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Combining genetic and nutritional strategies improve the intrinsic and extrinsic qualities of pork

B. Lebret¹, S. Lhuissier¹, E. Labussiere¹, A. Connan² and I. Louveau¹

¹PEGASE, INRAE, Institut Agro, 35590 Saint-Gilles, France, ²Guyader Gastronomie, 35 Avenue de l'Hippodrome, 22200 Saint-Agathon, France; benedict.lebret@inrae.fr

To develop pig production practices that aim to improve the intrinsic (sensory, nutritional) and extrinsic qualities of pork (relocation of feed resources), we evaluated the effects of genetic and nutritional factors on growth performance and on carcass and pork quality. A total of 60 female pigs from two genotypes [LW × LD] × Piétrain NN (P, non-carrier of the n allele of the RYR1 (halothane) gene) or [LW × LD] × Duroc (D) were submitted to two different feeding regimes. Pigs were divided into 4 experimental groups (n=15/group) at 30 kg body weight (BW). The PC and DC groups received a control diet (C) including oilseed meal, while the PR and DR groups received a 'Roc+' (R) diet including extruded faba bean as major protein source and extruded linseed as source of n-3 fatty acids (FA). The animals were raised in individual pens and fed *ad libitum* from 30-115 kg BW, with nutritional intake (digestible lysine : net energy ratio) being adjusted weekly to the average requirements of pigs within each group. Growth rate, feed efficiency and slaughter BW were higher for D vs P pigs (P<0.001) and, to a lesser extent, for R vs C (P<0.05) pigs. D pigs exhibited lower carcass lean meat content, lower proportions of ham and loin and higher proportions of belly and backfat than P pigs (P<0.01), whereas carcass traits were not influenced by the diet. Loin meat (Longissimus muscle) from D pigs had lower drip loss, higher ultimate pH and higher intramuscular fat content (P<0.05), and was judged to be more marbled, tender and juicier by trained panellists (P<0.01) than that from P pigs. The diet did not influence the sensory traits but improved the nutritional value of pork by markedly reducing the n-6:n-3 and saturated:n-3 FA ratios (P<0.001) in both loin and backfat tissue. The combination of D genotype and R diet improves the sensory and nutritional properties of meat while contributing to the relocation of the production of feed resources, thus improving the intrinsic and extrinsic qualities of pork in a farm to fork strategy.

Multicriteria performance of fattening pigs assessed with the bioclimatic model ThermiPig

N. Quiniou¹, A. Cadéro^{1,2}, M. Marcon¹ and L. Brossard²

¹IFIP-Institut du Porc, La Motte au Vicomte, 35650 Le Rheu, France, ²PEGASE, INRAE, Institut Agro, 35590 Saint-Gilles, France; nathalie.quiniou@ifip.asso.fr

The dynamic model ThermiPig was developed to simulate thermal balance at the fattening room scale, as the result of the heat produced by the group of pigs or provided by incoming air and equipment and that lost due to air renewal or thermal conductivity of the walls and ceiling. A growth model (assuming thermoneutral conditions, InraPorc) and a bioclimatic model (ThermiSim) were combined to create ThermiPig. It considers a common time step (1 hour), definition of the pig thermoneutral zone (based on body weight and type of floor), evaluation of impacts of cold and hot exposure on the amount of available energy for growth, and the circadian distribution of heat produced daily by each pig (based on meal partition over the day and post-prandial thermic effect of feed). Data collected *in vivo* from a group of 96 pigs of the IFIP experimental station were used to evaluate the accuracy of the prediction of ambient temperature (T). Characteristics of the fattening room, regulation rules of the climate box control of the ventilation system, nutritional characteristics of the 2-phase feeding sequence, and outdoor conditions (hourly T and relative hygrometry) observed during the *in vivo* trial were used as inputs of the model, and simulation were performed on 30 virtual groups of pigs from the same genders and crossbreed. With average *in silico* growth performance of the 30 groups similar to observed ones, the error of prediction (RMSEP) on ambient T averaged 0.6 °C. Thereafter, ThermiPig was used to simulate the impacts of alternative regulations for ventilation or the use of new equipment (heater, pad cooling) on growth performance of pigs, N excretion, and indirect energy (from feed intake) and direct energy (from electricity consumed by equipment) consumption. Comparison of multi-criteria performance *in silico* helps identify the most interesting option. Economic performance depends on carcass value minus costs of feed intake and electricity (depending on the energy source). Therefore, more accurate prediction of carcass value is expected in the next version of the model by considering effects of ambient temperature on the distribution of body fat and protein metabolism.