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Hygienic quality and shelf life of a European sausages line packed in modified atmosphere

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Abstract – *Globalization has done to modernize the way of producing food, consumers are more demanding and not only the nutritional characteristics are a decisive factor when it comes to buying, it is also evaluated the form, packaging, and the life of the product. The aims of this study was to determine through analysis of microbiological and sensory quality and hygienic life line of a European sausage packaged in modified atmospheres (MAP) in appropriate storage conditions (temperature of cooling between (0-4 °C), is performed also measurement of the percentage of residual gas, present in the head space of the packaging and the evaluations of the organoleptic properties of the product. Where it became apparent that the counts for the aerobic mesophiles expressed in log10 do not exceed the specifications set by the NTC 1325. The total coliform counts in some of the samples do not comply with the regulations, while the E. coli count during the analysis period remained constant with the <10 CFU/g, ILO conventions the measurements of the percentage of gas present in the head space of the packaging; it is evident that the residual between 10.4 -20.1% CO₂, and 0.0 -0.1% O₂. While the sensory analysis was based on an acceptability test where it established a score according to their assessment using a scale with values of (1-5); was used a sensory panel semi-trained.*

Key Words: *modified atmospheres (MAP), useful life, European traditional Musk sausages, residual gas*

I. INTRODUCTION

Meat products according to Varnam (1995) are those products based on meat and fat of beef or pork, added or not of additives, condiments, spices, water or ice, while the Decree 2162 (1983) classifies the meat products in the following way: processed products cooked, processed products raw, processed products canned; through the Decree 1500 (2007) establishes the technical regulation by which it is created the official system of inspection, monitoring and control of the meat, meat products and edible meat destined for human consumption and health requirements and safety that must be met in their primary production, in the same way, through The Decree 3075 (1997) describes the basic conditions of hygiene in the food manufacturing and establishes that the plants of benefit, meat processing will be the life of the product in accordance with the conditions of conservation, describes the packaging and labeling requirements: edible meat products and meat that use vacuum packaging and other technologies such as controlled atmospheres must establish the life of the product and fit the conditions of conservation of the same.

An alternative to improve both the organoleptic quality as the microbiological life of the flesh is the use of CO in modified atmospheres (Sørheimet *al.*, 1997; Otwell et *al.*, 2006). The use of this gas in mixtures with CO₂ and absence of O₂ in MAP, has been accepted by the U. S. FDA and has been shown to reduce the damage by oxidation of lipids and proteins, retard the development of microorganisms responsible for the decomposition of the flesh and generate a more stable color in the product (SCF 2001).

The technique of conservation in modified atmosphere (MAP) is to pack the food products in materials with barrier to the diffusion of gases, in which the gaseous environment has been modified to reduce the degree of breathing, reduce the microbial growth and delay the enzymatic deterioration with the purpose of extending the useful life of the product Gonzales (2000).

For Garcia (2006) modified atmosphere packaging (EAM or MAP) in its acronym, (modified atmosphere packaging) is the elimination of air inside the package and its replacement by a gas or mixture of gases, usually CO₂, O₂ and N₂, in materials with

barrier to gas diffusion. This modification in the gaseous environment decreases the degree of breathing, reduces microbial growth

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and delayed the enzymatic deterioration with the purpose of extending the useful life of the product.

According to parry (1995) Depending on the requirements of the food to be packed, will require an atmosphere with rich environments in CO₂ and O₂ in poor which reduce the process of breathing in the products, while retaining their physico-chemical characteristics, sensory and microbiological by a greater amount of time, and in the light of this, you choose a package or protective film that will also have to offer a transparency that allows the viewing of products and to provide mechanical strength.

The meat products are usually packed in vacuum or modified atmosphere to preserve them from the microbial deterioration and oxidative. According to Garcia (2006) the gases most commercially used in the meat industry are carbon dioxide, oxygen, and nitrogen.

Evennow there are bibliographic references available that assess packaging in modified atmospheres, few experiences are cited that take a whole production line, this research justifies its importance since in the Colombian market current European sausages is the only meat product packaged in MAP, from the above background, the objective of this study was to determine the quality and hygienic life line to a European sausage packaged in modified atmospheres.

II. MATERIALS AND METHODS

The research was conducted in the laboratory processing of meat and meat products in the Carnes Casa Blanca company located in the Medellin city, Antioquia, Colombia.

