

EFFECT OF VACUUM PACKAGING ON THE HIGIENIC AND ORGANOLEPTIC QUALITY OF BEEF CUTS

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KEYWORDS

Meat, beef, vacuum packaging, organoleptic quality.

BACKGROUND

During the last years many conservation procedures have been developed, such as vacuum packaging, in order to increase the selflife period of meat and to guarantee its sanitary and organoleptic quality (García et al., 1995). This technique provides the meat some particular characteristics involving its colour, lipid oxidation rate, aroma and microbial counts, which determine the higienic and organoleptic quality of the meat.

OBJETIVES

To study the selflife of vacuum packaged beef meat in four aspects: microbial counts, colour, lipidic fraction and consumers acceptability.

To know the storage period of beef during refrigeration after finishing vacuum.

MATERIAL AND METHODS

Material: Six steers from Pirenaica breed were slaughtered at similar nutritional and physiological conditions. Chuck and short plate cuts from each carcass were studied. After three days under refrigeration conditions, beef cuts were separated, cut and vacuum packaged in PA/PE bags of 120 μ (1cc/m²/24hr, O₂ permeability at 5°C and 75% relative humidity). Three vacuum sealed samples were obtained from each cut and carcass to be analyzed at days 0 (reference, sample 1), 15 (sample 2) and 30 (sample 3). When samples 2 and 3 were opened, two parts were obtained from each cut. The first one was analyzed at that moment (days 15 and 30), and the second one after three days under refrigeration conditions (days 18 and 33). During refrigeration after vacuum beef samples were placed in plastic foam packaging trays and overwrapped with an oxygen-permeable film. Samples were kept at 2-4°C and 90-95% relative humidity during both vacuum and refrigeration periods.

Methods: pH (ISOR 2917-1974) with the Orion Research potentiometer for solid samples. Microbiology, aerobic plate count (PCA, Difco) and violet red glucose agar (VRBGA, Difco). Test of the 2-tiobarbituric acid (TBA, Targladis et al., 1960). Fat extraction (Bligh & Dyer, 1959). Total fatty acids composition: methylation (Eichhorny et al., 1985) and identification by gas chromatography using a Hewlett Packard Chromatograph (HP-5890) with a HP-DB-WAX 19091N-136 column under the following conditions: a) carrier gas helium at 1 mL/min, b) oven temperature: 120°C-195°C at 7°C/min, 195°C for 70 min, c) injector temperature: 255°C, d) detector temperature: 240°C. Colour parameters: L*, a*, b*, C*, H*, using a MINOLTA C2002 Spectrophotometer. Quantitative descriptive analysis (QDA). Statistical analysis: Analysis of variance and multiple comparison test of Tuckey at 0,05 of level of significance were applied to the data.

RESULTS AND DISCUSSION

A normal-pH value was observed for all the beef samples. No oxidative phenomena was found for the vacuum storage period, while high malonaldehyde concentrations were detected during refrigeration, leading to the consumers unacceptability.

Both cuts showed a different fatty acids evolution during vacuum. The first 15 days of vacuum storage in increase in the relative percentages of saturated and monounsaturated fatty acids was observed, as well as a decrease in the polyunsaturated fatty acids content, in both chuck and short plate cuts. However, from days 15 to 30, the chuck fatty acids evolution was similar to that of the first 15 days, while in the short plate cut a considerable increase in the percentage of polyunsaturated fatty acids was found (fig. 1).

Concerning the Enterobacteriaceae counts, both cuts differed ($p < 0,05$) during vacuum. The chuck cut at day 18 had higher counts ($p < 0,05$) than at day 15, but no difference was found between 30 and 33 days of storage. On the contrary, the short plate cut counts at days 18 and 33 differed ($p < 0,05$) from those of 15 and 30, respectively. Besides, there must be pointed up that the count increase during three days of refrigeration (days 15 to 18) was higher than during fifteen days of vacuum (days 15 to 30) (fig. 2).

As far as the aerobic plate counts are concerned, no difference was found ($p < 0,05$) between both cuts, reaching a stationary phase after 15 days of vacuum (Baran et al., 1970).

