

ABSTRACTS
"XXXVI SYMPOSIUM DE CUNICULTURA DE ASESCU"
PEÑÍSCOLA (CASTELLÓN), SPAIN, MAY 12-13th 2011

The annual Congress of the Spanish Association of Cuniculture (ASESCU) was held in Peñíscola (Castellón, Valencia) on 12-13th May of 2011. The 36th edition was devoted to analyse the actual situation of the rabbit sector. It was presented an overview of the situation of the rabbit farming in the province of Castellón, an analysis of the factors that determine the final price of the rabbit meat in the market. Moreover, a special session devoted to the rabbit farmers studied the environmental control in the farms and the main factors influencing the profitability in the rabbit farming. Main papers related to coccidiosis, mixomatosis and a summary of the norm extension carried out by the Spanish Rabbit Interprofessional (INTERCUN) were also presented in 3 different conferences. Furthermore, a total of 32 communications were presented in 7 working sessions. Nutrition session analysed diet digestibility in lactating does, the increasing of soluble fibre and starch in diets for growing rabbits, the effect of a feed restriction in fattening rabbits, pre-weaning feeding management of growing rabbits and does, the inclusion of palm kernel meal in diets for growing rabbits, and the digestibility of *Lablab purpureus* and *Stizolobium niveum*. Technico-economic management session studied concepts for improving profitability of farms. Genetics session evaluated several maternal lines and cross does for longevity, and studied doe genetic origin, environmental conditions during lactation and kit survival during the fattening period. Ethology session analysed aggressiveness in breeding does, the effect of type of cage on does behaviour, and evaluated sampling techniques for assessing does behaviour. Reproduction and body composition session studied several aspects related to the body composition of does, the application of bioelectrical impedance for its assessment, the effect of different treatments of ovulation induction, and the relation between the performance of the does and plasma concentration of non-esterified fatty acids. Carcass quality session analysed the prediction of intramuscular fat and fatty acid content in rabbit meat by near infrared spectroscopy, the nutritional quality of rabbit meat fed with a feed enriched in omega 3, risk factors related to rabbit digestive pathologies on carcass classification, the anatomical assessment and meat quality, and prediction of rabbit carcass composition using visual image analysis. Pathology section studied the use of the Pheneplate System for autovaccine design, the effect of heat stress on the immune system of rabbit does, the characterization of nasal carried *Staphylococcus aureus* strains, the pharmacokinetic of marbofloxacin and several fluoroquinolones, and the development of a subunit vaccine against rabbit hemorrhagic disease virus.

NUTRITION

DIET DIGESTIBILITY IN LACTATING DOES RELATED TO ENVIRONMENTAL TEMPERATURE AND GENETIC LINE

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A digestibility trial with a diet containing 18.7 MJ gross energy, 175 g crude protein (CP) and 168 g acid detergent fiber per kg dry matter was carried out from 14 to 18 d post-partum using 63 rabbit does at first or second lactation, from 2 genetic lines (20 females from the LP line: constituted by longevous-productive criteria, and 63 females of

<http://dx.doi.org/10.4995/wrs.2012.1098>

the V line selected for litter size at weaning during 16 (n=21) and 36 (n=22) generations). Half does were allocated in a conventional housing with temperature fluctuating between 14 and 20°C and other half in a climatic chamber, with daily temperature following a sine curve from 25 to 36°C (heat stress). Environmental temperature affected the feed intake, 30% lower for animals in climatic chamber, and, consequently, the apparent digestibility coefficients were higher for the does submitted to heat stress (67 vs. 62% for crude energy and 76 vs. 68% for CP, in climatic chamber and conventional housing, respectively). There were not differences between first and second lactation and genetic line seems not affect digestibility coefficients, but does from LP line and V line at 36th generation increased more the apparent digestibility coefficient of crude protein than those from V line at 16th generation when allocated into climatic chamber (10 and 8 vs. 4 points of percentage, respectively).

INCREASING SOLUBLE FIBRE AND STARCH IN DIETS FOR GROWING RABBITS: EFFECTS ON DIGESTIVE EFFICIENCY AND GROWTH PERFORMANCE

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From 34 d of age until slaughtering (75 d), 246 hybrid rabbits were divided into 6 experimental groups and fed 6 diets *ad libitum*, according to a bifactorial arrangement with 3 levels of starch (6.0, 10.3 and 14.7%) and 2 levels of soluble fibre (10.0 and 13.8%). When dietary starch was increased, the apparent digestibility of DM (54.7 to 62.9%) and all nutrients linearly increased ($P<0.001$). Weight gain and feed conversion linearly ($P<0.001$) improved (6.4 and 11.1%, respectively), and feed intake decreased (5.6%). A significant interaction ($P=0.05$) was observed for NDF digestibility: as the starch level increased, NDF digestibility improved less in the diets with 10.0% soluble fibre than in the diets with 13.8% soluble fibre. The increase of dietary soluble fibre improved ($P<0.001$) DM digestibility (54.0 to 63.9%) and daily growth (by 5.3%; $P=0.05$) and reduced feed

intake and feed conversion (by 12.4 and 15.0%, respectively; $P<0.001$). In conclusion, the use of soluble fibre is recommended in association with, rather than in replacement of, starch to increase the energy value of diets and improve overall farm-feed efficiency.

