration in tissue was < 0.5 µg/g. Seven of the 13 *S. aureus* strains tested had $MIC < 0.5$ µg/mL while the other 6 strains had $MIC \geq 0.5$ µg/mL. This result indicates that tiamulin treatment to rabbit *S. aureus* infection could be feasible; but it is necessary to study antibiotic sensitivity of each case since there are tiamulin resistant strains in the population and it is also necessary to determinate the accurate tiamulin tissue level.

STAPHYLOCOCCUS AUREUS AUTOGENOUS VACCINES IN COMMERCIAL RABBIT FARMS. FACTORS AFFECTING EFFICACY

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Staphylococcosis is one of the most significant bacterial diseases in rabbit farms that cause high mortality in suckling rabbits and pyogenic processes in does and growing rabbits. In this study, *Staphylococcus aureus* autogenous vaccines were applied to all the animal stock in 15 commercial rabbit farms following the recommended protocol. Productive data was collected before vaccination and after a minimum of one year vaccinating period. Presence of new outbreaks of staphylococcosis during that vaccinating period was also recorded. Autogenous vaccine application was considered effective in 73.3% of the farms (11/15) in which a decrease in mastitis affected primiparous does or in suckling rabbits mortality rate was observed. Nevertheless, in 9 out of those 11 farms, at least one disease outbreak was recorded. Some factors affecting autogenous vaccine efficacy have been detected,

as presence of some severe concomitant diseases, the correct vaccine protocol application and the introduction of animals or semen from a different origin than usual. The time interval for applying a new dose to the animal stock of the farm must be less than 6 mo in every case.

THE IMPORTANCE OF *STAPHYLOCOCCUS AUREUS* TYPING: ORIGIN, VIRULENCE AND DEVELOPMENT

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Staphylococcus aureus is a bacterium that has become very important in recent decades. It affects both humans and animals and causes great economic losses. The evolution of *S. aureus* strains in the last 15 yr is studied in this research by typing with VNTR and MLST. Sixty-four different genotypes were obtained with the first technique and 13 ST with the second. The most prevalent genotype was A1/II1/6 (54.93%) and the most common ST was the ST121 (82.02%). In turn, A1/II1/6 was ST121. ST96 strains represented only the 8.67%. The most common genotype belonging to ST96 was B1/IV1/a. The ST121 remains the most prevalent over these 15 yr. The ST96 is second in prevalence except for the years 2013 and 2015 (3rd in prevalence). ST121 strains have numerous virulence factors, which may explain that it is the most widespread clone.

HOW RABBIT IMMUNE RESPONSE VARIES DEPENDING ON THE STRAIN OF *STAPHYLOCOCCUS AUREUS*

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One of the challenges facing rabbit breeding is the presence of *Staphylococcus aureus* widely in commercial farms. *S. aureus* is a Gram-positive bacterium that can infect both humans and animals. Affects rabbits of all ages and produces different types of lesions like mastitis, which is one of the main causes of culling of adult does. An experimental infection was designed in order to compare local and peripheral immune responses developed by the

animal after intramammary inoculation using two strains (ST121 and ST96) isolated from natural cases of mastitis. One hundred per cent of the animals infected with the strain ST121 developed mastitis, while the inoculated animals with the clone ST96 did not show any signs of mastitis at the end of the study. These findings are consistent with the variations observed in the population of leukocytes analyzed by flow cytometry: monocytes of rabbits inoculated with clone ST121 increased from day 3 post-infection until the end of the period study, while T cells experienced a progressive decrease, mainly due to the decrease of the subpopulation of CD4⁺ and CD8⁺ T cells. However, none of these oscillations in leukocyte subpopulations were observed in rabbits infected with the strain ST96. These results confirm that, as well as the immune system of the host, the genetic characteristics of the bacterium are essential for the development of lesions.

CLINICAL AND PATHOLOGICAL PARAMETERS OF MYXOMATOSIS IN THE NORTHEAST OF PORTUGAL

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This paper presents the results of a clinical and pathological study, which was performed in 12 rabbits from a farm in Portugal. The aim of the study was to investigate the characteristics in rabbits with clinical myxomatosis. Differences were observed. Most animals showed cerebral oedema. Five animals had blepharitis. Half of the animals had myxoma, 5 of which in the ears, 2 eyes and one in the genitals. The latter animal also had concurrent injuries in the ears and eyes. Six rabbits animals had pneumonia and one of them had abscesses. All animals were diagnosed by histopathology. In this study were observed 6 animals with cutaneous and respiratory form simultaneously suggesting a change in the typical pattern classification. This study provides preliminary data and more extensive research is needed with several farms to confirm our findings.

