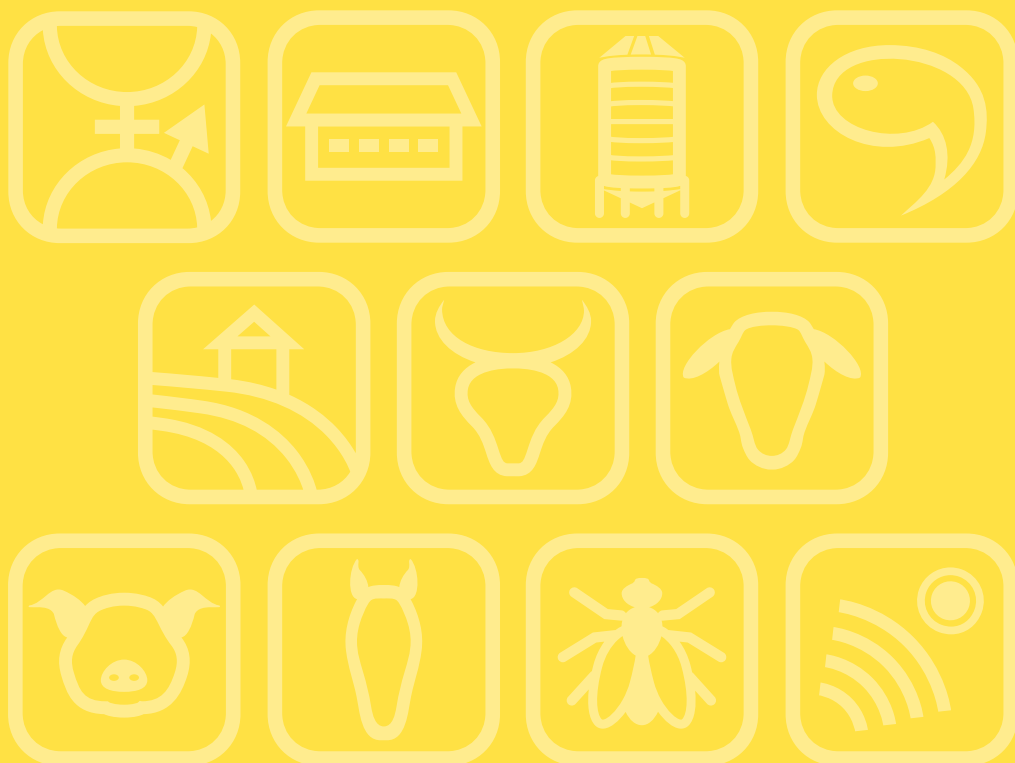


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Effects of adrenocorticotropin stimulation on hormones and growth factors in milk of lactating sows*E. Kanitz, A. Tuchscherer and M. Tuchscherer**Leibniz Institute for Farm Animal Biology, Wilhelm-Stahl-Allee 2, 18196 Dummerstorf, Germany;**ellen.kanitz@fbn-dummerstorf.de*

The maternal environment exerts important influences on offspring growth, metabolism, neurobiology, immune function and behaviour. The hypothalamus-pituitary-adrenal (HPA) axis, which regulates the secretion of glucocorticoids, is one of the systems highly susceptible to early-life programming. During lactation, mother's milk is an important physiological pathway for nutrient transfer and hormone signalling that potentially influences offspring phenotype. The aim of the study was to investigate whether maternal stress in pigs may activate the HPA axis and alter bioactive factors in milk. As a model for maternal stress, German Landrace sows were given adrenocorticotropin (ACTH; Synacthen Depot, 100 IU per animal) twice a day from lactation day 2 until 14. During the treatment period, saliva and milk samples were taken and maternal behaviour was observed. Saliva was examined for cortisol levels and milk was analysed for cortisol, oxytocin, interleukin-6 (IL-6), tumour necrosis factor- α (TNF- α) and transforming growth factor- β (TGF- β) concentrations by commercially available enzyme immunoassays either directly or after extraction. Physiological and behavioural data were evaluated by MIXED or GLIMMIX procedures in SAS/STAT software. Administration of ACTH increased the cortisol concentrations in saliva ($P < 0.01$) and milk ($P < 0.001$) compared to control animals during the treatment period. This increase of cortisol levels was associated with a decrease of TGF- β ($P < 0.01$) and oxytocin ($P = 0.06$) concentrations in milk. There were no significant effects of ACTH administration on IL-6 and TNF- α concentration. Furthermore, the ACTH treatment affected the maternal behaviour, which resulted in a more restless behaviour of the sow and in a lower suckling stability of their piglets (both $P < 0.01$). In conclusion, the present results indicate that an enhanced HPA axis activity may be reflected in milk cortisol levels, and also may alter behaviour, hormones and cytokines with potential adverse effects on the offspring's development in the context of health and welfare.

