

## STUDY REGARDING THE CORRELATION BETWEEN METHOD OF PACKING AND PROPERTIES OF STORED MEAT

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### Abstract

*Meat, through its valuable composition is an important component of human nutrition by superior quality of proteins which is rich in essential amino acids. Unfortunately, fresh meat is subject of rapid deterioration, even when stored at 0°C. So, in order to increase the shelf life of meat product, new packet methods were developed. The aims of this study were to analyze which are the correlation between manner of packing and properties of stored meat. It was study the evolution of sensorial, physic- chemical and microbiological parameters of beef. Like materials it was use unpacked beef, vacuum packed beef and MAP packed beef, all stored in the refrigeration conditions. After the experimental it could be say that the vacuum packed beef had the best performance from sensorial point of view. The same results were obtained also for microbiological behavior. Much more, it could be observe, when growth of aerobic bacteria is inhibited in case of vacuum packed beef, the lactic bacteria grow more rapidly then MAP packed beef. From physic-chemical point of view, it seems that the register parameters are around the same values indifferent which method was use for packing beef. It could be said that the vacuum packed is a proper manner of packing beef in order to maintain the sensorial and microbiological properties of beef for a longer stored time, in refrigeration condition, without any risk for consumers.*

Keywords: beef, vacuum packed, MAP packed,

### 1. INTRODUCTION

Meat, through its valuable composition is an important component of human nutrition by superior quality of proteins which is rich in essential amino acids. Unfortunately, fresh meat is subject of rapid deterioration, even when stored at 0°C. a wide range of microorganisms coming from different sources are introduced to surfaces which contain abundant nutrients and which have a higher water availability. Only a few of the contaminants will be able to initiate growth, and only some of these will eventually spoil the meat by means of their biochemical attributes.

Predominance of different groups of microorganism on meat depends on the characteristics of the meat, the environment in which meat is stored as well as the processing that meat may undergo.

In order to increase the shelf-life of raw meat, specialists have searched for ways to keep spoilage organism away from meat, to reduce their growth rate or to select those with low spoilage potential.

The storage life and keeping quality may be extended by modifying the gaseous atmosphere surrounding the meat.

Vacuum and modified atmosphere packaging (MAP) are two method commonly used in wholesale marketing to modify the gas atmosphere. Both of these procedures and conventional overwrapped (aerobic) trays are also used in retail marketing (Hood and Mead, 1993).

Vacuum packaging is the preferred method for the storage and distributor of meat larges pieces. Within the vacuum packs, the residual oxygen is rapidly consumed by tissue and microbial respiration, and CO<sub>2</sub> increase to about 20%. Completely anaerobe conditions are rarely achieved, since all film in commercial use have certain oxygen permeability.

Carbon dioxide is used in MAP of beef because it inhibits microbial growth. Generally it is used in combination with nitrogen and /or oxygen. The percentage used varies from 10% to 40% in case of CO<sub>2</sub> and 90% to 60% in case of oxygen [1]. In general, the higher in the CO<sub>2</sub> concentrations, the better in terms of

inhibitions of spoilage microorganisms. A long shelf -life may be attained in case of 100% CO<sub>2</sub>, but it could appear chemical changes which are detrimental to meat quality. However, depending on several factors, like pH, temperature of storage, initial level of contamination, enter - bacteria could grow and cause spoilage (Gill and Mollin, 1991).

The existence of an equilibrium between the internal and external factors determines the optimum conditions that ensure the preservation of products for a longer period of time.

The objective of the present research was to evaluate which are the correlation between manner of packing and properties of stored meat.

## 2. MATERIALS AND METHODS

In the researches we used like raw material beef muscles in a refrigerating state (from 0 to 24 hours after the slaughter) provided by S.C. Dooly Com S.A. Botosani, Romania. The samples were prepared following the work scheme:

Skeleton → Slicing → Selection → Refrigeration → Packing (vacuum or MAP) → Stored on refrigeration conditions (0<sup>0</sup>C - 4<sup>0</sup>C) → Examinations (sensory, physic-chemic and microbiologic)

The obtaining samples were note like that:  
*M – witness- refrigeration unpacked beef, P1- vacuum packing beef, P2- MAP packing beef.*  
The samples were stored in the same condition of humidity and temperature, and, the quality evaluation was made after 24, 72 and 120 hours.

Like packaging materials it was use thermal contractible film and plastic casserole special for meat packing. For vacuum packing it was used Webomatic machine and for MAP packing Sealpac machine.