EFFECT OF A FEED RESTRICTION AFTER WEANING ON MORTALITY AND PERFORMANCE OF FATTENING RABBITS

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The aim of this work was to study the effect of a moderate and gradual feed intake restriction after weaning (around 35 d of age), on performance and global feed efficiency of growing rabbits. The intake restriction consisted in feeding a limited amount of feed (80, 100 and 120 g/d) on the 3 wk after weaning. Six feeding trials were conducted using 480 weaned rabbits in each of them, and 6 commercial feeds with different type of medical supplementation. Feed intake, rate of growth, mortality and global feed efficiency were determined at the end of the restriction period and over the whole fattening period. The oocysts and *C. perfringens* counts in hard faeces were also analyzed by treatment. No problems of high mortality due to ERE were detected over the trials. In these conditions, mortality of restricted rabbits was 33% lower ($P=0.02$) in the period of restriction and tended to decrease for the whole fattening period. The results showed that a moderate restriction of feed intake after weaning improves 4% ($P<0.001$) global feed efficiency of the fattening period, and has not detrimental effects on the slaughtering weight of animals compared to *ad libitum* feeding. Moreover, adoption of measures to control the coccidia and *C. perfringens* proliferation in the digestive contents of growing rabbits might be useful to reduce mortality on the fattening period.

INFLUENCE OF PRE-WEANING FEEDING MANAGEMENT ON THE PERFORMANCE OF GROWING RABBITS AND RABBIT DOES

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The effects of 2 type of feed distributed at end of lactation period on performance of rabbits does and growing rabbits was studied. Between the 22nd and the 35th d after parturition, 2 groups of 15 lactating rabbit does and its litters were fed on diets with nutritional specifications for lactating rabbit does (Group C) or growing rabbits (Group G). From the 35th d (weaning) until the 69th d the after parturition does of both groups received a diet for lactating females and growing rabbits of both groups fed diets for growing rabbits. Live weight and feed intake of growing rabbits and rabbits does were controlled weekly. The experiment showed trends to better performance when rabbits does received always diet C ($P=0.12$) and when growing rabbits were fed all the time with diet G ($P<0.07$). Probably, the low number of replicas and small differences between results did not allow that differences were statistically significant. In the future, the experiment will be repeated with a greater number of animals and during a longer period to validate the results.

INCLUSION OF PALM KERNEL MEAL IN DIETS FOR GROWING RABBITS

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In this work the inclusion of 20% of palm kernel meal in balanced feeds for fattening rabbits has been studied. Two feeding trials were conducted throughout the fattening period (from 35 to 63 d of age) using 480 weaned rabbits in each of them to determine feed intake, rate of growth, food efficiency and mortality. The results show that palm kernel meal is a suitable ingredient for rabbit's feeds that allows supporting high levels of consumption and performance in the fattening period. However, its NE value might be lower than that expressed for his concentration in DE. On the other hand, his incorporation allowed reducing fattening mortality, which might be related to its high concentration in medium chain fatty acids and/or to its low concentration of starch.

IN VITRO DIGESTIBILITY OF DRY MATTER AND NEUTRAL DETERGENT FIBER IN WHOLE MEAL OF *LABLAB PURPUREUS* (DOLICHO) AND *STIZOLOBIUM NIVEUM* (MUCUNA)

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The technique *in vitro* was used utilizing the rabbit's cecal inoculum to determine the DM and NDF digestibility in whole meal of *Lablab purpureus* (dólico) and *Stizolobium niveum* (mucuna). The feeding samples were distributed in a random block design in 6 muslin bags and were incubated at 38°C during 48 h. The highest values of DMD were observed in the experimental diets which didn't show differences between them. The lucerne showed low values of DMD ($P<0.001$) in relation to the control diet and the diets containing the whole meal. No difference was observed in the *in vitro* digestibility index of NDF or in the pH variations between the studied diets at 24 h. After a period of 48 h of incubation, low values of pH ($P<0.001$) were observed in the control and 20% whole meal of dolicho. The results suggested that the inclusion of dolicho and mucuna whole meal up to 20% in diets of rabbits didn't affect the *in vitro* digestibility index of DM and NDF. The pH variations were determined by the incubation time and the kind of feed, what unfavourable behaviour in single sources of nutrients like lucerne.

TECHNICO-ECONOMIC MANAGEMENT

SOME CONCEPTS FOR IMPROVING PROFITABILITY OF RABBIT FARMS

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The economical situation of the Spanish rabbitries in the last years is especially weak, involving a reduction of the profitability. In this work, some

concepts of technical management and possible consequences of changes in management on profitability are argued.