The sample is packaged in a modified atmosphere in a baler of atmosphere with thermoforming-fill-seal (MULTIVAC RT105), which presents a coil base that allows the formation of the tray, a filling station where they were placed in the samples manually, then the upper coil of the machine using a cover film covered the packaging, it will be immediately applied vacuum for removing gases present in the packaging, and subsequently was given the injection of a mixture of 30% CO₂ and 70% Nitrogen balance, then were sealed by the application of heat and pressure, and transversely cut generating individual packages, which were deposited in plastic baskets to be stored in a cold room at a temperature between 0-4 °C until the end of the study.

It took 30 samples at random from the European line of sausages, developed between the week 12 to 20, which were stored at refrigeration temperature.

For this measurement of percentage of residual gas was used a portable gas analyzer (PBI Dansensor), which has a pump absorption of CO₂ and O₂ which is executed when you click on the container with a thin needle which allowed take a sample of the residual gas that was present in the head space of packaging.

The microbiological analyzes were carried out the day on which the sample was collected, we used different culture media to distinguish the bacterial groups present in the samples of the European line of sausages. Medium was used COLINSTANT CHROMOGENIC AGAR (Scharlau) to determine the presence of *total coliforms and diarrhoe*, through the technical derecuento horizontal (NTC 4458), the east BAIRD PARKER AGAR BASE (Scharlau) with addition of egg yolk and potassium tellurite to 1% as an indicator for the detection of the presence of *Staphylococcus aureus* coagulase-positive (NTC 4779), the east SULFIT-POLIMYXIN-SULFADIAZINE-GÈLOSE SPS (Scharlau) for the detection of spores of *Clostridium* sulfite reducing (E. C. S. R), (NTC 4834TH), the BUFFERD peptone water (Scharlau) used for a pre-enrichment not selective; broth Rappaport Vassiliadis EU Pharm i am Broth (AES's laboratorie), and board of xylose-lysine- deoxycholate (XLD) (MDM) for the detection of *Salmonella spp* (NTC 4574TH). For the detection of *Listeria monocytogenes* was used for the pre-non-selective enrichment broth LISTERIA ENRICHMENT BROTH BASE (FRASER) of (Scharlau); for the selective enrichment the same Fraser broth supplemented with supplement of Fraser and AGAR, LISTERIA OTTVIANI Agosti (ALOA) of AES's laboratorie for the detection of *Listeria monocytogenes* (NTC4666). The sensory analysis was conducted on the basis of the aroma, taste, appearance and texture every fifteen days until the last week of study; this analysis is based on an acceptability test where each taster established a score according to their assessment using a scale with values of (1-5); was used a sensory panel semi- trained, consisting of 10 tasters.

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III. RESULTS AND DISCUSSION

Table 1. Results in CFU/g of analysis for determination of Aerobic mesophiles (AM), total coliforms (TC) and fecal coliform (FC) in studies of products, with respect to time.

PRODUCT ANALYZE D	Analyzes																							
	16-January			23-January			30-January			06- February			14- February			22- February			28-Feb.			07-March.		
	A. M	C. T.	C. F.	A. M	C. T.	C. F.	A. M	C. T.	C. F.	A. M	C. T.	C. F.	A. M	C. T.	C. F.	A. M	C. T.	C. F.	A. M	C. T.	C. F.	A. M	C. T.	C. F.
Sausage Debrecziner	210	<10	<10	510	<10	<10	680	<10	<10	1000	<10	<10	1520	<10	<10	2900	<10	<10	3700	<10	<10	----	----	----
Berlin sausage	520	<10	<10	600	<10	<10	700	20	<10	780	10	<10	900	<10	<10	1800	20	<10	6200	20	<10	----	----	----
Frankfurter sausage	100	<10	<10	120	<10	<10	450	<10	<10	1020	<10	<10	8100	<10	<10	9000	<10	<10	11000	<10	<10	----	----	----
Sausage switzerland	<10	<10	<10	20	<10	<10	200	<10	<10	1800	<10	<10	4000	<10	<10	7420	<10	<10	12000	<10	<10	----	----	----

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It performs an initial analysis of the samples in study to determine presence or absence of pathogenic microorganisms; microbiological results for the determination of *Staphylococcus aureus* coagulase-positive results are already in line not evidence that growth typical of the colonies on agar Baird-Parker ,

For the determination of *E. C. S. R*, *Salmonella spp.* , and *Listeria monocytogenes*, not count was obtained indicating the good microbiological quality of the raw material used, the sanitary conditions of the process of the elaboration of the cooked meat products and control at each stage of the development of the products; these results allow to give continuity to the analysis of life.