All the samples were made on S.C. Dooly Com S.A. Botosani, Romania and the samples scientific examination are made in the research

laboratory of Faculty of Food Engineering from Suceava, Romania.

The establishing of the sensory characteristics of meat is done in a certain order being underlined the appearance, the color, the consistency, the smell. Due to the fact that the measure instrument is represented by the human perception organs (with their specificity and physic or variation the sensory methods have a subjective character).

The physic-chemical quality of samples was determined according to the international standard methods A.O.A.C. (H<sub>2</sub>S reaction, pH, easy hydrolytically nitrogen, ammonia identification with Nessler reactive, and freshness coefficient “c” like the report of titrable acidity and oxidation capacity of meat). For microbiological evaluation it was used the standard methods for isolation, identification and cultivation of lactic, proteolytic and anaerobic bacteria. It were used personality grows media, and the Petri plate were stored in standard conditions of temperature and time.

## 3. RESULTS AND DISCUSSION

**3. 1. Sensory quality of beef** was appreciating taken into account the following characteristics: the color, the flavor (smell and taste), freshness, consistence, texture. After the sensory evaluation it could be notice that flavor, freshness, consistence and texture of beef, is almost the same, indifferent which method of packing was used. Though, it could be notice that in case of vacuum packed beef, it wasn't record visible histological modification, the appearance of muscle fibers being unchanged against witness beef. A really interesting situation appear in color vary. Immediately after the packaging, the meat presented different color characteristics against the fresh meat, the cause of them being probably the partial reduction of oxygen. During the entire storage in refrigerating conditions the vacuum packed meat maintained its color being noticed a certain degree of discoloration on its surface against the inner areas of the muscular tissue. The causes of discoloration of the outer layer of muscular

tissue are generated by the pH of the meat and loss of juice. The pH maintenance at low values determines a “closed” meat structure as well as the modification of water distribution in the extra and intra cellular spaces so that percentage of light reflected increases and the color of the meat become brighter. After 72 and 120 hours of store, the color of MAP beef was changed switch to brown against vacuum packed beef color which remains almost the same like after 24 hours. For color dynamic evaluation it was used the “points scale method” between 1(for the worst color) and 15 (foe the best color)

The dynamic of color changing is record in figure 1.

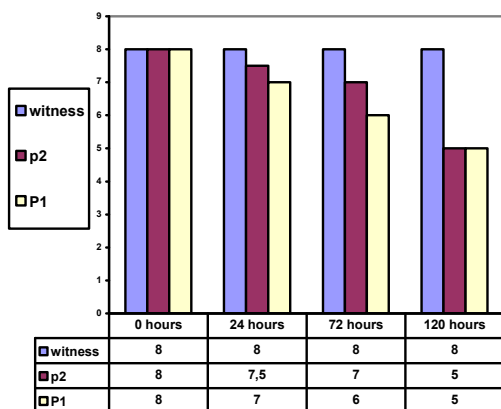


Figure 1 The dynamic of color during the store

### 3. 2. The physic-chemical quality of beef.

In order to have a good perspective on the whole of transformation, it was necessary to make some physic-chemical determination on the three samples of beef.

All the results are shown in figure 2.

After 24, 72 and 120 stored hours each sample had negative results for H<sub>2</sub>S reaction and ammonia identification with Nessler reactive. Therefore it could be said that the sample are still proper for consume.

Analyzing the figure 2, it could be notice, that in case of MAP and vacuum packed beef, the easy hydrolytically nitrogen (NH<sub>3</sub>/100mg) had lower values in case of MAP and vacuum packed beef against the witness. This evolution, indicate a good preservative for beef packed in those manners.

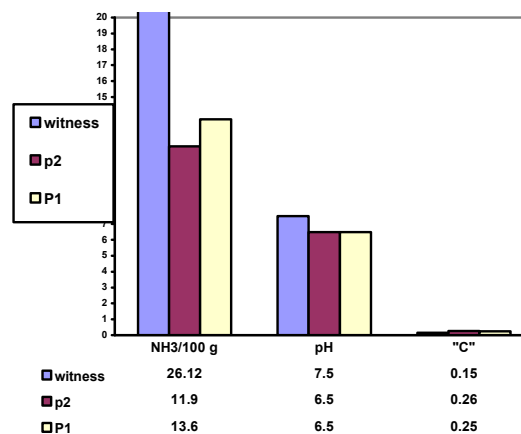


Figure 2 The physic-chemical characteristics evolution during 72 hours

The same conclusion could be notice if we observe the values of freshness coefficient “c”, which is almost double in case of witness against the packed samples.

