**PE1.53 Meat quality of Galia and Redone pigs: impact on protein status after cooking 338.00**

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**Abstract: The aim of this experiment was to compare carcass traits, meat quality of two breeds Galia and Redone. Moreover, we aimed at establishing their meat protein status before and after cooking. Sampling of Longissimus dorsi (LD) muscles from this two pig lines (Galia, n=22 and Redone, n=24) was carried out. LD was stored for 2 days at 4°C. Colour parameters, pH, drip loss, cooking yield were determined. Lipids and proteins oxidation, protein aggregates and protein hydrophobicity were evaluated. The slaughter and hot carcass weights of Galia pigs were higher than Redone pigs, but with a similar backfat thickness. Redone pigs exhibited higher meatiness (57.32 vs 55.29), and at the same time higher marbling (2.22 vs 1.53). Ultimate pH (measured at 24h and 48h post mortem) was higher in LD muscles from Redone. The drip loss of LD muscle was higher in Galia than Redone (3.76 vs 2.22). Cooking affected protein status in both breeds: protein hydrophobicity, protein aggregates and carbonyl level increased in cooked meat whatever the duration time. Overall Redone pigs showed interesting carcass and meat quality atttributes as revealed by their higher level of muscularity, higher technological yield. Higher sensory quality may be expect due to higher marbling which did not significantly affect oxidation susceptibility of protein and lipid in muscle and in cooked meat.**

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**Index Terms—meat quality, protein, pig, breed, protein status**

## I. INTRODUCTION

Meat quality depend of various factors: breeding, rearing, slaughtering, and post mortem conditions. Consumer is searching for a meat having good taste and therefore, selection based on muscle lean content is not sufficient. Intramuscular fat influence on increase of palatability of cooked meat. Duroc and Meishan lines are known for the high IMF level. Recently [1] reported IMF level in Redone breed similar to Duroc lines. Parallel to sensorial quality, nutritional value of meat is more and more studied ([2], [3] ; [4]). Meat is rarely consumed before any thermal treatment, which is known to generate free radicals and decrease antioxidant protection. After cooking, protein oxidation (carbonyl formation from basic amino acids, decrease in free thiol and oxidation of aromatic amino acids) can affect essential amino acids bioavailability and consequently decrease the nutritional value of meat. The aim of this study was to characterise carcass quality, fresh and cooked meat and proteins status from Redone, which composition is closed to Duroc lines, and Galia breeds.

## II. MATERIALS AND METHODS

A total of 46 female pigs were used in this study (24 pigs from Galia and 22 pigs Redone breed). They were slaughtered at about 105 kg live weight in commercial slaughterplant in accordance to the legally binding procedure (the distance from the farm to the slaughterhouse 200km, a rest of about 2h, automatic electric stunning and exanguination in a horizontal position). Backfat and loin thickness were measured with CGM apparatus. Meatiness was evaluated according to [5] on the 7th rib. Colour parameters (CIE L*a*b*) were assessed

using CR310 Minolta 48h after slaughter. Marbling was determined with a japanese scale and by a sensorial jury. The deline of pH was measured at 1,3, 24 and 48h post mortem. Drip loss was determined at 48h post mortem according to [6]. Glycogen, glucose and glucose-6-phosphate after glycogen hydrolysis with amyloglucosidase [7] and lactate [8] in the muscle were also determined. On the basis of them the glycolytic potential (GP) was calculated according to [9]. Cooking yield of meat was determined by subjecting 500g of meat sample to heat treatment until the core of the sample reached 72°C. Protein carbonyl groups were evaluated by the method of [10] with slight modifications for measurement in meat samples [11]. Hydrophobicity of myofibrillar proteins was determined using the hydrophobic chromophore bromophenol blue (BPB) according to [12] with slight modifications. Lipid oxidation was measured by the ThioBarbituric Acid Reactive substances (TBARS) method according to the method [13] modified by [11]. Protein aggregates were detected by a front face fluorescence technique. Before measurement, myofibrillar protein concentration was adjusted to 0,04 mg/mL of 20 mM phosphate buffer at pH6. The fluorescence was measured with a standard spectrofluorometer Perkin-Elmer LS 50B fitted with a front surface accessory (Perkin-Elmer Plate Reader).