ETHOLOGY AND WELFARE

EFFECT ON RABBIT FEMALES AND KITS OF A GROUP HOUSING SYSTEM

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The productive life of 32 rabbit does was measured for 7 mo. Half of them were allocated in individual cages and other half in a mixed housing system (collective cages during pregnancy and late lactation and individual cages from partum to 11 or 18 d post-partum). Productive performances were not affected by housing system, but half of rabbit does allocated in mixed housing group shown body injuries at weaning (28 d) and litter mortality was higher after grouping in collective cages related to individual cages (10 vs. 0.8%), and in collective cages was higher for younger kits (10 vs. 6.2%), especially when 11 d old litters were mixed with 18 d old litters (23 vs. 1.8%).

BEHAVIOUR AND HANDLING OF RABBIT DOES IN GROUP HOUSING SYSTEM

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The behaviour of 25 rabbit does in collective systems was evaluated and handling time compared with 25 rabbit does allocated in individual cages along three parturitions. The frequency of different behaviours of does (nest approach, feeding and aggression) within 30 min after regrouping at 18 d post-partum, the location of kits after 30 min and 24 h of regrouping and handling parameters (time for weaning and palpation and frequency of cage cleaning) were evaluated. The does from second and third parturition had higher frequencies of the behaviour of feeding, aggressive and escape that primiparous does. Dominant females had a higher frequency of feeding, aggressive and escape behaviours ($P < 0.05$). After 24 h most of kits were located outside of nest (16%) or into others nest (64%). The time for does palpation was greater in collective pens (64%) but individual cages demanded more cleanings (113%).

PHYSIOLOGICAL RESPONSE TO ACUTE STRESS IN RABBITS FED WITH ENRICHED DIETS WITH N-3 POLYUNSATURATED FATTY ACIDS

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A total of 700 kits were randomly distributed in flat-deck group cages avoiding litter effect. They were fed 2 isofibrous, isoenergetic and isoproteic diets formulated with 2 different sources of fat: mixed fat (control group, C, n=350) and a supplement of salmon oil rich in polyunsaturated fatty acids (PUFAs) n-3 (PUFA group, P, n=350). After a fattening period of 34 d, growth was lower in P kits but they tended to a better conversion ratio and feed efficiency. Before slaughter, 60 rabbits (30 C and 30 P) were randomly selected to simulate acute stress of transport, using 15 animals from each group by means an acute heat stress trial performed in an isolated thermal chamber (40°C for 3 h). Hot carcass weight was lower in P kits, but biometric parameters and carcass yield was similar between groups. Heat stress increased the haematocrit of P rabbits. Following the same pattern, liver colour of the stressed kits had a higher value for brightness, saturation and hue than unstressed kits. In heat stressed animals, muscle pH was lower at slaughter but after 24 h post-mortem, it was similar between stressed and unstressed kits. Regarding muscle and carcass colour, there was no significant effect of diet or stress, but there was an effect with time *post-mortem*.

EFFECT OF ACTUAL CLIMATE CHANGE IN ENVIRONMENTAL TEMPERATURE ON GROWTH AND REPRODUCTIVE TRAITS OF TWO LINES OF RABBITS IN EGYPT

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The growth traits (individual body weight at weaning (PS) and at slaughter (PS)) and litter size traits (total born (NT), number weaned (ND), number marketed (NS)) were studied in two lines of rabbit (Alexandria (ALEX) and V) in the winter and summer in Egypt in 2 consecutive years. V Line is a maternal line and ALEX Alexandria line is formed as a synthetic paternal line. Our purpose was to obtain indications about the genetic variation between the 2 lines that formed the experiment in their adapting to production conditions of rabbit in Egypt. Total of 262 does (140 in winter and 122 in

