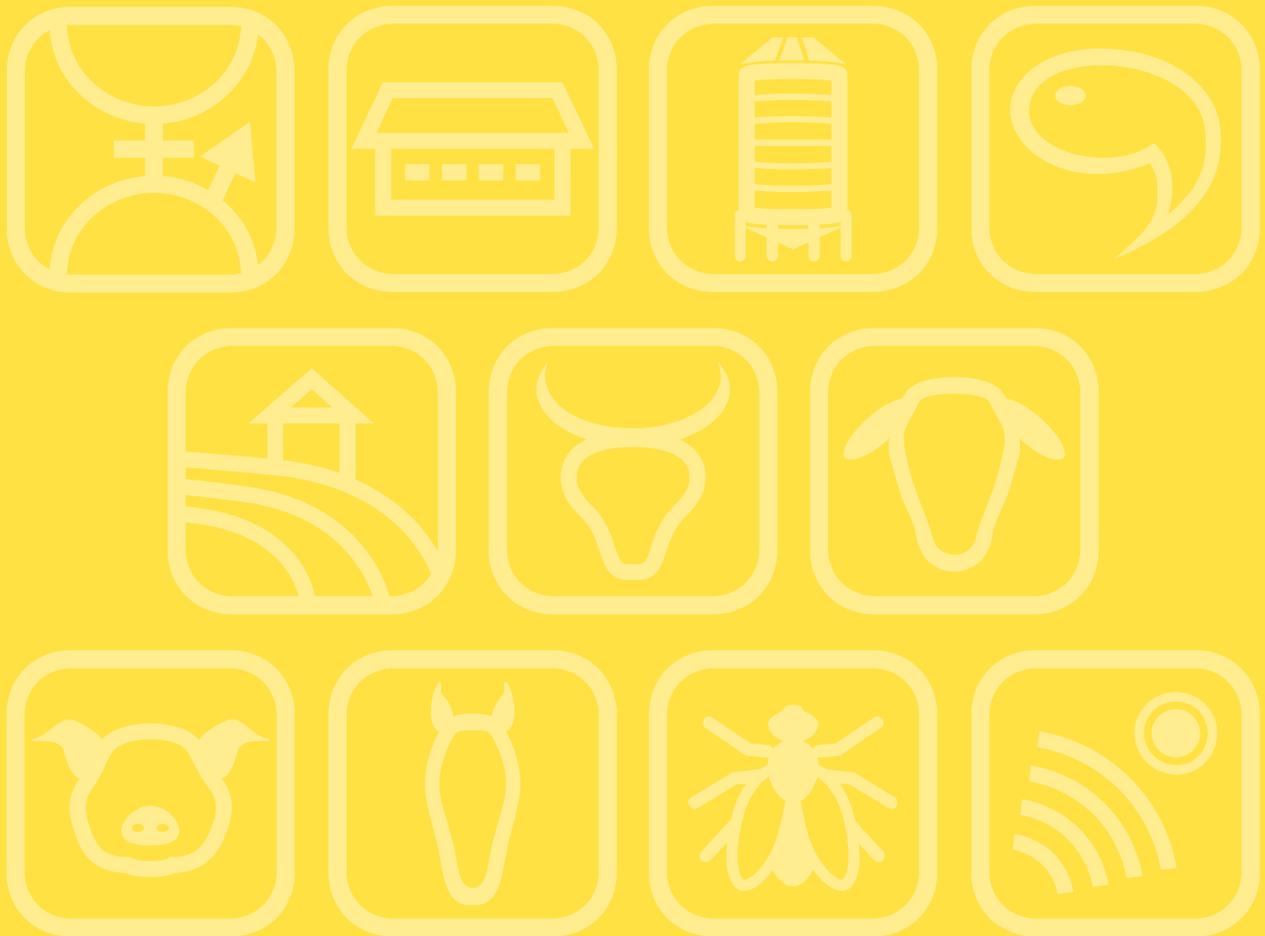


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Mining whole genome resequencing data to identify functional mutations in boar taint-candidate genes

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Next generation sequencing applied in pigs have recently produced re-sequenced pig genome data from different individuals belonging to a large variety of breeds. The availability of these large datasets is opening new opportunities to mine public nucleotide archives and identify mutations that could putatively affect economic relevant traits. Moreover, resequencing data from pooled pig DNA could provide cost-effective whole genome information from a large number of animals. In this study, we mined 110 individual pig genomes retrieved from the European Nucleotide Archive and from proprietary datasets generated from pigs of 28 different breeds. This dataset was integrated from 8 pooled whole genome resequencing datasets generated from 35 individuals each from 8 distinct commercial or autochthonous breeds (Italian Large White, Italian Duroc, Italian Landrace, Apulo Calabrese, Cinta Senese, Casertana, Mora Romagnola, Nero Siciliano), respectively. Individual and pooled pig genome datasets were searched for polymorphisms in 135 annotated candidate genes, including 25 genes involved in androsterone and skatole biochemical related pathways. Short reads from these genomes were aligned using bowtie to a customized reference sequence generated from the reference pig genome, including sequence of selected genes (with depth ranging from 4 to 40X for each genome). A total of 100k variants were identified (2.3% in coding regions with about 500 missense mutations and a few other potential functional mutations). About 15% of these numbers refers to genes encoding enzymes involved in the androsterone and skatole biochemical pathways. This study provided an overview of the variability in targeted gene regions potentially involved in determining boar taint in pigs. Partially funded by European Union's H2020 RIA program (grant agreement no. 634476). Abstract reflects the authors' view. European Union Agency is not responsible for any use that may be made of the information it contains.

Outlook on local pig breeds as drivers of high quality pig production-ambitions in project TREASURE

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Project's idea is a new paradigm of pig production systems and development of sustainable pork chains based on European local pig breeds which are held in less intensive systems, use locally available feeding resources and are adapted to local agro-climatic conditions. Local pig breeds provide products with typical, generally high sensory quality and regional identity searched by consumers. Despite revived interest, these breeds are mainly untapped and often remain endangered. The few successful examples in Europe demonstrate that the best conservation strategy is to ensure breed is self-sustaining resulting from good valorisation of pork products. As their productivity is low, local pork chains can become sustainable only when their genetic potential is benefited, production systems optimised and their products viable on the market. To enhance sustainability of pork chains based on local breeds, it is essential to gain scientific proofs of their genetic singularity, productive potential and product qualities, to develop genetic tools for authentication and breeding, to optimize pig nutrition and management (enhance welfare, use of local feeding resources), to evaluate their environmental impact, to assess consumers' attitudes, acceptability and purchase intentions, and to develop adapted marketing strategies. In addition, project promotes knowledge exchange and building of functional networks among regions esp. by means of creating an 'umbrella' trade mark as exploitation booster. These challenges are addressed by the project and will be presented. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Environmental impacts of pig production systems relying on European local breeds