REPORT OF TECHNICAL MANAGEMENT RESULTS WITH BDCUNI 2010

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Technical management indexes during 2010 in Spanish rabbit farms using bdcuni (database of technical management in Spanish commercial rabbitries, www.ivia.es/bdcuni) are shown in the present work. Indexes obtained were positive pregnancy test (84.2%), kindling rate (79.5%), number of kindlings per doe and year (7.6), kindling interval (49.7 d), mortality during lactation (12.5%), mortality during the fattening period (8.2%), averaged slaughter weight (2.119 kg/rabbit), weaned rabbits per doe and year (60.4), produced rabbits per doe and year (55.4), kg produced per doe and year (117.4), total born alive per kindling (9.4), weaned rabbits per kindling (8.2), produced rabbits per kindling (7.4), kilograms produced per kindling (16.0), total born alive per insemination (7.5), weaned rabbits per insemination (6.6), produced rabbits per insemination (6.0), kg produced per insemination (12.8) and global feed conversion ratio (3.37). Also first results of the reference groups, geographic area (North area, South area and East area) and management (one batch and more than one) are shown.

GENETICS

EVALUATION OF FOUR MATERNAL LINES AND CORRESPONDING CROSS DOES FOR LONGEVITY

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The objective of this study was to evaluate 4 maternal lines and the corresponding crossbred does, from a complete diallel cross, for functional

longevity. The 4 maternal rabbit lines involved were A, V, H and LP. The lines considered have been selected for litter size at weaning for a long time. Our purpose was to get indications of variation between the 16 genetic groups. This trait was defined as the number of days between the first positive palpation and the death or culling of the doe; it represents the ability to delay involuntary culling. A total of 4 141 longevity records were obtained from September 2008 to January 2011 and were analysed with the Survival kit 6.0 using a fixed effects Cox proportional hazard model. The model incorporated time-dependent factors, such as Farm-year-season, number born alive, order of positive palpation and physiological status of the female; as well as the time-independent factor of the genetic type of the doe. Lines A and H have a similar ability to avoid risk factors and they both are more sensitive to these factors than lines V and LP. The differences between crosses and its reciprocal were generally not significant. The estimated heterotic effects, average of crossbreds minus average of purebreds, showed the importance of using crossbreds between specialized lines to produce the does for intensive meat rabbit production, as the risk associated to purebreds is higher than that to crossbreds.

DOE GENETIC ORIGIN, ENVIRONMENTAL CONDITIONS DURING LACTATION AND KIT SURVIVAL DURING THE FATTENING PERIOD

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A total of 3 765 growing rabbits were used to evaluate the effect of the genetic origin and the environmental temperature and diet used during lactation on the mortality rate registered during the fattening period (28 to 60 d of age). A factorial design 3×3 was used: genetic origin [LP (line constituted by productive longevity criteria); V16 (16th generation of line V, selected for litter size at weaning) and V36 (36th generation of line V)]; lactation environment [*i*] housing in climatic chamber at 25-36°C and diet C with 11.7 MJ DE/kg DM, *ii*] housing in conventional

room at 9-23°C and diet C and *iii*) conventional room and diet F with 9 MJ DE/kg DM]. The lactation temperature and diet were the main controlled factors affecting the mortality rate during the growing period. Mortality for growing rabbits housed under heat stress conditions during the lactation was higher to that recorded for conventional housing (24 and 16%, respectively; $P < 0.001$). Respect to the C diet, the use of the F diet during lactation also reduced the mortality during the fattening (16 and 9.5%, respectively; $P < 0.001$). With regard genetic origin, LP litters showed a significant lower mortality than those from the V16, having V36 intermediate values (15.2, 18.7 and 17.7%, respectively).

ETHOLOGY

AGGRESSIVENESS IN BREEDING DOES DEPENDING ON AGE. IMPLICATIONS IN ANIMAL MIXING

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Aggression can become a problem in group housing breeding rabbits as it increases with age and it would probably appear when mixing is carried out. On the other hand, animals housed in the same barn could identify their odor and this familiarity could lead to changes in behaviour. The aim of this study is to determine through a resident-intruder test, the age in which aggression reaches the highest level as well as the influence of the origin of the intruder rabbit. Seventy four does were used in this study. Thirty two does were tested as resident and the rest were tested as intruders. The intruders came from 2 different origins: 16 intruders came from cages inside the same experimental room and 16 came from an adjacent room. For each confrontation the time at which each behavior started was recorded obtaining the latency to the first aggression as well as the latency to a fight which led to stop the test. Age had a clear effect on latency to the first aggressive behavior and on latency to a strong fight so from puberty latencies decreased. The latency to a strong fight was lower when intruders came from the same room ($P < 0.001$). Intruder's origin did not have effect on latency to the first aggression. According to these results animal mixing should be carried out as soon as it possible in order to minimize aggressiveness. On the other

hand, mixing animals coming from different barns could reduce aggressiveness but this assumption requires further studies.