summer) and 1514 records for growth traits (955 in winter and 559 in summer) obtained between September 2013 and February 2015. The index temperature and humidity (THI), in northern Egypt (Alexandria) where the experiment was carried out, was between 21.19 and 19.98 in winter vs. 30.75 and 30.92 in the summer of the years 2013-2014 and 2014-2015, respectively. The females of the line V showed a high reproductive level (NT, ND and NS) compared to young rabbits ALEX line while the ALEX line had higher PS than the line V. No significant differences were observed between the young rabbits at weaning of both lines. The results showed significantly lower values in the characters NT, ND and NS in the summer compared to winter in the two lines. It was noted that the body weight of the young rabbits at weaning was significantly improved in the winter of 2014-2015 compared with winter 2013-2014 which could be due to the change in ambient temperature. The rise in temperature had a positive effect on the characters studied in winter while it had a negative effect in the summer that may be making the selection response is not observed.

EFFECT OF CLIMATIC STRESS ON PHYSIOLOGICAL PARAMETERS OF FEMALE RABBIT UNDER EGYPTIAN ENVIRONMENTAL CONDITIONS

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This study was conducted to investigate the effect of heat stress on some haematological and biochemical blood parameters on two lines of female rabbit. A total of 135 female of 2 lines of rabbits (Alexandria (ALEX) line and V line) were used in the experimental period, 67 females Alexandria line and 68 females V line rabbits. The samples were taken at 21 d of gestation period. Results revealed that the Alexandria line was increased significantly than V line regarding number of white blood cells and Lymphocyte % by 3.4 and 2.9%, respectively, respect to the experimental mean. On the other side, the V line was significantly higher than ALEX line for number of red blood cells, Hb, and packed cell volume by 5.8, 4 and 3.4%, respectively, respect to the mean. Also, both total protein and Albumin levels increased significantly with V line compared with Alexandria line by 4.22 and 12.93%, respectively. The previous parameters were significantly increased with the increasing of the temperature during summer season at 21 d of gestation period. Does of ALEX presented higher plasma glucose, serum cholesterol

and globulin concentration than V line strain with 2.33, 7.93 and 5.28%, respectively. Glucose and cholesterol concentration during summer were higher compared with the observed in winter season with 6.96 and 10.49%, respectively, of the mean. The doe rabbit's serum total protein and globulin were significantly increased with the increasing of the temperature during summer season at 21 d of gestation period. But, albumin level was decreased significantly at summer season compared with winter season. In summary, all the physiological blood parameters for both lines were higher in the summer season in comparison with the winter season. V line showed a good immunity level to be used as commercial line under Egyptian conditions.

AGE AND DENSITY EFFECTS ON BEHAVIOUR OF GROWING RABBITS

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The aim of this study was to evaluate the effect of animal density (7 or 14 rabbits/m²) and age (36 to 70 d) on the behavior of growing rabbits. 180 hybrid rabbits (New Zealand×California), both sexes were used. Weekly animals have been filmed and their behavior analyzed to set their frequency. Were considered 4 categories of behavior (normal, abnormal, social and complementary). Animals at final of growing period have expressed more socials and abnormal behavior, whereas the normal behaviors have occurred more in the middle of growing period. The frequency of complementary behaviors has been no different during all rabbit growth. Regarding animal density effect, rabbits with higher density spent more time just to make normal behaviors and less in fast movements. Under the conditions of this work, animal age had effects more evident on behavior than animal density.

MANAGEMENT AND GENETICS

PROPOSAL FOR A NEW INDEX TO MEASURE THE TECHNOLOGICAL LEVEL OF RABBITRIES IN ORDER TO EVALUATE THEIR SUSTAINABILITY BASED ON SURVEYS CONDUCTED IN THE 'CUNICULTORS DE CATALUNYA' GROUP

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We used the information obtained through a survey conducted in the SAT 'Cunicultores de Catalunya', collected through the *bdcuni* platform, to characterize the technological level of these rabbit farms. A series of technological innovation indicators were chosen, they were structured into groups and weights were assigned within the group and between groups. The value of Technological Index of SAT on a scale of 0 to 10 (weighted by number of females) was 5.86, and the individual values of the farms ranged from 2.6 to 8.3. The highest values were observed in groups Machinery (8.1), Outsourcing of jobs (7.9) and Genetics and Reproduction (7.3). The lowest indicator was for the Nutrition group (3.1). There has been a significant incorporation of technological advances in rabbit farms (comparing with the 2009 National Survey), but it is still possible to improve the levels of all indicators. It would be necessary to relate these indicators with technical data management and, specially, with economic data.

