

Soybean Derivatives in the Sausage SHELF Life

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Introduction:

The use of soybean derivatives in the meat industries of our country is perfectly established. Soybean proteins are utilized as meat extensions (Kadane,1979). Commercial products, which contain these proteins and are commercialized as ingredients for the meat industry, such as soybean textured protein (50% of protein), concentrated (60% to 70% of protein) and isolated soybean (90% of protein) present a relatively complex composition. They also comprise other chemical substances which add other properties besides emulsifying and substituting meat (Kadane,1979;Kile et alii,1988). Peptides taken from the aqueous extract of soybean has been proved to stimulate the lactic flora thus reducing considerably the time of elaboration of the fermented meat products (Miyamoto et alii,1987; Terra and Martins,1986; Terra et alii,1987). Poliphenolic composites, which exist in the soybean derivatives, protect the fat of the meat products against oxidation (Berry et alii,1985; Pratt and Birac,1979; Ziprin et alii,1981). As everybody knows, those processes are extremely relevant when the sensorial and nutritional features of the sausage products are taken into account (Rhee and Smith, 1984; Sosulski,1979). Together with those chemical substances, that may be called "benefic" there are the oligosacaridic, potentially utilized by the microorganisms. If the microorganisms have a chance to develop, this development might reduce the life-time of the meat products (Kadane,1979).

The present research has the purpose of studying the effect of the concentrated (PS-60 and PS-70) and isolated of soybean (HG-90) into the shelf life of the sausage using as indicators some chemical and microbiologic aspects.

Methods and Materials:

Soybean Derivatives

The results of soybean PS-60 (60% of protein) and PS-70 (70% of protein) were obtained at Oliveira S.A. (Porto Alegre,RS). The soybean isolated HG-90 (90%) is being commercialized by Samrig S.A. (Porto Alegre,RS).

Sausage

Three parties of sausage were elaborated, each one containing 2% of PS-60 (I), 2% of PS-70(II) and 2% of HG-90 (III) respectively. Basic components were swine meat (70%), leather emulsion (5%) and chicken meat mechanically separated (10%), fat (15%), iced water (10%), prague dust (0,3%) refined sodium chlorate (0,3%), Krakoline II (0,2%), fixing material A-80 (0,2%) and starch (2%).

Internal temperature of cooking reached + 72°C. Parties were done according to the normal procedure used in the local refrigerated sites and were stored in portions of 300 g in bags of saran under vacuum and refrigerated at + 5°C. In the zero moment and at each week sample were taken. Those samples were submitted to chemical, microbiologic and sensorial analysis.

Kreiss Reaction

It was done on the fat taken from the samples of sausage heated at 70°C under a nitrogen current. Development of red color has indicated the presence of aldehyde epihidrinic as a consequence of fat oxidation (Terra and Brum, 1988).

pH

It was determined over the homogeneized of the sample with destiled water, using a pH measurer, Digimed, according to a technic described by TERRA and BRUM.(1988).

Mesophilus and Psychrotrophic Aerobic Bacteria

Twenty five g of the samples were weighed aseptically in sterilized and homogeneized recipients

in a liquidifier with a sterile glass, where 225 ml of buffered water pH 7,2 sterilized were utilized as diluent. The purpose was to obtain an initial dilution of 10^{-1} . From the initial dilution decimal dilutions were made, with the same diluent (International Commission on Microbiological Specifications for Foods, 1981). The standard agar and 48 h at 35°C incubation were utilized for the counting of mesophilic bacteria. For the counting of the psychotrophic bacteria the temperature of 7°C, during 10 days was utilized (American Public Health Association, 1984).

Sensorial Analysis

Ten tasters, who were previously trained, attributed grades ranging from 0 to 9, weekly, the features which were judged were color, aroma, flavour and texture presented by the different samples of sausage. Sausages were offered to the tasters after they were immersed into boiling water for five minutes (Chaves, 1980).

Results obtained were submitted to statistical analysis (Test of Friedman, χ^2 of Friedman) (Campos, 1983).

Results and discussion:

The concentrated and the isolated of soybean are largely utilized in the manufacturing of sausage with the purpose of emulsifying the fats. Such capability is a consequence of the high amount of soluble protein presented in their composition. However, they present other constituents, among them the oligosaccharide which could be utilized for the development of bacteria with the consequent decrease of the "shelf life" of the sausage.

TABLE 1

Until the 2nd week of storage the bacterial development was modest (Table 1). However, in the 3rd week the sausage containing PS-60 presented a bacterial counting of 10^8 ufc/g - more than the recommended limits prescribed by the ministry of Agriculture of our country. This bacterial development caused a fall in the pH to 6,21, below the initial pH which was 6,43 (Table 2).

TABLE 2

The sausage containing PS-70, in spite of the fact of having a bacterial population not more than 10^6 ufc/g has shown a decrease in its pH to 6,19 (Table 2).

