

Assessing Fat Deposition between Subcutaneous Fat Tissue and Muscle in Lean and Obese Pigs fed on Reduced Protein Diets

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Obesity entails the deposition of excess lipid within cells. Despite massive efforts to disclose the molecular mechanisms underneath this issue, considerable uncertainty on the dietary causes of obesity still remains. In this experiment, forty male pigs from Alentejano breed and Crossbred were selected as they can mimic genetically obese and lean models, correspondingly. Ten animals from each genotype were randomly assigned to one of two diets, with or without dietary protein restriction, in a 2 x 2 factorial arrangement. After slaughter, subcutaneous adipose tissue (SAT) was histochemically stained for adipocytes (H&E) while *Longissimus lumborum* (LL) muscle was stained for intramuscular adipocytes (H&E) and intramyocellular lipid aggregates (oil red O). The genetic expressions of PPAR γ , C/EBP α and FABP4 involved in lipid metabolism pathway were carried out in both tissues. A clear effect of breed was observed on insulin and leptin concentrations in plasma, having obese pigs higher values. Following the same pattern, higher P2 backfat thickness was found in obese pigs concomitantly with larger, but fewer adipocytes, when compared to lean pigs. Concerning the LL muscle, the intramuscular fat was elevated, once again, in obese pigs and further corroborated by larger adipocytes. Curiously, the adipocytes number was superior in pigs fed on reduced protein diet as well as the proportion of oil red O stained fibers, independently of breed. The genetic expression pattern of PPAR γ , C/EBP α and FABP4 was differential between SAT and LL muscle. No differences were found for PPAR γ expression among groups in the fat tissue. In contrast, the PPAR γ genetic expression was higher in the LL muscle of lean pigs than in obese pigs. The relative C/EBP α and FABP4 mRNA levels in the SAT were increased in obese pigs, without changes in the LL muscle. Relatively to SAT, in lean pigs fed on low protein, the FABP4 expression was higher than in lean pigs fed on the control diet. The inverse trend was observed in obese pigs. In conclusion, the genotype is clearly a determinant factor upon fat deposition, affecting more strongly the SAT than the LL muscle, as validated by the genetic profile of lipid sensitive factors. As pigs may provide a valuable comparative model for human obesity, the restriction of dietary protein could unexpectedly impact of intramuscular lipids and inadvertently reduce circulating insulin possibly contributing to the risk of type 2 diabetes mellitus.