Session 02

Poster 10

Effects of maternal factors during pregnancy on the birth weight of lambs in dairy sheep*J. Pesántez^{1,2}, L. Torres², M. Sanz², A. Molina³, N. Pérez⁴, M. Vázquez³, C. García², P. Feyjoo³, E. Cáceres³, M. Frias³, S. Mateos³, F. Fernandez⁵, J. Gonzalez^{3,4}, A. Gonzalez^{2,3} and S. Astiz²**¹University of Cuenca, Av. 12 de Octubre, 010220, Ecuador; ²INIA, Av. Pta. de Hierro s/n, 28040, Spain, ³UCM, Av. Pta de Hierro s/n, 28040, Spain, ⁴TRIALVET, Encina 22, 28721, Spain, ⁵Granja Cerromonte, Avila, 05358, Spain; congarcon@gmail.com*

The aim of the present study was to evaluate the influence of physiological and productive factors of ewes (age and type of pregnancy and level of milk production) during pregnancy on birth weight of lambs. The study was carried out in a single commercial farm on 334 Lacaune dairy sheep, classified by age (187 mature and 147 maiden ewes), pregnancy type (155 single vs 179 multiple pregnancies), milk production average milk yield per day (YDIM), from conception to drying off; 45 Low yielding, LYDIM, < 1.37 l/d; 70 Average yielding, AYDIM, 1.37 to < 1.8 l/d; 72 High yielding, HYDIM, > 1.8 l/d; and average milk yield per day during month of conception (Yc); 45 Low yielding, LYc, < 0.91 l/d; 70 Average yielding, AYc, 0.91 to < 1.3 l/d; and 72 High yielding, HYc, > 1.3 l/d). Lambs body weight was recorded in 576 lambs (253 males, 323 females) at birth and at 18 days old. Differences among groups were evaluated with ANOVA and Kruskal-Wallis test when non-normal distributed. The lambs born to mature ewes were heavier than those from maiden ewes both at birth (4.2 ± 0.8 vs 3.5 ± 0.8 kg; $P < 0.0001$) and at 18 d-old (8.8 ± 2.0 vs 6.8 ± 1.6 kg; $P < 0.0001$). Newborns from single pregnancies were heavier at birth than those born from multiple pregnancies (4.3 ± 0.9 vs 3.8 ± 0.8 kg; $P < 0.0001$), but no difference was found at 18 d-old (8.0 ± 2.1 vs 7.9 ± 2.1 kg; $P > 0.05$). The birth weight of lambs was similar in the groups HYDIM and AYDIM and heavier in these both groups than lambs from the groups LYDIM (4.3 ± 0.8 ; 4.3 ± 0.8 ; 4.0 ± 0.8 kg; $P < 0.05$); there were no differences at 18 d-old. Concomitantly, lambs of the groups HYc and AYc were heavier than lambs in the group LYc at birth (4.4 ± 0.8 ; 4.2 ± 0.7 ; 4.1 ± 0.8 kg; $P > 0.05$), but values were similar among the three groups at 18 d-old. The present study suggests that, age, type of pregnancy and level of milk production during gestation in ewes are determinants of lamb birth weight.

Ten years evolution of dairy cattle herds: fertility, production and management

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This study described the productive data evolution from 71 dairy herds over ten years (2008 to 2017). During this period, two global management strategies changed: timed Artificial Insemination (AI) programs since 2011 onwards and composting bedding systems since 2014. The results showed an increase of total cows/ herd (293 ± 299 in 2008 vs 498 ± 558 cattle in 2017), and maximal herd size (980 in 2008 vs 2,505 cattle in 2017). The percentage of heifers (based on the total of animals) was 69.0% without a tendency of change over the years. Regarding production, average daily milk yield per lactating cow increased with time (30.3 ± 2.5 in 2008 vs 33.5 ± 2.2 l/cow in 2017). While calving to first AI interval and estrous detection rate remained stable (91 days and 51.2%, respectively), average days in milk decreased with time (204 ± 14 d in 2008 vs 195 ± 16 d in 2017). Similarly, the total of AIs per pregnancy decreased from 4.4 ± 1.2 in 2008 to 3.6 ± 1.1 AI/P in 2017. Accordingly to these data, conception and pregnancy rates increased (CR= $28.7 \pm 5.0\%$ and PR= $15.0 \pm 3.5\%$ in 2008 vs CR= $32.0 \pm 5.6\%$ and PR= 16.4 ± 4.3 in 2017). Age at first AI decreased from 16.1 ± 1.4 m of age in 2008 to 14.8 ± 1.5 m in 2017, with a reduced age at first calving from 26 ± 1.7 m to 25.1 ± 1.6 m of age in 2017. Neonatal mortality was 8.5%/year during the whole period, with a minimum of 7.2% in 2013 and a maximum of 13.4% in 2008. The annual percentage of culled cows remained stable (29.1 ± 6.8 in 2008 vs $29.8 \pm 7.2\%$ in 2017). Dry period length decreased from 64 ± 10 in 2008 to 62 ± 9 d in 2017, without an apparent decreasing tendency over the period. In conclusion, the increase in the size of farms is confirmed during this 'after milk quota period'. The historically impaired fertility with an increasing individual production could not be observed. Moreover, cow's fertility and heifers reproductive efficiency (age at first calving) improved during this period.