Only in the 5th week of storage the sausage with HG-90 showed a microbial counting of 10^8 ufc/g with a decrease in its pH.

The velocity of the fall of pH was different for the sausage according to its emulsifier; however the pH at the end of the 6th week were very near for the sausages with PS-70 and HG-90 (Table 2).

TABLE 3

During the sausage storage, there is the risk of oxidation of its fat because sausage is a meat product with a high level of lipids which is under light exposition and a high level of oxygen. If this occurs (the oxidation) it changes the color, aroma and taste of the sausage (Rhee and Smith, 1984; Sosulski, 1979).

None of the sausage samples has presented positive Kreiss reaction (Table 2). All the formulas have presented good sensorial characteristics with the tasters giving grades that were not different statistically at 5% level (Table 3). The highest mean corresponded to the sausage elaborated corresponded to the sausage elaborated with HG-90 and the lowest to the sausage with PS-60. However, they were not statistically different.

From the 3rd week on all the parties of sausage presented a bacterial population superior to the recommended; however they had adequate sensorial characteristics. Such facts are similar to the ones reported by TERRA and MARTINS (1986), TERRA et alii (1987) and MYAMOTO (1987). They have studied the stimulant action of the existent active principle on soybean as well as the effect

anti-oxidant of the poli-phenol on the fats of the sausage (Berry et alii, 1985; Pratt and Birac, 1979; Rhee and Smith, 1984; Sosulski, 1979; Ziprin et alii, 1981). It seems that it is not a good practice to characterize the quality of the meat products through a simple counting of the mesophil aerobic bacteria.

Conclusion:

The sausage with PS-60 presented a bacterial development which was faster than the others probably because it had a larger quantity of oligosaccharide such fact did not happen with the sausage elaborated with PS-70 that, even possessing more oligosaccharide than the HG-90 has not presented the corresponding bacterial development.

REFERENCES

- AMERICAN PUBLIC HEALTH ASSOCIATION - Compendium of methods for the microbiological examination of foods. 2 ed. Ed. M.L. Speck, Washington, D.C., APHA, 1984.
- BERRY, B.W.; LEDDY, K.F. & BODWELL, C.E. - Sensory characteristics, shear values and cooking properties of ground beef patties extended with iron and zinc fortified soy isolate, concentrate or flour. J. Food Sci. 50: 1556-59, 1985.
- CAMPOS, H. de - Estatística experimental não paramétrica. Piracicaba. 1983. 349 p.
- CHAVES, J.B.P. - Avaliação sensorial de alimentos. Viçosa. Imprensa Universitária da Universidade Federal de Viçosa. 1980, 69 p.
- INTERNATIONAL COMMISSION ON MICROBIOLOGICAL SPECIFICATIONS FOR FOODS- Microorganismos de los alimentos, Zaragoza, Acribia, 1981. v.2, 215 p.
- KADANE, V.V. - Vegetable proteins in cooked and or fermented sausages. J. Am. Oil Chem. Soc. 56: 330-339, 1979.
- MIYAMOTO, T.; HIRATA, N. & NAKAE, T. - Isolation from soy milk of a growth-stimulating substance for lactic acid bacteria. Jpn. J. Zootech. Sci. 58: (9): 754-763, 1987.
- PRATT, D.E. & BIRAC, P.M. - Source of antioxidant activity of soybeans and soy products. J. Food Sci. 44: 1720-1722, 1979.
- RHEE, K.S. & SMITH, G.C. - Effects of sodium tripolyphosphate and ascorbic acid added with glandless cottonseed flour to ground beef. Journal of Food Protection 47 (3): 182-188, 1984.
- RICE, D.R.; NEUFER, P.A. & SIPOS, E.F. - Effects of soy protein blends, fat level, and cooking methods on the nutrient retention of beef patties. Annual Meeting of the Institute of Food Technologists, New Orleans, June 19-22, 1988.
- SOSULSKI, F. - Organoleptic and nutritional effects of phenolic compounds on oilseed protein products: a review. J. Am. Oil Chem. Soc. 56: 711-716, 1979.
- TERRA, N.N. & MARTINS, J.F. - The soya protein in dry sausage industry. European Meeting of Meat Research workers, 32nd, 1986. Proceedings III.
- TERRA, N.N.; VALENTE, C.R.; FROSI, V. & STOFFELS, I.M. - The action mechanism of the soy protein in the dry sausage. European Meeting of Meat Research Workers, 33rd, 1987. Proceedings II.
- TERRA, N.N. & BRUM, M.A.R. - Carne e seus derivados. São Paulo. Nobel, 1988.
- ZIPRIN, Y.A.; RHEE, K.S.; CARPENTER, Z.L.; HOSTETLER, R.L.; TERRELL, R.N. & HILL, R.C. - Glandless cottonseed, peanut and soy protein ingredients in ground beef patties: effect on rancidity and other quality factors. J. Food Sci. 46: 58-61, 1981.

