

Effect of castration age on weight and size of some bones in Piemontese male cattle

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ABSTRACT: Effect of pre- and post-pubertal castration on bone weight and measurements has been studied in 3 groups of Piemontese male cattle (EC - early castrated, LC - late castrated, IM - intact) reared in the same environmental conditions and slaughtered at about 18 month of age, at about 550 kg of l.w., and at the same commercial fattening degree. At side commercial dissection all separated bones were weighted, and on the main ones (scapula, humerus, radius, femur, and tibia) linear measures were recorded and then some conformation ratios were calculated (weight/length, length/width, and length/circumference). Data were analysed by GLM ANCOVA procedure, correcting data on side weight to avoid bias due to differences in carcass weight. No differences were found in side bone weight (23.58 ± 2.61 kg), so as in single bone weight, measures and ratios.

Key words: Bone weight and measurements, Steers, Young bulls, Piemontese.

INTRODUCTION – Bone growth and distribution are influenced more by sex than by breed, and so also differences due to castration and depending on the age at castration (i.e. before or after puberty) could be expected. In fact, castration caused a small but significant reduction in the relative growth of the forequarter bones and an increase in the relative growth of the hindquarter bones, with differences in bones weight among different breeds (Shahin et al., 1992). Even if some information on the effect of castration on daily gain, feed conversion and carcass composition have been recently published on Piemontese steers (Biagini and Lazzaroni, 2005; Lazzaroni *et al.*, 2000, 2001a, 2001b, 2002a, 2002b), little is known about its effect on the growth of individual bones, also on different breeds. In the present study effects of castration on the bone weight and measures in Piemontese calves gelded at different age were evaluated, to explain possible differences in body size and muscular development and to complete the characterisation of this breed.

MATERIAL AND METHODS – The study was carried out on 24 carcasses from 3 groups of double muscled Piemontese young bulls: early castrated (EC; 5th month of age), late castrated (LC; 13th month of age) and intact males (IM; control group). The animals were reared for about 400 days under the same environmental condition and fed at the same energy level, then slaughtered at the same age (about 18 month), weight (about 550 kg l.w.), and commercial fattening degree. After 7 days, the carcass right sides (182.6 ± 16.5 kg) were commercial dissected, and all separated bones were weighted. On the main ones (scapula, humerus, radius, femur, and tibia) linear measures (length, width, and circumference) were recorded and then some conformation ratios (weight/length, length/width, and length/circumference) were calculated. Data were analysed by GLM ANCOVA procedure (SPSS, 2003), correcting data on side weight to avoid bias due to differences in carcass weight.

RESULTS AND CONCLUSIONS – During commercial dissection differences were found for meat weight, higher in IM than in EC and LC (145 vs. 142 and 141 kg, respectively; $P < 0.05$), so as for fat weight, higher in EC and LC than in IM (7.9 and 7.7 vs. 4.8 kg, respectively; $P < 0.01$; table 1). No differences were found in side bone weight (23.58 ± 2.61 kg), with bone weights respectively 92.61 and 90.88 % of IM in LC and EC, so as in fore- and hind-quarter bones weight (13.3 and 10.3 kg, respectively). Similar results

Table 1. Side weight (mean \pm S.D.) and meat, fat and bone weight corrected on side weight (estimated mean \pm S.E.).

	IM	LC	EC
Side weight (7 d, kg)	196.54 \pm 15.89 ^A	175.55 \pm 10.07 ^B	175.70 \pm 14.30 ^B
Meat weight (kg)	145.21 \pm 1.20 ^a	141.23 \pm 1.06 ^b	142.36 \pm 1.06 ^b
Fat weight (kg)	4.78 \pm 0.61 ^B	7.71 \pm 0.54 ^A	7.94 \pm 0.54 ^A
Bone weight (kg)	23.46 \pm 0.86	23.87 \pm 0.78	23.42 \pm 0.78

^{A, B} = $P < 0.01$; ^{a, b} = $P < 0.05$.

Table 2. Weight, linear measures and conformation ratios of some main bones corrected on side weight (estimated mean \pm E.S.).

	IM	LC	EC
Scapula			
Weight (g)	1129 \pm 41	1130 \pm 37	1073 \pm 37
Length (mm)	379 \pm 18	379 \pm 16	400 \pm 16
Width (mm)	240 \pm 13	242 \pm 11	237 \pm 11
Weight/Length	3.03 \pm 0.20	3.05 \pm 0.18	2.67 \pm 0.18
Length/Width	1.60 \pm 0.11	1.32 \pm 0.10	1.68 \pm 0.10
Humerus			
Weight (g)	1791 \pm 68	1880 \pm 60	1867 \pm 60
Length (mm)	324 \pm 7	313 \pm 6	308 \pm 6
Circumference (mm)	172 \pm 6	171 \pm 5	157 \pm 5
Weight/Length	5.55 \pm 0.26	6.02 \pm 0.23	6.08 \pm 0.23
Length/Circumference	1.89 \pm 0.08	1.84 \pm 0.07	1.98 \pm 0.07
Radius			
Weight (g)	1845 \pm 73	1894 \pm 65	1905 \pm 65
Length (mm)	437 \pm 15	421 \pm 13	456 \pm 13
Circumference (mm)	171 \pm 7	187 \pm 6	180 \pm 6
Weight/Length	4.24 \pm 0.19	4.53 \pm 0.17	4.18 \pm 0.17
Length/Circumference	2.60 \pm 0.14	2.25 \pm 0.13	2.54 \pm 0.13
Femur			
Weight (g)	2820 \pm 113	2982 \pm 100	3017 \pm 100
Length (mm)	414 \pm 7	409 \pm 6	412 \pm 6
Circumference (mm)	157 \pm 6	159 \pm 5	153 \pm 5
Weight/Length	6.81 \pm 0.25	7.28 \pm 0.22	7.32 \pm 0.22
Length/Circumference	2.65 \pm 0.12	2.61 \pm 0.11	2.71 \pm 0.11
Tibia			
Weight (g)	1461 \pm 58	1507 \pm 52	1475 \pm 52
Length (mm)	330 \pm 8	311 \pm 8	318 \pm 7
Circumference (mm)	175 \pm 4	180 \pm 4	170 \pm 4
Weight/Length	4.43 \pm 0.17	4.85 \pm 0.15	4.65 \pm 0.15
Length/Circumference	1.90 \pm 0.07	1.73 \pm 0.06	1.87 \pm 0.06