EFFECT OF TYPE OF CAGE ON RABBIT DOES BEHAVIOUR AT DIFFERENT PHYSIOLOGICAL STATES

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The aim of this trial was to study the effect of type of cage (conventional *vs.* enriched) on rabbit does behaviour in different physiological state (pregnancy *vs.* lactation). Video recordings of 12 does during 24 h at 2 different moments were performed. The observed behaviours were classified into 3 independent categories (location, locomotion and actions). A clear predominance using foot mats (mainly in lactation phase) was observed, but this time was significantly lower in enriched cages due to the platform use (67.1 *vs.* 4.2%; $P < 0.05$). No significant effect of type of neither cage nor physiological state on time does were lying down and sitting were found (78.4 and 20.7% of day, respectively). The standing behaviour was observed in pregnant does, being performed only to eat or smell retained faeces on the platform. In lactation phase, does were more nervous trying to flee off kids, being it possible when the platform was available. Pregnant does spent more time than lactating does on grooming, biting bars and interacting with neighbours ($P < 0.01$; 0.05 and 0.05, respectively). Lactating does spent more time drinking than pregnant does. The results of this trial show that an increase of available space with a raised platform may be a good alternative to improve does welfare, especially at the end of the lactation phase, although the retention of droppings on platform may cause health problems.

EVALUATION OF DIFFERENT SAMPLING TECHNIQUES TO REDUCE THE TOTAL OBSERVATION TIME REQUIRED TO ASSESS RABBIT DOES BEHAVIOUR. METHODOLOGICAL ANALYSIS

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The aim of this study was to evaluate different sampling techniques to reduce the total observation time required to assess the behaviour of rabbit does housed in 2 types of cages (conventional vs. enriched) and at 2 different physiological states (pregnant vs. lactating). Continuous recordings of 24 h were considered as the control method to validate the other sampling techniques, with recordings of different duration and frequency (regular short and long methods and irregular 6 h and 8 h methods). Results showed that the regular methods lead to better estimates of rabbit does behaviour than the irregular ones. From a practical point of view, the regular short method would be the most adequate, as the total number of hours of observation and analyses are considerably reduced.

REPRODUCTION AND BODY COMPOSITION

RELATIONSHIP BETWEEN CHEMICAL BODY COMPOSITION, FERTILITY AND PROLIFICACY IN PRIMIPAROUS RABBIT DOES

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This study evaluated the effect of chemical body composition at first and second artificial inseminations (AI), determined by bioelectric impedance technique, on fertility and prolificacy of primiparous rabbit does. Data of 137 does from 2 farms using 2 different genetics (UPV and Hyplus) and 3 breeding systems were analyzed. Fertility was 56.2% and the percentage of kits born alive over total born was 87.5%. Breeding system had no effect on fertility or the percentage of kits born alive. Higher body protein, fat and energy of the rabbit doe at first AI increased the fertility in the second parity ($P=0.007$, $P=0.03$ and $P<0.001$ respectively). Fat and energy content of the doe at the second AI affected positively fertility in the

second parity ($P<0.001$ and $P<0.001$ respectively), while protein influenced positively only prolificacy ($P<0.001$). The increase of the ratio protein/energy in both AI moments had a negative influence on fertility in the second parity ($P<0.001$), rabbit does with 12 g protein/MJ showed a higher fertility than those with higher values.

STUDY OF BODY COMPOSITION IN RABBITS FROM 25 TO 77 DAYS OF AGE AND APPLICATION OF BIOELECTRICAL IMPEDANCE ANALYSIS (BIA)

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The aim of this study was to estimate the *in vivo* body composition of growing rabbits from 25 to 77 d of age by the bioelectrical impedance analysis. One hundred and fifty rabbits grouped at 5 different ages (25, 35, 49, 63 and 77 d) with weights ranged from 231 to 3138 g were used. A 4-terminal body composition analyser (Model BIA-101, RJL Systems, Detroit, MI USA), was used to determine resistance and reactance values. The distance between internal electrodes, and body length and weight were also measured. All the animals were slaughtered and processed for chemical analyses (DM, lipids, proteins, ash and energy). Energy and fat increased with the age, while protein, ash, and humidity decreased. Mean values of resistance, reactance, impedance, animal length and distance between electrodes were $83.5\pm 23.1 \Omega$, $18.2\pm 3.8 \Omega$, $85.6\pm 22.9 \Omega$, $30.6\pm 6.9 \text{ cm}$ y $10.8\pm 3.1 \text{ cm}$.

