LAMB MEAT QUALITY: INFLUENCE OF DIET ENRICHED WITH OMEGA-3 ON AMINOACID PROFILE

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ABSTRACT

A study was carried out on differences in the quality of meat from Val di Belice lambs fed with different amounts of fish meal in order to increase omega-3 PUFA. The presence of PUFA influences aminoacid levels of the *longissimus dorsi* muscle.
Key words: lamb, diet, PUFA, aminoacids.

INTRODUCTION

Countless nutritional studies over the past twenty years have found omega-3 polyunsaturated fatty acids, (e.g., linolenic, eicosapentaenoic, and docosahexaenoic acids), to be health-promoting. However, a shelf-life problem exists with all omega-3 fatty acids given their high susceptibility to autoxidation. The application of techniques for slowing this deteriorative process is essential if omega-3 enriched products are to be successful in the marketplace. The importance of polyunsaturated fatty acids (PUFA) in human nutrition and disease prevention has long been recognized. Both omega-3 and omega-6 PUFA are precursor of eicosanoids, which are involved in many important biological processes in the human body.

It appears that the diets both of man and of intensively reared animals have become unbalanced in terms of fat content – particularly polyunsaturated fatty acids. The content of omega-3 fatty acids has declined while that of omega-6 fatty acids has increased. The balance can be restored by supplementing diets with fish lipids which are rich in long chain omega-3 fatty acids (Hargins and Van Elswyk, 1993; Van Oeckel et al., 1996).

The objective of this study was to investigate the effect of a diet enriched with fish oil on the aminoacid profile of lamb muscle.

MATERIALS AND METHODS

Thirty-six 30-day-old Val di Belice breed wether lambs (mean live weight 12.10 ± 0.25 kg) were randomly divided into three groups of 12 (**A, B** and **C**) and randomly assigned to individual pens and housed indoors. Six lambs for the first two groups were slaughtered at 60 days of age, whereas the remaining twentyfour lambs were slaughtered at 100 days. After 7 days adaptation, the three groups received hay *ad libitum* and were assigned to one of the following treatments: the first group was the control(**A**); the second group received concentrated feed enriched with 1% omega-3 fish oil (**B**); the third group received concentrated feed enriched with 3% of omega-3 fish oil (**C**). At the end of feeding the lambs were fasted overnight and slaughtered at a commercial abattoir. Samples for meat quality investigations were removed 48 h post mortem from the *longissimus dorsi* muscle and stored at –80° C. Muscle samples were homogenized, accurately weighed and hydrolyzed, in acid conditions. The acid samples were buffered to pH 8.6 and then derivatized with 6-aminoquinolyl-N-hydroxysuccinimidyl carbamate. Aminoacid standard H containing Arg, His, Ile, Leu, Lys, Met, Phe, Tyr, Thr, Val, Ala, Asp, Glu, Gly, Pro and Ser [2.50 mmol/mL each], purchased from Pierce, was used to define the linear regression equations for the aminoacid evaluation. The analyses were performed with HPLC System Waters: 600 LC; 474 Scanning Fluorescence Detector; Millennium® Chromatography Manager; Column C18 spherisorb ODS; at 37 °C, by using an optimised gradient of water, acetonitrile and buffer.

Fifteen amino acids were identified and quantified (Arg, His, Ile, Leu, Lys, Met, Tyr, Thr, Val, Ala, Asp, Glu, Gly, Pro, Ser) by comparing their retention times and peak areas with those of the standards. Analyses were made in triplicate and the results were expressed as mean values ± standard deviation. Muscle composition was compared using ANOVA; all the data were analysed with the statistical analysis system SAS (1998).

RESULTS AND DISCUSSION

Data on the aminoacid contents of the *longissimus dorsi* muscle of the lambs slaughtered at 60 days of age (A and B) and at 100 days of age (A, B and C) are presented in Figures 1 and 2 respectively.

Fig.1 - Aminoacid profiles of Longissimus Dorsi muscle "Val di Belice" breed lamb of 60 days old

