# INFLUENCE OF THE PACKING IN THE SHELF LIFE OF SLICED HAMS

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## Background

Now a crescent demand of the consumers for quality, fresh, natural and convenient foods is verified. The meats and meat products can maintain the quality for long periods with packings in which: it is delayed the microbiologic deterioration, it is maintained a desirable coloration, it is delayed the humidity loss and the fat oxidation (SARANTÓPOULOS, 1991). In general, the sliced products are highly perishable because they present content of salt between 2 and 4%, pH larger than 6.0 and residual nitrite below 100 ppm (BOEREMA, 1993). In this way, when they are maintained in unsatisfactory sanitary hygienic conditions they damage quickly. And if none specific measure is taken to extend the shelf life and to control the pathogens microorganisms, this can be a potential factor of risk to the consumer's health (KRÖCHEL, 1999). The sliced ham when conditioned in packing of high permeability to $O_2$ has useful life reduced to 4 days, and when vacuous wrapped, its useful life can increase in 25 days and in packings with modified atmosphere (AM) in 30 days (BRODY, 1996). However, the different films used in AM can alter the conservation time. The vacuous packing usually used in the packaging of whole parts and applied in the commercialization of small portions has as objective to protect the meat product from the contact with the air oxygen. The oxygen favors the growth of aerobic microorganisms of high deterioration potential that alter the odor, the color and the appearance of the meat products. The oxygen also carry the oxidative rancidity of the fats what takes to the emergence of an odor and flavor undesirable and also causes alterations in the pigments of the meat, destroys certain vitamins and aromas. In the absence of oxygen the lactic bacteria prevail and they cause smaller alteration in the meat quality even in high countings (SARANTÓPOULOS, 1994). The packaging systems in AM are conceived to make the change of the original atmosphere around of the product by a mixture of gases, in way to foresee and to exercise a control about the alterations that will occur in the product, in the packing and in the gaseous atmosphere, due to the interaction of the gases with the product; breathing of the product and to the permeability of the packing system. The main objective of the atmosphere modification is to preserve the freshness of the first day processing product and to extend the period of maintenance of this freshness and the quality attributes during a larger useful life (GOMES, 1998).

## Objectives

Compare the sliced ham shelf life submitted to the vacuous packing (EV) and packing with AM (AM group, 2 types of films) on the microbiologic development and physiochemical conditions.

## Material and methods

The ham (sliced without fat layer) was manufactured according to descriptive memorial of commercial company - PR) and built-in in packing of PEBD/PA. The whole process was carried out as the GMP norms. After cooking and cooling, the whole parts were sliced (1,5 mm), conditioned in packings of 100g, totaling 180 packings for each treatment. The slices were put upon manually and wrapped as described: **EV treatment** of low permeability to gases (Polyamide and Polyethylene of Low Density - PA/PEBD). **Treatment with modified atmosphere $AM_1$:** the packing material was Polyester and Polyethylene of Low Linear Density (PET/PEBDL), with permeability rate to gases and water steam superior in relation to other packing**. Treatment with AM2:** the packing material was Policlorete of Vinilidene/Copolymer Ethilene and Acetate of Vinile / Polyethylene of Low Linear Density (PVDC/EVA/PEBDL). In the $AM_1$ and $AM_2$ treatments it was used the gases composition of 50% $N_2$ and 50% $O_2$. The samples stockpiling was in camera at temperature between -1 and 4°C. The analyses (microbiologic, pH and humidity) were carried out according to the methodology of LANARA/1981 (LANARA, 1981).

