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Growth, carcass and cooked meat characteristics of lambs sired by Dorset rams heterozygous for the Callipyge gene and Suffolk and Texel rams

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Abstract

Dorset (D) rams heterozygous for the Callipyge gene were single—sire mated to non-carrier ewes to produce Callipyge heterozygous (CLPG, $n = 49$) and normal (D, $n = 33$) lambs. Suffolk (S) and Texel (T) rams were mated to similar ewes to produce non-carrier crossbred S ($n = 55$) and T ($n = 52$) lambs. Lambs were finished on a high-energy diet to a target live weight of 57 kg. Pre-slaughter weight was recorded for each lamb prior to its transfer and slaughter through a commercial facility. Hot carcass weight and kidney and pelvic fat (KPF) were recorded at slaughter. Chilled carcasses were measured then fabricated into trimmed retail cuts by plant personnel. Each cut was weighed, and two loin chops were collected from each carcass for later cooking. CLPG lambs had the highest dressing % (53.6 versus 49.8–50.6; $P < 0.05$). At the same cold carcass weight, CLPG lambs had larger longissimus muscle areas (19.5 cm^2 versus 14.0–15.2 cm^2 for the rest; $P < 0.05$), less KPF (0.9 kg versus 1.04–1.13 kg; $P < 0.05$), less carcass fat ($P < 0.05$ for all measures), shorter carcasses (60.7 cm versus 61.8–64.7 cm; $P < 0.05$), and heavier trimmed sirloins, legs, and shoulders than any other group (a11 $P < 0.05$). They were similar to S lambs in receiving the lowest mean USDA yield grade. CLPG carcasses had the highest proportion of carcass weight represented by trimmed cuts (70% versus 65.7–67.8% for the rest; $P < 0.05$), the highest proportion of trimmed cuts (62.2% versus 59.7–60.6% for the rest; $P < 0.05$) represented by the most valuable cuts (leg + loin + rack + sirloin), and the highest composite carcass value ($135.8 versus $125–129 for the rest; $P < 0.05$). CLPG lambs also produced loin chops with the highest mean Warner–Bratzler shear values (5.4 kg versus 2.8–2.9 kg for the rest; $P < 0.05$) and the highest % cooking loss (31% versus 29–29.6% for the rest; $P < 0.05$).

Keywords: Lamb; Callipyge; Carcass; Meat

1. Introduction

American lamb producers are caught in a dilemma—processors are demanding heavier slaughter lambs in order to reduce processing overhead cost while consumers have reduced their consumption of fat from animal products as they have become more diet and health conscious (NRC, 1988). The American Sheep Industry Council has promoted a certified lean lamb classification and has been instrumental in implementation of a revised USDA lamb yield grading system to encourage production of leaner lamb carcasses. There

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is little evidence to date that producers of leaner lamb are receiving monetary rewards for their efforts.

The objective of this study was to examine growth, carcass and meat characteristics of lambs produced by terminal sires including rams heterozygous for the Callipyge gene. The study was designed to collect both carcass and economic value data through a commercial slaughter/fabrication system in order to examine both the physical and monetary aspects of carcasses of various genotypes.

2. Materials and methods

Lambs were produced by balanced designed mating of ewes of several breed types (Hampshire (H), Coopworth × Polypay (CP), Hampshire × Coopworth × Polypay (HCP) and Hampshire × Polypay (HP)) to Dorset rams heterozygous for the Callipyge (CLPG) gene, Texel rams, and Suffolk rams. The CLPG gene has been mapped to ovine chromosome 18 (Cocket et al., 1993, 1994) and its phenotype is characterized by a non-Mendelian inheritance pattern, referred to as polar overdominance (Cocket et al., 1996). The CLPG gene causes a rapid postnatal muscle hypertrophy and a reduction in adipose tissue deposition in sheep (Jackson et al., 1993; Snowder et al., 1994; Abdulkhaliq et al., 2002).

Ewes were run as a single flock from the end of mating through weaning of their lambs. Ewes were lambed through a barn where all lambs were identified at birth. All lambs were docked, and male lambs were castrated, by elastrator bands applied within 24 h of birth. Ewes and lambs grazed ryegrass/clover pasture without supplementation until weaning.

Lambs were designated by genotype/sire breed as Callipyge heterozygous (CLPG, $n = 49$), or non-Callipyge from Dorset (D, $n = 33$) or progeny of Texel (T, $n = 52$) or Suffolk (S, $n = 55$) sires. Genotype was assigned to each Dorset-sired lamb prior to weaning on the basis of visual and handling appraisal of muscularity. Three scorers independently assigned a muscling score on a 4-point scale of increasing muscularity. Scores of 1 and 2 were assessed as normal, 3 and 4 as Callipyge heterozygous. Following slaughter, these lambs were again assigned genotype based on carcass muscularity (esp. leg score and LMA) and leanness. Genotype assignment was completely consistent between the two scorings.

A total of 189 ewe and wether lambs of similar weaning weight and balanced for dam genotype were grown to a mean final live weight of 57 kg. Lambs were randomized within genotype and gender to concentrate versus pasture (grazing) treatments (TRT: 1 = concentrate, 2 = pasture). At weaning, concentrate lambs were penned indoors by genotype and gender and were started on the concentrate diet while the pasture lambs were grazed as a single group for a period prior to being finished indoors on the same concentrate diet.

Lambs were slaughtered in four groups of comparable size as they reached target slaughter weight of 57 kg. Lambs of all genotypes, types of birth and genders were uniformly represented in each slaughter group. Because the concentrate lambs grew faster, they reached target weights sooner and comprised all of the first and second slaughter groups. The third slaughter group was comprised of the remainder of the concentrate lambs and the faster growing of the pasture lambs while the fourth slaughter group contained pasture lambs only.

Live weights were recorded prior to trucking lambs to a commercial facility. At slaughter, hot carcass weight was recorded and pelvic fat (KPF) was removed and weighed.

After a 24-h chill period, yield grade and leg score were assigned by a plant USDA grader (USDA, 1992) and then carcass measurements were obtained by experienced university personnel. Carcass length was measured and cold carcasses were weighed and dissected between the 12th and the 13th ribs to measure longissimus muscle area (LMA) and several estimates of carcass fatness. Fat measurements included 12th rib fat thickness (FDL) measured over the center of the longissimus muscle, sacral fat thickness (FDS) measured at the middle of the fourth sacral vertebrae, lower rib fat thickness (FDR) measured at the point of the greatest fat thickness over lower rib, and body wall thickness (FDB) measured 5 cm ventral to the lateral edge of the longissimus muscle. Carcasses were then fabricated by plant personnel into trimmed, tray-ready retail cuts according to the following commercial procedure: Shoulders were removed from the carcass between the third and fourth ribs. The neckpiece was removed by cutting in a straight line extending from the back, and shoulders were separated by a cut through the vertebral column. The shanks and brisket were removed by a cut parallel to the backbone across the humerus slightly above the knuckle. Shanks were removed at the joint from the brisket. The wholesale rack was separated from the carcass between the 12th and the 13th ribs. The breast was separated from the wholesale rack 7.6 cm from LM. The rack was halved by a split down the spinal column. The loin was cut from the leg perpendicular to the backline between the last two lumbar vertebrae. The flank was separated from the loin 2.5 cm from the outer edge of the LM. The wholesale loin was halved down the vertebral column. The legs were also split down the vertebral