ESTIMATE OF BODY COMPOSITION IN RABBITS FROM 25 TO 77 DAYS OF AGE BY THE BIOELECTRICAL IMPEDANCE METHOD

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The aim of this study was to determinate and validate with independent data the prediction equations obtained to estimate *in vivo* the body composition of growing rabbits, by using the results of body composition and bioelectrical impedance analysis (BIA) values obtained in the previous communication. A multiple linear regression analysis was done to determinate the equations, using animal weight and length of animals, and the impedance data from the previous work (Saiz *et al.*, 2011) as parameters. Coefficient of determination (R^2) of the equations obtained to estimate humidity (g), protein (g), fat (g), ash (g) and energy (MJ) content were: 0.99, 0.99, 0.97, 0.98 and 0.99, and relative mean prediction error (RMPE) were: 2.24, 5.99, 16.3, 8.56 and 7.81%, respectively. When humidity was expressed as percentage (%), the R^2 and RMPE were 0.85 and 1.98%, respectively. When the prediction of the content of protein (% DM), fat (% DM), ash (% DM) and energy (kJ/100 g DM) were done, R^2 values were 0.79, 0.83, 0.71 and 0.86, and RMPE: 4.78, 12.2, 8.39 and 3.26%, respectively. Reactance was negatively correlated with water, ash and protein content ($r=-0.32$, $P<0.001$; $r=-0.20$, $P<0.05$; $r=-0.26$, $P<0.01$) and positively correlated with fat and energy ($r=0.23$ and $r=0.24$; $P<0.01$). Otherwise, resistance was positively correlated with en humidity, ash and protein ($r=0.31$, $P<0.001$; $r=0.28$, $P<0.001$; $r=0.37$, $P<0.001$) and negatively correlated with fat and energy ($r=-0.36$ and $r=-0.35$; $P<0.001$). Moreover, age was negatively correlated with water, ash and protein content ($r=0.79$; $r=-0.67$ and $r=-0.80$; $P<0.001$) and positively correlated with fat and energy ($r=0.78$ and $r=0.81$; $P<0.001$). It could be concluded that BIA it's a non invasive and good method for estimate *in vivo* body composition of growing rabbits from 25 to 77 d of age.

CORRELATION BETWEEN TECHNIQUES FOR ESTIMATING BODY COMPOSITION IN RABBIT DOES

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The aim of this work was to study the correlation between different methods for determining the *in*

in vivo body condition (BC) in rabbit does: Body Condition Score (BCS), the Ecography (ECO) and the Bioelectrical Impedance Analysis (BIA) and their relation with the fertility and prolificity. In a total of 17 rabbits were applied the 3 techniques, were weighed and measurements were made on the day of AI (11 postpartum), and every week until the day before parturition. The BC estimated with the 3 different methods varied along the experimental period ($P<0.001$), decreasing due to the overlap of gestation and lactation. However, the weight of females was virtually the same throughout the experiment. The BCS dorsal was correlated with the PPC of the rump ($P<0.001$) and with the BIA ($P<0.05$). The PPC of the rump was correlated with the ECO ($P<0.05$) and the latter with BIA ($P<0.05$). High scores of PPC dorsal were positively correlated with estimated fat ($P<0.05$) and negatively with protein ($P<0.05$). The ECO was correlated only slightly ($P=0.06$) with percentage of body fat estimated from BIA equations. None of the methods studied had significant correlations with fertility, while the ECO tended to correlate negatively with prolificacy ($P=0.09$). Moreover, the BCS and the estimated amount of body protein content during lactation were negatively correlated with the number of kits weaned ($P<0.001$). The different methods of body condition studied here are correlated with each other, each having its limitations, the PPC (subjectivity), ECO (punctual depots, bad determination in pregnant does, shaving) and BIA (fat estimate has a high prediction error). Although these methods inform about reserves mobilization of does, with the results of this work we cannot able to predict certainty the fertility and prolificacy, so we suggest further research.

BODY COMPOSITION AND PRODUCTIVE PARAMETERS OF PRIMIPAROUS DOES SUPPLEMENTING WITH PROPYLENE GLYCOL FOR LONG TIME

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The aim of this work was to compare the effects of different oestrus synchronization methods in

rabbits during the 2 first reproductive cycles, when animals were inseminated and weaned at 25 d post-partum (pp). A total of 146 pregnant rabbit does were distributed in 6 experimental groups: 1) Control, without treatment, 2) eCG, 25 IU eCG injected i.m. 48 h before the second insemination, 3) PPG-c, 2.5% of Propylene Glycol (PG) was added to water from parturition until weaning, 4) PPG-l, PG was added to water from the middle of pregnancy to weaning, 5) PPG-l+eCG and 6) PPG-c+eCG, were the combination of PG and eCG treatments. The body weight and the body composition of does, the feed intake and the milk production, as well as the fertility after the second artificial insemination were determined. Body weight ($P<0.001$), fat content ($P<0.001$) and energy ($P<0.001$) decreased through the lactation period in all the groups. Rabbit does supplemented long time with PG (PPG-l and PPG-l+eCG) had lower fat ($P<0.001$) and energy content ($P=0.002$) than the rest of groups during the first cycle and the first week post-partum of the second cycle. Rabbit body weight increased ($P<0.001$) and protein content slightly decreased in all groups at the second cycle ($P=0.003$). Rabbits supplemented with PG (PPG-l and PPG-l+eCG) tend to have a lower feed intake during pregnancy than the control group ($P=0.094$) and, at the first cycle, feed intake during lactation of the same groups also was lower than control ($P=0.054$). In general, feed intake during pregnancy ($P<0.001$) and lactation ($P<0.001$) was higher in the second cycle than in the first one. Milk production and fertility were not affected by treatments. Taking together all results, we can conclude that as long is the administration of 2.5% PG in the water, more reduced body reserves of rabbit does are observed along their first productive cycles, decreasing feed intake and without fertility or milk production improvement.