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Traditional pig production systems, relying mainly on local pig breeds and outdoor rearing, have been poorly investigated so far in terms of environmental impacts. The few existing studies did not account for possible sequestration of carbon and emissions consecutive to grazing. Twenty-five farms of Gascon breed in France (FR), 8 with Mora Romagnola breed in Italy (IT), and 15 of Krškopolje breed in Slovenia (SI) were evaluated while accounting for the emissions from pasture intake and the potential for carbon sequestration. Pig production system in SI presented the lowest impacts per kg of live weight, due to better feed conversion ratio caused by indoor production and due to lower impacts of feeds – most diets were based on grains, vegetables, tubers and roots produced on farm. Among the systems, acidification potential (AP) was 13% higher in IT than the average for FR and SI, due to higher dietary crude protein content (+9% than the average), while the eutrophication potential (EP) was 27% higher in FR system than the average, as a result of higher phosphorus content of feeds (+28% than the average). When the potential of carbon sequestration was taken into account, the GWP impact was reduced 4% on average. Conversely, when accounting for the emissions from pasture intake the GWP was increased by 2%, mainly when a high digestible grass was considered. The use of high digestible grass provided lower AP and EP impacts than low digestible grass. The large variability between farms in terms of environmental impacts suggests that the margins for improvement of local breeds' production rely on improvement of feed composition and supply, and origin of feed ingredients. There is a great need for better estimation of digestibility of grasses and of carbon sequestration, in order to reduce the uncertainties associated with the environmental impacts evaluated of outdoor pigs' systems. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Digestibility and nitrogen balance in Cinta Senese growing pigs fed different protein levels

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The aim of this study (of TREASURE project) was to evaluate the protein digestibility and the N retention of four diets, containing 12, 14, 16 and 18% of crude protein (CP) in Cinta Senese growing pigs. Bentonite as internal indicator was added to each diet (2% as fed). Eight castrated males, weighing 55 kg of lw on average, were cyclically fed with the four diets according a Latin-square design. The animals were regularly weighed before each experimental cycle to adjust the daily amount of feed, according to their metabolic weight (90 g DM/kg MW). Every cycle consisted in 10 days of diet adaptation in box, two days of adaptation in metabolic cage and three days of trial, when faeces and urines were collected. The whole trial lasted a total of 8 weeks. Sampling took place at fixed hours, once a day for urines and twice a day for faeces. On feed and faeces, the following analysis were carried out: moisture, protein, ether extract, ash, NDF, ADF, ADL and acid insoluble ash (AIA). On urines, nitrogen content was determined. Total tract apparent digestibility (TTAD), balance and efficiency of nitrogen utilization and energy partition of the experimental diets were calculated. Data were analysed by SAS using the GLM model and considering sampling day and animal as fixed effects and diet and metabolic weight as continuous effects. TTAD of dry matter, organic matter and protein showed a parabolic trend with maximum at 14.5-15.0% of CP. Concerning the N-related parameters, results showed that the N intake, N adsorbed and total N excreted increased with the dietary CP content. Contrariwise, the biological value (BV) of the diet and the N retained/intake ratio linearly decreased as the CP increased. Indeed, the lowest BV was observed for the 18% CP diet (45.28%), while the highest was showed by 12% CP diet (59.82%). Energy digestibility followed a parabolic trend, while metabolizable energy decreased linearly from 12%CP to 18%CP diets. In conclusion the protein requirement for Cinta Senese growing pig (from 50 to 80 kg lw) can be fulfilled by the 12% CP diet. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Effects of immunocastration on performance and nitrogen utilization of Iberian pigs

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Immunocastration -vaccination against gonadotropin releasing hormone (GnRH)- has been shown to prevent sexual development and boar taint in pigs being a feasible alternative to surgical castration (SC). Studies in conventional pigs point out that immunocastrated (IC) pigs show better performance than SC pigs. Apart from the benefits on animal welfare, this fact could be of interest for Iberian pigs and other fatty pig types, characterized by long productive cycles and low capacity for lean tissue growth. There is a question on whether protein requirements might be increased in IC compared to SC Iberian pigs. The purpose of this study was to examine the effects of immunocastration on Iberian pig growth and nitrogen (N) retention under 3 dietary protein concentrations. Fifty-four pure Iberian pigs were used (3 sexes: IC males, IC females, SC males; 3 isoenergetic diets: 150, 130 and 110 g CP/kg DM, 6 pigs/treatment combination). Vaccination against GnRH was at 4.3 (40 kg) and 6 months of age (70-80 kg). Pigs were individually housed consuming the experimental diets from 40 to 105 kg-BW with a slight restriction. Digestibility and N balance assays were performed at 50 and 90 kg BW, respectively. The IC males showed higher overall growth rate (+13%; $P<0.001$) and feed efficiency (+9.6%; $P<0.001$) than SC males and IC females, and slightly higher daily feed intake (+3%, $P<0.001$). No significant effect of dietary protein level was found on growth or feed efficiency. Before the second vaccination, IC pigs showed higher N retention (13 to 39%; $P<0.001$) and efficiency of N utilization (22 to 47%; $P<0.001$) than SC males and IC females. Pigs fed the lower protein content diet retained less N ($P<0.05$). However, no significant differences among sex groups in N retention parameters were detected after the second vaccination. Higher performance of IC male pigs seems to be related to a greater capacity for N retention before receiving the second dose of the vaccine. Funded by European Union's H2020 RIA program (Grant agreement No 634476). Abstract reflects the authors' view. European Union Agency is not responsible for any use that may be made of the information it contains.

Development of long-term, pre-finishing immunocastration protocols for male Iberian pigs: 2. carcass

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Male immunocastration (IC) should be adapted to the long life cycle of Iberian (IB) pigs. We previously developed long-term, 3-dose, pre-finishing IC protocols for male Iberian pigs whose efficacy seemed to be influenced by nutritional and stress level. Study 1 aimed to improve the efficacy of protocols by a short-term increase in feeding intake. IC males (ICM; n=47) were fed commercial concentrate in an extensive system, immunized against GnRH at 11, 12 and 14 months (m) of age and slaughtered at 16 m. The treated subgroup (23 ICM) was submitted to a 15-day ad libitum feeding period starting at the 3rd vaccination, and the remaining ICM were the Control subgroup. The treated ICM group reached 100% efficacy as all its animals had <150-g testes (which was the threshold for blood testosterone presence in our earlier studies). In contrast, 4/24 Control ICM had >150-g testes. Study 2 aimed to adjust the protocol to suit the chronology of the acorn-feeding free-range period (montanera; MT). We tested whether improving body condition homogeneity at the start of MT would homogenize testicular atrophy. Control IB pigs (C; n=18) were immunized at 10.5, 12 and 13.5 m. Treated pigs (T; n=17 IB males) were immunized at 10.5, 11.5 and 13 m, with a 15-day ad libitum (AL) feeding period starting at the 3rd dose. Montanera started at 13.5 m, and slaughter took place at 16 m. The AdLib group (IB × Duroc; n=15) were fed AL with concentrate during growth and finishing phases in an extensive system, immunized at 8, 9 and 10 m, and slaughtered at 13 m. The Adlib and T treatments showed a 100% efficacy. Backfat androstenone and skatole levels were basal. Ham yield and backfat thickness were similar for the 3 groups. Unlike in Study 1 and our previous studies, intramuscular fat content, backfat thickness and meat texture did not seem different from those usually reported for surgically castrates. We conclude that nutritional level can be used to improve the IC efficacy. Longer finishing after the last vaccination may increase fat deposition. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Gut microbiota analyses for sustainable European local porcine breeds: a TREASURE pilot study

