LIPID OXIDATION OF LOW-FAT PORK LIVER PÂTÉS AS AFFECTED BY *BIFURCARIA BIFURCATA* EXTRACT

Agregan, R.[1], Purriños, L.[1], Zamuz, S.[1], Domínguez, R.[1], Pateiro, M.[1], Franco, D.[1] and Lorenzo, J.M.[1*]

[1] Centro Tecnológico de la Carne de Galicia, Rúa Galicia Nº 4, Parque Tecnológico de Galicia, San Cibrao das Viñas, 32900 Ourense, Spain
*Corresponding author email: jmlorenzo@ceteca.net

Abstract – The effect of *Bifurcaria bifurcata* extract on lipid oxidation of pork liver pâtés with partial replacement of fat by vegetable oils was evaluated during the whole display. Conjugated dienes, TBARs index and volatile compounds were analyzed. No significant differences (*P*>0.05) on conjugated dienes were observed among batches neither storage time. A similar trends was found for TBARs values with a little decline at 180 days, although not significant (*P*>0.05) were observed. Total aldehydes and 2-hepatanone contents significantly (*P*<0.05) decreased at the end of storage period. Hexanal was the most abundant volatile compounds both at the beginning and at the end of storage.

Key Words – natural antioxidant, shelf-life, vegetable oils.

I. INTRODUCTION

Liver pâté is a traditional fat product very rich in fat and iron, therefore very oxidizable [1]. To palliate this trouble, synthetic antioxidants such as tert-butyl-4-hydroxytoluene (BHT) are used in industry, but they have been linked to health risks [1]. Due to this fact, current research focuses on using natural antioxidants instead of synthetic. Marine macro algae are reported to be a good source of natural antioxidants such as catechins, flavonols or polyphenols, with efficiency proved [2], presenting itself as an alternative. Thus, the aim of this study was to assess the effectiveness of the *Bifurcaria bifurcata* macro algae extract as preventing lipid oxidation in pork liver pâté, with 50 % of fat replaced by canola and high oleic sunflower (83 % of oleic acid) oils to get a healthier fatty acid profile.

II. MATERIALS AND METHODS

II.1 Manufacture of the pâté

Three different batches in three different days were manufactured: a control batch (CO), a positive control batch (BHT) and a batch with *Bifurcaria bifurcata* extract (BB). Three replicates for batch were done. A batter of liver and lean meat was done and maintained at darkness 24 h. Later, it was mixed with an emulsion of fat (pre-cooked at 70 ºC/15 min), vegetables oils (canola and high oleic sunflower oils in 50:39:12.5% w/w, respectively), and BHT or *B. bifurcata* extract. The pâtés were packed into metal cans (100 g) and submitted to thermal treating at 75 ºC/75 min. After, they were cooled at -21 ºC/30 min and stored at 4 ºC for 180 days. Pâtés were analyzed for conjugated dienes (CD) and TBARs at 0, 90 and 180 days, and for volatile compounds (ketones and aldehydes) at 0 and 180 days.

II.2 Lipid oxidation

Lipid stability was evaluated through the CD and TBARs index measurements. CD were determined according to the method described by Botsoglou *et al*. [3], expressing the results as µmol/g sample, and TBARs by the method of Vyncke [4]. The volatile compounds (ketones and aldehydes) were assessed by the method described by Dominguez *et al*. [5].

II.3 Statistical analysis

Results of analyses were examined through a model ANOVA using the IBM SPSS Statistics 19.0 program software package. The pairwise differences between least-square means were evaluated by Duncan's method. Differences were considered significant if $P<0.05$ and the values were given in terms of mean values and standard error (SEM).

III. RESULTS AND DISCUSSION

The evolution of CD and TBARs values of pork liver pâtés is shown in Figure 1 and 2, respectively. No significant differences ($P>0.05$) on conjugated dienes were observed among batches neither storage time. The same stability along the time was reported by Karwowska *et al*. [6] during the storage of organic fermented sausages added with acid whey and mustard seed. The TBARs values did not change significantly ($P>0.05$) among batches and remained stable during the storage period with a slight decline at 180 days, although not significant ($P>0.05$). This fact could

be due to the conservation conditions (vacuum packaging in containers, darkness and refrigeration temperature) that limit the oxidation process According to Karwowska *et al*. [6], the decrease in the TBARs values could be attributed to the reaction of malondialdehyde with aminoacids, sugars and nitrites in complex formulations.

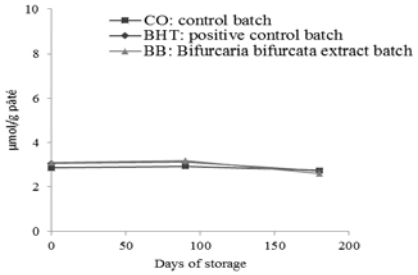

Figure 1. CD at 0, 90 and 180 days on liver pâtés

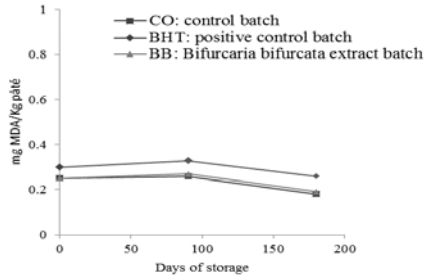

Figure 2. TBARs values at 0, 90 and 180 days on liver pâtés

Important chemical groups (ketones and aldehydes) related to lipid oxidation such as ketones and aldehydes were studied using HS-SPME-GC-MS. Only two ketones (2-pentanone and 2-heptanone), and four aldehydes (pentanal, hexanal, heptanal and butanal, 3-methyl-) were detected in pork liver pâté (data not shown). As expected, hexanal was the main volatile compound found at the end of the storage period (between 3-8 $AU\times10^{-6}\cdot g^{-1}$dry matter) followed by butanal, 3-methyl- (between 2-3 $AU\times10^{-6}\cdot g^{-1}$dry matter) and heptanal (between 1-2 $AU\times10^{-6}\cdot g^{-1}$dry matter). This finding is in agreement with those reported by Pateiro *et al.* [7] who noticed that hexanal was the major compound in liver pâtés after 24 weeks of refrigerated period. There were not significant differences between CO and BB groups on total volatile compounds at the end of storage time. These outcomes are in disagreement with data reported by Pateiro *et al.* [7] who found lower amount of lipid-derived volatile compounds in liver pâté manufactured with grape and tea extract than control group.

IV. CONCLUSION

The results obtained in the study showed that there was not lipid oxidation during the whole display of liver pâté. In addition, seaweed extract presented a similar behavior than BHT.

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