

## INTENSIFICATION OF PROCESSING TECHNOLOGY OF RUSSIAN TRADITIONAL RAW SAUSAGES

Lubchenko V.I., Korshunova T.N., Kuznetsova T.G., All-Russian Meat Research Institute after V.M. Gorbатов  
Talalikhina 26, 109316, Moscow, Russia

To intensify the production process of raw sausages (RS), improve their taste and aroma a possibility of combined use of carbohydrate components (CC) and wine-alcohol composition (WAC) was studied.

Previous investigations showed good prospects and usefulness of carbohydrate components (glucose and maltodextrins with glucose equivalent from 13 to 20% in a ratio 1:1) in the amount from 1.0% to 1.2% and the wine-alcohol composition (with the extract of oak wood) from 0.5% to 1.0% in the production of raw sausages.

### Purpose of investigations

Investigations of combined use of carbohydrate components and wine-alcohol composition on changes of physical, biochemical, microstructural characteristics of raw sausages and state of lipids of sausages during storage.

### Object and method of investigations

In production of RS the levels of additives for combined use were as follows:

Experiment 1 – CC – 1.0% + 1.0% WAC; experiment 2 – 1.2% + 0.7% WAC, control – without additives.

Mass fraction of moisture in raw sausages was determined with the help of the instrument "LPVMM-1", pH was determined in water extracts on a potentiometer pH-340 and with the help of a portable instrument pH-meter, model 2696. Microstructural investigations: the specimens were fixed with a 15% solution of neutral formalin during 48 hours at a room temperature according to generally accepted procedure. The sections were prepared on microtome-cryostat MK-25 with the thickness 20-25  $\mu\text{m}$ . The obtained sections were stained by hemotoxilin according to Erlich with further staining by 0.5% solution of eosin. To reveal localization of fat the sections were stained with an alcohol solution of Sudan 3. The investigations were carried out with the help of a light microscope "Jenoval" (Germany) with a camera attachment "Pentacon" with 400-magnification.

In the process of drying in the samples were determined titratable acidity, the content of free fatty acids, the sum of carbonyl compounds. During a 4-month storage in the sausage samples were determined the value of acid number of fat, the value of peroxide number as well as the degree of acidity of fat – thiobarbituric value.

### Results and discussion

The pattern of pH value change was identical in all the samples, but in the experimental ones pH lowering during maturation was more intensive because the presence of easily splitting substrate – carbohydrate – caused enzymic activity of acid-forming groups of microorganisms, whose metabolism products increased acidity of sausage meat. The minimum value of pH was at 7-10 days of drying (4.86; 4.89 in the experiments; 5.08 – in the control). In the final product of the experimental samples the values of pH are also lower (in the experiments – 5.21; 5.25; in the control – 5.45). An increase in acidity of sausage meat led to a decrease of moisture binding capacity of meat proteins and as a consequence – more intensive dehydration of raw sausages during processing that was seen from the analysis of drying process. Combined use of CC and WAC (experiments 1 and 2) made it possible to accelerate the process of drying of raw sausages and achieve a specified content of moisture on the average by 5 days earlier than in the control.

Investigations characterizing the influence of combined use of CC and WAC on biochemical indices of raw sausages are presented in Fig. 1.

Analysis of findings obtained shows that combined use of additives in drying of RS enhances biochemical reactions and as a consequence a larger accumulation of free fatty acids in the experiments, the sum of carbonyl compounds, increase of the characteristic of titratable acidity after smoking and during the whole period of drying, and also stabilizes changes of these characteristics in periods of their falling. Thus at the end of drying process in the experimental samples 1 and 2 concentration of free fatty acids is by 12.3% and 12.9%, respectively (on the average by 12.6%) higher; and the sum of carbonyl compounds – by 28.85 and 30.8%, respectively, (on the average by 29.8%) are higher than in control samples.

Analysis of change of free fatty acids and the sum of carbonyl compounds between experimental samples indicated an insignificant quantitative exceeding of these substances at the beginning of drying in the samples of experiment 2, but by its end their content in the samples of both experiments was practically identical. Thus, differences in accumulation of FFA in experimental samples at the beginning of drying were 1.6 mg/%, and at the end – 0.3 mg/%.

