EFFECT OF STARCH ADDITION IN THE QUALITY OF FERMENTED SAUSAGES.

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SUMMARY

Fermented meat products have a relatively long shelf-life due that they combine some factors which prevent microbial spoilage. Among these are low water activity and presence of a predominant competitive microflora. Due to their stability even at extreme conditions of temperature and humidity, these products are feasible to become a good protein source in semi-tropical conditions, in spite of not being familiar for the average consumer of these zones. However, their cost is high mainly due to the raw materials as well as the inventory cost during a long storage period. In order to make these products more accesible for the consumer, it is possible to extend them with low cost materials such as starch. In this study the addition of starch to a fermented meat product was analyzed with regard to shelf-life and likness to a control. In a preliminary experiment the behaviour of gels made from two botanic sources (potato and corn) as well as two types of starch (pregelatinized and non-pregelatinized) were tested. The results favoured the use of non-pregelatinized corn starch. In a second experiment, a corn starch gel was used as an extender to the fermented sausages before inoculating with a commercial starter. The extended product has a less consistent texture and paler colour than the control. Volatile fatty acids and diamine production had the same trend for the control and the samples added with a gel and with powdered starch. This means that the studied samples had similar shelf-life as the control.

INTRODUCTION

Intermediate moisture meats are becoming popular because of their stability without refrigeration as well as because they keep their original nutritional value after long storage periods. These products have a water content between 15 and 50%, a middle point between raw meat, which deteriorates easily, and dehydrated meat, highly stable but with poor texture. Intermediate moisture meats have a relatively long shelf-life without loosing their succulence. The reduction is water activity is achieved in meat products by several methods, among them the use of humectants (medium and high molecular weight compounds, generally polyalcohols) or by the action of microorganisms, mainly lactic acid bacteria, followed by a period of ripening. However, fermented meat products have a high cost due to the raw materials as well as the time involved in their fabrication. Some meat products are commonly extended with starch in order to improve the texture and to reduce costs. Among these products are some emulsions as well as restructured meats, but no information is available regarding the extension of fermented meat products with starches and its effect on the quality of the final product. The objective of this study was to analyze the differences in quality and shelf-life between a fermented product and a product extended with starch.

MATERIALS AND METHODS

Experiment 1.

The following starches were tested as model systems:

Table 1. Starches tested

Type	Concentration	Source
Corn (pre-gelatinized)	1,2,3,6%	Commercial
Corn (fecula)	1,2,3,6,10%	Commercial
Corn + coloids *	1,2,3,6%	Commercial
Potato	2,3,5,8%	Purified in our laboratory

* agar + carrageenan

the starches were tested for: viscosity (Brookfield viscometer, model LVF), consistency (PAM penetrometer with 45º and 60º probes) and visual appearance (syneresis and consistency).

Experiment 2.

Three sample batches of fermented sausages were prepared: a control, sausages extended with corn gel and sausages added with powdered, non-gelatinized corn starch. The sausages were prepared imitating a traditional fermented product The meat (85:15 pork) was taken from carcasses where no sex, breed, age or nutrition was recorded. It was mixed with lard (30% of the total product weight), spices (garlic and pepper), salt, sugar and sodium nitrite (160 ppm in the final product). The mixture was inoculated (3% v/w of a cell suspension O.D.=1) with a commercial starter of Lactobacillus plantarum + Micrococcus kristinae-varians (LM-3, Vigusa, Mexico City). The inoculated mixture was stuffed into synthetic casings and incubated at 35ºC for 24 to 48 hours until pH=5 or less. The sausages were then stored at 15ºC for up to 30 days.

Once one starch type was chosen (fecula) it was added to the sausage formulation. As no heat treatment is applied to fermented sausages, a gel was prepared prior to the addition to the meat block (20% starch/water); 4% of meat+lard was substituted by this gel. As a means of comparison, powdered fecula starch was added to a third sample batch (4% starch powder/meat+lard).

The analysis of the samples were carried out every 3 days for the following response variables: pH, water activity (Decagon CX-1 system), colour (Hunter Lab model D25-PC2), volatile fatty acids: acetic, propionic and butyric acids (GLC SRI 8610 integrated to a peak sample software, adapted to a IBM-PC), diamine concentrations (tyramine and putrescine+cadaverine), according with the method described by Ponce et al. (1991). The data were analyzed for correlation, analysis of variance and regression using a SAS package adapted to a HP Vectra 386-PC.

RESULTS AND DISCUSSION

Experiment 1. Potato starch formed an heterogenous gel with a slight yellowish colouration which can affect the acceptability of the sausage. Gels made with corn starch added with agar and carrageenan had a marked syneresis after one day of storage. The most stable gels were those made with pre-gelatinized corn starch and with corn (fecula) starch. Pre-gelatinized corn starch made gels at lower temperature and shorter time than the others, but less firm than corn (fecula starch). Therefore, fecula starch was chosen to be added as extender to the fermented sausage.