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The study of gut microbiota and its effects on hosts has emerged as an essential component of host homeostasis and global efficiency. Besides host's influence on gut microbiota, major quantitative and qualitative changes may occur in the composition of the intestinal microbiota due to the influence of diet and other environmental factors. In accordance with the TREASURE project global aim of enhancing sustainability of production systems for local pig breeds, the objective of our task was to conduct a pilot characterisation of intestinal microbiota in order to test its usefulness to characterize several local European pig populations and their production systems. This approach has been applied to populations belonging to the following European traditional breeds: Gascon (France), Iberian (Spain), Krskopolje (Slovenia), Mangalitsa (Serbia), Moravka (Serbia) and Turopolje (Croatia). For each breed, faecal samples have been collected along different experiments performed in the TREASURE project targeting the comprehension of a particular traditional production system (e.g. open-air farming), management practice, or the comparison of breeds. In all experiments, the metagenomics technique employed is the re-sequencing of the bacterial 16S in an Illumina MiSeq system. Overall, the results have shown that the gut microbiota analysis is a promising approach for the characterisation of these local breeds, by allowing a deeper understanding of their production systems and potentially allowing the development of new certification approaches. Preliminary results will be summarized in this communication. Funded by European Union's H2020 RIA program (Grant agreement no. 634476).

Modelling study with InraPorc® to evaluate nutritional requirements of growing pigs in local breeds

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Models as InraPorc® have been developed to simulate pig growth and to determine nutrient requirements. They are largely applied to conventional breeds but so far not to local breeds. Our study aimed to use InraPorc® to determine nutrient requirements of growing pigs from local breeds in H2020 EU project TREASURE. Data on feed composition, allowance and intake, and body weight (BW) were extracted from literature reports or experiments conducted within the project. They were used to calibrate parameters defining a growth and intake profile in InraPorc®. We obtained 15 profiles from 9 breeds (Alentejano, Basque, Bísaro, Calabrese, Cinta Senese, Iberico, Krškopolje, Mangalitsa Swallow Bellied and Moravka). Breeds had 1 to 3 profiles depending on experimental conditions or data sources. Conditions of the study affected calibration results. The mean protein deposition (PD) was low for all breeds from 39.9 to 91.0 g PD/day vs over 110 g/d in conventional breeds. For 40-100 kg BW range, the age of the pigs at 40 kg BW was between 110 and 206 days, denoting different feeding management in addition to genetic differences. Average daily gain (ADG) and feed intake curves showed similar shape. Protein deposition rate was the highest in breeds with the highest ADG. Lysine requirements were largely covered in all studies and breeds, the highest requirements being observed with the highest ADG. In all breeds a low part of total body energy retention was dedicated to protein, conversely to lipids. Despite some methodological limitations, this study provides a first insight on nutrient requirements for some local breeds. Funded by European Union's Horizon 2020 RIA program (grant agreement no. 634476).

An alternative to restricted feeding in Iberian pigs using an agro-industrial by-product of olive oil

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Traditional Iberian pig production is characterized for having a fattening period with a feeding based on acorn and pastures. During the previous growing period, the feeding is restricted to avoid undesirable weight gains. However, this procedure could cause feeding stress. The use of ad libitum diets based on olive by-products during the growing period may be an alternative to avoid this stress. Two diets based on olive by-products, one incorporating dry olive pulp in the feed (DD) and the other one incorporating olive cake in wet form (WD) were compared with a control standard diet group (CD). CD and DD diets were supplied once a day and WD diet was supplied ad libitum and supplemented with a specific feed given once a day. Comparisons were performed using ANOVA for: growth, backfat fatty acid profile, carcass composition, percentage of intramuscular fat (%IMF) and other quality meat traits (thaw, cook and centrifuge force losses, shear force, marbling, Minolta colours and myoglobin concentration). No significant differences between the treatment groups were observed for most of the traits. Although animals fed with DD and WD diets grew slower than those fed with CD during the growing period, no differences in the total average daily gain were observed. DD animals showed a higher carcass yield and less %IMF in loin. Olive-cake diets caused higher levels of unsaturation than CD one after the growing period. Lower centrifuge force losses were observed in WD than in CD. DD samples were paler and less red-coloured and has lower myoglobin content than CD and WD ones. Results (of this study within project TREASURE) suggest that WD diet could be a suitable feeding for growing period in traditional Iberian pig production since negative effects on growth, carcass and quality traits were not observed in the current study. Funded by European Union's H2020 RIA program (Grant agreement no. 634476).

Effects of pasture keeping and acorn feeding on growth, carcass- and meat quality of SH pigs

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The Schwäbisch-Hällisch pig (SH) is the oldest autochthonous pig breed in Germany. It has been rescued through a regional marketing program. The traditional feedstuff acorn was revitalized through a premium meat program where outdoor reared pigs get an acorn supplementation. In this study, the effects of pasture keeping and acorn supplementation on growth, carcass composition and meat quality traits of purebred SH pigs were investigated. In 2015 and 2016 in total 305 pigs were introduced to the trial when entering the fattening barn with an average weight of 34 ± 6 kg. The final live weight was 138 ± 14 kg with an average slaughter weight of 107 ± 12 kg. Up to a live weight of 91 kg all pigs were fattened under equal conditions. They were kept in a barn with outdoor access, a total place allowance of 1.7m^2 per animal and a cereals soya bean mixture as feed (ad lib.). After division in three trial groups one group went to pasture where every animal had a place allowance of 400m^2 . The pasture was equipped with huts and a water-/feeding station. The outdoor group (OA), represented by 57 pigs, was fed with a cereals soya bean mixture which was supplemented with dried acorns (20%). The indoor group with acorn supplementation (IA) consisted of 58 pigs and got the same feed as the OA group. As a control group (IC) 190 pigs were fattened indoor without acorns. All animals were fed ad libitum. All feeds had common energy- and protein levels (appr. 13 MJ-P; appr. 17% CP). Regarding growth performance the OA pigs showed significant lower daily gain than the other groups in the last fattening period (704g vs 789g (IA) and 785g (IC)). The OA group had with 2.9% a significant higher intramuscular fat content (IMF) than the IC group (2.3 %) while the IA animals reached 2.7 % IMF. The OA group showed significant lower drip loss values than the others (OA=0.9% IA=1.7% IC=1.7%). In conclusion pasture keeping reduces growth performance but improves meat quality. Acorn supplementation also has a positive effect on meat quality traits.

