EFFECTS OF HARVEST TIME POST-SECOND INJECTION ON CARCASS CUTTING YIELDS AND BACON CHARACTERISTICS OF IMMUNOLOGICALLY CASTRATED MALE PIGS

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Abstract- **The objectives were to evaluate cutting yields and bacon characteristics of immunologically castrated (IC) male pigs harvested at 4 or 6 weeks post second injection. A total of 156 male pigs (physical castrates or IC males) were selected from a population of 1200 finishing pigs. Data were analyzed with the Mixed procedure of SAS as a split-split plot design. There were few interactions between sex and cutting yields. Lean cutting yields (without the belly) of IC males were 2.62 percentage units higher (P < 0.0001) than physical castrates and carcass cutting yields (with the belly) were 2.27 percentage units higher (P < 0.0001) for IC males when compared to physical castrates averaged over both harvest times. Bellies from IC males were thinner (P = 0.01) and had narrower belly flop distances (P < 0.0001) than bellies from physical castrates. Iodine values of IC males improved 1.9 units between pigs harvested 4 and 6 weeks post second injection, while physical castrates only improved 0.5 units over that time. Cured belly yields did not differ (P = 0.74) between IC males and physical castrates. Immunological castration improved cutting yields and did not affect cured belly characteristics during the finishing phase of production regardless of harvest time post second injection.**

Keywords- **GnRF, immunological castration, Improvest**

I. INTRODUCTION

Improvest® (Pfizer Animal Health, Kalamazoo, MI) is a swine immunological product that stimulates the pig's immune system to produce antibodies against gonadotropin releasing factor (GnRF), temporarily blocking its activity. Reported data has shown an improvement in feed efficiency [1,2] no differences in pork quality parameters [3,4] an increase in carcass leanness [5,6] and higher cutting yields [7] of immunologically castrated (IC) males when compared to physical castrates.

Because of variation in live weights of pigs within a finishing barn near the time of harvest, it is common practice to market pigs over a period of several weeks [8]. This allows slower growing pigs more time to gain weight and come closer to the desired compositional end point. It is important to understand if the advantages of immunological castration persist over the entire marketing period. Therefore, the objectives in this study were to evaluate carcass cutting yields, belly quality, and bacon processing characteristics of IC male pigs harvested at either 4 weeks (early harvest group) or 6 weeks (late harvest group) post second injection.

II. MATERIALS AND METHODS

Pigs selected for the study were a subset of animals used in a large commercial feeding study involving 1200 total finisher pigs (PIC 337 x PIC C-22). At one week of age, pigs were randomly assigned to one of two sexes (physical castrate or IC male). Pigs designated for physical castration were surgically castrated within 10 d of birth. At six weeks of age, pigs were switched to different diets based on sex. Both sexes were fed a step-down lysine program, but IC males were fed a diet higher in lysine than physical castrates throughout the grower and finisher phase of the trial and culminated in physical castrates being fed 0.83% lysine in the late finishing phase and IC males being fed 1.00% lysine during the late finishing phase. DDGS were fed at 20% until 21 weeks of age and then at 10%. After the final evaluation period, all pigs were individually weighed (without a fast) and ranked based on live weight within their respective pens. To mimic current industry practices, the heaviest 60% of the pigs within a pen (15 per pen) were designated for harvest at 23 weeks of age and classified as the early harvest group. Two weeks later, the remaining 10 pigs in each pen were weighed again and classified as the late harvest group. Within each harvest group, the second heaviest, second lightest, and median weight pig per pen were selected (6 per pen) for in depth analysis.

A. Carcass Cutability

At four days postmortem, the right side of each chilled carcass was initially fabricated into ham, loin, belly (spareribs left on), whole shoulder (neck bones removed) and jowl to comply with Institutional Meat Purchase Specifications (IMPS) as described by the North American Meat Processors Association. Each primal piece was weighed again before further fabrication into subprimal cuts. Because of the variability in live weight and HCW across treatments, carcass cut-out data were also expressed as a percentage of chilled side weight. Carcasses were fabricated in the same manner described by Boler et al. [7]. Bone-in lean cutting yield was calculated with the following equation: lean cutting yield = ((trimmed ham + trimmed loin + Boston butt + picnic) / chilled side weight) * 100 and carcass cutting yield was calculated with the following equation: carcass cutting yield = ((lean cutting yield components + trimmed belly) / chilled right side weight) *100.