## Results and discussion

The pattern counting in plates (CPP) in the day zero demonstrated that the samples of $AM_1$ showed superior counting ($2x10^2$ UFC/g) than the vacuous wrapped products ($< 10^1$ UFC/g) and in $AM_2$ ($2x10^1$ UFC/g). This indicated that the hygienic and disinfect practices and/or the temperature control were inadequate in some of phases of processing, slicing or packing of the product, so that the number of mesofiles microorganisms in the initial phase of the storage in the different treatments was not similar. In studies carried out in cooked, sliced, and cooled meat products conditioned in vacuous packing, HOLLEY (1997) verified that the microflora deleterious tends to develop more quickly in the surface. In the fungus counting (CF), the treatment $AM_1$ showed results superiors ($2.9x10^2$ UFC/g) to the EV and $AM_2$ treatments (with counting $< 10^1$ UFC/g). And similar behavior was observed for the counting of *S. aureus* indicating that possibly it has happened larger contamination in the moment of samples packing of the treatment $AM_1$. The total and fecal Coliformes analyses showed counting $< 10^1$ in all of the treatments and it was not observed development of the same ones along the 35 days of stockpiling. The data for CPP (Figure 1) show the growth evolution of mesofiles for 35 days. Those results when submitted the regression analysis showed efficient adjustment to linear line. The results for CPP showed difference ($P<0.05$), indicating that the growth evolution of mesofiles in each treatment was different. As the legislation (Portaria no. 451 from 09/19/97 by MA) doesn't present microbiologic limits for this product, it was considered as CPP limit $10^3$ UFC/g, adopted by the company. Thus, the shelf life of the products was of 18, 21 and 24 days for EV, $AM_1$ and $AM_2$, respectively. These results showed that the sliced hams submitted to AM showed a larger shelf life than the EV product when considered the mesofiles. When considered the treatments with modified atmosphere, the $AM_2$ (PVDC/EVA/PEBDL) showed more efficient conservation conditions than $AM_1$ (PET/PEBDL), although the gases composition of both has been the same. Considering the microbiologic limits used by the company, it was verified that EV was good for the consumption until the 18th day of stockpiling (3.34 log UFC/g). Comparing this value with the average of the two treatments with AM, these show themselves for the consumption around 23rd day of stockpiling (3.51 log UFC/g and 3.30 log UFC/g), what can be said that the packing with AM extended in 5 days in relation to EV. The presence of fungus in sliced ham is undesirable because its development exert alterations in the odor, flavor and can promote the inflation of the packing (SARANTÓPOULOS, 1994). As the legislation (Portaria no. 451 of 09/19/1997 by MA) doesn't show microbiologic limits for this product, the inferior limit adopted was $10^2$ UFC/g. The $AM_2$ showed true values $< 10^2$ UFC/g until the 24th day while in the EV and $AM_1$ treatment the counting $< 10^2$ UFC/g was maintained until the 14th day, in other words, a difference of 10 days of shelf life (Figure 2). KRÖCHEL (1999) report that microbiologically some products show larger deterioration probability because they don't possess barriers against the growth of deleterious bacteria. As sliced cold cuts and vacuous wrapped, cooked ham and built-in products that in spite of the pasteurization and storage at low temperature needs to be quickly consumed. This reduction in the time of useful life it can be attributed, in the EV and $AM_1$ treatment, to the partial permeability to the gases and to the loss of a larger amount of

$CO_2$, that causes the fungus growth. On the other hand, the $AM_2$ showed smaller loss of $CO_2$ and control in the fungus development. Analyzing the obtained averages of the 35 days, it was detected difference ($P<0.05$) from the 28th day. In the zero time, the product showed pH of 5.4 and there was increase with the evolution of the packaging time. Possibly such behavior is resulted from the proteolitic microorganisms growth. Among the pH results there was not difference.

## Conclusions

The AM packing extended in five days of the ham sliced shelf life in relation to vacuous packing. The pH increase was associated to the proteolitic microorganisms growth. The shelf life of the ham wrapped in $AM_2$ was superior the shelf life of the product wrapped in $AM_1$.

## References

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**Table 1** Counting (UFC/g from sample) in sliced ham in the day 0.

| Treatments | | | |
|---|---|---|---|
| Analysis | Vacuous | $AM_1$ | $AM_2$ |
| Pattern counting in plates | $<10^1$ | $2x10^2$ | $<10^1$ |
| Fungus counting | $<10^1$ | $2,9x10^2$ | $<10^1$ |
| *Staphylococcus aureus* | $<10^1$ | $<10^2$ | $<10^1$ |
| Total coliforms | $<10^1$ | $<10^1$ | $<10^1$ |
| Fecal coliforms | $<10^1$ | $<10^1$ | $<10^1$ |

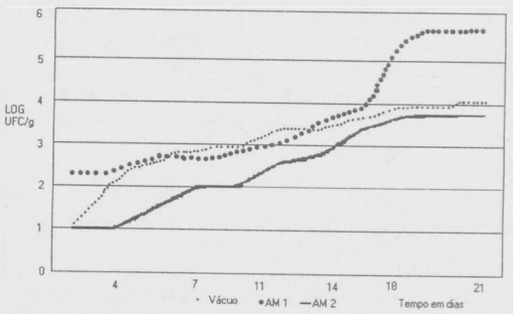


Figure 1. Evolution of pattern counting growth

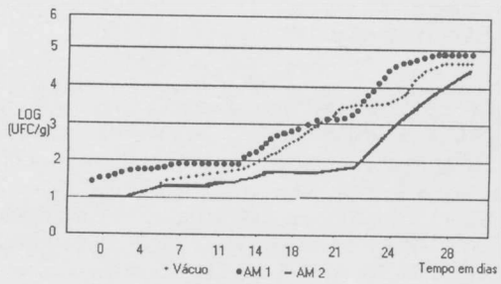


Figure 2. Fungus growth evolution.

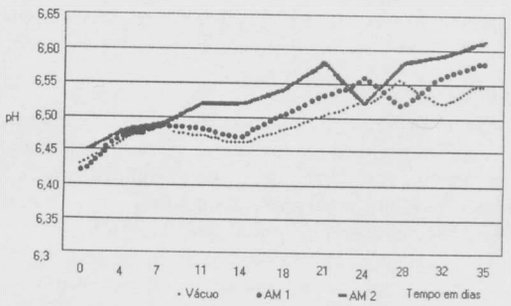


Figure 3. pH behavior.