OVULATORY RESPONSE OF PITUITARY AND RABBITS SUBJECTED TO DIFFERENT TREATMENTS OF OVULATION INDUCTION

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In rabbit reproductive managements by means Artificial Insemination (AI), it is needed the ovulation induction with GnRH analogues as busereline. Their administration can be intramuscularly (i.m.) or intravaginal with the seminal dose. In this study, we have evaluate the pituitary and ovulatory response to the i.m. (BM) intravaginal (BV) administration of busereline, as well as the sole raw semen (SP) or the saline solution intravaginal deposition without ovulation induction. To study the pituitary response to these treatments we have developed and validated an enzmoimmunoassay rabbit specific to determine serum LH at 0 and 60 min post-AI. A laparotomy was made in all does to determine ovulatory and pregnancy response. In BM and BVgroups the serum LH concentrations were higher than in the other groups but similar to each other at 60 min post-induction. Group SP also showed increased serum LH concentrations at 60 min post-AI with respect S group, but not so high as in groups BM and BV. With these results, we could conclude that an intramuscularly and intravaginal treatment can induce a serum LH increasing enough to validating a specific EIA to LH of rabbit. Moreover, the pituitary response of rabbit does inseminated with raw semen has been higher than in the group inseminated only with saline, indicating the presence of some molecule in the semen that could be absorbed from vaginal mucosa to induce ovulation.

RELATION BETWEEN THE PERFORMANCE OF THE RABBIT DOES AND PLASMA CONCENTRATION OF NON-ESTERIFIED FATTY ACIDS

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The main objective of this research was to study the relation between plasma concentration of non-esterified fatty acids (NEFA) and the performance of the rabbit females. The NEFA was higher the first day of lactation than at mating or at 12 d of gestation. There was a lineal relation between NEFA and ovulation rate, and also lactating females (0.463 mmol/L) showed higher NEFA than non-lactating females (0.304 mmol/L). The relation between the NEFA at first day of lactation and milk production was lineal, showing different coefficients of regression according to litter size.

CARCASS QUALITY**PREDICTION OF INTRAMUSCULAR FAT AND FATTY ACID CONTENT IN RABBIT MEAT BY NEAR INFRARED SPECTROSCOPY**

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Intramuscular fat (IMF), fatty acid content of *Longissimus* muscle and their prediction by near infrared spectroscopy (NIRS) were evaluated. One hundred and thirty-seven rabbits from 3 different synthetic lines slaughtered between 5 and 61 wk of age were used for NIRS calibration. *Longissimus* muscles were freeze-dried, scanned by NIRS reflectance and fat and fatty acid content were chemically analysed. *Longissimus* showed low fat content and high polyunsaturated fatty acid content. Parameters of calibration equation reported excellent results for IMF ($r^2=0.99$). Prediction of individual fatty acids was appropriate (r^2 between 0.93 and 0.97). Saturated, monounsaturated and polyunsaturated fatty acids predictions equations were satisfactory (r^2 between 0.90 and 0.98).

NUTRITIONAL QUALITY OF THE RABBIT MEAT FED WITH A FEED ENRICHED IN OMEGA 3

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Several experimentations have been carried out to study the influence of the omega 3 level in the feed on the rabbit meat level in this fatty acid, but only few of them deals with the use of the flaxseed. Some publications (Dal Bosco *et al.*, 2003; Colin *et al.*, 2005) and the EARL 3L's data bank emphasize a direct connection between the alpha-linolenic acid level in the feed and the omega 3 content of the rabbit meat. Besides, this enrichment decreases the saturated fatty acids level, the omega 6 level and consequently the omega 6/omega 3 ratio below 4. In consequence, the contribution of around 0.65% of alpha-linolenic acid in the feed by using flaxseed allows to bring in average 967 mg of omega 3 for 100 g of back or 459 mg for 100 kcal and 1 004 mg

of omega 3 for 100 g of shoulder or 483 mg for 100 kcal and consequently to claim the allegation "rich in omega 3". This enrichment doesn't modify the hedonic characteristics of the rabbit meat.

