E22

METABOLIC AND CONTRACTILE ENZYMES ACTIVITY IN LD MUSCLE FROM HEREFORD, ANGUS AND BRAHMAN-CROSSBREED STEERS

Gonzalez, Claudia B. & Pazos, Adriana A.
Instituto de Tecnología de Alimentos, CICV, INTA.
C.C. 77 (1708) Morón, Buenos Aires, Argentina
Key Words: Brahman, Breeds, Meat Quality, Metabolic Enzymes, Contractile Enzymes

Introduction

Muscles are composed of fibers of various types, most of them having a predominant metabolic type, which contractile and metabolic characteristics are possible to be described.

It has been well demonstrated the biochemical properties of bovine muscles of animals of various ages, sexes and types. Moreover Longissimus dorsi (LD) muscle has been frequently used as indicator muscle in meat quality studies typified as oxidative fast-twitch one, since it has a higher percentage of type II fibers, specially type IIB fibers (Briand et al. 1981a; Talmant et al. 1986).

Many authors have clearly reported a relationship between ultime meat quality and muscle fiber type composition (Rao & Gault, 1989; Karlsson et al. 1993). Furthermore, most results concerning meat quality show that both quantitative and qualitative characteristics of meat products would be altered in proportion of the degree of alteration of the fiber type profiles. Enough relationships between different muscle properties have been recorded to warrant cautious use of breeding programs which may tend to promote significant alteration in fiber type profiles (Ashmore, 1974; Valin et al. 1992).

The objective of this paper was to study in Hereford (H), Angus (A) and Brahman (B) crossbreed steers the relationship between meat quality and metabolic types of muscle.

Materials and Methods

Sixty steers representing six breed types A, AxB1/4 (BA1/4), AxB3/8 (BA3/8); H, HxB1/4 (BH1/4), HxB3/8 (BH3/8) were used. The selected steers were placed on feed with high pasture quality until slaughter. Slaughtering was carried out at similar fattening, monitored both visually, by three trained evaluators, and with real-time ultrasound measurements.

Immediately after slaughtering the left carcasses muscle LD were removed, packaged in aluminun paper and stored at 0ºC until assaying for haem iron content or were vacuum-packaged and kept frozen (-20ºC) until they were analyzed for ATPase activity. Other samples of LD muscles were immediately frozen in liquid nitrogen and stored at -20 ºC until assaying for LDH activity and its isoenzymes.

Pigment iron content was measured by Hornsey technique (1956) using 5 g ground muscle samples and expressed as ug haem iron x g fresh muscle.

For LDH activity and its isoenzymes, the muscle was thawed, homogenized in cold buffer medium (pH 7.4) containing 20 mM Tris. LDH activity was assayed in a Gilford spectrophotometer by following the oxidation of $NADH_2$ at 340 nm (Fritz et al, 1970). Enzyme activity was expressed as U per mg protein. Separation and quantitation of LDH isoenzymes was accomplished by polyacrylamide gel disc electrophoresis according to the procedure of Dietz & Lubrano (1967). The gels were scanned in an integrating densitometer.

Myofibrillar ATPase activity was measured according to the method described by Briand et al. (1981a). Results were expressed as μmol of ATP hydrolyzed x min x mg myofibrillar protein (37ºC).

Data were analyzed by analysis of variance with General Linear Model of SAS (1985) for a one-way Anova design by breed (H or A). LDH isoenzymes data were analyzed by sub-units and by breed. Means separation for significant ($P < 0.05$) main effects was accomplished by Tukey's mean separation test (Steel & Torrie, 1980).

Results and discussion

Fig. 1 shows haem iron content in LD samples of A, H and its B cross-breeds. The haem iron content was high in all genotypes studied, and similar to values reported in the bibliography for bovine LD muscle (Bousset & Dumont, 1984; Talmant et al. 1986). Not significant differences among breeds of A and H cattle was detected.

Fig 2 depicts LDH activity in LD samples of the genotypes cited. As expected the enzyme activity in LD was high, since high glycolitic activity is associated with type II fibers (Briand et al. 1981b), and besides genotypes did not differ significantly. These results were partially related with the distribution of LDH isoenzymes (fig. 3). LD samples from A exhibited, at first, a different distribution pattern ($P < .05$) from BA1/4 and BA3/8 one, since fraction M_4 was higher and H_4 was lower than the former. However, M_4 sub-units from LD of both H and BH1/4 were similar but lower than BH3/8 one, and H_4 values had a tendency to diminish to BH3/8 genotype . All other fractions analyzed (M_3H, M_2H_2, MH_3) were the same (NS) among breeds. The relative proportions of the different LDH isoenzymes and LDH activity could be ,in all cases, related with a fast-twitch red muscle where M_4 predominates, total lactic dehydrogenase activity is high and have a low proportion of H_4 (Briand et al. 1981b).

Myofibrillar ATPase activity (fig. 4) was high in all genotypes and there were no significant differences among them, but we could clearly see a tendency to increase when Bos indicus inheritance increases.

Gallinger et al. (1995) had reported a tendency to diminish the tenderness values as the Bos indicus inheritance increased. These results can support the relationship between tenderness and changes in the enzymatic profiles.

Considering our current results, it can be assumed that LD from both purebreed, A and H, have the metabolic profile of a fast twitch-oxidative glycolitic muscle (red), highly

pigmented (haem iron), rich in glycolitic enzymes and having a high ATPase activity. However, a relationship between meat quality and fiber typing among genotypes was not found. Only LD muscle of B3/8 showed a tendency to differ enzymatically from purebreed, probable pointing out a more dynamic role of B3/8 breed (i.e involved in motor activity in living animal).

