RELATIONSHIP OF FATTY ACID PROFILE AND MARBLING LEVEL IN MEAT FROM WATER BUFFALO (*BUBALUS BULALIS*) AND ZEBU-TYPE CATTLE

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Introduction

In America, beef cattle (*Bos indicus* or *Bos taurus*) has been the traditional source of red meat. The multipurpose Asiatic water buffalo (*Bubalus bubalis*) has been mainly exploited for milk production, but poorly utilized for meat production in the Latin American region. Little information exists about the possible association between relative amounts of total fatty acid and the quantity of lipid and marbling levels in the *L. dorsi* of grass-fed buffalo and zebu-type cattle produced extensively under savannah conditions in tropical America, as well as the influence of intrinsic factors (i.e., age and gender) on the fatty acid composition of both species. The purpose of this paper was: to determine the associations between the amounts of total fatty acids (FA) with total lipids and marbling levels in the *longissimus thoracis* muscle derived from buffalo and zebu-type cattle at two comparable ages (19 and 24 months of age) and different gender (bulls and steers).

Materials and Methods

Thirty-two water buffaloes and 34 zebu-type cattle were randomly selected at weaning (7 months of age approximately) in the same cow-calf operation located at the western Venezuelan llanos. Half of each group (16 buffaloes and 17 cattle) was castrated, placed on continuous grazing of a *Brachiaria* spp pasture without supplementation other than minerals, and slaughtered at 19 and 24 months, approximately. After 24 hr chilling (0°C) carcasses were evaluated for marbling level according to Venezuelan standards (Decreto Presidencial No. 181, 1994): practically devoid (Pd), traces (Tr) and slight (L). At 48h *post-mortem* steaks (2.54 cm-thick) from the *longissimus thoracis* muscle were frozen at –20 °C for subsequent study. Samples were partially thawed, trimmed of all surrounding fat tissue and analyzed for total intramuscular lipids (g/100g fresh tissue). Details of lipid and fatty acid profile (mg/100g fresh tissue) analyses have been described by Uzcátegui-Bracho *et al.*, (2001). Analysis of variance (ANOVA) was performed using the least squares procedure (SAS, 1996). Spearman and Pearson analyses were used to correlate the total FA with marbling level and total lipid, respectively.

Results and Discussion

Total saturated (SFA), unsaturated (UFA), monounsaturated (MUFA) and *cis*-polyunsaturated (PUFA) fatty acids increased ($P < 0.05$) with marbling levels in all animal groups (Table 1). Also, a highly significant and positive correlation ($r=0.6$; $P < 0.05$) between the already mentioned groups of FA and marbling level and total lipids was observed. PUFA content increased at the highest marbling level contrasting with the statements of Eichhorn *et al.*, (1986), for whom the increase in PUFA at lower marbling level is due to the decrease of triacilgliceride/ phospholipids ratio. This could be explained by the fact that there was very little variation in marbling levels of the analysed meat samples, probably due to the animals' genetics. Variation in the total FA and total lipids with marbling levels was similar for both species, and no interaction effect ($P > 0.05$) of age or gender was observed; the same behaviour was observed in the correlation analysis. The MUFA/SFA ratio at different marbling levels was similar for both species, and this ratio was comparable to that reported by Costa *et al.*, (2006), in pure Barrosa calves of 6 to 9 months and by Kazala *et al.*, (1999) in cattle of 16 and 18 months approximately. Uzcátegui *et al.*, (1999) reported higher MUFA/SFA ratio (1.75) in older animals when analysing meat samples from Venezuelan cattle of 2.5 to >4.0 years old. The relative low MUFA/SFA ratio observed in this work may be related to the age at slaughtered (19 and 24 months). Except for PUFA/SFA ratio (which decreased in meat samples scored "L"), there was no variation in the FA ratios considered herein. Similar results were reported by Uzcátegui *et al.*, (1999). It is assumed that the n-6/n-3 ratio in the human diet is more relevant than the PUFA/SFA ratio, since its balance plays an important role in the prevention of several chronic and auto-immune disorders (Enser *et al.*, 1996). In our study, the average value for n-6/n-3 ratio (approximately 3.5) almost triplicates that reported by Enser *et al.*,(1998), but it is within the optimal range (2.5-5.0) established by Lee *et al.*, (1989).

