SHELF LIFE OF VACUUM PACKAGED COOKED HAM SLICED ON HYPERMARKET SHOP CONDITIONS

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Introduction

Some hypermarkets, for benefit of consumer's time, in order to avoid long waiting while shopping, make sliced ham aerobic and vacuum packages which are placed into open refrigerated exposure equipment at temperatures between 0ºC and 5ºC. In former legislation, revoked by 2000/13/CE Directive, the pre-packaged foodstuffs for immediate sale were not allowed to be exposed on the day after package. However, the referred Directive (article 14) gives autonomy to each member-state to decide the labelling indications including the durability period in those particular cases, being necessary to determine the shelf life of pre-packaged ham in the point of sale conditions. The types of package, the environmental hygiene where product is sliced, and temperature control at which the ham is exposed, are fundamental factors influencing its shelf life. The aim of this work was to make product aging studies in order to determinate shelf life of vacuum packaged cooked ham, sliced on hypermarket shop conditions, to evidence a durability period longer then 24 hours.

Materials and Methods

The sampling of sliced ham took place in the hypermarket shop itself. The cooked ham was sliced (1.25mm thick) in a ham cutter (Bizerba VS 12 D, Portugal) which had previously been sanitized, and was immediately divided into portions which were weighted (approximately 150g) and packaged in aerobiosis on polystyrene platters (Hutamaki, United States) covered with extensible film (Lin-Wrap Film PVC, Linpac, Ovarpack, Portugal) and under vacuum inside polyethylene and polyamide (PE, PA) impermeable bags (Rovac A Bag 90 µm, CasFil-Indústrias Plástico SA., Portugal) with O_2 permeability of 45 ml/m^2/day/bar, sealed in a vacuum machine (Audionvac VMS 153, Holland). All these operations occurred in the hypermarket, under normal working conditions. The packages were rapidly transported under refrigeration to the laboratory, and were stored at 4ºC in the dark, to simulate the temperature shop conditions, due to the impossibility of storing test samples with commercially packaged cooked available ham.

Microbial analysis were performed in the aerobic packaged sliced ham after storage for 0, 3, 5, 7, 9 and 11 days, whereas those samples under vacuum packaged were analysed at days 0, 5, 7, 9, 11, 15 and 21. At least a minimum of three replicates were made in different days.

Microbial analysis: Total Aerobic Mesophylic Counts (Tryptone Glucose Extract Agar, TGE, Scharlau) - incubation for 72 hours at 30ºC; *Escherichia coli* (Tergitol BCIG Agar, Biokar Diagnostics) - incubation for 24 hours at 44.5ºC; *Enterobacteriaceae* (Violet Red Bile Dextrose Agar, VRBD, Scharlau) - incubation for 48 hours at 37ºC; *Pseudomonas* (Pseudomonas Agar Base, Oxoid and Pseudomonas C-F-C Supplement-SR103 E, Oxoid) –incubation for 48 hours at 25ºC; *Brochothrix thermosphacta* (Streptomycin Thallous Acetate Actidione Agar, STAA Agar Base, Oxoid and STAA Selective Supplement SR151 E, Oxoid) – incubation for 48 hours at 25ºC; Lactic Acid Bacteria, LAB (Man, Rogosa, Sharpe, MRS Agar, Scharlau) – anaerobic incubation for 72 hours at 30ºC. Counts were expressed in log cfu/g. The detection of *Listeria monocytogenes* in 25g of sample was made according to international standard ISO 11290-1. Statistical analysis of data was done performing T-Student Test with SPSS 11.5 for Windows.

Results and Discussion

Sliced cooked ham samples initially presented 3.17 log cfu/g mesophylic aerobic counts. The *Enterobacteriaceae* initial counts were 1.28 log cfu/g and *Escherichia coli* count was above analytical method sensitivity, denoting good hygiene practices during slicing (Figure 1) (Holley *et al.*, 1996).

The results obtained show that until the day 5 of pre-packaged cooked ham storage there was no significant increase in bacterial counts levels (Figure 1), either for aerobic (A) or vacuum (B) packaged. The different microbial groups stayed in lag phase, due to refrigeration temperatures inhibition. The spoilage flora was mainly LAB and *B. thermosphacta*. Both had a significant growth increase from the 5th day of storage in aerobic packaged sliced ham ($p<0.05$), and from the 7th day in samples under vacuum condition ($p<0.05$). LAB counts tended to increase in both type of packages not being inhibited by package conditions, while *B. thermosphacta* had significant increases in aerobically packaged samples stored at 4ºC (Samelis *et al.*, 2000). Although, we can consider this bacteria as the main responsibility for cooked sliced ham spoilage when vacuum packaged (Figure 1B). Only after the 11th storage day, significant counts differences were observed between samples aerobic and vacuum packaged, for total aerobic mesophylic ($p< 0,001$) and *B. thermosphacta* ($p<0,01$) (Figure 2A and B). Considering microbiological criteria for cooked sliced fine grocer's products as 3 x 10^5 cfu/g total aerobic mesophylic counts (Journaux Officiels, 1998), the counts of this bacterial group

in aerobic packaged **sliced ham** were below that limit until the day 11 of storage, whereas the vacuum samples reach the limit only on the 15th **storage day** (Figure 2A). From the beginning to the end of storage, safety was assured due to absence of *Listeria monocytogenes* in 25g of sample for all analysis done (accomplishing 2073/2005/CE Regulation). The *E. coli* count was **bellow 0 log** cfu/g for all samples analysed.

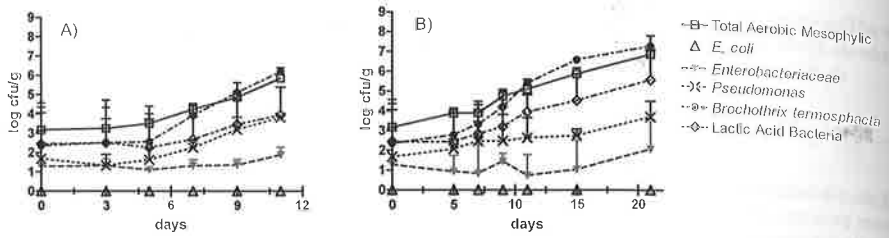

Figure 1: Aerobic (A) and vacuum (B) packaged sliced ham microbiological counts evolution.

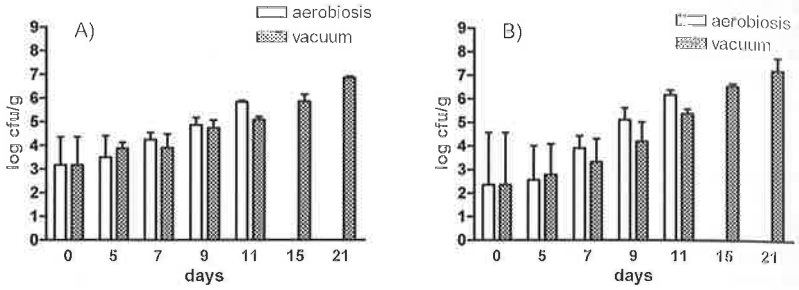

Figure 2: Total mesophylic aerobic (A) and *Brochothrix thermosphacta* (B) counts evolution comparing aerobic and vacuum packaged sliced ham.

Conclusions

When good hygienic practices are respected during product slicing procedures in sale point shops, and storing refrigeration temperature is regarded, the sliced ham aerobically packaged (attending the referred microbiological limit criteria) has a hygienic shelf life of 11 days, whereas the sliced ham vacuum packaged has 15 days. The retail sliced ham in this study conditions was safe for consumption due to the absence of *Listeria monocytogenes*.

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