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Effects of rice husk supplementation during pre-finishing on production traits of Iberian pigs

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Iberian pigs must be feed-restricted during the pre-finishing period (premontanera) due to their adipogenic nature. Supplementation with rice husk (a fibrous, abundant and inexpensive by-product) before finishing may increase satiety, decrease stress and competition, increase animal welfare and might reduce weight gain variability and improve carcass uniformity. This study evaluated the effect of rice husk supplementation on weight gain, carcass composition and hematological traits. Castrate male Iberian pigs were assigned to 3 treatment groups (n=15/group), which, during premontanera, from 10 to 14 months of age, were fed concentrate-based diets differing in fibre content, namely Control (C; 5.0%), Medium Fibber (MF; 8.5%) and High Fibber (HF; 12.0%) groups. The MF and HF diets included rice husk (integrated into the concentrate) as a supplemental source of fibre. Rations were isocaloric. Five pigs from each treatment were slaughtered at the end of premontanera, whereas the remaining animals were submitted to free-range acorn-feeding (montanera) and slaughtered at 16 months of age. Body weight (BW) and in vivo ultrasonographic body composition were monitored. A blood sample was collected at the end of premontanera to determine the neutrophil/lymphocyte ratio as a chronic stress index. None of the groups had diarrheic problems, regardless the fibre level. Average daily gain from the 12th to the 14th month of age was greater for the HF group, which also exhibited a more homogeneous growth rate among animals. Moreover, the HF group had the thickest carcass backfat and smallest loin area among the animals slaughtered before montanera. Regarding backfat fatty acid composition premontanera, HF pigs had the lowest C17:0 and C18:3 and the greatest C20:1 percentages, and a trend for greatest MUFA and smallest PUFA values. In conclusion, supplementation with high levels of fibre (12%) from rice husk did not have any negative effect on health, growth or carcass composition.

Determination of fatty acid groups in intramuscular fat of various local pig breeds by FT-NIRS

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The objective of the present study is to evaluate the potential use of FT-NIRS for predicting intramuscular fat (IMF) and fatty acid groups (MUFA; PUFA; PUFA n-3, PUFA n-6; SFA) on pig grounded muscles. The research considered 160 fresh samples of *Longissimus* collected from 12 European local pig breeds (TREASURE* project).

For every sample, lipids were extracted from IMF and fatty acid profile was determined by gas chromatography. Two aliquots of each sample were scanned using FT-NIRS Antaris II model. Mathematical pre-treatments (multiplicative scatter correction, 1st and 2nd derivative) were applied and outliers' spectra were identified and removed when necessary. Partial least square regression was used on the average spectrum and the models validated using an external data set. Results are evaluated in terms of coefficient of regression and root mean square errors in calibration (R^2 -RMSE) and validation (R_p^2 -RMSEP).

As expected, the best results were obtained for IMF with R^2 higher than 0.99 and RMSE lower than 0.2. Unsaturated fatty acids, probably due to the absorption of the *cis* double bond in a specific region of near infrared spectra, obtain acceptable R^2 (0.89 for MUFA and 0.75 for PUFA n-3 and PUFA n-6). SFA achieved a R^2 of 0.81 that is lower than values reported in other studies probably because of the large variability of genotypes used.

The validation models achieved both lower coefficients of determination and higher RMSEP than the calibration models; however, R^2 differences between calibration and validation were smaller than 5%, except for SFA.

Hence, the FT-NIRS seems promising to estimate the principal parameters of fatty acid groups on muscle samples from different European autochthonous pig breeds. Inclusion of other samples can improve the accuracy and the robustness of the models, especially considering the high variability of the samples.

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Consumers' study on traditional pork products from local breeds: expectations and hedonic evaluation

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Assessing consumers' acceptability of traditional pork products (TPP) from local pig breeds is essential to ensure sustainability of regional pork chains. As part of TREASURE project, expectations and hedonic perception of Protected Designation of Origin (PDO) Noir de Bigorre (NB) dry-cured ham produced from pure Gascon breed were assessed. The study was conducted in Toulouse (France) as expanding market for TPP with 124 consumers, regular purchasers of TPP (quota sampling method). Three products were used, described as follows: 'NB-PDO drycured ham 24 months ripening – local pig breed in extensive system' (NB24), 'NB-PDO dry-cured ham 36 months ripening – local pig breed in extensive system' (NB36) as innovative TPP to enhance sensory quality, and 'Iberian ham – 50% Iberian pig' (IB) as competing product. Following the expectation disconfirmation theory, the sensory test included three phases: blind (tasting without information), expected (product description only: no tasting) and actual liking (tasting with information), assessed using a 9-point scale from 1: extremely dislike to 9: extremely like. Data were submitted to ANOVA (mixed model). Blind hedonic test showed no differences ($P>0.05$) between products that all displayed high liking score (6.7 to 6.8). Product description strongly influenced expected liking ($P<0.001$) with higher score for NB36 than NB24 (7.8 vs 7.2, $P<0.05$) and lowest score for IB (5.2). Hedonic test with information showed higher actual liking for NB36 and NB24, that were similar, than for IB (7.4 and 7.2 vs 5.9, $P<0.001$). Both NB hams displayed higher actual than blind liking ($P<0.05$), denoting positive effect of information on acceptability. Actual liking was similar to expected for NB24, indicating fulfilment of hedonic expectations. By contrast, actual liking was lower than blind for IB ($P<0.05$). Results will be completed with consumer preferences and willingness to pay for TPP and innovations in TPP. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Economic valuation of social demand for key features of the Noir de Bigorre pork production chain

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Extensive farming systems produce for the society goods and services definable as public goods (biodiversity...), or having public good features (landscape attractiveness...). The provision of these public goods may not be guaranteed due to the lack of recognition of their values in markets and policies that ultimately can put in risk the future of these systems. Within TREASURE project, a choice experiment (CE) survey was applied to assess the social demand for relevant attributes of the Noir de Bigorre (NB) French regional pork chain producing Gascon local pig breed in extensive system with public good character. CE is an economic valuation method estimating the social demand for a given attribute or for combinations of them in management scenarios. Five relevant attributes of the NB chain and their current and potential levels in alternative management options were identified from focus groups: probability of existence of the breed in next 25 years, farm size, feedstuff origin, geographical availability of the products and type of selling places. A monetary attribute was included to assess the social demand for the previous attributes. A valuation questionnaire was administered to 418 individuals (365 through web-based survey, 53 face-to-face), half of them located in the South West of France, i.e. the production area of the NB chain. Results of the CE showed that the respondents had a distinctively urban profile, with no agricultural family background. Almost 40% of the respondents did not know or consume products from the NB chain. On average guaranteeing the survival of the breed achieved the highest willingness to pay (112.37 €/household/year). Respondents were willing to pay 42.35€ to maintain equal number of small and medium farms and 21.86€ to have feedstuff produced in the proximity of the farms. Geographical availability and selling places of products contributed to a lesser extent to shape their preferences. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Majorcan Black Pig: a sustainable production system for high quality meat products

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Majorcan Black Pig (MBP) is a native breed from Mallorca, in the Balearic Islands, characterized by its high rusticity and adaptation to Mediterranean climatic conditions, with ability to exploit the scarce natural resources. This pig population had a great importance in the economy and cultural heritage until mid-20th century. The introduction of leaner pig breeds, the impact of different diseases and rural migration led to a progressive decline of this breed. Recognized as an endangered autochthonous pig breed in Spain, MBP has a conservation and improvement program supported by Balearic Government technical services. The current census is close to 80 farms with more than 1,300 breeding pigs. MBP farms are managed in extensive conditions and the feeding regime is based on pasture, cereals, legumes, figs, almonds, acorns and Mediterranean shrubs, with eventual supplementation based on barley and green peas. Performances are largely dependent on available natural resources; mean productivity is 16 piglets/sow-year and a post-weaning growth around 500 g/day until the slaughtering target weight (140-160 kg). Compared with commercial breeds, MBP has a largely higher subcutaneous fat depot, with carcasses showing back fat depths reaching 7 cm and flare fat weights usually up to 6 kg. Important differences are also observed in meat quality, with the loin of MBP presenting higher intramuscular fat content (~8%), darker colour, slightly lower shear force, higher levels of MUFA (~50%) and lower levels of PUFA (<10%). The main products are the 'Sobrassada de Porc Negre Mallorquí', a specialty fat-rich cured sausage granted with a PGI certification, and the roasted 'porcella' (3 month purebred piglets). The proportion of animals devoted either to produce 'porcella' or to be fattened until a heavy slaughter weight depends upon the available natural resources. This practice represents a really sustainable production system. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Innovative patties from Majorcan Black Pig meat: results of a consumer study in Barcelona