Verification Tests residual gases

Table 2. Measurement of residual gas present in the head space of the packaging

PRODUCT	RESULT RESIDUAL GAS	
	01/02/2013	19/02/2013
Sausage Debrecziner MAP 22	20.1 % CO ₂ 0.1 % O ₂	19.5 % CO ₂ 0.0 % O ₂
Berlin sausage MAP 22	19.3 % CO ₂ 0.1 % O ₂	17.4 % CO ₂ 0.0 % O ₂
Frankfurter sausage MAP 22	13.8 % CO ₂ 0.1 % O ₂	19.5 % CO ₂ 0.0 % O ₂
Sausage switzerland MAP 22	15.4 % CO ₂ 0.1 % O ₂	13.8 % CO ₂ 0.0 % O ₂

MAP 22 30 %CO₂ -Balance Nitrogen

Table 2 shows the results of the measurements of the percentage of gas present in the head space of the packaging of samples in the study; it is evident that the residual between 10.4 -20.1 %CO₂, and 0.0 -0.1% O₂; parameters that allow you to check the conditions of packaging, the amount of the mixture of the injected gas, the amount of gas that is absorbed by the product and the quality of the packing material used. The results in the measurements show ideal conditions on the parameters mentioned above

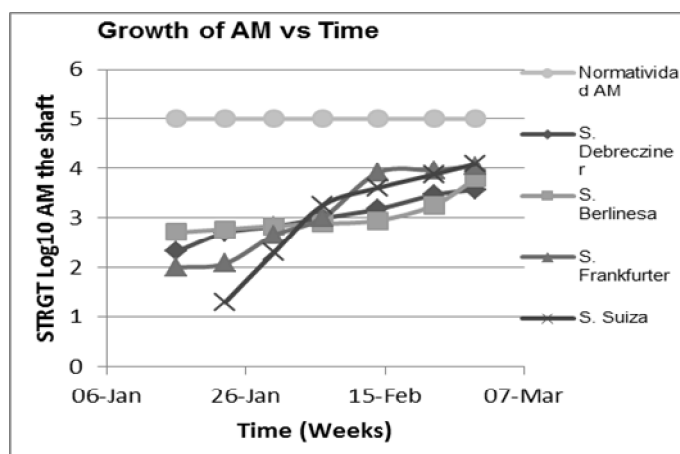


Fig. 1 Count of CFU/g of Aerobic mesophiles (AM) expressed in log₁₀ Units , with respect to time, compared with the parameters for aerobic mesophiles established in the Norming (NTC 1325)

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It is observed the behavior in the time of the growth of aerobic mesophiles in the different samples in study with respect to time, where it is evidenced that the counts for the aerobic mesophiles expressed in log₁₀ do not exceed the specifications set by the NTC 1325.

There are counts of total coliforms in some of the samples without violating these with the normativity while the E. coli count during the analysis period remained constant with the <10 CFU/g in accordance with the rule mentioned above

The estimated time of life for the processed meat products Berlin cooked sausage, Sausage Frankfurter, Debrecziner Sausage, Sausage Switzerland in modified atmosphere packaged is 45 days from the date of preparation; the time of life established is always guaranteed and when the product is in the original packaging and stored at refrigeration temperature between (0- 4°C).

The results were analyzed by reference to the NTC 1325 fifth update, with respect to the results of the first week show the product in accordance with the standard, which has allowed us to continue with the study of life.

It was not presented count of analysis of aerobic mesophiles, total coliforms and *diarrhoe* that exceed the maximum allowed in the NTC 1325 Fifth update that is 100000 CFU/g for the count of aerobic mesophiles, 500 CFU/g for the count of total coliforms and <10 CFU/g for E. coli; such as microorganisms indicators of the sanitary quality and hygienic processing of the food.

IV. CONCLUSIONS

The tests ensure the integrity of the modified atmosphere packaging, the determination of the residual gas allows you to check the amount of gas present in the head space of the packaging; it also permitted check indirectly the microbiological stability of the product in time displaying correct results. The packaging of processed meat products under modified atmosphere allows you to make sure the color and distinctive flavor, as well as the content of nutrients due to that maintains a speed of optimal breathing throughout your period of conservation. In tagging and labeling specifies that the product after being opened, should be consumed in the shortest time possible.

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