Table 1. Average values of the number of mesophylus aerobic bacteria andpsichrotrophic aerobic bacteria of the sausages elaborated with the soybean derivatives which are stored under refrigeration (+ 5°C).

Time (week)	Mesophylus aerobic bacteria (ufc/g)			Psichrotrophic aerobic bacteria (ufc/g)		
	PS-60	PS-70	HG-90	PS-60	PS-70	HG-90
0	1,4 x 10 ⁴	7,2 x 10 ³	5,3 x 10 ³	5,9 x 10 ²	4,0 x 10 ²	7,0 x 10 ²
1	2,9 x 10 ⁵	4,3 x 10 ⁴	3,1 x 10 ³	3,1 x 10 ⁵	2,2 x 10 ³	4,0 x 10 ³
2	9,0 x 10 ⁵	7,2 x 10 ⁴	3,4 x 10 ⁵	1,3 x 10 ⁶	4,0 x 10 ⁴	6,5 x 10 ⁵
3	2,7 x 10 ⁸	1,0 x 10 ⁶	8,2 x 10 ⁶	2,8 x 10 ⁸	1,2 x 10 ⁶	9,3 x 10 ⁶
4	2,5 x 10 ⁸	6,0 x 10 ⁶	8,9 x 10 ⁶	2,5 x 10 ⁸	2,2 x 10 ⁶	1,0 x 10 ⁷
5	4,1 x 10 ⁸	2,7 x 10 ⁸	4,8 x 10 ⁸	4,2 x 10 ⁸	2,4 x 10 ⁸	4,2 x 10 ⁸
6	5,2 x 10 ⁸	2,1 x 10 ⁸	2,7 x 10 ⁸	8,9 x 10 ⁸	2,1 x 10 ⁸	3,0 x 10 ⁸

Table 2. Average variation of pH and reaction of Kreiss of the sausages elaborated with different soybean derivative which are stored under refrigeration (+ 5°C).

Time (week)	pH			Reaction of Kreiss		
	PS-60	PS-70	HG-90	PS-60	PS-70	HG-90
0	6,43	6,32	6,36	(-)	(-)	(-)
1	6,43	6,32	6,36	(-)	(-)	(-)
2	6,43	6,32	6,36	(-)	(-)	(-)
3	6,21	6,19	6,36	(-)	(-)	(-)
4	6,10	6,19	6,36	(-)	(-)	(-)
5	5,66	6,19	6,11	(-)	(-)	(-)
6	5,55	5,87	5,89	(-)	(-)	(-)

Table 3. Average of the grades attributed by the tasters to the sausages elaborated with the different soybean derivatives which are stored for 6 weeks under refrigeration (+ 5°C).

Soybean derivative	Atribut	Time (week)						Average
		0	1	2	3	4	5	
PS-60 (I)	Color	7,85 ^a	7,28 ^a	7,66 ^a	7,75 ^a	7,14 ^a	8,27 ^a	7,70 ^a
	Aroma	7,85 ^a	7,28 ^a	7,16 ^a	7,25 ^a	7,00 ^a	7,28 ^a	7,36 ^a
	Flavor	7,28 ^a	6,42 ^a	7,50 ^a	7,62 ^a	7,42 ^a	6,71 ^a	7,13 ^a
	Testure	7,85 ^a	7,14 ^a	7,66 ^a	7,62 ^a	7,28 ^a	8,00 ^a	7,61 ^a
PS-70 (II)	Color	7,85 ^a	8,00 ^a	8,00 ^a	7,62 ^a	7,00 ^a	8,00 ^a	7,72 ^a
	Aroma	7,42 ^a	7,71 ^a	7,33 ^a	7,62 ^a	7,00 ^a	7,28 ^a	7,39 ^a
	Flavor	6,57 ^a	7,14 ^a	7,60 ^a	7,37 ^a	7,57 ^a	6,86 ^{ab}	7,10 ^a
	Testure	7,71 ^a	7,57 ^a	8,00 ^a	7,37 ^a	7,71 ^a	8,14 ^a	7,71 ^a
HG-90 (III)	Color	7,71 ^a	8,00 ^a	7,16 ^a	7,75 ^a	7,71 ^a	8,14 ^a	7,74 ^a
	Aroma	7,00 ^a	7,57 ^a	7,16 ^a	7,12 ^a	7,28 ^a	8,00 ^a	7,37 ^a
	Flavor	6,57 ^a	7,42 ^a	6,83 ^a	7,25 ^a	7,14 ^a	8,00 ^b	7,19 ^a
	Testure	7,57 ^a	7,71 ^a	7,16 ^a	8,00 ^a	7,71 ^a	8,28 ^a	7,75 ^a

(*) The results which have the same letter have not differed significantly at 5% level.