EFFECT OF STRATEGIC MAIZE SUPPLEMENTATION ON COLOUR AND pH OF LONGISSIMUS AND SEMITENDINOSUS MUSCLES OF BEEF STEERS

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Background.

Visual appearance of meat determines whether the consumer buys that product or not. Colour is one of the main appearance factors of meat (Kropf, 1980). It has been demonstrated that there exists a relation between ultimate muscle pH (pH_U) and meat tenderness (Watanabe *et al*., 1995), as well as the relationship between muscle colour and tenderness of *Longissimus* muscle from cattle fed a high concentrate diet (Wulf *et al*., 1997). Muir *et al*. (1998), in their comprehensive review, reported significant differences in pH_U in two out of five experiments, when grain and grass fed beef cattle were compared; pH_U was higher for the latter, although diets among experiments differed in the basal forage.

Efforts have recently been directed to include measurements of muscle colour and pH in order to improve current beef quality grading systems (Wulf and Page, 2000). However, most of these studies have been carried out with cattle fattened in feedlots or fed on high concentrate diets for a prolonged period. On the other hand, short term energy supplementation in pasture based beef production systems, which amounts to not more than half of the daily food intake, is a common feeding practice to overcome seasonal forage production, particularly in the last phase of fattening (Grigera Naón *et al*., 2000). Therefore, it is relevant from the point of view of beef producers, to ellucidate possible effects of feeding regimes of cattle on both paramaters in different meat cuts in order to cater for the demands of consumers.

Objective.

To assess the effects of limited grain supplementation at the final stage of fattening on meat colour and pH and the relationship between both parameters in *Longissimus* and *Semitendinosus* muscles, of steers reared on pastures and slaughtered at a similar subcutaneous fat depth.

Methods.

Twenty seven Angus steers, of twenty three months of age, were alloted at random to either grazing a mixed pasture (**PO**) (n=12) or grazing the same pasture supplemented daily with cracked maize grain at 1.5% of liveweight, over 60 days previous to slaughter (**PM**) (n=15). Slaughter point was visually determined by a trained abattoir official and objectively by measuring fat depth between the 12^{th} and 13^{th} rib using an ultrasound unit (Aloka SS 900, Fujihara Ind. Co. Ltd., Japan). Colour was assessed on the *Longissimus* muscle exposed between the 12^{th} and 13^{th} rib and on the exposed mid cross section of the *Semitendinosus* muscle. Blooming time in both cases was 80 minutes (Wulf and Wise, 1999). Colour readings were taken in the **L* a* b*** colour space, using a Minolta Chroma Meter CR-300 colorimeter (Minolta Co. Ltd., Japan) and pH was measured in both muscles using a Testo 230 phmeter with a puncture type combination electrode (Testo GmbH & Co., Germany). Data were analyzed using procedures GLM and CORR of SAS (1998) ; Pearson correlation coefficients were calculated and L.S.D. test of means was performed.

Results and discussion.

Steers were slaughtered when fat depth reached 7.25 ±0.5 mm. Results are given in Table 1. Meat from animals fed maize grain showed higher pH ($P< 0.05$) than those grazing pasture. This is in conflict with some of the experiments reviewed by Muir *et al*. (1998). This apparent discrepancy may stem from the fact that in our case the basal feed, which was fresh pasture, was the same in both treatments and in **PM** the supplement amounted to 40% of the total diet on a dry matter basis, whereas in both experiments reported by Muir *et al.* (1998) there were no common feedstuffs and in the supplemented treatments concentrates amounted to 70% of the total feed intake. Differences of pH between muscles were not significantly different ($P> 0.05$).

Feeding strategy affected **a*** and **b*** ($P< 0.05$) and not **L*** ($P> 0.05$). When muscles were compared, significant differences ($P < 0.05$) were found for parameters **L*** and **b*** and not for parameter **a*** ($P> 0.05$). The values for **L*** and **b*** are comparable to those measured on muscles from six steers by Picallo *et al.* (2000) and by Vestergaard *et al.* (2000) in young bulls.

Among feeding strategies (Table 2), **b*** was correlated (r = - 0.48) with pH in **PO**. In the case of *Longissimus* muscle **b*** was a stronger predictor of pH (r = - 0.86) than **a*** (r = - 0.66). In spite of the fact that differences were not significant ($P> 0.05$), there was a trend in the case of **PM** and for *Semitendinosus* muscle for **b*** to be a better predictor than **a***. Wulf *et al.* (1997) reported that **b*** was the best predictor of muscle pH (r = - 0.60), **a*** was intermediate (r = - 0.52) and **L*** the poorest (r = - 0.48).

Conclusions.

Short term supplementation of steers grazing pastures with a limited amount of maize grain at the end of the fattening period affected pH and **a*** and **b*** colour parameters. There were differences in **L*** and **b*** between *Longissimus* and *Semitendinosus* muscles. Colour parameter **b*** appeared to be the best pH predictor, particularly for meat from steers fed only on pastures.

Acknowledgements.
This work is part of UBACyT project GO 16 and was performed within the cooperation agreement between the University of Buenos Aires and JICA (Japan International Cooperation Agency).

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Table 1. Mean values of pH and colour parameters and their standard errors

	pH	L*	a*	b*
Feeding treatments:				
PO	$5.50^{a} \pm 0.02$	$38.3^{a} \pm 1.0$	$25.1^{a} \pm 0.8$	$12.9^{a} \pm 0.6$
PM	$5.72^{b} \pm 0.04$	$39.4^{a} \pm 1.0$	$22.2^{b} \pm 0.6$	$10.9^{b} \pm 0.8$
Muscles:				
Longissimus	$5.58^{a} \pm 0.05$	$36.6^{a} \pm 0.8$	$23.5^{a} \pm 1.1$	$10.6^{a} \pm 1.0$
Semitendinosus	$5.63^{a} \pm 0.04$	$40.4^{b} \pm 0.9$	$23.8^{a} \pm 0.5$	$12.9^{b} \pm 0.4$

Within a column for treatments and muscles means lacking a common superscript differ ($P < 0.05$)

Table 2. Correlations between pH and colour parameters

	L*	a*	b*
Feeding treatments:			
PO	- 0.40	- 0.37	- 0.48 *
PM	- 0.17	- 0.04	- 0.30
Muscles:			
Longissimus	- 0.07	- 0.66 **	- 0.86 ***
Semitendinosus	- 0.11	- 0.19	- 0.27

For values within the table: * = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$