(55th Annual Meeting of European Association for Animal Production ,
Bled, Slovenia September 5th -9th, 2004

Commission on Pig Production, Session P4.22, Abstract N°119

Assessments of processing suitability of pork meat in function of meat origin and diet.

G.Barbieri, A Pizza, R. Pedrielli, M. Bergamaschi, C. Gianni and M. Franceshini, Cooked meat products and meat technology, e-mail: cookedtech@tiscali.it*
Stazione Sperimentale per l'Industria delle Conserve Alimentari,43100 Parma, Italy

Introduction

Physical and chemical properties of raw meat affect maturation and processing suitability.
It is well known that the functional properties of salt soluble proteins, such as water-binding and fat-binding capacity, gelation and emulsification ability, are essential for achieving the desired textural properties of whole and comminuted cooked meat products (1,2).
Among the parameters that affect these properties are breed type and breeding.(3) In particular, dietary supplementation with linoleic acid increases PUFA composition and affects oxidative stability, but it also influences the texture of raw meat, since it decreases whole-body fat via fat to lean partitioning, improves intramuscular fat and delays intra-muscular collagen maturation (4,5).
Moreover, treatment or handling of the muscles, post-mortem ageing and freezing and frozen storage can produce profound effects on the structural and chemical properties of muscle foods (6,7), including changes in muscles fibres, fat stability and solubility of myofibrillar protein, all of which significantly influence the quality attributes of meat and meat products.

Aim

The purpose of this study was to investigate the effect of raw meat origin and diet on the extractability of soluble proteins, on the rheological properties and on the oxidative stability of three types of chilled meat cuts utilised in cooked product formulations. In addition, the changes in these parameters were monitored at three frozen storage times.

Materials and Methods

Experimental design

Samples of shoulders (glycolytic muscles), masseters (oxidative muscles) and thigh trimmings of heavy (Duroc x Large White) pigs, fed with a high linoleic acid diet (HPLA) and with a standard one (HPC), were compared with meats of commercial hybrid light pigs from two different origins (LP1and LP2). All the samples, chilled at 0°C for 5 days and analysed, were partially vacuum-packed and frozen for 13 days, 7 months (237 days) and 11 months (322 days) at –16°C.

Analysis.

All the samples were analysed for proximate composition, collagen, protein solubility, pH and TBARS values. The Warner–Bratzler shear test and compression test were carried out on slices (about 1 cm thick) of shoulder samples, after cooking. ANOVA of data were performed using an SPSS statistical package.

Results

Meat origin significantly ($p<0.05$) affected protein solubility and mechanical properties of chilled samples. Heavy pig meats were characterised by greater myofibrillar solubility and Warner-Bratzler shear force (WB) value and lower elasticity module MY10 in comparison to the meats from light pigs (Fig.1, Fig.2).

Fig.1 Effect of origin and diet on extactability of myofibrillar proteins of all the chilled samples

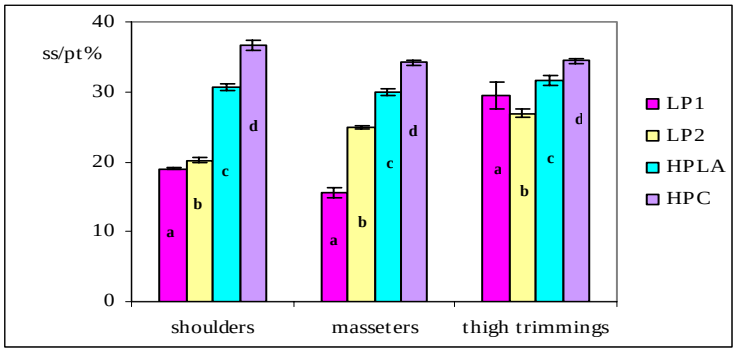
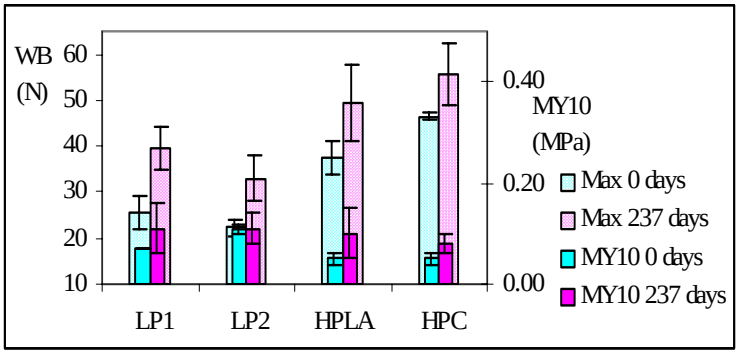
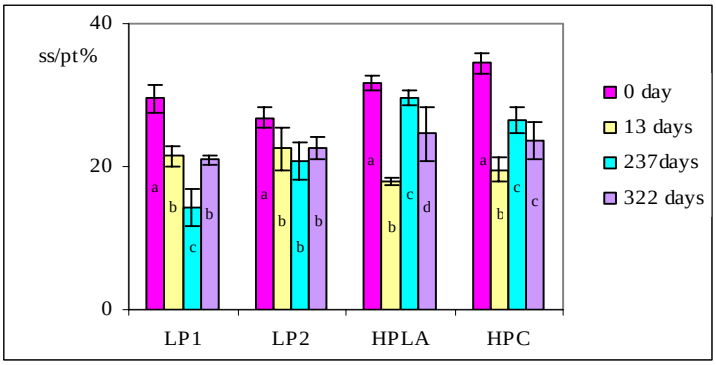


