

Effects of Rosemary and Dodecilgalat on Fat Stability of Grill Sausages Kept in Cold Storage  
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SUMMARY: The effects of two antioxidants - rosemary and dodecilgalat, on grill sausages kept in storage at the temperature of  $+4^{\circ}\text{C}$  during the period of 7 days were examined. The obtained results show that undesirable changes of fat develop much faster in sausages without antioxidants than in those containing antioxidants. Here, rosemary appeared to be somewhat more efficient in preventing oxidation of fat than dodecilgalat. When storage was ended, sensory properties of sausages without antioxidants were evaluated as bad, primarily because of the changed taste and aroma. No significant changes were found in sensory properties during storage of sausages containing antioxidants. Sausages with rosemary were evaluated somewhat better than those containing dodecilgalat.

INTRODUCTION: It is well-known that during storage of minced meat products very soon appear oxidative changes in fat, causing negative effects on their taste and aroma. Because of these, their shelf-life is limited during storage in cold or frozen state.

PEARSON et. al. (1977) pointed out by mincing the meat the membranes of muscle cells become destructed and as a result oxygen is incorporated in them. Phospholipides from membranes come in touch with oxygen and also with other catalysts from tissue (enzymes, hemopigments, ions of metals and others) are very quickly subject to oxidation. Added salt also quickens oxidative changes of fat in meat products (STOICK et.al., 1989 and others).

Use of antioxidants can very efficiently prevent oxidation of fat. Various antioxidants (natural and synthetic ones) can be used. Synthetic antioxidants, however, can have a negative effect on the processes of metabolism in the organism; in view of this, there is an increasing use of natural antioxidants which are also frequently found in some spices. One of these is rosemary. Rosemary is a plant growing in the Mediterranean coastal areas. It is used as a spice and as a preservative in various dishes and meat products.

A great number of authors found rosemary to have a very favourable effect on slowing down the process of oxidation of fat in various meat products (OŠTRIĆ-MATIJAŠEVIĆ, 1962, BARBUT et.al., 1985, KORCZAK et. al., 1988, and others).

The primary objective of this work was to make a comparative examination of effects of rosemary and synthetic antioxidant dodecilgalat on fat stability and sensory properties of grill sausages.

MATERIALS AND METHODS: The primary make-up of the grill sausages included pork, category B - 77% and fatt tissue - 23%. Meat and fatt tissue were minced in the meat grinder wolf at

the grinding plate with holes  $\varnothing$  8 mm. The minced meat mix was added by salt, sugar, black pepper and garlic. All the ingredients were mixed in the meat mixer. The stuffing was divided into three portions. The first portion was added 0,01% of dodecilgalat (DDG), the second portion was added 0,2% of grinded rosemary, while the third portion was a control one.

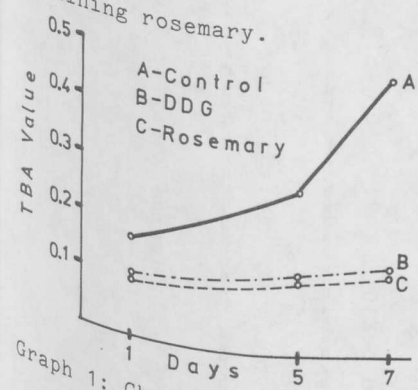
The stuffing was filled into small pork intestines of  $\varnothing$  32 mm to 34 mm. The sausages were kept in plastic bags and stored in the refrigerator at  $+4^{\circ}\text{C}$ . Samples for testing were taken after the 1-st, 5-th and 7-th day of storage.

The sample testing included changes in fat, evaluation of sensory properties and changes of total aerobic bacterial count. The changes in fat were followed by TBA value, peroxide number and acid number (PAREZANOVIĆ et.al., 1970). The TBA value was determined by spectrophotometric measurement of optical density of acid fat extract at 532 nm. The content of fatty acids was also tested by means of gas chromatography (gas chromatograph Varian 1400 with FID detector).

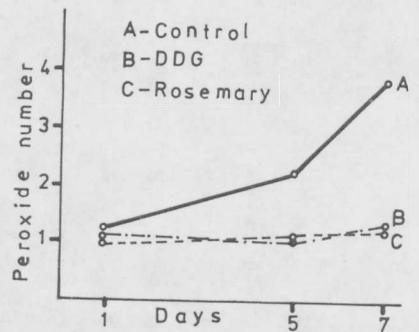
Prior to the organoleptic test, the sausages were heat treated on a grill for 10 minutes. The organoleptic evaluation of the samples was conducted by a five-member board. The point rating system ranging from 1 to 5 points was applied. The mark 5 was designated as "excellent" and 1 was "very bad", and 3 was taken as a limit of acceptability.

The plate count agar was used to determine the total aerobic bacterial count.

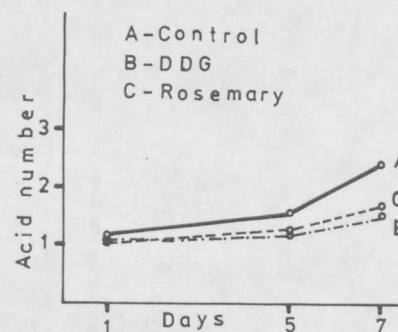
**RESULTS AND DISCUSSION:** On the basis of data on changes of TBA values (absorption) some differences were found between the samples with and without antioxidants (Graph 1). In the control samples a significant increase of TBA value (about 0.300 was found. However, in samples with 0.01% DDG and in those with 0.2% of rosemary the increase of TBA value was very small (about 0.040). Very small differences in TBA values were between samples with DDG and those containing rosemary.



