

## EFFECT OF SELECTED HERBS ON pH OF RAW SAUSAGE

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### Background.

The decrease of pH as a result of activities by lactic acid bacteria (Liepe, 1989; Weber, 1994) is the basic physico-chemical change during ripening of raw sausages which affects the forming of the colour and aroma of the product, release of water during drying, linking of meat pieces and consolidation of the filling (Coretti, 1971; Flores, 1996; Vukovic, 1998). Some natural spices stimulate the microflora of raw sausages to produce lactic acid (Nes and Skjelkvale, 1982). Zaika and Kissinger (1984) establish that spices contains manganese which stimulates bacteria to produce lactic acid.

The objective of this work was to examine the effect of herbs of the family Lamiaceae – marjoram, basil, savory and rosemary – on the pH during ripening of raw sausages.

### Materials and methods.

Raw sausages were made from pork (35%) and beef (35%), and fatty tissue of pigs (30%), which were frozen to -18°C three days before use. It was added 26g of nitrite curing salt, 3g of dextrose and 3g of saccharose per kilo of mass. Also, it was added 0.1%, 0.3% and 0.5% of marjoram (*Majorana hortensis* Moench.), basil (*Ocimum basilicum* L.), savory (*Satureja hortensis* L.), and rosemary (*Rosmarinus officinalis* L.) to raw sausages. Control groups of sausages did not contain herbs. Before use, the herbs were ground and analyzed for the content of etherial oils (ISO, 6571/84 E) and manganese (Ellis, 1991). After the mass was filled into artificial collagen casings  $\phi$ 50mm, the sausages were maintained for 10 hours at 15°C, and then fermented for 7 days at 18-20°C, and then dried for 21 days at 14°C. The sausages were lightly smoked between days 2 and 5 of ripening. The pH value of raw sausages was measured on days 1, 7, 14, 21, and 28 of ripening with "Iskra" pH-meter using a "Cole Parmer" special glass electrode, with was previously calibrated at pH 7.00 and 4.01 (ISO, 2917/74). The number of lactic acid bacteria, expressed in the number of lactobacilli, was determined on MRS-agar at 30°C (De Man et al., 1960). The results are expressed as the average value of three examinations.

### Results and discussion

The effect of basil, savory, marjoram and rosemary on the pH of raw sausages is presented in figures 1, 2, 3, and 4.

Initial pH values of raw sausages were from 5.6 to 5.9, which is the usual for this type of product (Coretti, 1971). During ripening of raw sausages, pH values measured in sausages with added herbs were lower than in sausages without these herbs. Especially low pH values were determined in raw sausages with 0.3% and 0.5% herbs. At the end of ripening, the lowest pH values were measured in raw sausages with 0.5% herbs: in sausages with basil and savory 4.9, in sausages with marjoram 5.0, and in sausages with rosemary 5.1, while the pH of raw sausages made without herbs was between 5.1 and 5.3.

Low pH values in raw sausages coincide with the ripening period when the number of lactobacilli in sausages reaches its maximum ( $10^7/g$  to  $10^9/g$ ). However, it must be pointed out that no significant differences were established in the maximum number of lactobacilli between raw sausages made with herbs and raw sausages without herbs.

Zaika and Kissinger (1984) believe that manganese which is contained in herb residue after extraction of oleoresins, which could possibly inhibit lactic acid bacteria, stimulates these bacteria to produce lactic acid in raw sausages. Oleoresins were not extracted from the herbs used in this work, and the determined quantity of manganese in them was 60.7 mg/kg in marjoram, 54.7 mg/kg in savory, 31.5 mg/kg in basil, and 15.0 mg/kg in rosemary.

