GAMMA IRRADIATION OF NATURAL PORK CASINGS

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BACKGROUND:

Natural pork casings are obligatory used in portuguese country-style sausages. Microbial load of fresh natural casings is too high, increasing the risk of meat paste contamination with pathogenic microorganisms which can induce foodborn diseases. As a matter of fact, the high contamination of natural casings by enteric and exogenous microbial flora is unavoidable.
The usual processing of the intestines doesn't ensure reliable hygienic quality (Labie, 1987).
The utilization of chemicals to improve bacteriological quality is quite common. Gabis *et al.* (1974) used acetic acid or sodium hydroxide to provide microbicidal acidic and basic pHs in brines and crystalline salt to destroy *Salmonella* in natural casings. Others chemicals such as lactic, tartaric and citric acids, hydrogen peroxide, ethanol are used as bactericidal agents alone or in combination. Unfortunately there are very few studies about the evaluation of their killing effects over the natural resident flora. It must be pointed out that the use of these chemicals is limited by the presence of toxic residues or by their negative effects in the technological characteristics of casings (reduced resistance and retractability).
Heat processing in water at 60°C of large pork intestine casings have been studied (Fraqueza, 1992) as an alternative to chemicals. Decimal reduction time ($D_{60°C}$) of the native aerobic mesophilic population was 5.38 minutes.
The introduction of a new step in natural casings technology to reduce the microbiological load and kill pathogenic microorganisms is badly needed.

OBJECTIVES:

The aim of this work is to improve the hygienic quality of natural pork casings, to evaluate the killing effect of gamma-radiation on the resident microbial and on some technological characteristics such as the resistance to bursting during the filling and cooking of a country-style blood sausage.

METHODS:

Pork intestines were stripped and washed to eliminate the fecal content. Pork casings were prepared from small intestine (small casing) and colon (large casing), packed in polylaminated bags under vacuum and stored at -20°C. Portions of small intestine and colon were irradiated with an absorbed dose of 5 and 10 kGy in a Co^{60} source. Microbiological analyses were made in five untreated and irradiated paired portions of small and large casings (total aerobic plate count, most-probable number (MPN) of coliform bacteria, fecal *Streptococci* and spores of sulfite-reduction *Clostridia* counts). All counts were expressed as logarithms of colony forming units per gram (log cfu/g).
Tests for resistance were performed on the following cooked blood country-style sausages manufactured with the above mentioned casings. Blood and rice sausages (Barreto *et al.*, 1990) were manufactured by thorough mixing of equal amounts of minced frozen mesentery fat (lymph nodes included), recently thawed bloody pork meat trimmings, liquid pork blood and pre-cooked drained rice with the following seasonings: 4% minced fresh coriander leaves, 2% minced fresh onions, 1.5% salt and 0.5% ground cumin seeds.
The paste was stuffed into small and large pork casings, untreated and irradiated. The sausages (20cm long) were loose fastened with cotton yarn, immediately scalded for 45 minutes in a water bath heated at 85°C, dried in air and cooled in the fridge at +2°C. The following day each sausage was packed in vacuum sealed polylaminated plastic pouches.

RESULTS AND DISCUSSION:

The effect of irradiation on the different microorganisms analyzed is presented in Table 1. Resident bacteria are always present in high numbers on natural pork casings (Antoine, 1989). The D_{10} value of mesophilic aerobic microorganisms found in the large casings was 2.60 kGy and in the small ones 1.51 kGy. This fact may be related with the higher fecal *Streptococci* content of the large casings. The coliform bacteria were found in large amounts in small and large casings, the radurization with 5 kGy was able to reduce at least 5 logs of these microorganisms. This absorbed dose induced a reduction of 4 logs of the fecal *Streptococci* counted in small and large casings. The D_{10} value determined for fecal *Streptococci* in large casings was 2.98 kGy.
The spore counts of sulfite-reduction *Clostridia* in the large casings were higher than in the small ones, the D_{10} value being 14.49 kGy; this figure is seven times higher than the D_{10} value reported in the literature (Urbain, 1986; Grecz *et al.*, 1983; Diehl, 1995). This fact may be related with the protection provided to spores by intestine structures.

Table 1: Effect of irradiation on the bacterial population of natural pork casings

	Small casings (n=5)			Large casings (n=5)		
Irradiation dose	0kGy	5kGy	10kGy	0kGy	5kGy	10kGy
Total aerobic (log cfu/g)	6.62	1.79	0.00	5.74	3.10	1.91
Coliforms (MPN/g)	5.20	0.00	0.00	5.40	0.00	0.00
Fecal *Streptococci* (log cfu/g)	4.46	0.00	0.00	5.13	1.68	0.00
Spores of sulfite-reduction Clostridia (log cfu/g)	0.12	0.00	0.00	1.23	1.21	0.54

Change in coloration have been produced by irradiation; the intensity of pink color being more important in small casing treated with the higher radiation dose. This change can be related with the oxygenation of the haemapigment (Zimmerman and Snyder, 1969) in the intestine wall.

The evaluation of casing resistance shows that all the sausages (irradiated and untreated) have supported the filling and heat treatment without bursting.

After cooling, the sausages stuffed in irradiated casings maintained the characteristics of appearance, color, odor, taste and texture of this country-style blood sausage and endured vacuum packing in thermo-sealed polylaminated plastic pouches for storage.

CONCLUSIONS:

Gamma-ray irradiation of pork intestines with 5 kGy is a convenient method to reduce contamination without impairing the resistance and retractability of those natural casings used in country-style blood sausages.

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