COMPARISON OF PRODUCT YIELD FOR ENTIRE MALES AND CASTRATE PIGS BASED ON CT-SCANNING

Niels Christian Kjaersgaard[1] and Marchen Hviid[1]

[1]Danish Meat Research Institute, Measuring Systems, Maglegaardsvej 2, DK-4000 Roskilde, Denmark

Abstract – Within the European Union there is an intention of stopping surgical castration of pigs from 2018. A possible scenario within a few years is therefore that up to 50 % of the slaughtered pigs will be entire males. Previous research from 1995 showed that entire males in general had larger fore-ends and smaller middles and legs than young sows and castrates. However, the populations, feeding and management have changed since then. Our newly performed tests show that there is still a significant difference in product yields for the fore-end and for the bacon product in middle. In some tests, a significant difference was found in product yields for the middles and legs as well. The significant difference for the middles might primarily be caused by higher yields for backs of castrates than entire males. The yield difference for the bellies was not significant.

Key Words: entire males carcass yield virtual cutting

I. INTRODUCTION

Within the European Union there is an intention of stopping surgical castration of pigs from 2018. A possible scenario is therefore that up to 50 % of the slaughtered pigs in Europe within a short period of time can be entire males.

In order to be able to analyse the consequences of such scenarios it is important to know if yields from entire males are different from castrates. Previous research from 1995 [1] showed that entire males in general had larger fore-ends, smaller middles and legs. The populations of pigs slaughtered, slaughter weight, management and feeding has changed since then. Whether or not there is still a difference in yields between entire males and castrates is analysed in this project.

II. MATERIALS AND METHODS

Entire males slaughtered at a commercial slaughterhouse were selected based on slaughter weight and grading lean meat percentage (LMP) at the day of slaughter. The aim was that the number of carcasses in each sample group should be representative for the Danish production of entire males, see Table 1. All in all this was accomplished. The range of the LMP was 52 - 65, and the slaughter weight was 62 - 97 kg. The total number of carcasses was 51.

Table 1. Number of carcasses in each sample group

		LMP			
		≤ 57.9	58.0 - 59.9	60.0 - 61.9	≥ 62.0
Slaughter weight	≤ 76.9	1	3	4	4
	77.0 - 80.9	2	4	6	2
	81.0 - 84.9	1	4	6	2
	≥ 85.0	3	4	3	2

The day after slaughter the left sides of the carcasses were prepared identically before scanning according to the EU recommendation (except for leaving the hind foot on the carcass). Each sample was CT-scanned the day after slaughter when the carcass temperature was 5 - 7 °C. The scanning was performed using the following protocol settings: Standard reconstruction, 140 kV, 80 mA, 0.9 x 0.9 x 10 mm^3 voxel size, axial scanning.

DMRI and the Danish slaughterhouses already had a database with a considerable number of young sows and castrates that were CT-scanned in the same way. These carcasses also came from studies carried out at commercial slaughterhouses. All the CT-scanned castrates were divided into the same 16 sample groups as for the entire males based on the measured LMP and slaughter weight. From each sample group, a number of carcasses were randomly chosen in accordance with Table 1.

The previously CT-scanned young sows and castrates were not chosen only to be representative for the Danish population, but for other considerations as well. Furthermore, the Danish population of young sows, castrates and entire males will not have the same distribution according to weight and LMP, but in this investigation we wanted to compare with equal sub samples from the two genders.

In order to verify that the 51 carcasses from entire males and castrates were comparable, the "true" LMP based on CT-scans [2] were found for each of the two sub samples. The average LMP based on CT-scans for the 51 carcasses was 59.9 for the castrates and 60.0 for the entire males.

Using the software PigClassWeb as described in [3] the CT-scanned carcasses were cut virtually to the commercial cuts of the primal joints. The cuts are similar to ESS-Food standard 1201, 1301 and 1601+1801 [4]. The virtual cuts makes it possible to use the same carcass an unlimited number of times for different products and the cuts will always be "ideal", as it is based on anatomic points in the carcass [2].

III. RESULTS AND DISCUSSION

The virtual product yields are based on weight of meat, fat and bone estimated from PigClassWeb. The yields have been normalized so that the sum of the primals for each half carcass equals 36 kg.

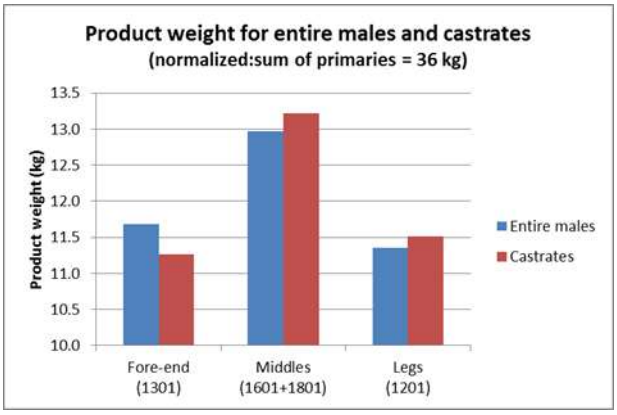

Figure 1. Product weights for primals

A t-test with $\alpha = 0.05$ has been performed and shows that yields of the fore-end, middles and legs are significantly different for castrates and entire males. Average weight and p-values for primals can be seen in Table 2.

