OCURRENCE OF CONJUGATED LINOLEIC ACID IN *LONGISSIMUS* MUSCLES OF WATER BUFFALO (*Bubalus bubalis*) AND ZEBU-TYPE CATTLE RAISED UNDER SAVANNAH CONDITIONS AND KILLED AT TWO CONSTANT AGES.

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Background

Ruminant meat has been often associated with high levels of serum lipids and cholesterol in Venezuela (Huerta Leidenz *et al.*, 1998), as well as high levels of mutagens and carcinogens worldwide (Belury, 1995). However, recent studies have discovered important chemoprotective properties of the conjugated linoleic acid (CLA), an unique component of ruminant products. CLA is defined as a combination of several positional and geometric isomers (more than 10 isomers) of the linoleic acid (C18:2 *cis*-9, *cis*-12) (Belury, 1995). The increasing interest in CLA has arisen due to its anticarcinogenic activity (Visonneau *et al.*, 1997). Additionally, CLA has been reported to reduce atherosclerosis and the total serum cholesterol, and to alter the low-density lipoprotein/high-density lipoprotein cholesterol ratio in rabbits (Lee *et al.*, 1994). The *cis*-9, trans-11 (c9,t11) isomer is believed to be the most common natural form of CLA, and has shown the best beneficial biological effects (Belury, 1995). The best dietary sources of CLA are food products derived from grass-fed ruminants, according to Chin *et al.*(1992). So far, little is know about the natural CLA isomers distribution in lean meat derived from bovids (cattle or buffalo) produced extensively in tropical America under savannah conditions, as well as the influence of intrinsic factors (i.e., age and sex condition) on the CLA content of these red meats.

Objectives

1. To examine the occurrence of CLA isomers in the intramuscular fat of lean LD from water buffalo and zebu-type cattle produced under similar environmental and feeding conditions of the tropics.
2. To study the variation of intramuscular lipids and its CLA content for grass-fed water buffalo and zebu-type cattle as affected by age and sex condition.

Methods

Thirty-two water buffaloes and 34 Zebu-type cattle were randomly selected at weaning (7 mo of age approximately) in the same cow-calf operation located at the western Venezuelan llanos. Half of each specie group was castrated and put as a whole grazing group on improved savannahs in another ranch. Animals were randomly allotted by sex and specie to two slaughter age groups (17 and 19 months of age). At 48 h postmortem rib (Longissimus) samples were excised, vacuum-packaged, blast frozen and stored at -20 ° C until further analyses. Longissimus samples were thawed, trimmed of all surrounding fat and analyzed for total intramuscular lipids (g/100 g fresh meat) by the Folch *et al.* (1957) procedure. After saponification, lipid extracts were methylated using the AOAC method (AOAC, 1990). Content of the fatty acid methyl esters of two CLA isomers (C18:2 c9,t11 and C18:2 t10,c12), and linoleic acid (C18:2 c9,c12) were determined by gas chromatography using C17:0 as the internal standard. Lipid concentrations of individual CLA isomers (mg/g total lipids) were combined to obtain the total CLA lipid content. A complete randomized design in a 2^3 factorial arrangement with unequal number of animals per cell, was used. The analyses of variance (ANOVA) was executed by the least squares procedure using SAS (1996).

Results and discussion

Total lipids intramuscular content varied significantly with the specie (Table 1) but it was not affected ($p>0.05$) by age (Table 2) or sex condition. Similar values in total lipids content were found by Uzcátegui *et al.* (1999) in *longissimus* muscles taken from older slaughter cattle. Content of linoleic acid was not affected by specie ($p>0.05$) at any of the slaughter ages under consideration. However, a previous work in our laboratory (Uzcátegui-Bracho, *et al.*, 2001) had found that the polyunsaturated fatty acids (PUFA) contents were higher in buffalo meat when observations for both species at 19 and 24 months of age were pooled. Specie differences reported by Uzcátegui-Bracho *et al.* (2001) were due to the higher levels of C18:2 c9,c12, among other PUFA in buffalo meat. Total lipid content, total CLA, CLA isomers and the CLA/C18:2 c9,c12 ratio were significantly higher ($P<0.05$) in buffalo meat as compared to that from cattle (Table 1). No previous report on CLA content of water buffalo meat was found in the American literature. Generally, our total CLA concentration values (mg/g total lipids) are similar to those CLA contents reported by Mir *et al.* (2001) in cattle fed on a barley-based diet in Canada, but lower to those reported by Shantha *et al.* (1997) in *semimembranosus* muscle of grass-fed cattle in the U.S.A. and Dhiman (1999) in beef from steers fed a typical feedlot diet. However, Dhiman (1999) reported a relatively lower mean content of the t10,c12 CLA isomer. Differences in CLA concentration found with other reports may be due to many factors including total lipid concentration, muscle sampled, feeding systems, age and genetic characteristics of the experimental group. Total CLA, t10,c12 CLA isomer and the linoleic acid increased ($p<0.05$) as the bovids aged from 17 to 19 months (Table 2) and this may be due to longer time on grass feeding. Several researchers have observed an increase in PUFA in grass-fed cattle (French *et al.*, 2000) and Shantha *et al.* (1997) have shown that grass-fed cattle have significantly higher levels of CLA. None of the CLA isomers were affected by the sex condition and similar results were found by Fritsche and Fritsche (1998) in cattle.

Conclusion

Our results in regard to intramuscular concentration of total CLA and individual isomers, particularly c9,t11, show some apparent advantages for buffalo meat from a nutritional standpoint but meat from both species could be equally considered as an important natural dietary source of CLA.

Pertinent literature

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Table 1. Effect of specie on intramuscular lipid content (g/100g fresh meat), lipid concentrations of CLA and linoleic acid (mg/g lipid) and the CLA:linoleic acid ratio in *longissimus dorsi* of savannah-fed bovids (means ± S.E.)

Variable	Buffaloes	Zebu-type cattle	P-value
Total intramuscular lipids	1.43 ± 0.04	1.29 ± 0.04	0.02
C18:2 c9,t11	1.45 ± 0.05	1.13 ± 0.05	0.0001
C18:2 t10,c12	0.64 ± 0.02	0.53 ± 0.02	0.002
Total CLA	2.08 ± 0.07	1.65 ± 0.07	0.0001
C18:2 c9,c12	15.43 ± 0.43	15.80 ± 0.43	NS
CLA : C18.2 c9,c12	0.09 ± 0.004	0.07 ± 0.004	0.0001

NS = Nonsignificant (p>0.05)

Table 2. Effect of slaughter age on intramuscular lipid content (g/100g fresh meat), lipid concentrations of CLA and linoleic acid (mg/g lipid) and the CLA:linoleic acid ratio in *longissimus dorsi* of savannah-fed bovids (means ± S.E.)

Variable	17 months	19 months	P-value
Total intramuscular lipids	1.37 ± 0.04	1.34 ± 0.04	NS
C18:2 c9,t11	1.22 ± 0.05	1.35 ± 0.05	0.06
C18:2 t10,c12	0.54 ± 0.02	0.63 ± 0.02	0.007
Total CLA	1.76 ± 0.07	1.98 ± 0.07	0.02
C18:2 c9,c12	14.43 ± 0.43	16.79 ± 0.43	0.0003
CLA: C18.2 c9,c12	0.08 ± 0.004	0.08 ± 0.004	NS

NS = Nonsignificant (p> 0.10).