## III. RESULTS AND DISCUSSION

Carcass traits and meat quality parameters in LD muscle are presented in Table 1. Carcass weight of Redone pigs was lower but showed higher meatiness level ($p<0.0009$). The higher muscularity in Redone came with higher level of intramuscular fat. Generally IMF development occurs during growth and such animals are more prone to adipogenesis and showed a poor growth rate compared to modern hybrids [14]. [15] reported interesting QTLs (quantitative trait loci) in Duroc contributing for increased intramuscular fat, increase loineye muscle area. On different chromosome, [16] reported a QTL affecting IMF in cross line Meishan and purebreed Dutch line. Colour parameters (lightness and yellowness) did not differ between the two breeds. Redone LD muscle showed a lower redness value, which may be due to marbling. Indeed, a lighter colour and a higher marbling score are often found in meat ([14]; [17] ; [18]). According to [19], a threshold level of marbling is needed to ensure a satisfactory eating experience for consumers but for overall appearance acceptability score a low or medium amount of marbling is required [20]. Too visible fat content may lead to a decrease of purchase intent [18]. By their high meatiness and marbling score meat from Redone pigs exhibited interesting meat quality potential Indeed, a higher IMF in meat was characterized by higher juiciness, and related to a higher overall sensory quality [21] . Also, [22] who compared purebreeds of Duroc, Landrace, Large white, Pietrain and Meishan, reported that in general, pigs lines with higher level of marbling had higher drip loss and lower tenderness and lower scores for juiciness. In our experiment, the results showed that Galia meat had higher drip loss, lighter meat, lower marbling and lower ultimate pH. The results are comparable with those obtained in the longissimus thoracis muscle of Landrace pigs ([22]; [23]). Ultimate pH was higher in Redone LD muscle (5.55 vs 5.41) but pH decline was similar in both breeds. Glycolytic potential was higher in Galia LD muscle and residual glycogen 3 times higher. Glycolytic potential is an estimate of the amount of glycogen that is present in the muscle at slaughter. The higher ultimate pH of Redone can be explained by a lower glycolytic potential. We observed that the pH continued to decrease between 24 and 48h. Most of the time, pH measured at 24h is considered stable but in our experiment we showed that post mortem glycolysis continued in some extent because a decrease of 0.09 pH unit was noted. Similarly, [24] reported a decrease of 0.15 pH unit during the same time in pig Longissimus lumborum but remained then stable over 96h. The value of ultimate pH is of importance for “Jambon de Paris” processing. Pig legs are sorted by its value in the abattoir, which determine a technological value of the pig leg. When received one or two days later in the processing plant, pH may have decrease, as we observed in our samples, leading then to a discrepancy between the value of meat bought and the product received. Cooking yield was higher in Redone meat and strongly inversely correlated to drip loss ($r=-0.64$). Such a correlation was also reported by [24]. The higher level of drip loss in meat could be related to higher level of glycolytic potential. In the case of acid meat, low ultimate pH is related to reduced water holding capacity, and reduced yield of cured cooked ham ([25], [26]; [27]; [28]; [29]). Protein hydrophobicity aggregates level and, protein and lipid oxidation on raw and cooked meat are presented in Table 2. Protein status was similar in

the raw LD muscle of Galia and Redone breeds. Cooking increased protein hydrophobicity by 80% in both breeds, independantly of the duration of cooking (10 min. or 30 min.). The same trend was observed for protein aggregates. This increase of surface hydrophobicity is due to conformational changes occuring when protein are submitted to heat treatment. The rupture of hydrogen bonds has been largely described to be the major cause of protein unfolding during treatment. The unfolding of myofibrillar proteins favours the exposure of nonpolar amino acids at the surface of proteins. Carbonyles level, which represents basic amino acids oxidation, increased during cooking duration. These results are in agreement with those of [3] showing that carbonyls level increased with cooking time to reach a maximum after 45 min at 100°C. The increase of proteins oxidation during cooking can be attributed partly to the loss of antioxidant protection of muscle [30]. Moreover, during cooking, an important amount of heme iron is modified to non nonheme iron by heat, favouring lipid and protein oxidation [31]. Cooking increased protein aggregation rapidly. After 10 min thermal treatment the fluorescence value was maximum and remained stable for longer cooking time. We may hypothesized that, in myofibrillar proteins, an increase of hydrophobicity favours protein aggregation, as showed above. We noticed an absence of fluorescence increase over 10 min cooking. This could be attributed to the possible absorption of the excitation light or to the reabsorption of emission fluorescence light by various chromophores as Schiff bases or Maillard and Amadori products, with can be formed by the interaction of myofibrillar proteins and lipids or sugars during cooking. Lipid oxidation as measured by TBA-RS showed no oxidation in raw Redone meat compared to Galia although the level of IMF was higher. However after cooking, higher TBARS were recorded and this difference between breed had disappeared. The increase of lipid oxidation after cooking could be explained by the loss of antioxidant activity. Storage is known to affect slightly antioxidant enzymatic activity, such as glutathione peroxidase activity (GSHPx). Nevertheless after heating treatment, this activity decreased [30] up to 80% for a 80°C heating treatment.

## IV. CONCLUSION

Overall Redone pigs showed interesting carcass and meat quality atttributes as revealed by their higher level of muscularity, higher technological yield, higher marbling and lower drip loss. Higher sensory quality may be expected due to higher marbling which did not significantly affect oxidation susceptibility of protein and lipid in muscle and in cooked meat. By generating conformational changes and protein aggregates, cooking my impact the nutritional value of meat protein, for instance by decreasing the ability of digestive tract enzymes to recognize proteolysis sites.

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