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The Majorcan Black Pig (MBP) is an untapped breed from Mallorca Island, in the Mediterranean Sea. The aim of the study was to innovate new, healthier products to expand demand and ensure the survival of MBP farms by identifying new market niches. To achieve this, bioactive compounds such as β -glucans and polyphenols were added to the patties, by including mushrooms (*Boletus edulis*) or blueberries (*Vaccinium corymbosum*), respectively in their composition. A study with 120 consumers was carried out in Barcelona. The consumers had to test five types of MBP patties, three innovative treatments and two controls: MBP patties (A), MBP with porcini mushrooms (B), MBP with blueberries (C); Pork and beef (D) and beef (E). The experimental design consisted of three tests: (1) Blind test: consumers tasted the five types of patties (overall liking on a scale from 1 (dislike extremely) to 9 (like extremely)). (2) Expected test: Consumers indicated general acceptance to the description of the five treatments, with the information about the origin of the meat, production system and potential beneficial effects of the added healthy ingredients. (3) Informed test: Consumers repeated the sensory test, but with the same information as the previous test in each tasting. There were no significant differences according to gender in the blind test. MBP patty treatment had a significantly higher sensory acceptance than the rest (in both the Blind and Informed test). In addition, the average score obtained by the MBP patty was significantly higher in the Blind and Informed tests – which include a sensory evaluation – implying that it was the preferred one by the consumers. The type of patties with vegetal ingredients were scored significantly lower than the other types of patties, and there was no significant effect of the information that had been given to consumers, indicating that consumers did not like so much the sensory characteristics of these patties (texture and flavor). There is a need to provide clear and understandable information to the consumers about the differential characteristics of the products, ensuring sensory quality. Funded by European Union's H2020 RIA program (grant agreement no.634476).

Some results on performances of Krškopolje pigs in project TREASURE

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Krškopolje pig (KKP), a Slovenian autochthonous breed, has been little studied and more knowledge is needed about their growth potential and performances in different production systems. Present work aims to overview the preliminary results of H2020 project TREASURE, evaluating performance in different rearing systems: conventional (CON) organic (ORG) and traditional (TRD). Growth was evaluated in lactation (study 1, CON vs ORG, n=156), growing and fattening period (study 2, CON vs ORG n=36; and study 3, CON vs TRD n=12); main carcass traits were evaluated after slaughter at approximately 230 days of age (study 2 and 3). Results show that weight at weaning and growth rate in lactation were $\approx 20\%$ lower in ORG than CON farms, whereas no major differences in growth rate were observed between pigs in two systems in growing/fattening period when similar nutritional value of the diet and feeding was provided. However, in fattening period pigs in ORG system had 13% higher daily gain than in CON system, which could be ascribed to high consumption of alfalfa hay and perhaps less feed dissipation. Yet no differences in body weight and carcass traits were noted between the two groups at the end of the trial. Similar daily gain was observed in KKP pigs raised in CON and TRD system during growing period (until app. 45 kg), whereas in the period between 45-90 kg pigs fed TRD meal (ad libitum), which is based on mix of cereals and root crops, achieved 49% lower daily gain ($P < 0.01$) compared to those fed complete feed mixture (CON). Consequently CON pigs were heavier at slaughter (+32 kg, $P < 0.001$), had increased backfat (+7 mm, $P < 0.05$) and muscle (+18 mm, $P < 0.01$) thickness, but were not different in meat % ($P > 0.05$). Preliminary results presented provide some information about performance of KKP, however further studies are needed to know better its growth potential and nutritional needs. Funded by European Union's H2020 RIA program (Grant agreement no. 634476).

Effect of acorn feeding on quality and aromatic profile of dry sausages produced from Turopolje pigs

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Turopolje pig (TP) is an endangered Croatian autochthonous breed typically reared in an outdoor production system linked to local oak forests and marsh meadows in Turopolje region in Central Croatia. To self-sustain TP breed the utilization of meat products with added value has recently been proposed in TREASURE project. So far little information is available on the quality attributes of TP meat products, including the effect of locally available feeding resources. Hence present study aimed to examine the quality and aromatic profile of dry-fermented sausages of TP that were reared in similar conditions but fed either conventional (CF) or acorn supplemented (AF) finishing diet. The quality of end product, pH and aw values, moisture, fat and protein content, fatty acid (FA) profile, oxidative stability, texture profile analysis (TPA), sensory evaluation and aromatic profile were determined. Data were analysed by TTEST or NPAR1WAY (for sensory data) procedure at an alpha level of 0.05. Compared to CF, AF sausages tended ($P < 0.1$) to have higher moisture content and TPA chewiness, but generally had similar physicochemical, rheological and sensorial traits and FA composition, except for higher share of C14:0. Lipid oxidation, measured as 2-thiobarbituric acid-reactive substances, was more pronounced in AF than CF sausages. Aromagram showed terpenes as the most abundant volatiles (around 52% of the total area) in both types of sausages, followed by aldehydes (11-14%), aromatic hydrocarbons (6-10%), phenols (6-7%), alcohols (5-6%), acids (4-6%), Sulphur compounds (2-5%), ketones (around 3%), esters (less than 2%) and aliphatic hydrocarbons (less than 1%). Compared to CF, AF sausages had less aromatic and aliphatic hydrocarbons and sulphur compounds, and more esters. These results suggest that acorn feeding may affect some properties of TP dry-fermented sausages but more research is needed. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Consumers' acceptance of health-related innovations in dry-cured ham from Turopolje pig breed

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Turopolje pig (TP) is a local Croatian breed which nearly extinct in the second half of the 20th century. Currently, despite the state support, the TP is still endangered and to self-sustain the breed a new marketing strategy, based on the meat products with an extra added value, is needed. As consumers nowadays increasingly demand for more convenient and healthier types of products, in present work (within TREASURE project) we investigated consumers' acceptance of health-related innovations associated with the reduction of salting or smoking of TP dry-cured ham. A consumer (n=120) sensory test was carried out in Zagreb city area with the three types of TP hams (typically salted and smoked, less salted or less smoked) and two types of standard hams (conventional and premium) from modern pig breeds. Effect of information on innovation and/or breed on ham preferences was tested using three-step procedures as blind, expected and actual (informed) test on liking scale from 1 (dislike extremely) to 9 (like extremely). Data were analysed by GLM procedures at 0.05 α -level. In the blind test, in the absence of information, no significant differences between ham liking scores were found. In the expectancy test, when only information is given, all types of TP ham were more preferred than conventional ham, but only typical TP ham was preferred over the premium ham. Finally, when tasting is repeated with the information, all TP hams were scored higher than premium ham, while innovative TP hams were scored similar as conventional ham. This results suggest the preference of TP hams over the standard hams and a good acceptance of health-related innovations in TP ham by Croatian consumers. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Majorcan Black Pig carcass, meat and fat quality parameters assessed by a standardised toolbox

