PARTITIONING OF CARCASS COMPONENTS OF TRANSGENIC PIGS

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SUMMARY

This study evaluated carcass and primal cut composition of fourteen transgenic (T) pigs expressing a bovine growth hormone gene and sibling control (C) pigs. All pigs were fed a common diet and were slaughtered at either 54 (L) or 93 (H) kg live weight. Significant treatment by live weight interactions were observed for several carcass traits evaluated. Carcasses from T- pigs contained 14% more separable lean and 37% less separable fat than C-pigs, however, these differences were of a greater magnitude at the heavier weights. Heavy T-pigs contained 85% less carcass fat than heavy C-pigs, while lighter T-pigs contained 34% less fat than lighter C-pigs. Heavy T-pigs contained 71% less carcass fat than lighter T-pigs, whereas heavy C-pigs contained 26% more carcass fat than lighter C-pigs. The same response was true for intramuscular fat deposition.

Introduction

The technology for introducing recombinant genes into laboratory animals has been available since 1980. Gene transfer into farm animals is required to evaluate its potential for improving production efficiency and disease resistance of livestock. Transgenic pigs have been produced by the microinjection of single-cell zygotes and two-cell ova with linear molecules of mouse metallothionein I promoter/regulator fused to bovine growth hormone (bGH) structural genes. It is well established that the administration of exogenous porcine growth hormone (pGH) to pigs at different stages of growth and development (e.g., between 25 and 105 kg) improves performance and results in alterations in body composition (reductions in carcass fat and increases in protein/lean content). Research in our laboratory recently demonstrated a dilution effect of fatty acid accretion in carcass tissue from transgenic (T) pigs with the increase in body weight beyond 48 kg. Carcass fat deposition in T-pigs was found to follow a similar pattern. As body weight increased in T-pigs from 48 kg to 92 kg, carcass fat accretion decreased. Little is known regarding partitioning of body/carcass components of T-pigs expressing a bGH gene. Therefore, the purpose of this study was to determine what effect the introduction of a recombinant bGH gene into pigs has on the partitioning of carcass tissue components.

Materials and Methods

This study evaluated carcass and primal cut composition of fourteen transgenic (T-pigs) expressing a bGH gene and sibling control (C) pigs. All pigs were fed a common diet and were slaughtered at either 54 (L = light weight) or 93 (H = heavy weight) kg live weight. Each T-pig had at least one C-pig of similar weight for comparison purposes. The left side of each carcass was physically separated into primal cuts (i.e., shoulder, loin, ham and belly) and each cut was, in turn, physically separated into lean, fat (included skin) and bone portions. Intramuscular fat for each primal cut was chemically determined using the separated lean tissue component corresponding to that cut. Total carcass fat was determined by grinding the intact right side from each carcass and chemically analyzing the ground samples.

Data were analyzed by the analysis of variance technique (SAS, 1990) using a 2 x 2 factorial treatment arrangement.

Results and Discussion

Separable carcass components (i.e., lean, fat and bone), total carcass fat and percentages of the carcass comprising the four primal cuts are presented in Table 1. Significant treatment by weight group interactions were observed for the lean and fat portions of the separable carcass components. Carcasses from heavy and light weight T-pigs contained the same amount of separable lean as the light C-pigs, however, the heavy C-pigs contained less lean than the other three groups. Carcasses from heavy and light weight T-pigs contained the same amount of separable fat (X = 15.4%), however, light C-pigs contained 32% more separable fat than T-pigs and heavy C-pigs contained 92% more fat than T-pigs. T-pigs contained more separable bone than C-pigs. The proportion of fat that was physically separated out (representing separable carcass fat) in T-pigs was somewhat misleading because much of the mass was connective tissue (skin) rather than all fat. When carcasses were separated into the four primal cuts, it became evident that the hams of T-pigs were larger and loins smaller than those of the sibling C-pigs. A significant treatment by weight group interaction was observed for total carcass fat (determined by chemical analysis). Carcasses from heavy T-pigs contained 71% less carcass fat than light T-pigs, whereas heavy C-pigs contained 26% more fat than light C-pigs. Furthermore, heavy T-pigs contained 85% less carcass fat than heavy C-pigs, while light T-pigs contained 34% less fat than light C-pigs.

Separable carcass cut components and percentage intramuscular fat by treatment and weight group are presented in Table 2. Minimal differences in the amount of separable lean were found between the light weight T- and C-pigs, however at the heavier weights T-pigs contained significantly more lean in all four primal cuts than heavy C-pigs. Heavy C-pigs contained significantly more separable fat in all four primal cuts than light weight C-pigs and both these groups (H and L C-pigs) contained more separable fat than either of the T-pig groups. In the cuts that contained appreciable amounts of bone, carcasses from T-pigs contained more bone than C-pigs. Intramuscular fat deposition in the four primal cuts followed a similar pattern as described for total carcass fat (chemically analyzed).

Conclusion

The technology (transgene) for introducing recombinant genes into farm animals, in this study bGH, provided significant alterations in the partitioning of carcass components in transgenic pigs. Results suggest tremendous improvement in the lean-to-fat ratio in carcasses from transgenic pigs compared to sibling control pigs. Furthermore, the magnitude of increasing lean and decreasing fat in transgenic pigs increases as carcasses get heavier, which is the opposite result in control pigs. The ham, a major primal cut in the pork carcass was larger in transgenic pigs, while the loin was smaller compared to controls.

References

SAS, (1990). SAS User's Guide for Personal Computers. SAS Inst., Inc., Cary, North Carolina.