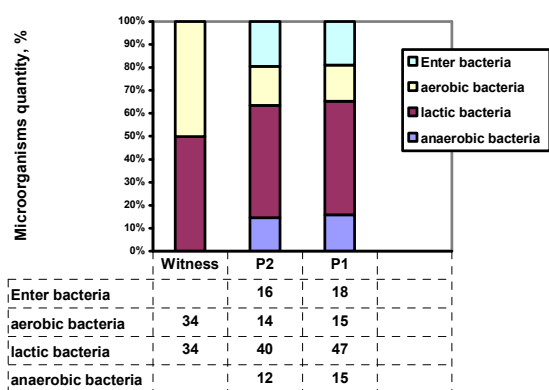
### 3.3. The microbiological quality of beef.

In order to establish the correlation between the method of packing and a safety beef for consumers, and also the efficiency of packing method was very important to evaluate the profile of microorganisms which was developed on the beef surface.

Initially, the microbiological profile was distributed in 35.30% aerobic bacteria and 34.70% lactic bacteria. Enter bacteria and anaerobic bacteria were under detection values.

During the storage period the profile was changed (figure 3), so it could be notice the anaerobic bacteria and enter bacteria appearances, and an increase of lactic bacteria.

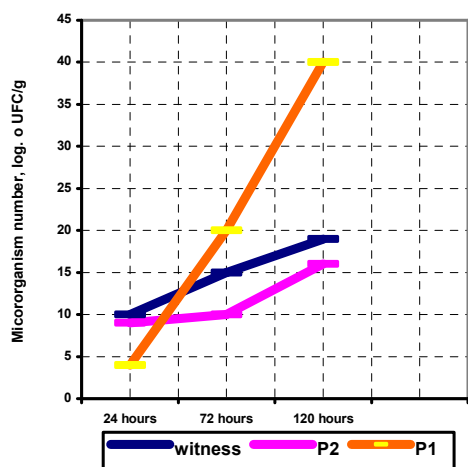
Following the lactic bacteria evolution comparatively the aerobic and mezophile, it could be concluded that in the first period of storage, respective 0-72 hours, between these two bacteria type exist a temporary methabioze relationship. The presence of aerobic bacteria is favorable for lactic bacteria because consume the remnant oxygen thus the gaseous environment will be change became optimal for lactic bacteria.



**Figure 3 Microbiological profiles on the beef surface after 120 storage hours**

Because the higher oxygen partially pressure inside the pack, and also, because of the proportion between O<sub>2</sub> and CO<sub>2</sub> aerobic bacteria and mezophile and psihrofile, represented a semnificative proportion into the microbiological profile of vacuum packed beef. The presence of remnant oxygen will support also the growth of enter bacteria.

The semnificative increase of lactic bacteria (figure 4) against the others categories of bacteria was favored by the modification of environment conditions like a result of vacuum packing, respective of reduction of remnant oxygen concentration and the increase of CO<sub>2</sub> partially pressure.



**Figure 4 Dynamic of lactic bacteria multiplication during the beef storage**

From the point of view of efficiency of packing method, is was obvious that the best results it

seems to be record in case of vacuum packed beef, where the lactic bacteria have a real increase and therefore it will be assure the optimal conditions for elongate the shelf life.

Simultaneously with the quantitative microbiological determinations, it was make H.I.L. testes for bacteria with proteolytic activity.

For all categories of beef, packed or unpacked I and L test were negative all storage long. If it tacking into account the H<sub>2</sub>S titer, became obvious that vacuum packed effect is also the inhibition of bacteria with proteolytic activity with positive consequence on beef preservability.

#### 4. CONCLUSIONS

First of all, packed beef have a better commercial appearance and the sensorial characteristics will be maintained more time; comparatively with MAP packed beef, the vacuum packed was much more favorable from color maintained point of view. In the same time, the vacuum packed beef, wasn't sustain visible histological modification, the appearance of muscle fibers being unchanged against witness beef.

From physic- chemical point of view, it seems that the register parameters are around the same values indifferent which method was use for packing beef, with a better tolerance for vacuum packed beef.

From microbiological point of view, in case of vacuum packed meat it was observed a modification of microbiological profile on the meat surface because of O<sub>2</sub> consume and CO<sub>2</sub> accumulation through cellular respiration. The aerobic bacteria were replaced by lactic bacteria.

Vacuum packed effect is also the inhibition of bacteria with proteolytic activity with positive consequence on beef preservability.

In case of vacuum packed meat, the preservation strong effect was give by lactic acid provides by lactic bacteria with fermentative metabolism.

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