EFFECT OF RISK FACTORS RELATED TO RABBIT DIGESTIVE PATHOLOGIES IN COMMERCIAL FARMS ON CARCASS CLASSIFICATION AT THE SLAUGHTER HOUSE

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In batch management systems of rabbits, a delay of gain weight over the fattening period decreases final weight and might increase weight heterogeneity of the batch at slaughtering. This work has studied the effect of some factors related to infectious enteric pathologies at fattening commercial farms on carcass classification by weight at the slaughter house. Results show that mortality, number of oocysts in hard faeces and *C. perfringens* in dust samples of the farms are highly correlated to the proportion of carcasses allocated to each weight category. The improvement of health status of fattening rabbits increases the average price by animal at the slaughter house, and therefore the economic results of farms.

ANATOMICAL ASSESSMENT AND MEAT QUALITY OF RABBITS WEANED AT 28 OR 42 DAYS

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The meat quality, pH and color of 44 hybrid rabbits (*New Zealand* × *Californian*) were analyzed according to 2 weaning ages (28 and 42 d). The carcasses were analyzed anatomically (dorsal length, sacral length, scapular fat, intrabdominal and total dissectable fat, weight of the hind left, muscle, bone, Muscle/Bone ratio, *psaos major*, liver and kidney) and chemically (Humidity, DM, CP, Ether Extract and Ash). A total of 28 rabbits were analyzed microbiologically (aerobic mesophiles, Enterobacteriaceae, *Pseudomonas* spp. and total coliforms). Late weaning resulted

in carcasses with a pH 24 h postmortem lower than carcasses of kits weaned at 28 d ($P<0.001$). It played a role in the bone development producing a shorter dorsal length ($P<0.003$), longer sacral length ($P<0.001$) and a higher number of the hind leg bone and carcass ($P<0.05$). As a result, the meat/bone ratio was lower ($P<0.001$). Early weaning also influenced inversely by the protein content and directly on the moisture content of meat from the hind limb ($P<0.001$). The microbiological quality was not affected by weaning age, except for *Pseudomonas* spp. whose concentration was higher in rabbits carcasses weaned at 42 d ($P<0.001$). Further studies with more samples could confirm the influence of weaning age on the qualities of the carcasses of rabbits and its possible impact on rabbit industry.

PREDICTION OF RABBIT CARCASS COMPOSITION USING ATTRIBUTES EXTRACTED FROM CHOP IMAGES

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This study aimed to use features that are extracted after image analysis from a cut point between the sixth and seventh lumbar vertebrae images to predict rabbit carcass composition. Images were captured on 18 rabbit carcasses and fat and muscle measurements were obtained from that cut point between the sixth and seventh lumbar vertebrae. With multiple regression analysis it was possible explain 52% ($P<0.05$) to 88% ($P<0.01$) of the variation of muscle and fat amount and proportion and 74% for muscle/bone ratio. Further studies are necessary to improve image capture and image analysis speed to add practical significance of this methodology.

EVALUATION OF VIDEO IMAGE ANALYSIS TO PREDICT CARCASS COMPOSITION IN RABBIT

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There is no information available on the use of video image analysis (VIA) for carcass composition evaluation of rabbits. Thus the objective of the current work was to evaluate a VIA methodology

in assessing carcass composition of rabbits. Video images were captured from 20 rabbit carcasses. For each carcass 13 measurements were obtained after image analysis, which can explain 91.2, 91.4 and 67% of the muscle, fat and bone amount, respectively. This approach shows that rabbit carcass composition evaluation is possible by VIA. Improve image capture and image analysis must be considered in future studies.

PATHOLOGY

DIFFERENTIATION BY PHENEPLATE SYSTEM OF *ESCHERICHIA COLI* STRAINS FROM RABBITS AND ITS USEFULNESS FOR AUTOVACCINE DESIGN

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Typing of bacteria means the separation of bacterial strains below the species level and is necessary when species identification is not enough, such as epidemiological investigations and ecological studies. In farmed animals, *Escherichia coli* typing from different samples allow to identify specific strains present in each farm and compare isolates from different dates, different sites or different productive periods. In the present study we use the pheneplate system (PhP-RE, Bactus AB) to characterize *E. coli* isolates from digestive problems in farmed rabbits. The PhP system is a computerized biochemical fingerprinting method which allows to compare different phenotypic patterns of isolates. PhP system is a useful method to choose *E. coli* strain for different purposes such as autovaccine production.

EFFECT OF HEAT STRESS ON IMMUNE SYSTEM OF RABBIT DOES FROM DIFFERENT GENETIC ORIGIN. PRELIMINARY STUDIES

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It has been observed in several animal species that there are genetic differences in response to high temperatures. In this study we aimed to determine, in controlled conditions, how the selection for litter size or productive longevity may have affected the immune capacity of rabbit does subjected to heat stress. Preliminary results suggest that the selection by reproduction criteria (litter size at weaning for 20 generations) could have affected the immune responsive of the rabbit does (as there is a reduction of defensive cells), while the use of animals selected by robustness criteria could allow optimal reproductive levels, without loss of capacity to deal with immune challenges.