Fig.2 Effect of origin and diet on reological parameters of chilled and frozen shoulders



On the other hand, diet factor influenced protein solubility and in particular the rheological parameters. There were no significant ($p>0.05$) differences in MY10 parameters (Fig.2), but standard heavy pig (HPC) resulted in significantly ($p<0.001$) greater shear force values (WB) than HPLA, owing to the characteristic of myofibrillar and collagen protein in meat from pig with a growth enhancing (linoleic acid) diet.
With the freezing operation, myofibrillar solubility significantly ($p<0.05$) decreased for all the samples (Fig.3) and WB and MY10 values increased for the shoulders (Fig.2) The differences between the breed type decreased; in fact, there were no significant differences in MY10 values, and the extractability of salt-soluble proteins became comparable (Fig.3).

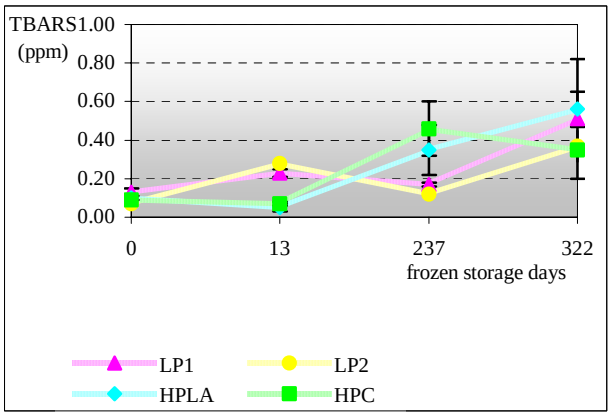
Fig.3 Extraction yield of myofibrillar proteins in chilled and frozen thigh trimmings of different origins and diet



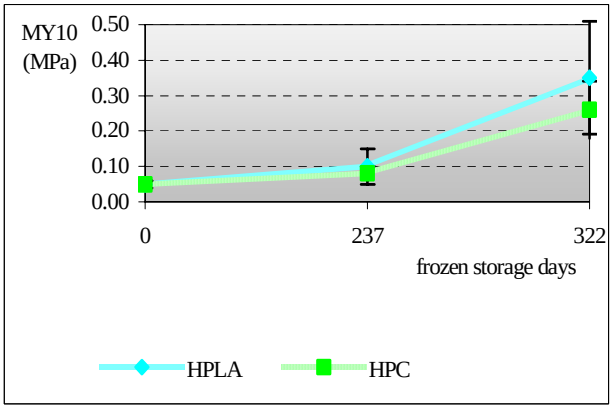
Significant differences were especially observed between the chilled and the first storage time samples, whereas there were few differences between the three different storage times for the extractability of salt soluble proteins, since vacuum-packaging probably obviated chemical changes ($p>0.05$) in frozen material during storage (Fig.3).
Moreover, prolonged storage increased TBA values in oxidative muscles (Fig.4a) especially in HPLA and LP1 samples and MY10 values in shoulders (Fig.4b) of different origins.

Fig.4-Effects of prolonged storage a) on TBARS values in masseters (oxidative muscles) and b) on MY10 parameters of heavy pig shoulders

a)



b)



Conclusions

In the chilled samples, breed type affected technological characteristics in all the cuts. Heavy pig meat of both the animal productions showed greater extractability of myofibrillar proteins, and therefore higher firmness and elasticity parameters than the light pig meat.
The diet integration with high levels of linoleic acid negatively affected the texture of shoulders. The freezing operation and frozen storage had a more significant effect than breed type on the technological properties of all the samples. These operations negatively influenced extraction yield of myofibrillar proteins and elasticity and decreased the differences among the samples of different origins. Prolonged storage negatively affected the oxidative stability of the oxidative muscles.

References

1) Young, Y.L., Myofibrillar protein from different muscle fiber types: implications of biochemical and functional properties in meat processing, (1994), Crit. Food Sci. and Nutr. 34(3) 293-320.
2) Smith D. M., Meat proteins: functional properties in comminuted meat products. (1988), Food Technology , April, 116-120.
3) G.Barbieri, A.Pizza and C.Gianni, Relationship between physical and chemical attributes of beef and pork muscles and processing suitability (2004), It J. Food Sci. 16, 59-68.
4) Dugan M.E.R., Aalhus J.L., Shaefer A.L. and Kramer J.K.G., The effect of conjugated linoleic acid on subsequent pork quality (1997) Can. J. Anim. Sci., 79,723-725
5) Corino.C, Filetti F., Gambacorta M., Manchisi S., Magni S., Pastorelli G., Rossi R. and MaioranoG. Influence of dietary conjugated linoleic acids (CLA) and age at slaughtering on meat quality and intramuscular collagen in rabbits, (2003) Meat Sci. 66, 97-103
6) Miller, A.J., Ackerman S.A., and Palumbo S.A., Effects of frozen storage on functionality of meat for processing, (1980) J.Food, Sci, 45,1466-1471
7) Roger W. “Cured and processes meat” in “Freezing Effect On Food Quality” (1996) ed. L.E.Jeremiah.