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TREASURE project aims to develop sustainable pork chains based on European local pig breeds. The Porc Negre Mallorquí (Majorcan Black Pig, MBP) is an untapped pig breed from Mallorca, in the Balearic Islands, included in the project due its high rusticity, adaptation to the environment and meat quality differentiation. Particularities of MBP are mostly unknown out from Mallorca, with only one representative meat product, the 'sobrassada de Mallorca de Porc Negre', a fat-rich cured sausage owning a PGI trademark. Carcass, meat and fat quality of MBP was evaluated, according to a standardised toolbox of parameters. The toolbox aimed for a harmonised knowledge of untapped breeds, made from the contribution of researcher's expertise and the literature. The mean values and standard deviation for carcass traits (n=29) were: 156.8±11.8 kg for live weight, 125.3±12.9 kg for carcass weight, 75.1±3.2% for carcass dressing, 88.7±3.7 cm for carcass length and 55.2±10.1 mm for ZP fat. The most remarkable results for the meat quality parameters toolbox (n=58) were an ultimate pH of 5.58±0.12 and electrical conductivity of 6.99±3.44 mS, a lightness value (L*) of 44.10±3.59, a drip loss of 1.49±1.46%, a shear force of 3.46±1.07 kg, and an intramuscular fat (IMF) content of 6.11±3.09%. The maximum value of IMF was 19%, a hint of the wide variability within this untapped breed, representing a disadvantage for the product standardisation in case of fresh meat, but not for 'sobrassada', mainly made of grounded ham, shoulder and loin. The results for the major fatty acid (FA) groups in back fat (n=48) samples were 41.00±1.42% of saturated FA, 51.27±1.64% monounsaturated FA and 6.88±0.71% polyunsaturated FA. 'Sobrassada' includes 40-50% of back fat, thus the FA composition is critical for product quality. The FA composition, with a high proportion of MUFA and low of PUFA contributes to an optimal technological quality of MBP back fat. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Effects of breed, tissue and gender on cholesterol contents of pork from local Lithuanian pig breeds

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The objective of this study (within TRESURE project) was to examine the effects of breed, tissue location and gender on the cholesterol content in different tissues of local Lithuanian pig breeds. The study was carried out on 24 Lithuanian White and 18 Lithuanian indigenous wattle pigs, 28 females and 14 castrated males. All pigs received a complete concentrate feed. Pork composition and properties were detected according to the EU reference methods. The cholesterol content was determined by HPLC analysis using the system Shimadzu 10Avp. The data were subject to the analysis of variance in general linear (GLM) procedure in SPSS 17. The model included the fixed effect of breed, gender, tissue location and feeding level. LSD significance test was used to determine the significance of differences of means between the groups. The comparisons of local conserved Lithuanian breeds showed negligible differences in the longissimus muscle fat content, however semimembranosus muscle of Lithuanian White pigs had higher fat content than the same muscle of Lithuanian indigenous wattle pigs ($P<0.05$). Although longissimus muscle from both Lithuanian pig breeds has lower contents of cholesterol ($P<0.01$) compared with the conventional hybrids, the differences between Lithuanian breeds were not large. Only the backfat of Lithuanian White pigs had higher content of cholesterol than the backfat from Lithuanian indigenous wattle pigs ($P<0.05$). The lowest contents of cholesterol were found in the backfat ($P<0.001$) and the highest contents in the semimembranosus muscle from both breeds, however, the differences between the muscles were not significant. The gender of pigs showed its effect on the semimembranosus cholesterol content ($P<0.05$): females had higher content of cholesterol than castrated males. Cholesterol contents in both muscles showed negative correlations with pig age ($P<0.001$). In the semimembranosus muscle cholesterol content showed negative correlation with pig weight ($P<0.05$). Negative correlations were also found between backfat thickness and cholesterol content in backfat. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Major differences in gut microbiota composition of Iberian pigs in montanera vs commercial systems

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The traditional raising system for Iberian pigs includes an open-air fattening period (montanera) where animals have a diet dominated by acorns. This system allows obtaining dry-cured products of unmatched quality. The most usual method for the verification of montanera products relies on assessing the particular backfat fatty acid composition after slaughter. Given that the advances on nutrition science makes feasible to emulate montanera meat products in an industrial farming environment, there is a growing need for the identification of complementary certification approaches. The objective of this study of TREASURE project was to evaluate the potential of gut microbiota composition analyses from faecal samples collected at slaughter as a new discrimination method of the montanera production system. Gut microbiota composition of 131 Iberian pigs (92 montanera and 131 commercial feeds) was determined by re-sequencing the bacterial 16S gene in an Illumina MiSeq device. Bioinformatic analyses were performed using Qiime's subsampled open-reference OTU calling method. NMDS and PERMANOVA analyses performed using the Vegan R package showed significant effects of diet and sampling batch on gut microbiota composition. The microbiota of montanera-raised pigs showed a tendency towards a reduced microbial diversity. Differential abundance analyses performed with the metagenomeSeq R package confirmed these differences by identifying 997 out of 1,703 OTUs whose abundance was significantly different between both systems. Our results suggest that the gut microbiota composition of Iberian pigs sampled at the slaughter could be used as a supplementary certification tool of traditional montanera Iberian pigs. Funded by European Union's H2020 RIA program (grant agreement 634476).

Gut microbiota composition in Iberian pigs fed with olive oil by-products during the growing period

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The traditional Iberian pig production system is characterized by a final open-air fattening period (montanera), in which the animals are fed acorns and grass, preceded by a growing period where the feeding is restricted to avoid undesirable weight gain. New growing diets based on olive agro-industrial by-products could be an alternative to avoid this restriction. The objective of the current study (of TREASURE project) was to analyse the effect of two growing alternative diets on the gut microbiota composition from faecal samples collected before and after montanera. Three diets, one incorporating dry olive pulp in the feed (DD), one incorporating olive cake in wet form (WD) and a control diet (CD) were supplied to 45 animals (15 per diet) during the growing period (45 to 95 kg of body weight). The gut microbiota composition of each individual was evaluated at two time points: before transition to montanera (95 kg) and at slaughter (160 kg). Microbiota analyses were performed by re-sequencing the bacterial 16S gene (V3-V4) in an Illumina MiSeq. Bioinformatics analyses were performed by using Qiime's open-reference subsampled OTU calling approach. The effect of diets on microbiota composition and diversity was evaluated using the Vegan package in R. Bray-Curtis distances, NMDS and PERMANOVA analyses showed significant effects on microbiota composition. WD caused an increase in microbiota diversity. In the second sampling point, differences in composition and diversity could be also observed after acorn supplementation. Funded by European Union's H2020 RIA program (Grant agreement no. 634476).