Experiment 2. Water activity and pH had the characteristic trend expected during the fermentation and ripening processes (Graphs 1 and 2) although there were some differences among treatments. When the corn starch gel was added to the product pH values were lowered during ripening. During the incubation stage lactic acid bacteria utilize the sucrose present in the formulation, having as a result high lactic acid production. Later during ripening, L. plantarum metabolized the starch through an amylolytic pathway. As gels are easier to deplete by amylolytic enzymes than starch granules, pH in samples added with the gel are lower than those added with powdered starch.

As expected, water activity was lower in samples added with corn starch than in the control. No significant differences were observed between water activity values obtained from samples added with the gel and the powdered starch. It seems that some water trapping occurred when powdered starch was added to the formulation, reducing the water availability in the system.

The red component a in colour (Graph 3) had lower values during the first 16 days of study due that, having lower amount of meat, and therefore pigments, the values decreased and L values increased (data not shown). After 16 days, a values decreased in the control and increased in samples added with gel, as a result of oxidized compounds in higher amounts in the control tahn in the other samples.

Texture in samples added with powdered starch, as compared with the control, had no significant difference, as evaluated by sensory methods. Conversely, the firmness and cohesiveness of the samples added with gel were lower than the control.

During fermentation and ripening of fermented meat products, there are some chemical changes associated with microbial development, such as fatty acid production and protein hydrolysis, which are responsible for the aroma and flavour of this type of products. There was a sharp increase in the concentration of volatile fatty acids (vfa) such as acetic,

propionic and butyric, during the first days of ripening, followed by a decrease after 6 to 8 days (Graphs 4 to 6). When the water activity is high, lactic acid bacteria had a more efficient metabolism which leads to the production of vfa as secondary metabolites. The fermentative metabolic products of lactic acid bacteria are lactate, acetate and other short-chain fatty acids such as propionate and butyrate.

During ripening an increase in vfa occurrs due that water activity decreases during mold growth at the sausage casing surface. The production of this myceliar cover changes the redox conditions as well as water activity within the sausage and leads to fat and pigment oxidation, among other reactions. Molds, naturally occurring in casing surface during ripening, also promote fat and protein breakdown, which contributes to flavour and aroma.

Diamines contribute, in small amounts, to flavour and aroma, but can be also an indicator of spoilage. Lactic acid bacteria produce tyramine in dry and semi-dry sausages. During the first 12 days of ripening, diamine production was due to the presence of the inoculated lactic acid bacteria. After day 22, the increase in putrescine + cadaverine and tyramine could be associated with protein breakdown by fungal metabolism as well as by chemical reactions related to the decrease in water activity (Graphs 7 and 8).

CONCLUSIONS

Corn (fecula) starch formed a more stable and homogeneous gel than potato or pregelatinized corn starch. When a gel made with fecula starch was added to a comminuted meat product with further fermentation, the product had lesser cohesiveness and firmness, and was paler than the control. Volatile fatty acids and diamine production presented the same trend for the control than for the samples added with starch. This means that the studied samples had similar shelf-life than the control. In general, there were no statistical differences among the three treatments for any of the response variables studied.

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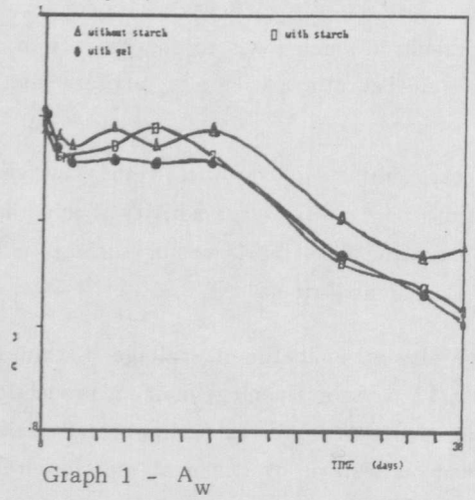
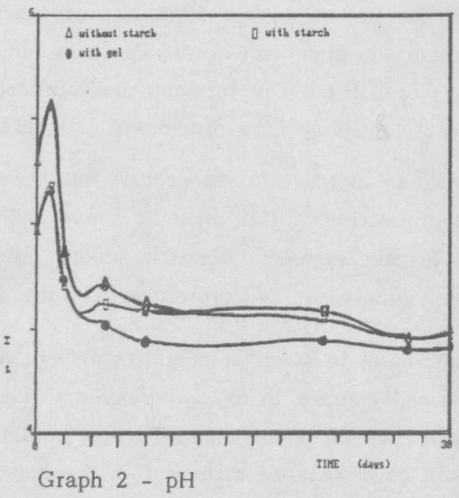
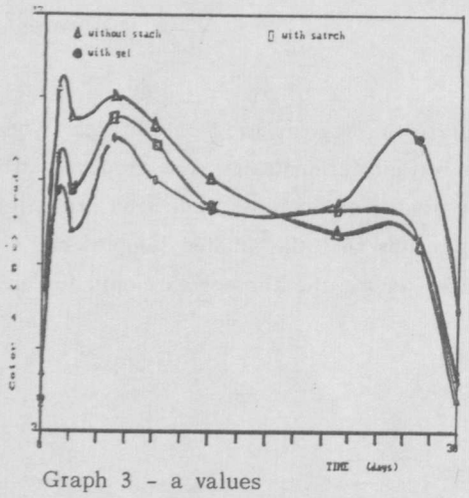