TECHNICAL AND ECONOMIC RESULTS OF THE RABBIT BREADING FARMS IN FRANCE IN 2014

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The RENACEB project aims to centralize at a national scale technical and economic data of rabbit breeding farms. In 2014, data concern more than 90% of the females present in organized production and highlight the stagnation of the technical criteria compared to 2013. Thus, the birth rate (82.9%) and productivity per insemination (15.57 kg/insemination) stabilize between 2013 and 2014. The economic results remain unchanged because of a decrease in both the feed price (287.2 €/kg; -6.5%) and the sale price (1.86 €/kg; -2.6%). The average income of the producers (1113.6 €/mo), which can be simulated with the results of the network of breeding farms CUNIMIEUX, slightly decreases, particularly due to an increase in the number of flocks that were postponed or cancelled during summer (8.01 flocks produced in 2014 vs. 8.16 in 2013).

EVOLUTION OF BODY CONDITION OF FEMALE IN A SELECTION EXPERIMENT FOR LITTER SIZE VARIABILITY

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An experiment of divergent selection for litter size variability is carried out. After 7 generations of selection, the low variability line has 1.17 kits² and 0.70 kits rabbits less than the high variability line. The aim of this work is to know the evolution of the weight and thickness of the perirenal fat throughout the productive lifespan of the lines. The measured traits were the weight of the female to the first mating (P_{1m} , g), at first delivery (P_{1p} , g), the second mating (P_{2m} , g), the second delivery (P_{2p} , g), the last mating (P_{um} , g), the perirenal fat of the female to the first mating (G_{1m} , mm), at first delivery (G_{1p} , mm), the second mating (G_{2m} , mm), the second delivery (G_{2p} , mm) and the last mating (G_{um} , mm) on the lines of high and low variability. Statistical analyzes were performed using Bayesian methods. The P_{1m} , P_{1p} , G_{1m} , G_{1p} , P_{2m} , P_{2p} and G_{2m} of the 2 lines has not been modified by selection. The G_{2p} was higher in the low variability line (0.17 mm, $P=87\%$) despite having one kit more. The high variability line has a higher weight and perirenal fat thickness at the end of its reproductive life (4.4 and 3.4%, respectively) than the low variability line. The conclusions are that low variability line manages your body condition better than the high variability line from the 2nd reproductive cycle. This result is an indicator of the greater robustness of selected to decrease variability in litter size females.

PRELIMINARY RESULTS ON REPRODUCTIVE AND GROWING PERFORMANCE OF A BREEDING NUCLEUS OF SPANISH COMMON RABBIT BREED

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This study aimed to characterize the reproductive and growing performance of rabbits from a Spanish Common Rabbit breed breeding nucleus belonging to the Teaching Farm of the Faculty of Agriculture of the University of Seville. The rabbits were kept in polyvalent cages and housed in a conventional indoor facility with natural ventilation. They were fed *ad libitum* a mixed balanced feed. Natural mating was used, litters were not standardised at birth, weaning was carried out on average at 30 d and growth was recorded until 60 d of age. Growth of an experimental batch was also recorded until 90 d. Fertility was 56%. Total kits born per litter were 5.7 and

kits born alive were 4.9, with perinatal mortality reaching 14.4%. Number of weaned kits per litter was 4.2, with mortality during the nursing period amounting to 14.5%. The number of kits per litter that reached 60 d of age was 4.1, with mortality during the fattening period being 1%. Average weight of kits was 53.6 g at birth, 634.8 g at weaning, 1611.3 g at 60 d and 2198.8 g at 90 d of age. Average daily gain during the nursing period was 19.7 g/d, and during the fattening period until 60 d of age was 34.0 g/d. In conclusion, rabbits of the Spanish Common Rabbit breed of the nucleus investigated show low litter size and live weight at the slaughtering age usual in Spain, but their slow growth rate permit them to reach at 90 d of age the average live weight at which rabbits are usually slaughtered in Spain. This coincides with the minimum age required for slaughter rabbits under organic farming rules, so this breed would be suitable for this production system.