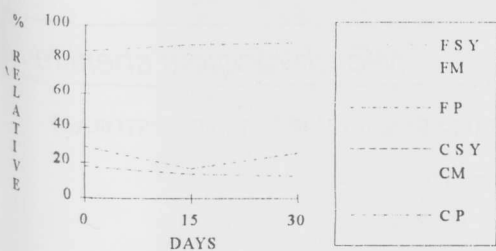


Fig. 1. Relative percentage of fatty acids, F: short plate, C: chuck, S: saturated, M: monounsaturated, P: polyunsaturated.

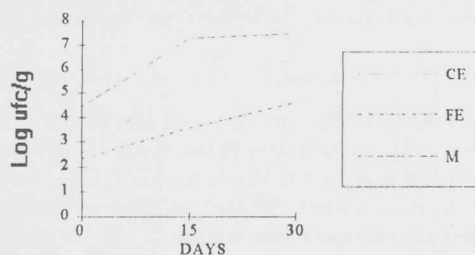


Fig. 2. Enterobacteriaceae and aerobic plate counts, CE: chuck Enterobacteriaceae, FE: short plate Enterobacteriaceae, M: aerobic plate counts.

In relation to the colour parameters, an increase in the L^* and b^* values was observed during the first fifteen days of vacuum, but no considerable changes were noticed in the second period. Both cuts had different C^* values during refrigeration. This value decreased ($p < 0.05$) for the short plate cut, while it remained constant for the chuck cut. During refrigeration there was a decrease of the a^* value and an increase of the H^* value, but no change was shown in both parameters for vacuum packaged samples (Jeremiah et al., 1995).

The presence of off-odors is directly related to the vacuum packaging duration. In our study, this off-odors were hardly noticeable after 15 days of storage (Seidman et al., 1976), but they reached an unacceptable level after 30 days (fig.3). The increase of off-odors during the three days of refrigeration must also be noticed. This trend might be due to the presence of certain Enterobacteriaceae (Gill and Newton, 1979).

Changes in the microflora might be the origin of the colour modifications appreciated by the panelists between the vacuum packaged meat (acceptable) and the refrigerated meat (unacceptable) (Seidman, 1970). Discoloration was higher during refrigeration than vacuum, which coincides with the decrease in the a^* value and the increase in the H^* value.

Colour was the main factor which influenced the panelists in the evaluation of the meat aspect. The refrigeration duration had a negative influence on the meat aspect, which was found to be higher with longer vacuum packaging periods.

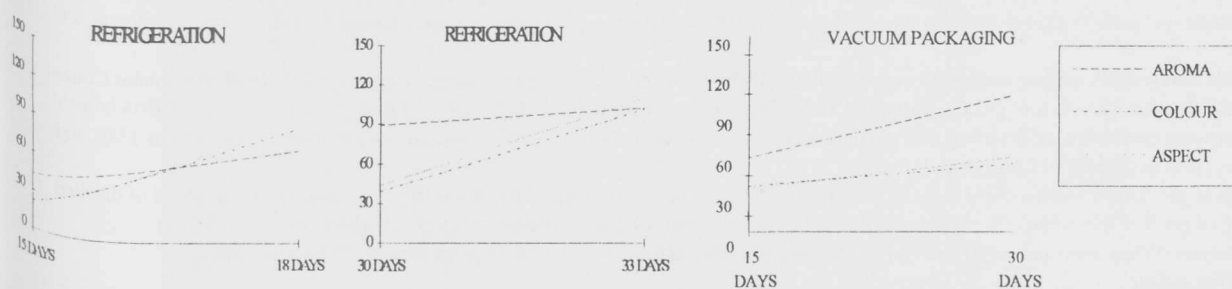


Fig. 3. Sensorial analysis (scale 0-150), 0-75 acceptable for the panelist, 75-150 unacceptable for the panelist.

CONCLUSIONS

The higienic and organoleptic quality of meat is modified with the duration of vacuum packaging storage: 15 or 30 days. The spoilage of meat has been observed during refrigeration after vacuum.

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