Conclusions

There were important changes in the content of some groups of fatty acids specially SFA, UFA, MUFA and PUFA *cis*, despite the relative low marbling levels and lipid content in the meat samples derived from the species considered. The variation observed in the total FA content according to marbling levels seemed to be independent of age and gender.

Differences in marbling levels (from Pd to L) only affected the PUFA/SFA ratio, and contributed to maintenance of optimal n-6/n-3 ratio.

Table 1: Fatty acid composition (mg/100g fresh tissue) and total lipids content (g/100g fresh tissue) in the *longissimus* muscle as affected by marbling levels (Means ± SE).

Total FA	N	Pd	Tr	L
Lipids	61	1.35 ± 0.12^{a}	1.62 ± 0.06^{ab}	1.79 ± 0.09^{b}
SFA	61	412.57 ± 29.19^{a}	548.74 ± 14.11^{b}	667.54 ± 18.40^{c}
MUFA	58	456.77± 27.73^{a}	550.08 ± 14.32^{b}	667.81 ± 17.54^{c}
PUFA	57	145.11 ± 5.48^{a}	173.47 ± 7.48^{ab}	187.34 ± 9.16^{b}
UFA	58	591.61 ± 36.44^{a}	721.82 ± 18.81^{b}	855.16 ± 16.04^{c}
PUFA n-6	57	109.11 ± 11.99^{a}	134.82 ± 5.79^{ab}	140.63 ± 7.09
PUFA n-3	33	31.42 ± 3.48^{a}	37.08 ± 1.78^{ab}	41.58 ± 2.12^{b}
PUFA *cis*	58	549.23 ± 34.72^{a}	669.58 ± 17.93^{b}	788.78 ± 21.96^{c}
PUFA *trans*	58	44.98 ± 4.45^{a}	52.04 ± 2.11^{a}	66.37 ± 2.63^{b}
Cis/trans	54	12.10 ± 0.61^{a}	12.36 ± 0.30^{a}	11.53 ± 0.38^{a}
UFA/SFA	55	1.30 ± 0.03^{a}	1.31 ± 0.01^{a}	1.28 ± 0.02^{a}
MUFA/SFA	54	1.05 ± 0.03^{a}	0.99 ± 0.01^{a}	0.99 ± 0.02^{a}
PUFA/SFA	57	0.35 ± 0.02^{a}	0.31 ± 0.01^{a}	0.28 ± 0.01^{b}
n6/n3	54	3.48 ± 0.19^{a}	3.62 ± 0.09^{a}	3.48 ± 0.12^{a}

^{a,b,c}: Different letters in same row indicate significant differences ($P < 0.05$), NC = non correlation (P>0.05). SE = Standard Error.
N = total number of samples; Pd = Practically devoid, Tr = Traces, L = Slight. SFA, UFA, MUFA, PUFA = saturated, unsaturated, monounsaturated and polyunsaturated fatty acid. SFA = 14:0, 15:0, 16:0, 17:0, 18:0, 20:0. UFA = MUFA + PUFA; MUFA = 14:1, 16:1 *trans*, 16:1 *cis*, 17:1 *trans*, 18:1 *trans* (elaidic), 18:1 *cis* (oleic), 18:1 *trans* (vaccenic), 20:1 *cis*, 22:1, 24:1. PUFA = 18:2 *cis* n-6, 18:2 *trans* n-6, 18:3 γ n-6, 18:3 α n-3, 20:2 *cis*, 20:3 *cis* α n-6, 20:3 *cis* n-3, 20:4 n-6, 22:2 *cis*, 20:5 *cis* n-3, 22:4 n-6, 22:6 *cis* n-3.

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