Session 35

Theatre 1

Challenges for livestock breeding in developing countries

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According to the Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture, breeding goals have been defined for 53% of the world's locally adapted national breed populations and 35% are under genetic evaluation. These percentages are significantly lower in developing countries and may be overestimated, considering countries that did not respond. Such information suggests that establishing and sustaining structured livestock breeding programmes remain challenging in many countries, particularly for low-input systems. The State of the World Report also identified gaps in terms of institutional capacities and supporting breeding policies. To circumvent those gaps and to improve the performance of local livestock, importation and introgression of exotic breeds are frequently considered as the solution by decision makers. However, the success of crossbreeding programmes depends on different prerequisites such as continual access to adequate breeding stock, adaptability of the stock to the local production environment, the management and level of inputs required for the improved livestock to express their genetic potential or integration within a reliable market chain. Furthermore, a lack of a long-term breeding strategy will result in indiscriminate crossbreeding threatening subsequently the diversity of locally adapted breeds, without obtaining desired gains in productivity and profitability. For any kind of breeding programme, priorities need to include capacity-building at all levels from livestock-keepers to policy-makers, as well as strengthening the organizational structures.

The effect of birth-weight on growth performance and meat quality in Iberian pigs

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The variability of birth-weight (BIW) in lean commercial swine breeds is known to cause heterogeneity in growth patterns and meat quality affecting profitability. This effect may be more severe in local breeds because of its reproductive characteristics. There is scarce information for traditional breeds, so we evaluated BIW effects on postnatal development during the growing-fattening phase (from 72 d-old to slaughter) and on carcass and meat quality at slaughter in Iberian crossbred pigs. Males and females (120 pigs each) classified by BIW into very low, low and average BIW (VLBIW, LBIW and ABIW) were distributed by sex and BIW. At 110 d-old, VLBIW and LBIW females showed a lower feed conversion rate (FCR, $P<0.05$) than the other groups. However, the VLBIW females had the highest FCR values from 111 d-old to the slaughter ($P<0.05$). At slaughter, VLBIW pigs showed less average daily gain weight (ADGW) and weight ($P<0.0001$) than heavier groups due to the lowest values of females. Age to slaughter was negatively correlated with BIW and decreased by approximately 28 days per kg of BIW increased ($P<0.0001$, for both). Regarding carcass quality analysis, VLBIW pigs showed shorter carcass than heavier groups ($P<0.05$). Meat quality showed that LBIW and ABIW males had the highest and lowest values of intramuscular fat values, respectively. The analysis of fatty acid (FA) profile of loin showed that sex modulated the neutral fraction (triglycerides) while BIW modulated the polar fraction (phospholipids). The polar fraction of LVBIW showed lower values of unsaturation index and polyunsaturated FA (PUFA; $P<0.05$, for both), but higher concentrations of monounsaturated and saturated FA (MUFA and SFA; $P<0.05$, for both). The neutral fraction of males showed higher desaturation indexes (MUFA/SFA and C18:1/C18:0 ratios) and MUFA content than females, but lower SFA content. Our results support the adverse effects of low BIW, modulated by sex-related effects, on postnatal growth traits and carcass and meat quality of Iberian pigs.