were found also in single bone weight, measures and ratios (table 2). Nevertheless it could be seen a trend in the considered bones, all (except scapula) lighter in IM than in LC and EC, and only few (radius and femur) lighter in LC than in EC. Considering the linear dimension, the IM present longer bones except for radius and scapula (longer in EC), while width and circumference were higher in LC than in IM and EC excepted for humerus, similar in IM and LC, but higher in these two groups than in EC. The variations in the conformation ratios follow the described weight and linear measures differences, and did not show the typical effect of castration on bones conformations. In fact, castration should lead to a prolongation of the process of epiphysial growth and to a no proportionate increase in the length of long bones (Hammond, 1932); besides, while the bones length increased the weight decreased (Brannang, 1971). These effects, due to a reduction in androgen secretion with an accompanying effect on metabolism and growth (Hock et al., 1988), were not shown in both EC and LC groups. The lack of effect of castration could be due to the relatively early age at slaughtering, when castration could not already show its effect on growth of long bones and on bones structure dimorphism. The absence of statistical differences in bones measures prevents any functional association between bones and muscles growth, as the latter shown no differences in their measures too (Lazzaroni and Biagini, 2007). So pre- and post-pubertal castration did not shown effects on bones growth and conformation in Piemontese male cattle slaughtered to the 18th month of age, in according to the local market requests.

REFERENCES – **Brannang**, E., 1971. Studies on monozygous cattle twins. XXIII. The effect of castration and age of castration on development of single muscle, bones and special sex characters. Part II. Swedish J. Agric. Res., 1, 69-78. **Biagini**, D., Lazzaroni, C., 2005. Effect of castration age on slaughtering performance of Piemontese male cattle. Ital. J. Anim. Sci., 4 (suppl. 2): 254-256. **Hammond**, J., 1932. Growth and development of mutton qualities in sheep. Oliver and Boyd. Edinburgh. **Hock**, J.M., Gera, I., Fonseca J., Ralsz, L.G., 1988. Human parathyroid hormone. Increases bone mass in ovariectomized and orchidectomized rats. Endocrinology, 122, 2899-2904. **Lazzaroni**, C., Biagini, D., 2007. Effect of castration age on weight and size of some muscles in Piemontese male cattle. Ital. J. Anim. Sci., 6 (suppl. 1): xxx-xyy. **Lazzaroni**, C., Toscano Pagano, G., Benatti, G., Andrione, A., Biagini, D., 2000. Live performance and meat production in Piemontese bulls and steers slaughtered at the same age. Book of Abstracts "51st Annual Meeting European Association for Animal Production", Den Haag (The Netherlands) August 2000, Wageningen Pers, Wageningen, The Netherlands, 268. **Lazzaroni**, C., Biagini, D., Andrione, A., 2001a. Meat yield in Piemontese steers vs. bulls slaughtered at the same age: commercial dissection. Atti 36° Simp. Internaz. Zootecnica "Prodotti di origine animale: qualità e valorizzazione del territorio", Portonovo (Ancona, Italia) Aprile 2001, MG Editori, Milano, Italy, vol. 2, 129-136. **Lazzaroni**, C., Biagini, D., Toscano Pagano, G., Andrione, A., Benatti, G., 2001b. Effect of castration on the growth of Piemontese male cattle fed at the same energy and protein level. Book of Abstracts "52nd Annual Meeting European Association for Animal Production", Budapest (Hungary) August 2001, Wageningen Pers, Wageningen, The Netherlands, 228. **Lazzaroni**, C., Biagini, D., Toscano Pagano, G., 2002a. Carcass measurements, meat and fat yield in Piemontese young bulls and steers slaughtered at the same age. Book of Abstracts "53rd Annual Meeting European Association for Animal Production", Cairo (Egipt) September 2002, Wageningen Pers, 181. **Lazzaroni**, C., Biagini, D., Toscano Pagano, G., 2002b. Valutazioni zootecnico-economiche sull'allevamento del manzo Piemontese nell'area di origine della razza. Atti Conv. Naz. "Parliamo di ... zootecnica e sviluppo sostenibile", Fossano (Cuneo, Italia) Ottobre 2001, 69-77. **Shahin**, K.A., Berg, R.T., Price, M.A., 1992. The effect of breed-type and castration on bone growth and distribution in cattle. Reprod. Nutr. Dev., 32:429-440. **SPSS**, 2003. SPSS Base 12.0 User's manual. SPSS Inc. Chicago, IL, USA.