Table 2. Average weight (kg) and p-values for primals

Product	Castrates (kg)	Entire male (kg)	Diff. (kg)	p-value
Fore-ends	11.27	11.68	+0.41	0.0002
Middles	13.21	12.97	- 0.25	0.030
Legs	11.52	11.36	- 0.16	0.014

It can be seen that the average yield for fore-ends is larger for entire males (0.41 kg) and smaller for middles and legs (0.25 kg and 0.16 kg, respectively).

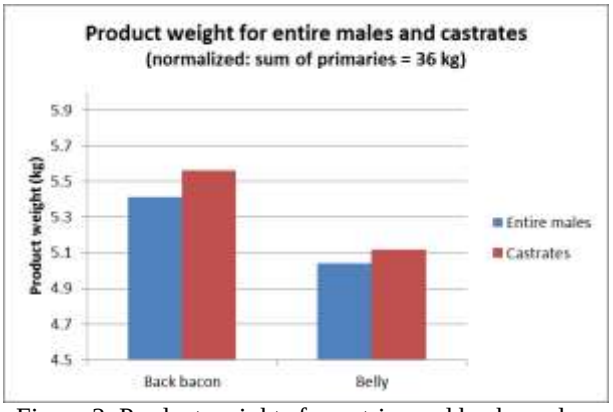

Figure 2. Product weights for untrimmed backs and bellies

The t-test in Table 3 shows that only the back has a significant difference in yields for castrates and entire males. The average yield for an untrimmed 18 cm back is 0.15 kg smaller for entire males than for castrates. The difference in yields for the belly is not significant.

Table 3. Average weight (kg) and p-values for back and belly

Product	Castrates (kg)	Entire males (kg)	Diff. (kg)	p-value
Back18 Untrimmed	5.56	5.41	- 0.15	0.012
Belly	5.12	5.04	- 0.08	0.294

The above findings are in line with expectations based on results of previous research [5].

The same test has been reproduced 10 times randomly selecting different sample groups.

Table 4. P-value for differences in yields for entire males and castrates

Test	Fore-ends	Middles	Legs	Back bacon
1	0.000	0.030	0.014	0.012
2	0.006	0.067	0.092	0.003
3	0.007	0.215	0.015	0.041
4	0.000	0.046	0.002	0.016
5	0.000	0.010	0.052	0.008
6	0.011	0.135	0.168	0.041
7	0.000	0.019	0.021	0.002
8	0.001	0.073	0.025	0.004
9	0.000	0.040	0.010	0.007
10	0.015	0.119	0.103	0.035
11	0.001	0.129	0.004	0.016

In Table 4 the p-value for differences in yields for entire males and castrates can be seen for the 11 tests performed. In each test there was a significant difference in the yields for both the fore-ends and the back bacon for castrates and entire males. In 7 out of 11 tests there was a significant difference in yields of the legs for castrates and entire males. For middles there was a significant difference in 5 of the 11 tests.

IV. CONCLUSION

The tests document that there is a significant difference in yields for the fore-end of entire males and castrates. This was demonstrated in each of the 11 tests performed. Entire males have a larger fore-end than castrates.

In some cases (depending on the samples chosen) there is a significant difference in yields for legs and middles as well. In some cases there are significant differences in yields for the middles, primarily caused by the entire males having smaller yields for backs than castrates. In each of the 11 tests performed there was a significant difference in yields for the back bacon product for entire males and castrates.

ACKNOWLEDGEMENTS

The financing of the work by the Danish Pig Levy Fund is gratefully acknowledged.

REFERENCES

1. Babol, J. & E.J. Squires (1995). Quality of meat from entire male pigs. Food Research International, Vol. 18-3: pp. 201-212.
2. Vester-Christensen M., S.G.H. Erbou, M.F. Hansen, E. Olsen, L.B. Christensen, M. Hviid, B.K. Ersbøll, R. Larsen (2009) Virtual dissection of pig carcasses. Meat Science 81 (699 - 704)
3. Christensen L. B., S.G.H. Erbou, M. Vester-Christensen, M. F. Hansen, M. Darré, M. Hviid, and E. V. Olsen (2010) Optimized Workflow and Validation of Carcass CT-Scanning, 56th ICoMST, Korea.
4. The ESS-Food Pork Catalogue can be found here: http://www.ess-food.com/ index.php?option=com_content&view=article&id=16&Itemid=23
5. Pedersen, O.K (1991). Klare forskelle på de rene racer. Landsbladet Svin 3/91 (18-21) - in Danish.