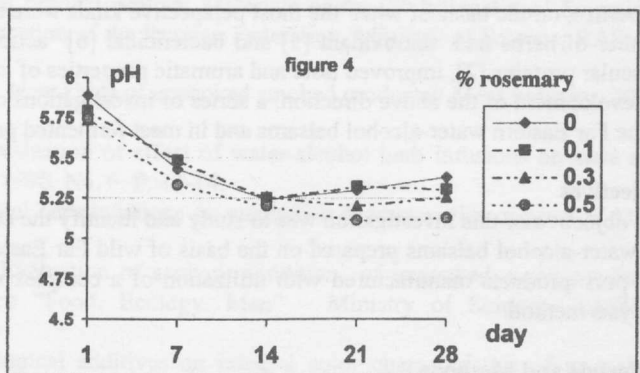
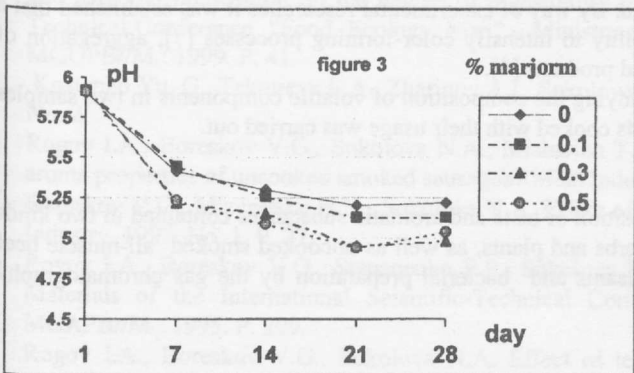
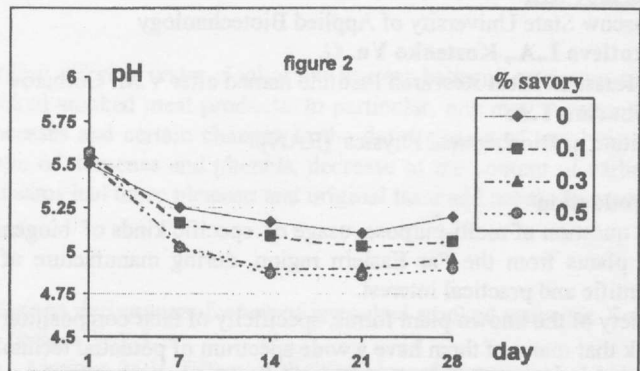
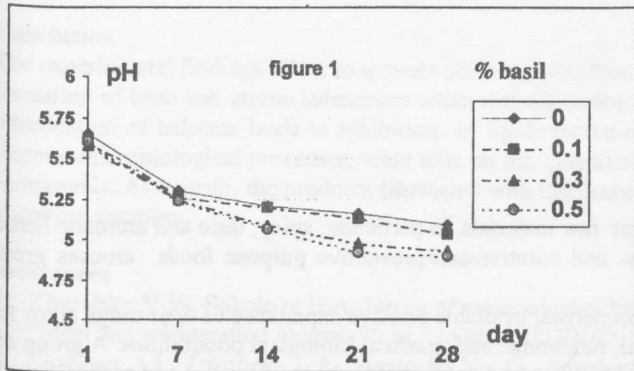
### Conclusion

It can be concluded on the basis of the results of these investigations that marjoram, savory, basil and rosemary affect a decrease of raw sausages during ripening, in particular in quantities from 0.3% to 0.5%, without essentially affecting the changes in the number of lactic acid bacteria.

### References.

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Effect of selected herbs on pH of raw sausages:  
basil (1), savory (2), marjoram (3) and rosemary (4).



Analysis of the qualitative and quantitative composition of volatile compounds of marjoram and rosemary showed that the main components were found by volatile liquid chromatography and mass spectrometry. Some compounds may be metabolized in the course of ripening. As concentration of volatile compounds in the acid balance is not high, their role in forming the odor of cooked products is probably not so significant. The fact that certain volatile compounds are contained in their effect, and the role of certain products is not clearly defined. The presence of some volatile compounds in marjoram and rosemary is not clearly defined. The presence of certain volatile compounds in marjoram and rosemary is not clearly defined. The presence of certain volatile compounds in marjoram and rosemary is not clearly defined.

Compound	Control		No. 1		No. 2		No. 3		No. 4	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Acetic acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Propionic acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Butyric acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Valeric acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Hexanoic acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Heptanoic acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Octanoic acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Nonanoic acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Decanoic acid	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0