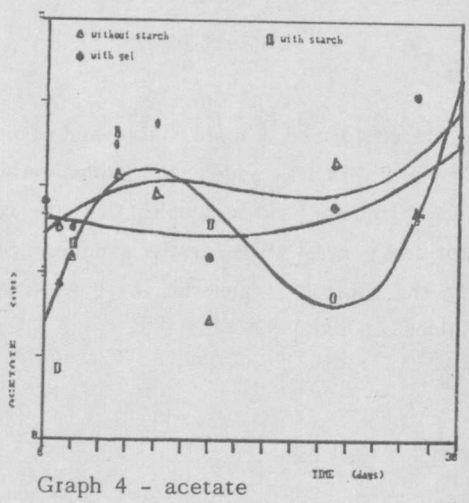
Graph 1 - A_w



Graph 2 - pH



Graph 3 - a values



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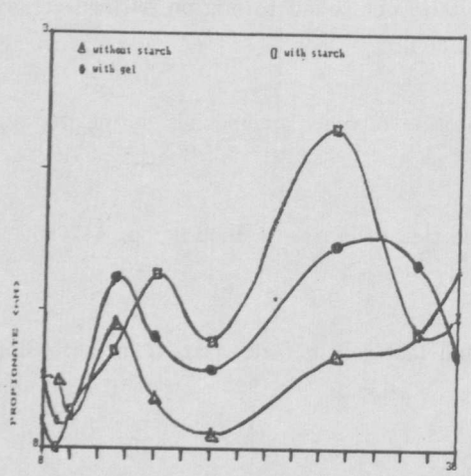
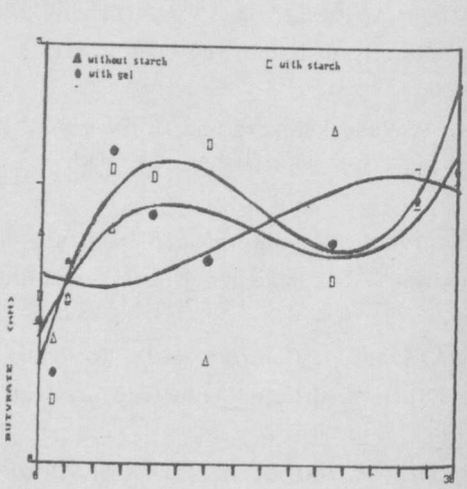
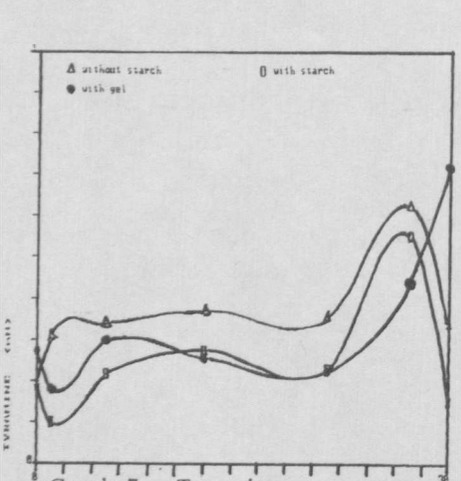


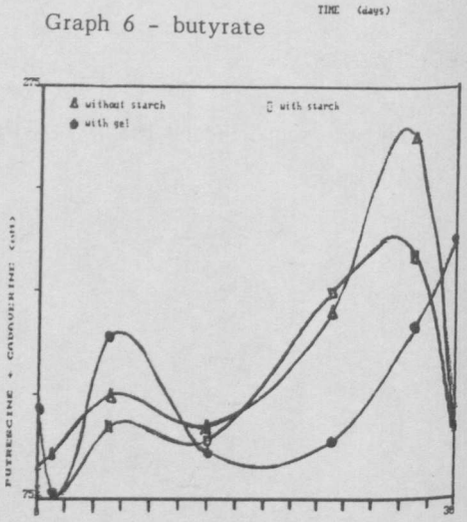
Graph 5 - propionate



Graph 6 - butyrate



Graph 7 - Tyramine



Graph 8 - Put+Cad