# CURING OF MECHANICALLY SEPARATED LAYER HENS MEAT AND ITS EFFECT ON THE LIPID OXIDATION OF A BOLOGNA-TYPE SAUSAGE

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## Background

The mechanically separated meats (MSM) have low stability during storage due to chemical and structural alterations which happen in the process of mechanical separation and provoke the development of undesirable aromas (rancidity) due to lipid oxidation. Nitrite ($NO_2$) is an essential ingredient in cured meats, being accounted for its red coloration - which is characteristic of the cured raw meats because of the reaction with the meat pigments. It has also other functions as antioxidant and in the production of the typical aroma of cured meats, as well as important antimicrobial effects, avoiding the production of toxins by *Clostridium botulinum* (KOLODZIEJSKA *et al.*,1990; HASIAK *et al.*, 1984). The maximum of 150 ppm of nitrite is allowed by the Brazilian laws (BRAZIL, 1998). Sodium erythorbate is used in meat products with the main functions of speeding up the pink coloring and stabilizing this characteristic color of nitrite-cured meats due to it's strong antioxidant effect, which also protect against lipid oxidation. The Brazilian legislation does not limit the use of sodium erythorbate in sausages (BRAZIL, 1998).

## Objective

The objective of this work is to evaluate lipid oxidation in bolognas produced with sodium-erythorbate-and-nitrite-cured mechanically separated spent layer meat (MSML) in comparison to bolognas made with MSML stored with no previous addition of additives.

## Methods

Two different treatments (the formulations used in both treatments are in Table 1) were processed in two replications, as described:

• Curing (CUR): bologna made with MSML cured with 150ppm of sodium nitrite and 1000 ppm of sodium erythorbate, previously stored for 90 days.

• Control (CONT): bologna made with MSML stored for 90 days without additives.

The MSML used was obtained from ground and frozen (-10ºC) carcasses after the extraction of the breast. The extraction was carried out by POSS extractor, model PDE 1000. The MSM was separated into 9.5-kg shares, which were mixed – in a CAF mixer, model M-60, for three minutes – with 0.5 kg of pure distilled water (control treatment) or dissolved-additives-added distilled water (pre-cure treatment: 1.5 g of sodium nitrite and 10.0 g of sodium erythorbate, equivalent to 150 ppm and 1000 ppm, respectively). The water was used to guarantee a better distribution of the additives in the MSMs. After the homogenizing, both treatments were packed in polyethylene bags, frozen and stored at -18ºC (±1ºC) for 90 days.

In the Bolognas processing, the MSML were chopped in a MAGURIT blocks cutter and then weighed. All ingredients and the ice were separately weighed as well. The comminution was initially carried out in a KRAMER & GREBE cutter up to temperatures around 10ºC. The refinement of the masses was finished in a STEPHAN colloidal mill. The temperature of the masses was around 14ºC after this process. Then, the emulsions were stuffed into 90-mm-wide impermeable plastic casings. They were cooked in a BECKER smokehouse until the internal temperature reached 72ºC (approximately 120 minutes) and, after that, the bolognas were cooled in a shower until the internal temperature reached 40ºC and stored in a cooling chamber at 7ºC.

For evaluation of the lipid oxidation during cooled storage, the bolognas were analyzed every seven days, from the fifth to the fortieth day after the processing, using the methodology proposed by TARLADGIS et. al (1960) for TBA analyses.

## Results and discussion

The results of lipid oxidation in bolognas made with 100% MSML are in Table 2.

In the summary of the variance analysis of the TBA indices presented in Table 3, we could observe that the effects of the treatment and the storage time were significant ($p<0.05$). The ANOVA showed that the average TBA values for the CONT treatment were higher ($p<0.05$) than those of the CUR treatment in every interval. Both treatments showed a direct effect of time ($p<0.05$) over the increase of the TBA index, with very low and similar ($p<0.05$) growing rates. These data showed that despite the additives levels used (150 ppm of nitrite and 1000 ppm of erythorbate) were enough to practically inhibit lipid oxidation during the storage of the bolognas, the use of oxidized raw material generate low-quality products, since they present a oxidant rancidity soon after processing. FRONING et al (1971) reported that sausages made with over 15% turkey MSM stored for 90 days presented high indices of TBA, resulting in product with a poorer quality than that of sausages made with fresh MSM. POLLONIO (1994) elaborated sausages with 20% chicken MSM stored for 1, 3, and 6 months, with or without curing with nitrite, ascorbate, and polyphosphate. The sausages made with cured MSM presented low TBA values (between 0,36 and 0,44), without significant differences when MSMs stored for up to 6 months were used, whereas sausages made with the control MSM presented TBA values that were increasingly higher as the storage period of the raw material was longer (0.57; 1.31 e 2.36 for 1, 3 and 6 months of storage, respectively). The magnitude of the TBA values found by the author was similar to that found in this work, from 0.20 to 2.30 mg malonaldehyde/kg sample.

## Conclusion

According to the results obtained, we can recommend the previous mixture of nitrite (150ppm) and erythorbate (1000 ppm) soon after the extraction in MSM which can eventually go through prolonged frozen storage before they are used in the production of cured cooked sausages.

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Table 1: Formulations used in the making of bolognas

| Raw Material | Curing treatment | Control treatment |
|---|---|---|
| MSML | 8.00 Kg | 8.00 Kg |
| Ingredients | Curing treatment | Control treatment |
| Salt | 200.0 g | 200.0 g |
| Commercial condiment | 100.0 g | 100.0 g |
| Soy protein | 100 .0 g | 100 .0 g |
| Cassava starch | 500.0 g | 500.0 g |
| Mashed garlic | 100.0 g | 100.0 g |
| Sodium tripolyphosphate | 30.0 g | 30.0 g |
| Sodium nitrite | - * | 1.2 g |
| Sodium erythorbate | - * | 8.0 g |
| Ice | 1.10 Kg | 1.10 Kg |

*Sodium nitrite and sodium erythorbate are added to the MSM before the storage, as described above

Table 2: average values of the TBA analyses in bolognas made with cured and non-cured MSML during refrigerated storage (mg malonaldehyde/ kg sample).

| | | Storage period (days) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 5 | 12 | 19 | 26 | 33 | 40 |
| CONT | Average | 2.26 | 2.25 | 2.33 | 2.27 | 2.36 | 2.27 |
| | SD | 0.01 | 0.02 | 0.04 | 0.01 | 0.02 | 0.01 |
| CUR | Average | 0.21 | 0.20 | 0.22 | 0.21 | 0.23 | 0.24 |
| | SD | 0.01 | 0.01 | 0 | 0.01 | 0.01 | 0.01 |

CONT: bologna made with MSML stored for 90 days without additives
CUR: bologna made with MSML cured with 150ppm of sodium nitrite and 1000ppm of sodium erythorbate, previously stored for 90 days.
SD: standard deviation

Table 3: Summary of the variance analysis for the TBA index in MSML cured and non-cured bolognas during refrigerated storage.

| Effect | Effect DF | Residual DF | F value | Pr>F |
|---|---|---|---|---|
| Treatment | 1 | 2 | 11209.5 | <0.0001 |
| Period | 5 | 10 | 19.28 | <0.0001 |
| Inter (treat*period) | 5 | 10 | 9.81 | 0.0013 |