Session 49

Poster 30

Integrated evaluation of the sustainability of the Noir de Bigorre pork chain

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The social expectation for more sustainable livestock farming systems is growing. However, multidisciplinary approaches to assess the sustainability of pig farming systems are not sufficiently addressed. Twenty-five farms of local pig breed's production in France (Noir de Bigorre chain – Gascon breed) were evaluated altogether in terms of environmental impacts (EN), economic sustainability (EC) and animal welfare (AW), using multiple factor analysis (MFA) and hierarchical clustering (HC). The first dimension of MFA (22.7% the total variance) was mainly associated to the EN ($r=0.56$) and AW ($r=0.52$), while the second (20.8% of the total variance) was linked to EC ($r=0.41$). The HC resulted in the identification of four groups: Group 1 comprised farrow-to-finish farms, with a farmer aged between 20-30 years-old, characterized by high EN, high dietary crude protein (CP) of fattening feeds and feed conversion ratio (FCR), low AW, and usually low EC. It could be described as 'sustainability unfavourable', with an overall inefficient management of the farm, when the high FCR could be a result of the high feed waste. Group 2, composed by 75% of feeder-to-finish farms, was characterized by high transferability, high land occupation (LO), and low AW. It could be described as 'AW unfavourable and Transferability favourable'; maybe due to the high LO, animals were raised with lower level of care. Group 3 comprised farrow-to-finish farms managed by a man, and characterized by high EC, high number of sows and low EN per ha. It could be described as 'EC and EN favourable', described by high farm size and good management practices. Group 4, characterized by high AW and low EN, could be described as 'AW and EN favourable', with more attention to AW and lower surface available to pig production. The use of an integrated evaluation highlights different profiles of farmers which are associated with various results in the different themes considered. Based on complementary themes, it provides a broader representation of the sustainability of pig farming systems than the use of one theme. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Polyphenols and IUGR pregnancies: maternal hydroxytyrosol supplementation and foetal development

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Hydroxytyrosol (HT) is a polyphenol present in virgin olive oil with antioxidant, metabolism-regulatory, anti-inflammatory and immuno-modulatory properties. Previous studies have shown positive effects of maternal HT supplementation during pregnancy on final birth weight in Iberian sows. However, there are few data on the physiopathogenesis of this effect. The present study analysed foetal phenotype after HT supplementation in pregnant sows with a nutritional restriction of 50%. From day onwards of pregnancy, 6 Iberian sows were treated with 2.1 mg/kg of feed day of HT (group HT) whilst 7 other sows were used as control (group C). At day 100 of pregnancy, a total of 100 foetuses were collected. foetal body weight and weights of all viscera were determined. For statistical purposes, litter size was categorized afterwards into two groups (1-7 vs >8 piglets/litter). The final distribution was 55 foetuses in group C and 45 in group HT. The results showed a similar mean litter size (7.8 ± 0.7 and 7.5 ± 1.2 foetuses for groups C and HT, respectively), with no significant differences in the incidence of IUGR between groups (6 IUGR foetuses in both groups). However, foetuses of group C were heavier than foetuses of group H both in small (752.74 ± 36.65 vs 701.25 ± 9.01 g respectively; $P < 0.005$) and in large litters (717.56 ± 20.50 vs 652.16 ± 20.89 g respectively; $P < 0.01$). These results are opposite of previous data in Iberian and hyperprolific sows and may indicate either inconsistent effects among replicate studies or different effects depending on the stage of pregnancy. Foetuses of large litters in the group HT showed higher weight ratios of the brain ($P < 0.05$), kidneys, pancreas, and spleen relative to body weight ($P < 0.0001$ for all). These traits suggest an adaptive response to maternal undernutrition of foetuses in the group HT despite a lower body weight.

Session 67

Poster 11

The effect of fertilization on qualitative and *in vitro* fermentation parameters of C3 grasses

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The aim of the study was to evaluate the effect of level of nitrogen (N) fertilization on certain qualitative parameters and *in vitro* total gas and methane (CH₄) production of temperate (C3) grass species commonly used in South Africa. Treatments included three C3 grass species (*Dactylis glomerata*, *Festuca arundinaceae*, *Lolium perenne*) with three levels of N fertilizer (0, 50 and 100 kg N/ha). The experiment was conducted in a greenhouse in 10 l pots using a standardised soil mixture. After seed germination all treatments were thinned to three uniform seedlings per pot. All pots received a single dressing of N fertilizer (LAN, 28%N) as per the experimental treatments. The pots were rotated weekly in the greenhouse to minimize environmental effects and watered to 90% field capacity. Samples for analysis were harvested by hand after an 8 week regrowth period. The data were subjected to an analysis of variance (ANOVA) with two factors and 3 block replications using the GLM procedure of SAS. Student's t-LSLSD (Least significant difference) was calculated at a 5% significance level to compare means of significant source effects. Increasing the rate of N fertilization increased the crude protein (CP) concentration but had no effect on the fibre fractions within species. *L. perenne* had the highest ($P < 0.05$) CP at the 100 kg N/ha treatment and the highest *in vitro* organic matter digestibility (IVOMD) across all N treatments compared to *D. glomerata* and *F. arundinaceae*. The rate of N fertilization had no effect on the *in vitro* total gas and methane (CH₄) production within the species. *L. perenne* and *D. glomerata* had the highest and lowest 48 hour CH₄ production respectively. *D. glomerata* emerged as the species with the lowest methanogenic potential (CH₄: Total gas) after 48 hours incubation. The data suggests that the stage of physiological development of forages might have a greater influence on the fibre fractions and methanogenic potential of forages compared to the effect of N fertilizer application.