Lithuanian consumer preferences towards products of different fatness

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The objective of the study (made in TREASURE project) was to analyse how Lithuanian consumers perceive pork products from fatty pigs and identify their attitudes, and the possibility to include special branded products from Lithuanian local pigs to the marketing scheme. Since ancient times Lithuanians have been cultivating animal husbandry and eating fresh, salt-cured and smoked meat. The interest in traditional and healthy food has increased in recent years encouraged artisans and restaurants to revive old food preparing traditions. The breeding of animals from rare breeds (genetic pool) and income from their production is not competitive compared with industrial breeds because of high amount of fat. One of the first steps to promote breeding of local pig breeds and their traditional products was their demonstration and knowledge dissemination during different agricultural exhibitions and shows. Lithuanian Endangered Farm Animal Breeders' Association contributed to producing and testing of two products: dried sausages and a kind of lard sausages 'Lašiniuotis'. To describe the preferences of consumers, the test of frequencies and chi-square tests were applied using the SPSS Statistics program. Respondents of different genders, age and employment presented consumption frequencies of different meat, including pork. Obviously, Lithuanians justified the reputation of pork eaters ($\chi^2=78.7$, $df=2$ $P<0.001$). Although only 25.2% of the respondents were involved in animal production, more than 80% of them answered that they possess information on pig growing and this shows that many people did not lose touch with the countryside. Public testing of the presented products showed that 227 (48.4%) consumers of different age and occupation preferred and voted for dried sausages and 242 (51.6%) respondents preferred and voted for 'Lašiniuotis'. It can be concluded that more fatty products could find consumers among Lithuanian population. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Gut microbiota composition in Krškopolje pigs under conventional and organic production systems

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The Krškopolje pig is the only indigenous Slovenian pig breed being still farmed. The breed is characterised by its rusticity and adaptation to the traditional farming system and has a black coat colour with a white belt across shoulders and forelegs. Despite the limited number of animals, the breed is on the way of becoming more sustainable due to the growing interest for local traditional breeds, in particular for organic farming. The objective of our study (made within project TREASURE) was to characterise the gut microbiota composition in 36 Krškopolje pigs raised by using three different diets: conventional feed, conventional feed supplemented with alfalfa pellets and organic feed supplemented with alfalfa hay. The gut microbiota composition of all pigs at two time points (155 and 228 days-of-age) was determined by re-sequencing the bacterial 16S gene in an Illumina MiSeq. Bioinformatics analyses were performed by using Qiime's open-reference OTU calling subsampled method following author's recommendations. NMDS and PERMANOVA analyses performed by the Vegan R package showed significant effects of dietary regime, showing that the organic feed produces a differentiation of the gut microbiota composition when compared with the other two diets and the two time points analysed. This pilot study illustrates the power of metagenomic analyses for the identification of effects of diets in the farming conditions of local European pig breeds. Funded by European Union's H2020 RIA program (Grant agreement no. 634476).

Gut microbiota composition of Turopolje pigs in outdoor production and acorn supplementation

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The Turopolje pig is a local porcine breed originating from Croatia characterised by its rusticity and adaptation to the traditional outdoor farming system linked to local oak forests. While this once-widespread breed was almost completely replaced by industrial breeds in the second half of the 20th century, there is growing interest on promoting its production in the framework of sustainable porcine production. The objective of our study (made in project TREASURE) was to characterise the gut microbiota composition in 24 Turopolje pigs raised outdoor by using a conventional feed vs a conventional feed supplemented with acorns. The gut microbiota composition of all pigs was determined by re-sequencing the bacterial 16S gene in an Illumina MiSeq device. Bioinformatics analyses were performed by using Qiime's open-reference OTU calling subsampled method following author's recommendations. NMDS and PERMANOVA analyses performed by using the Vegan R package showed significant effects of diet, showing that the acorn supplementation has a relevant impact on gut microbiota, notably by reducing richness and diversity. This result was confirmed in the differential abundance analysis which showed that 152 out of 1,466 OTUs were significantly different between the two groups. Interestingly, the predicted microbiota metabolic functions that were differentially abundant involved fatty acid and amino-acid metabolisms. Funded by European Union's H2020 RIA program (Grant agreement no. 634476).

Changes in carcass and meat traits during the montanera finishing period of Iberian pigs

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Iberian pigs are usually slaughtered at an average body weight (BW) of 160 kg. The free-range, acorn-feeding montanera starts at an average weight of 100 kg, lasts for 2.5-3 months, and pigs gain around 60 kg during this period. During this extensive finishing, the weight gain is mostly based on subcutaneous and intramuscular fat accretion, but other changes in carcass and meat composition may occur as well. This study (made in TREASURE project) evaluated the changes in carcass and meat composition occurred in Iberian pigs between the end of premontanera (pre-finishing period) and the end of montanera, as assessed in animals slaughtered at 110 and 160 kg BW, respectively. Castrate male Iberian pigs (n=45) were randomly assigned to 2 treatments (2 slaughter times) and raised on concentrate up to 110 kg BW. At this point, 15 pigs were slaughtered, and the remaining 30 pigs were finished in montanera with acorns and grass and were slaughtered at an average BW of 158 kg. Carcass and several meat traits were evaluated in both cases. In general, carcass fat (subcutaneous and intramuscular) increased significantly during the finishing period, with the exception of loin weight and area and the outer backfat layer, that remained unchanged after the finishing period. Hip height and ham length did not change, but carcass length increased significantly after finishing. In relation to meat colour, only the b index (blue to yellow) was significantly greater in finished pigs. Regarding backfat fatty acid profiles, PUFA and SFA decreased and MUFA increased significantly after the montanera finishing period, but C18:3 remained unchanged. In conclusion, pre-finishing Iberian pigs (at 110 kg BW) had similar muscle accretion, hip height, outer backfat layer thickness and C18:3 proportion than the finished ones. The BW gain during montanera was essentially based on fat deposition, and finishing increased the proportion of MUFA and decreased that of PUFA and SFA. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

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).

Assessing performance and management of European local pig breeds in project TREASURE

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Unlike in modern breeds, the knowledge on performance and management of local pig breeds is very limited. These are key aspects to be developed for their successful exploitation that requires strategies adapted to their specific productive and metabolic characteristics, quite different from those of modern pig breeds, to ensure their preservation and future expansion, particularly for those more endangered. These are some of the challenges addressed by the project TREASURE. For this purpose, a series of experiments involving 11 European local breeds -differing in the level of development- have been carried out covering various and complementary aspects like nutritional requirements in different productive phases (Cinta Senese, Iberian), feeding practices involving locally available resources (Krskopolje, Schwäbisch-Hällisches, Turopolje, Mangalitsa, Bísaro, Iberian, Gascon), and innovative management and housing practices to enhance product quality or improve animal welfare (Cinta Senese, Alentejano, Bisaro, Iberian, Mangalitsa, Moravka, Krskopolje, Schwäbisch-Hällisches, Black Slavonian). All these activities have been designed to obtain essential information to develop future productive strategies for each of the involved breeds, taking into account to obtain local high-quality products, and seeking for optimum pig performance and high animal welfare conditions in the production systems under consideration. The information provided constitutes a unique and valuable set of data for the management of these breeds and the further development of local pork chains. In some cases it is the first available data for the breeds concerned. A general overview of the developed activities will be presented highlighting some of the achievements obtained. Funded by European Union's H2020 RIA program (Grant agreement no. 634476).

