BIOACCESSIBILITY OF IRON, ZINC AND COPPER IN LONGISSIMUS AND PSOAS MUSCLES DURING THE AGING FROM ANGUS STEERS FED PASTURE OR CONCENTRATED

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I. INTRODUCTION

Bovine meat, is a major and valuable source of essentials minerals such as Fe, Zn, Se, Cu and Mn, antioxidant enzymes activators. Deficiencies in those minerals, are of global concern, causes anemia and it also impairs the cognitive performance of children [1] and accelerate the aging in the elderly [2]. Meat consumption is an interesting choice to prevent all these deficiencies, it contributes with the requirements of children and the elderly [1] and also with a balanced diet respect to protein requirements. However, metabolic use of this minerals in meat depends on the bioaccessibility. Previous works have shown that muscle type, race and aging could affect the availability for metabolic purposes [3]. In this work, we aim to evaluate the effect of the feeding systems, based on pasture or concentrate on the content and bioaccessibility of Fe, Zn and Cu in the Angus meat during the aging.

II. MATERIALS AND METHODS

Ten Aberdeen Angus (AA) steers from 26–30 months of age (live weight 495.8 kg), were reared under Uruguayan characteristic conditions, based on extensive grazing. They were grazed (130 days before slaughtering) consisting in tall fescue (*Festuca arundinacea*), white clover (*Trifolium repens*) and birdsfoot trefoil (*Lotus subbiflorus* cv El Rincón). On the other hand, ten other AA steers (live weight 498.2 kg) were obtained from an intensive feeding system (feedlot) that exports high quality beef (HQB), following the European Comission Regulation (Number 481/2012). The steers were finished 100 days before slaughtering with concentrate. The last consisted of whole plant sorghum silage, wet grain sorghum, corn silage, sunflower pellets, mineral sources, urea and ionophore. All animals were slaughtered the same day in an official abattoir of Breeders & Packers of Uruguay (BPU-Durazno). At 36 hours *post mortem*, muscles *Longissimus dorsi* (LD) and *Psoas major* (PM) were removed, divised in three samples, vacuum packed and immediately stored at -80 °C to prior analysis (day 0) or aged for 14 (day 14) or 30 days (day 30) at 1-2°C and stored at -80 °C. Mineral bioaccessibility was performed by a digestion simulated *in vitro* method as detailed in Ramos et al. [4]. Minerals content in meat previous *in vitro* digestion and in the digesta was measured [3]. A repeated measures ANOVA procedure was performed to determine the main effects of diet and muscle type at each time during aging on mineral content or the mains effects of diet and aging for each muscle type for bioaccessibility (NCSS, 2007).

III. RESULTS AND DISCUSSION

Results presented in Table 1 shown that content of iron and copper at 0 day of aging are higher in pasture than concentrated diet, and PM shown higher values than LD in both of them, while for zinc the difference founded are due to the muscle. LD has a higher zinc content than PM. At 30 days of aging, meat from pasture diet has more zinc than concentrated diet, however a half of zinc is lost during the aging in both meat types mainly in LD. The bioaccessibility is related to the diet for Iron, and for PM. Also pasture diet has a higher iron bioaccessibility than concentrated diet. For zinc each muscle has a different pattern of availability in a simulated digestive system. For PM zinc are higher in concentrated than pasture diet and for LD the inverse relationship was found.

Table 1. Content and bioaccessibility of iron, zinc and copper in *Longissimus* and *Psoas* muscles from Angus steers fed pasture or concentrated aged at 0, 14 and 30 days.

Items		Aging Days	Feeding Systems: Pasture LD	Pasture PM	Concentrated LD	Concentrated PM	Main effects
Mineral, mg/kg	Iron	0	23.5±3.7	32.3±3.9	19.4±1.9	25.4±1.3	Diet: p<0.01, P>C; Muscle: p<0.01, PM>LD
		14	22.2±0.8	22.5±1.5	18.8±1.0	24.2±2.1	Diet: NS; Muscle: p<0.05, PM>LD
		30	22.5±0.6	21.5±1.3	20.9±0.9	24.5±1.4	Diet: NS; Muscle: NS
	Zinc	0	78.8±14.8	24.2±3.8	74.1±14.7	33.8±5.5	Diet: NS; Muscle: p<0.01, LD>PM
		14	37.5±2.1	26.3±2.9	46.1±8.1	27.9±3.8	Diet: NS; Muscle: p<0.004, LD>PM
		30	42.9±2.3	27.1±1.9	46.8±2.5	33.2±1.9	Diet: p<0.03, C>P; Muscle: p<0.001,LD>PM
	Copper	0	0.51±0.06	0.96±0.11	0.43± 0.05	0.73±0.05	Diet: p<0.04, P>C; Muscle: p<0.001, PM>LD
		14	0.64±0.04	0.91±0.08	0.78±0.12	0.91±0.08	Diet: NS; Muscle: p<0.03, PM>LD
		30	0.88±0.22	1.07±0.08	0.77±0.05	1.07±0.08	Diet: NS; Muscle: NS
Bioaccessibility, %	Iron	0	76.2±19.8	65.2±14.2	60.3±5.7	63.1±9.3	LD Diet: NS; Aging: p<0.01, 14>0,30
		14	97.8±10.0	85.3±7.1	98.1±7.2	56.5±5.0	
		30	42.8±3.5	82.3±13.8	83.3±5.2	59.9±6.7	PM Diet: p<0.05, P>C; Aging: NS
	Zinc	0	7.2±0.7	18.2±2.1	5.3±0.7	22.2±1.4	LD Diet: p<0.001, P>C; Aging: p<0.001,30>14>0
		14	28.7±1.5	14.7±1.4	6.0±0.8	17.4±0.8	
		30	27.6±3.2	9.6±1.1	29.8±3.5	16.6±0.1	PM Diet: p<0.01, C>P; Aging: p<0.001, 0>14>30
	Copper	0	72.4±16.3	43.2±17.1	45.2±1.1	46.2±12.	LD Diet: p<0.001, P>C; Aging: p<0.029, 0,14>30
		14	67.0±1.4	22.9±2.5	33.9±5.3	52.8±24.1	
		30	50.4±7.3	15.5±3.2	19.5±2.8	48.1±9.5	PM Diet: NS; Aging: NS

Data are mean ± SEM.

IV. CONCLUSION

Beef meat is a valuable source of minerals, mainly iron, zinc and copper, but is noteworthy that feeding systems and aging for long time affect the availability of this minerals. Feeding system pasture based improve the availability of iron, zinc and copper in PM or LD muscles. Aging improve the availability of iron and zinc but not that of copper.

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