Conclusion

Muscular contractile and metabolic enzymes activity only is not a competent criterion to explain differences in meat quality properties when selecting animal type by cross-breeding.

Literature

Ashmore, C. R. (1974) J Anim Sci 38, 1158-1164.

Briand, M; Talmant, A; Briand, Y; Monin, G and Durand, R. (1981a) Eur J Appl Physiol 46, 347-358.

Briand, M; Talmant, A; Briand, Y; Monin, G and Durand, R. (1981b) Eur J Appl Physiol 46, 359-365.

Dietz, A. A and Lubrano, T. (1967) Anal Biochem 20,246-257.

Fritz, P.J; Morrison, W.J; White, E.L and Vesell, E. (1970) Anal Biochem 36, 443-453.

Gallinger, M; Gonzalez, C. B; Marcelia, M; Garcia, P. T; Artuso, C. A. and Lasta, J. (1995) (Submitted for publication).

Hornsey, H. C. (1956) J Sci Food Agric 7, 534-541.

Karlsson, A; Enfält, A-Ch; Essén-Gustavsson, B; Lundström, K; Rydhmer, L and Stern, S. (1993) J Anim Sci 71, 930-938.

Rao, M. V and Gault, N. F. S. (1989) Meat Sci 26, 5-18.

SAS 1985. SAS User's Guide: Statistics. SAS Inst., Inc., Cary, NC 27512-8000, USA.

Steel, A. and Torrie, J. H. (1980) Principles and Procedures of Statistics (2nd. Ed). MacGraw-Hill Book Co., N.Y.

Talmant, A; Monin, G; Briand, M; Dadet, M and Briand, Y. (1986) Meat Sci 18, 23-40.

Valin, C; Tourraille, C; Vigneron, P and Ashmore, C. R. (1982) Meat Sci 6, 257-263.

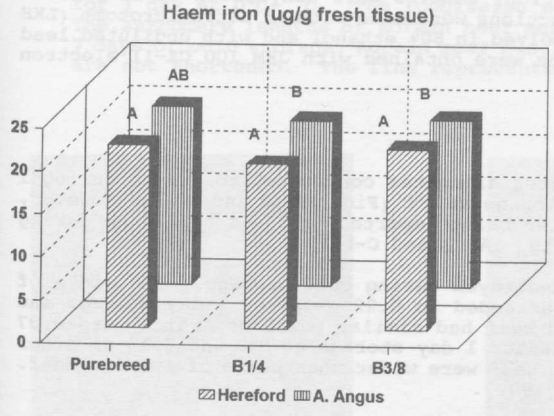

FIGURA 1

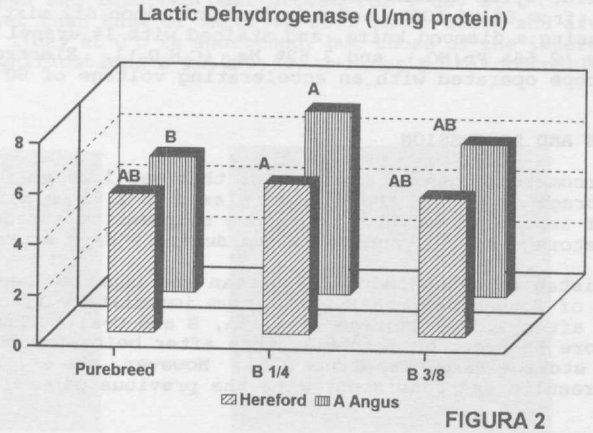

FIGURA 2

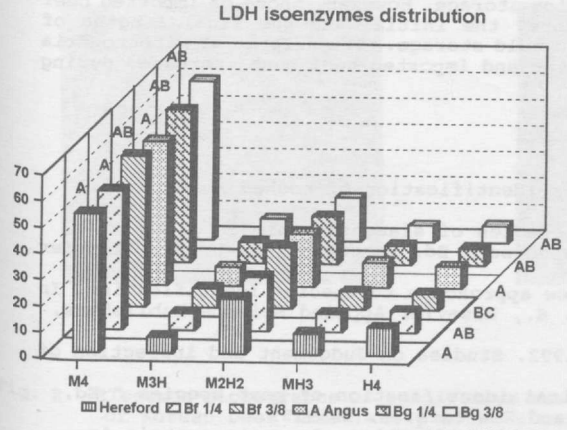

FIGURA 3

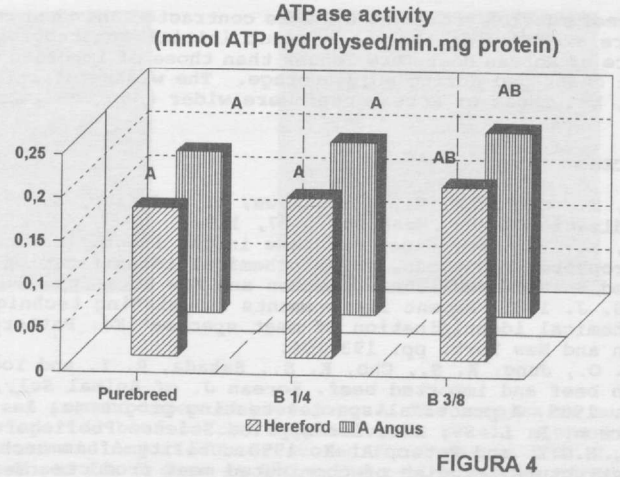

FIGURA 4