B. Fresh and Cured Belly Characteristics

Belly thickness was measured at eight locations across the belly. Belly flop distances were measured by draping a skin-side down belly over a stationary bar and measuring the distance between the two skin edges. Fresh bellies were allowed to equilibrate to approximately 4° C for at least 24 h after fabrication. During equilibration, bellies were laid flat and covered to minimize evaporative loss. After equilibration, fresh bellies were weighed to determine green weight, injected with a multi-needle injector using a Schroder Injector/Marinator, Model N50 (Wolf-Tec, Inc, Kingston, NY) with a cure solution to a target of 110% of original green weight, and weighed again to determine pump uptake. Pump uptake was calculated using the following equation: ((pumped weight -green weight)/green weight) *100 Bellies were allowed to equilibrate for 48 h after injection to allow for complete distribution of the cure solution. After equilibration, bellies were weighed again to determine equilibrated belly weight, combed from the flank end and cooked in an Alkar smokehouse (Lodi, WI) to an ending internal temperature of 55° C. After cooking, cured bellies were placed in a cooler for 24 h and allowed to cool to 4° C. After chilling, bellies were weighed again to determine cooked weight. Cooked yields were calculated with the following equation: (cooked weight / green weight)*100.

C. Statistical Analysis

Data were analyzed with the Mixed procedure of SAS (SAS Institute, 2004) as a split-split plot design. Pen served as the experimental unit and the fixed effects in the model were sex, weight category, time of harvest post-second injection, and the interaction of sex with weight category, sex with time of harvest post-second injection, and the three way interaction of the fixed effects. Block (BW at the time of allocation to treatment) served as the random variable. The whole plot of sex was tested with the interaction of block and sex. The split plot was harvest group (early or late) and block x sex x harvest group served as the error term. Statistical differences were considered significant at $P < 0.05$ using a two-tailed test.

III. RESULTS AND DISCUSSION

A. Carcass Cutability

Whole shoulders, bone-in Boston butts, boneless Boston butts, bone-in picnics, boneless picnics, and jowls from IC males were heavier ($P \leq 0.02$) than shoulder components of physical castrates. When expressed as a percentage of chilled side weights, whole shoulders, bone-in Boston butts, boneless Boston butts, bone-in picnics, and boneless picnics made up a larger proportion ($P \leq 0.02$) of the IC male carcasses than physical castrate carcasses. There were no differences ($P = 0.09$) in cushions as a percentage of chilled side weights between IC males and physical castrates.

There were no significant interactions ($P < 0.05$) between sex and time of harvest post-second injection for any loin primal or subprimal cuts. Whole loins ($P = 0.22$), trimmed loins ($P = 0.07$), and backribs ($P = 0.37$) were not different between IC males and physical castrates, but each of the loin components was heavier ($P \leq 0.03$) in IC males than in physical castrates. Whole loins (skin-on, untrimmed, and bone-in) of physical castrates made up a larger percentage ($P = 0.02$) of chilled side weights than in IC males. This is probably due in part to thicker back fat depths of physical castrates. Percentages of trimmed loins were not different ($P = 0.07$) between physical castrates and IC males. Canadian back loins, tenderloins, and sirloins each made up a larger percentage ($P \leq 0.04$) of chilled side weight in IC males than in physical castrates. Percentages of chilled side weights were not different ($P = 0.40$) for backribs.

There were no significant interactions ($P < 0.05$) between sex and time of harvest post-second injection for any ham primal or subprimal cut. Whole ham weights were not different ($P = 0.10$) between IC males and physical castrates, but trimmed hams, insides, outsides, knuckles, light butts and shanks were all heavier ($P \leq 0.04$) in IC males when compared to physical castrates. When expressed as a percentage of chilled side weights, whole hams, trimmed hams, and all five components of the ham (inside, outside, knuckle, light butt, and shank) were higher ($P \leq 0.04$) in IC males when compared to physical castrates.

There were no significant interactions ($P < 0.05$) between sex and time of harvest post-second injection for any belly cuts. Whole bellies ($P = 0.44$), trimmed bellies ($P = 0.23$), and sparerib ($P = 0.12$) weights were not different between IC males and physical castrates. Whole bellies ($P = 0.07$) and spareribs ($P = 0.08$) were similar between IC males and physical castrates when expressed as a percentage of chilled side weights. Trimmed bellies from IC males (11.54%) made up a smaller ($P = 0.04$) percentage of chilled side weights than trimmed bellies from physical castrates (11.87%).