Graph 1: Changes of TBA values



Graph 2: Changes of peroxide number



Graph 3: Changes of acid number

After the seventh day of cold storage, control samples had the biggest peroxide number, that is, the increase of this number in relation to the initial value was about 3 times (Graph 2). In samples containing antioxidants the peroxide number was increasing much slower.

In samples containing DDG it was about 1.12 time bigger in relation to the initial value, while in samples with rosemary it was bigger for 1.06 time.

On the basis of results obtained during the analysis of the acid number (Graph 3) it can be noticed that the increase of this number was somewhat slower in samples containing antioxidants than in the control ones.

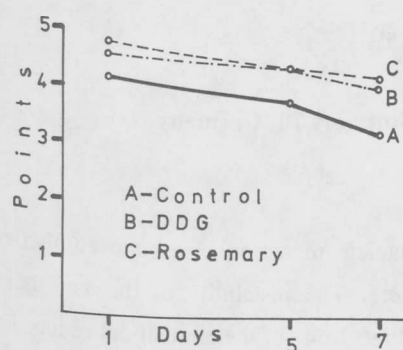
Table 1 shows the results of the analysis of the fatty acids content during the seven-day storage at +4°C. The obtained data indicate that the content of most fatty acids did not significantly change in relation to the tested samples with and without antioxidants, or during the testing period. In some samples the biggest changes during the seven-day testing period occurred in the content of stearic and oleic acids. Namely, during storage the quantity of stearic acid in control samples decreased from 13.1% to 11.8% while the oleic acid content increased from 43.5% to 46.7%. In samples containing rosemary a decrease of stearic acid content (from 13.9% to 12.4%) was also observed; at the same time, the oleic acid content increased (from 43.7 to 45.2%). In samples added by DDG, however, the content of stearic and oleic acids was not changed. As compared with control samples and samples containing rosemary, in the ones with DDG the stearic acid content significantly decreased and oleic acid increased at the beginning of testing.

Data on organoleptic evaluation (Graph 4) show that all control samples were the worst. Namely, at the end of testing these samples were designated the mark which was almost at the

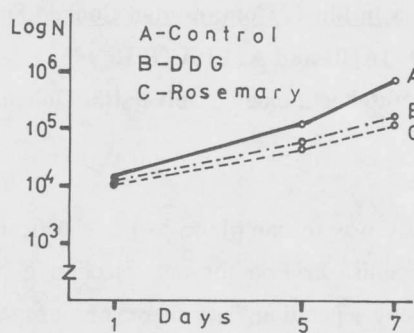
Tabl. 1. Changes of fatty acids content (%)

Fatty acids	Dodecylgalat			Rosemary			Control		
	I	II	III	I	II	III	I	II	III
10:0	0,3	0,4	0,2	0,2	0,3	0,3	0,4	0,5	0,2
12:0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
14:0	1,4	1,5	1,5	1,6	1,5	1,3	1,3	1,4	1,5
16:0	26,7	26,2	27,3	26,4	25,9	26,3	26,0	26,0	25,1
16:1	2,6	2,7	2,9	2,1	2,6	2,7	2,7	2,1	2,0
17:0	0,1	0,3	0,2	0,2	0,1	0,2	0,4	0,2	0,2
17:1	0,1	0,3	0,1	0,2	0,1	0,2	0,4	0,2	0,2
18:0	9,4	10,5	9,0	13,9	11,7	12,4	13,1	11,5	11,8
18:1	47,6	46,0	47,9	43,7	45,5	45,2	43,5	46,0	46,7
18:2	10,6	10,7	10,0	10,7	11,1	10,3	11,1	10,8	11,0
18:3	0,6	0,6	0,5	0,5	0,5	0,5	0,5	0,6	0,4
20:0	0,2	0,2	0,1	0,2	0,3	0,2	0,3	0,3	0,3
20:1	0,2	0,2	0,1	0,2	0,2	0,2	0,1	0,3	0,2

I - 1st day; II - 5th day; III - 7th day.



Graph 4: Sensory quality of grill sausages



Graph 5: Dynamics of total bacterial count

limit of acceptability. Such a low mark was effected by unfavourable changes of taste and aroma. Samples with antioxidants were much better evaluated than the control samples, and samples containing rosemary were somewhat better than those containing DDG.

Our results regarding positive effect of rosemary on keeping quality of grill sausages are in compliance with those obtained by OŠTRIC-MATIJAŠEVIĆ (1962).

The results of the bacteriological test of total bacterial count are presented in Graph 5. The obtained data show that at the beginning of testing in all samples the total bacterial count was approximately the same and that it gradually increased during storage. A somewhat bigger increase of the total count was observed in the control samples.

**CONCLUSIONS:** Rosemary and dodecylgalat significantly slow down unfavourable changes of fat in grill sausages kept in cold storage. Here, a somewhat more favourable effect was shown with rosemary. Sensory properties of samples with rosemary content were evaluated the best. In control samples and samples with rosemary some bigger changes appeared in oleic and stearic acids.

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