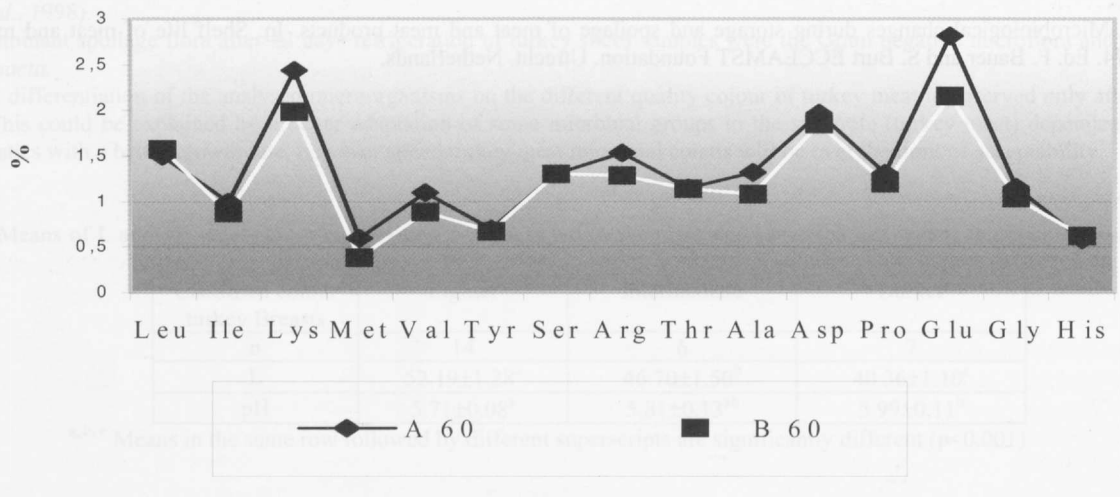
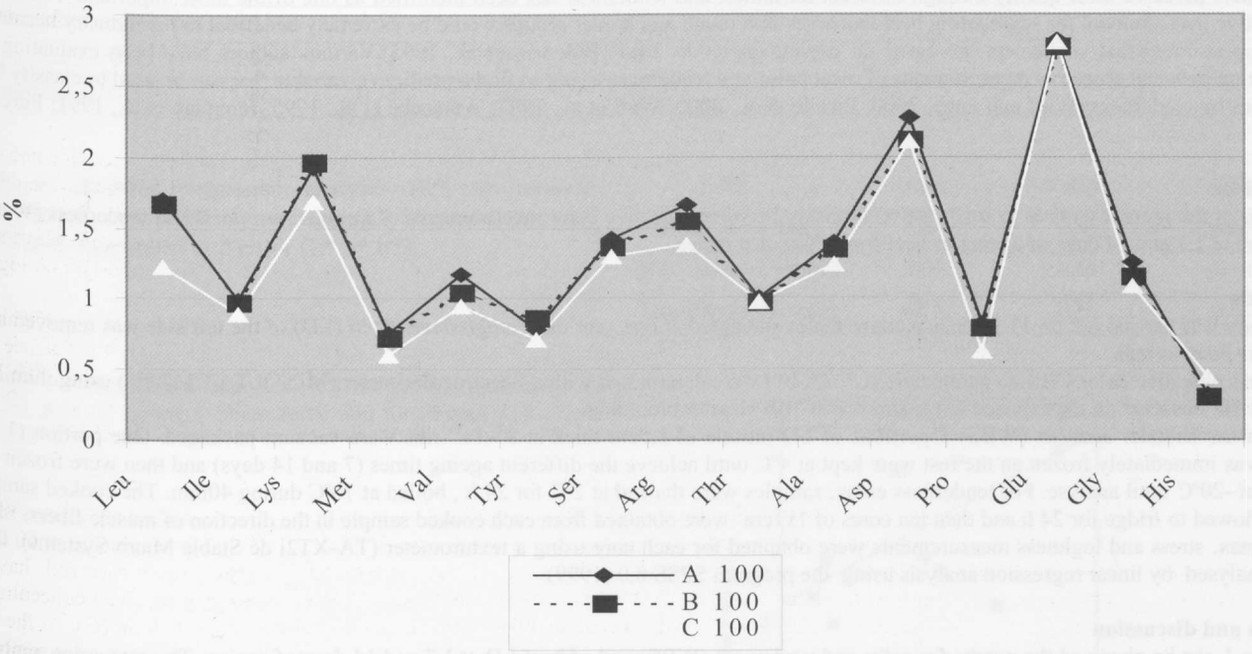


Fig.2 - Aminoacid profiles of Longissimus Dorsi muscle "Val di Belice" breed lamb of 100 days old



The results of the total aminoacid composition of all the samples analysed are, in general, in agreement with those reported in literature. Figure 1 show very few differences in lamb slaughtered at 60 days of age.
Some aminoacids, including Lysine and Glucine, presented significative differences ($P < .05$) in lambs fed with omega-3 fish oil. Little differences are observed in longissimus muscle from lambs slaughtered at 100 days of age, between the three groups as shown in figure 2. The lambs fed with 3 % omega-3 fish oil (**C**) compared with the control group (**A**) and the second group (**B**) evidenced statistical significance ($p < 0.5$) only for the aminoacids Leucine (1.2 vs 1.7 and 1.68) and Metionine (1.68 vs 1.99 and 2.01). For the other aminoacids the results are uninfluenced by diet. A better knowledge of the factors controlling the muscle's aminoacid content is necessary in order to improve the quality and the safety of meat. In fact, while the influence of nutrition on the fatty acid composition of the muscle tissues of ruminants has been established in lambs (*Caballero* G.et al. 1992; *Crouse*, J.D. et al. 1981; *Miller*, G.J., et al. 1980; *Rowe*, A.et al. 1999) there is very little information on the influence of nutrition on the aminoacid content of the meat. Many authors describe positive correlations between muscle fatty acid content and PUFA levels in the diet, therefore it is not surprising that the aminoacid meat percentage was negatively correlated with the PUFA contents in the diet (mean r value = -0.78 ± 0,07; $P \leq 0,001$). Moreover, the analysis method applied for the aminoacid evaluation, e.g. Reversed Phase HPLC was more rapid, accurate and precise than the chromatographic method. For these reasons, the results of the present research can be considered a first step towards definition of a quality control procedure that has as its goal the assessment of the meat aminoacid profiles.

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