There were no interactions between sex and harvest time for either lean cutting yields or carcass cutting yields. However, IC males had heavier boneless lean product weights regardless of time of harvest post-second injection when compared to physical castrates in all of the major primal cuts (Boston butt, picnic, loin, and ham) except the belly. Those advantages translated into higher ($P < 0.0001$) lean cutting yields and higher carcass cutting yields ($P < 0.0001$) of IC males when compared to physical castrates regardless of harvest time post-second injection. Lean cutting yields of IC males harvested at 4 weeks post-second injection were 2.61 percentage units higher than physical castrates and carcass cutting yields were 2.47 percentage units higher than physical castrates (Figure 1). Lean cutting yields of IC males harvested at 6 weeks post-second injection were 2.63 percentage units higher than physical castrates and carcass cutting yields were 2.06 percentage units higher than physical castrates (Figure 1). This resulted in a lean cutting yield advantage of IC males being 2.62 percentage units higher ($P < 0.0001$) than physical castrates and carcass cutting yields being 2.26 percentage units higher ($P < 0001$) than physical castrates when averaged over both harvest times.

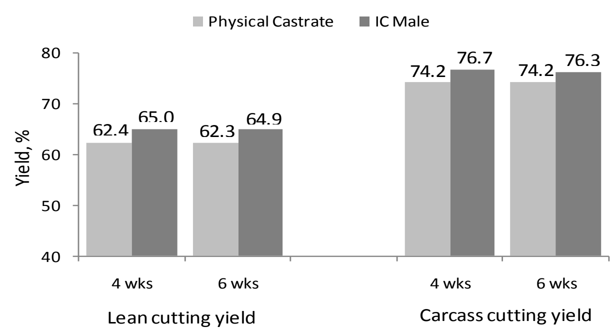

Fig. 1 Effect of sex and time of harvest post second injection on cutting yields

B. Fresh and Cured Belly Characteristics

Bellies from IC males were thinner ($P = 0.01$) and had narrower belly flops ($P < 0.0001$) than bellies from physical castrates. Higher concentrations of total PUFA of IC males harvested in the early group (4 weeks post-second injection) led to higher ($P < 0.05$) iodine values (79.9) than those of physical castrates (77.7) harvested in the early group.

However, there were no differences (P > 0.05) in iodine values between IC males (78.0) and physical castrates (77.2) harvested in the late group (6 weeks post-second injection). The magnitude of change in iodine value between pigs harvested in the early group versus those harvested in the late group for IC males was 1.9 iodine value units (Figure 2), but the magnitude of change for physical castrates' iodine value between those harvested early versus those harvested in the late group was only 0.5 units (Figure 2). This implies a greater opportunity to change fat quality with IC males than with physical castrates using different dietary ingredients.

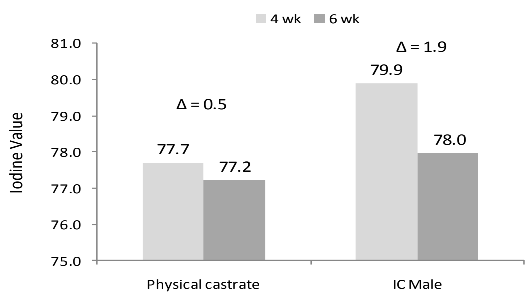

Fig. 2 Change in calculated iodine value between harvest time post second injection of immunologically castrated males and physical castrates

There were no significant interactions (P < 0.05) between sex and time of harvest post-second injection for any cured belly characteristics. There were no differences in belly green weights (P = 0.24) or pumped weights (P = 0.65) between IC males (5.08 kg; 5.73 kg) and physical castrates (5.20 kg; 5.78 kg) when averaged over both harvest times. Even though cook loss percentage was greater in IC males when compared to physical castrates, cooked yields were not different (P = 0.74) between the two sexes when averaged over both harvest times.

IV. CONCLUSIONS

Lean cutting yields and carcass cutting yields of IC males were approximately 2.5 percentage units higher than physical castrates. The advantages in cutting yields were present in groups of pigs harvested at either 4 or 6 weeks post second injection. Cutting yield can be attributed to increases in shoulder, loin, and ham components as a percentage of chilled side weight. Fresh bellies of IC males were thinner and had narrower flop distances than physical castrates. There were no differences in cooked yield for cured bellies between IC males and physical castrates. Overall, immunological castration with Improvest® improved cutting yields and did not affect cured belly characteristics.

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