CHARACTERIZATION OF NASAL CARRIED STAPHYLOCOCCUS AUREUS STRAINS REVEALS THEIR POTENTIAL TO CAUSE DISEASE IN RABBITS

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Staphylococcus aureus is an important cause of mastitis, pododermatitis and subcutaneous abscesses in rabbits. Different body sites can be colonized (nares, ears, perineum, etc.) being the first the most frequently colonized. Two hundred eighty-three rabbits from 12 rabbitries were examined for the presence of *S. aureus* in nares and lesions. The study showed that 43.81% of rabbits carried *S. aureus* in their nares, with significantly higher incidence in animals with staphylococcal-related lesions (75.75%) compared with apparently healthy animals (15.89%). The molecular typing analysis of the strains isolated from 65 nasal carriers animals with lesions, revealed that strains were undistinguished in 92% of cases. Moreover, the pathogenic arsenal of the strains was screened for the presence of relevant *S. aureus* virulence genes, including exfoliative toxins, leucotoxins, superantigens and MSCRAMMs. The results showed that the nasal carried strains contained the same combination of virulence factors that strains isolated from lesions. Our data suggest that the *S. aureus* gene combinations necessary for invasive diseases may also be necessary for nasal colonization and, therefore, the development of lesions is strongly dependent of host factors.

EFFECT OF DICLAZURIL ON RABBIT COCCIDIOSIS

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The purpose of this trial is to generate up to date results of diclazuril vs. robenidine in the control of coccidiosis in fattening rabbits. In this battery trial, the efficacy of clinacox in a mild coccidiosis was tested in rabbits. Sporulated oocysts (20 000) of *E. intestinalis*, *E. magna* and *E. media* were used for experimental infection. *Eimeria* oocysts were administered by intubation to the stomach at 35 d of life. Feed consumption, body weight change, oocyst excretion and clinical observations were used as parameters to evaluate the efficacy of diclazuril. According to our results Clinacox® provided an excellent protection against clinical coccidiosis in rabbits. Performance and parasitological parameters were significantly better in rabbits supplemented with diclazuril than in rabbits fed with robenidine.

PHARMACOKINETIC OF MARBOFLOXACIN IN RABBITS AFTER SUBCUTANEOUS ADMINISTRATION

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The single-dose disposition kinetics of marbofloxacin were determined in clinically normal rabbits (n=6) after subcutaneous administration of 2 mg/kg bodyweight. Marbofloxacin concentrations were determined by high performance liquid chromatography with fluorescence detection. The concentration-time data were analyzed by compartmental and non-compartmental kinetic methods. Marbofloxacin achieved maximum plasma concentration of 1.65±0.18 mg/L at 0.29±0.14 h. The terminal half-life was 1.98±0.64 h. Marbofloxacin showed a favourable pharmacokinetic profile in rabbits after subcutaneous administration. From this data, it seems that a 2 mg/kg dose of marbofloxacin would be effective by subcutaneous administration in rabbits against susceptible bacterial strains.

FLUOROQUINOLONE SUSCEPTIBILITY OF *STAPHYLOCOCCUS AUREUS* STRAINS ISOLATED FROM COMERCIAL RABBITRIES

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The antibiotic susceptibility of seventeen strains of *Staphylococcus aureus* isolated from commercial rabbitries with chronic problems of staphylococcosis was evaluated. The antibiotics tested were two fluoroquinolones which have been developed especially for using in Veterinary Medicine: marbofloxacin and enrofloxacin. Minimum inhibitory concentration tests were performed according to the microdilution broth method. The MIC₉₀ values obtained were 16 and 8 mg/L for marbofloxacin and enrofloxacin, respectively. These values suggest that the *S. aureus* strains isolated in this study are resistant to both fluorquinolones.

PHARMACOKINETICS OF 3 FLUOROQUINOLONES IN RABBITS AFTER INTRAMUSCULAR ADMINISTRATION

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Pharmacokinetics of danofloxacin, moxifloxacin and orbifloxacin were studied in healthy rabbits (n=18) after intramuscular administration of single doses of 6, 5 and 5 mg/kg, respectively. Plasma concentrations were determined by HPLC with fluorescence detection and were analyzed by pharmacokinetic compartmental and non compartmental methods. Half-lives of moxifloxacin and orbifloxacin were similar and shorter than that of danofloxacin. However, bioavailabilities of these antibiotics after intramuscular administration were similar and high, with values approximately

of 100 %. The 3 fluoroquinolones showed a favorable pharmacokinetic profile in rabbits.

DEVELOPMENT OF A SUBUNIT VACCINE AGAINST RABBIT HEMORRHAGIC DISEASE VIRUS

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The search for new alternatives of safer vaccines against Rabbit Haemorrhagic Disease remains a goal of different experimental groups around the world. The currently marketed vaccines are based on the inactivation of liver of previously infected rabbits with virulent virus and although quite effective, there remains the ethics and safety questioning. Having obtained the VP60 protein of the virus of rabbit haemorrhagic disease and the development of purification and formulation processes, there were produced the first pilot batches, which were evaluated for safety in rabbits and demonstrated efficacy in inducing protective antibodies disease.