Exploiting genomic data of autochthonous pig breeds: conservation genetics comes of age

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Animal genetic resources are important reservoirs of genetic diversity derived by distinct selection pressures or as result of adaptation to production conditions. The TREASURE project has investigated genetic variability in 20 European autochthonous pig breeds with the aim to describe their singularity, evaluate their adaptation, develop new methodologies for their management and identify DNA markers for breed allocation and meat authentication. Genomic data have been obtained by genotyping candidate gene markers and high density single nucleotide polymorphism arrays in ~48 animals from each breed and by whole genome resequencing. Description of genetic diversity has been obtained using several parameters. Runs of homozygosity and genomic inbreeding measures have been correlated with pedigree inbreeding coefficients. A few breed specific markers have been identified and applied. Genome wide association studies have identified genomic regions affecting unique phenotypes. This project represents one of the few examples of exploitation of genomic information that not only benefits the investigated animal genetic resources but also can provide useful information that could impact commercial populations. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

Structural differences among pig genomes illustrate genetic uniqueness of breeds

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The availability of high-throughput whole-genome sequencing (WGS) data illustrating differences among different pig breed genomes opened a new area of genomic research focused on variation caused by single nucleotide polymorphisms (SNP), small scale variation and structural variants which may all contribute to phenotypic variation among pig breeds. In our study (performed within TREASURE project) we re-analysed WGS-based data sets from more than 20 breeds, including commercial and local breeds as well as some wild boar genomes, deposited in publicly available databases. This bioinformatics tool enables discovery of new SNPs, estimation of allele frequencies (genotyping by sequencing) at candidate loci and identification of structural variation in a wide range of pig breeds. The analysis underlined the relevance of structural differences at KIT and MC1R locus involved in colour pattern formation, as well as LEPR locus associated with fatness, fatty acid metabolism and intramuscular fat composition. This approach allows discovery of important genomic differences between commercial breeds and local breeds which are analysed in the frame of the TREASURE project. Extensive mining of publicly available genomic data can together with the newly generated genomic information from local breeds, significantly contribute to the detailed characterisation of animal genetic resources present in local pig breeds. Funded by European Union's H2020 RIA program (grant agreement No. 634476).

Genetic structure of autochthonous and commercial pig breeds using a high-density SNP chip

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One of the main objectives in TREASURE project is the genetic characterisation of European autochthonous pig breeds through genetic and genomic tools. The aim of the current pilot study was to evaluate the usefulness of the GeneSeek Genomic Profiler porcine SNP chip to describe genetic diversity of five Mediterranean autochthonous and three commercial pig breeds. 44 animals from Iberian (12), Krskopolje (4), Casertana (5), Cinta Senese (5), Apulo Calabrese (5), Duroc (5), Large White (4) and Landrace (4) breeds were genotyped. All DNA samples were successfully genotyped (call rates ≥ 0.98). A total of 59,193 SNPs were used in the genetic analyses after QC filtering. Observed (H_o) and expected (H_e) heterozygosities, FIS statistic and genetic distances (DS and F_{ST}) were computed. The overall F_{ST} value was 0.15. H_o and H_s values per breed ranged from 0.25 to 0.36 (H_o) and from 0.26 to 0.40 (H_s). Calabrese and Duroc were the breeds with the highest (0.16) and lowest (-0.01) FIS values, respectively. DS and F_{ST} genetic distances were very similar. Duroc and Large-White were the closest breeds, since DS and F_{ST} were 0.09 and 0.19, respectively and Landrace and Duroc the furthest ones, being DS and F_{ST} values equal to 0.22 and 0.34. Distribution of minor allele frequencies (MAF) showed that Iberian is the breed with the highest number of monomorphic SNPs (25.3%) and Landrace and Krskopolje have more alleles at intermediate frequencies. These results provide insights on the genetic diversity and relationships among the investigated breeds. This study will be enlarged to characterize the structure of European autochthonous pig populations using the same SNP chip. Funded by European Union's H2020 RIA program (grant agreement no. 634476).

The effects of selection on the genomic architecture of the Italian Large White and Duroc heavy pigs

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Artificial selection may cause an increasing of homozygosity in circumscribed regions of the genome and lead to allele drift. This is particularly important for selection nuclei of pure breeds. In this work we analysed the genome of the Italian Large White (ILW) and Italian Duroc (ID) breeds, that are purposely selected for the heavy pig breeding industry, to identify regions of high homozygosity. A total of 1,953 Italian Large White and 460 Italian Duroc pigs were genotyped with the Illumina PorcineSNP60 BeadChip. Filtering was performed to remove poor quality single nucleotide polymorphisms (SNPs) having call rate < 0.9 that were then imputed whereas no other filter was applied. The Runs of Homozygosity (ROH) analyses were performed with the sliding window-based option of the Plink 1.9 software, allowing a minimum of 30 SNP to define a ROH. Then, for each SNP, the percentage of the number of animals that have a ROH containing the SNP was calculated and the top 0.994 percentile of the SNPs empirical distribution was considered. The analyses of the ILW detected four regions, three on porcine chromosome (SSC) 1 and one region on SSC14, with size from ~1 to 5 Mb and with maximum peak of shared regions of 70% on SSC1. The analysis of the ID pigs showed several SNPs shared by more than the 50% of the animals, particularly two regions on SSC9 and SSC15, with maximum peak of 95% on SSC15. The detected regions contained genes involved in functions such as DNA repair and biosynthesis of cellular amino acid. The possible effects of these regions and the genes included in relation to production traits still need to be analysed. Partially funded by European Union's H2020 RIA program (grant agreement no. 634476).

Incidence of RYR1 genotype and its effect on meat quality in Slovenian Krškopolje pigs

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In this study (of project TREASURE*), two objectives were pursued; to investigate the incidence and effect of RYR1 genotype on carcass and meat quality traits in the only Slovenian local pig breed Krškopolje (KK). Thirty-six castrates originating from 12 litters were reared on the same farm and slaughtered in a commercial abattoir at the average age of 228±6 days and weight of 121±14 kg. Carcass properties and longissimus dorsi (LD) quality traits and chemical composition were determined. Pigs were genotyped for c. C1843 (p. Arg615Cys) at RYR1 locus by PCR-RFLP method (mutant allele further denoted as 'n' and wild as 'N'). Data were analysed using GLM procedure of SAS/STAT module, with fixed effect of RYR1 genotype in the model. Genotype frequencies were 2.7, 41.6 and 55.5% for n/n, N/n and N/N respectively. Compared to N/N animals, pigs with mutant recessive allele (N/n) exhibited lower growth rate and leaner carcasses (i.e. higher lean meat %, muscle thickness and loin eye area, thinner backfat and smaller fat area over LD, P<0.05). A marked effect of RYR1 on meat quality was also observed. In N/n pigs, the rate of pH fall was faster (P<0.05). Meat of N/n pigs exhibited also higher shear force resistance (P<0.05) in addition to lower water holding capacity (higher drip, thawing and cooking loss, P<0.05). The present results demonstrate relatively high incidence of RYR1 mutation in KK pigs calling for more breeding effort for its elimination and thus improvement of meat quality and processing aptitude of the breed. Funded by European Union's H2020 RIA program (grant agreement no. 634476).