It should be noted that combined use of CC and WAC had a positive influence on dynamics of change of TA (the growth of this characteristic in experimental samples was going till 20 days, while in the control sample – up to 15 days). The increase of the index of titratable acidity (potentially acid radicals) in raw sausages has a stabilizing influence on quality of RS and has a specific role in ensuring safety of products.

Histological investigations were used to study microstructural changes of raw sausages of experimental and control samples during maturation and drying.

The obtained data have shown that after setting and smoking the experimental samples of sausages had a thinner and denser surface layer, consisting of packed fine-grain protein mass and reduced in volume, thinned muscle fibers, pronounced cross striation. The thickness of a surface layer in the control reached 450  $\mu\text{m}$ , while in the experiments 1 and 2, respectively, 300  $\mu\text{m}$  and 315  $\mu\text{m}$ , which pointed out to a more uniform removal of moisture in these samples.

Studies of internal layers of meat mass of the experiment and control showed some differences in their structure. Experimental sausage samples had a deeper level of homogenization and destruction of initial raw materials, increase in the amount of fine-grain protein mass, decrease in porosity and increase of interconnection of meat mass elements, intensive development of lactic-acid microflora as compared to controls (in the experiments up to 120-125 microcolonies in the field of view, while in the control up to 50).

After drying, the experimental samples had a similar structure and some structural peculiarities as compared to control. In deep layers large bundles of muscle tissue were formed from fibers, laying loosely in relation to each other, the latter were homogenous, often joined, while in the control samples groups of fibers with insignificant degree of destruction were found together

with homogenous muscle fibers. Fine-grain protein mass of experimental samples was denser, pierced with vacuoles of predominantly average size (250  $\mu\text{m}$ ), clearly shaped; the fiber component of connective tissue was homogenous, while in the control the fine-grain protein mass was less compact, somewhat separated with large and mean vacuoles (average diameter – 600  $\mu\text{m}$ ), large and average fat drops; in connective tissue fragments only an increase of degree of swelling of fiber components was observed.

The observed peculiarities of structure of the samples suggest more active processes of forming of a spatial framework in the experimental samples, that were followed with intensive destruction of cellular structure of tissue and also developing in earlier time as compared to controls.

Results of investigations of oxidative and hydrolytic lipids changes of raw sausages during 4 months are presented in Table 1.

As follows from the experimental data, general dynamics of development of processes of oxidative-hydrolytic change of sausages lipids was similar in all the samples. It was noted that combined use of CC and WAC led to a noticeable slowdown of the velocity of accumulation both the free fatty acids and the primary oxidation products. One should note the fact that there were no considerable differences in the concentrations of oxidative-hydrolytic changes of lipids between samples of the experiments 1 and 2.

Table 1

Oxidative-hydrolytic changes in lipids of raw sausages during storage

Storage time, (months)	Characteristics								
	Peroxide number, % iodine			TBV, mg/kg			Acid number (mg KOH per 1 g of fat)		
	Contr.	Exp. 1	Exp. 2	Contr.	Exp. 1	Exp. 2	Contr.	Exp. 1	Exp. 2
0	0	0	0	0	0	0	2.17	1.45	1.53
1	0.017	0.011	0.013	0	0	0	4.53	3.50	3.57
2	0.041	0.023	0.024	0	0	0	6.68	4.42	4.39
3	0.124	0.097	0.086	0.01	0	0	9.11	6.48	6.44
4	0.181	0.105	0.110	0.06	0	0	11.61	7.49	7.43

The table presents average values, standard deviation did not exceed 7% of the average value.

It should be also noted that in the control samples, as distinct from the experimental ones, malonic aldehyde (TBV = 0.01 mg/kg) was observed that suggested about more pronounced oxidative changes in a fat part of control samples of sausages during storage. Results of sensory evaluation have shown that the experimental samples had more saturated flavour and aroma, denser grained structure, good colour profile.

#### Conclusion

It can be concluded that combined use of carbohydrate components and wine-alcohol composition in the processing technology of sausages assists in more intensive dehydration of sausage meat, five days earlier drying, improvement of acid production, better formation of their structure that were manifested in stronger destructive changes and more pronounced arrangement of structural components during maturation and drying, as well as the pronounced accumulation of substances of flavour-aroma profile and some inhibiting effect on the processes of oxidative-hydrolytic changes in lipids of raw sausages.

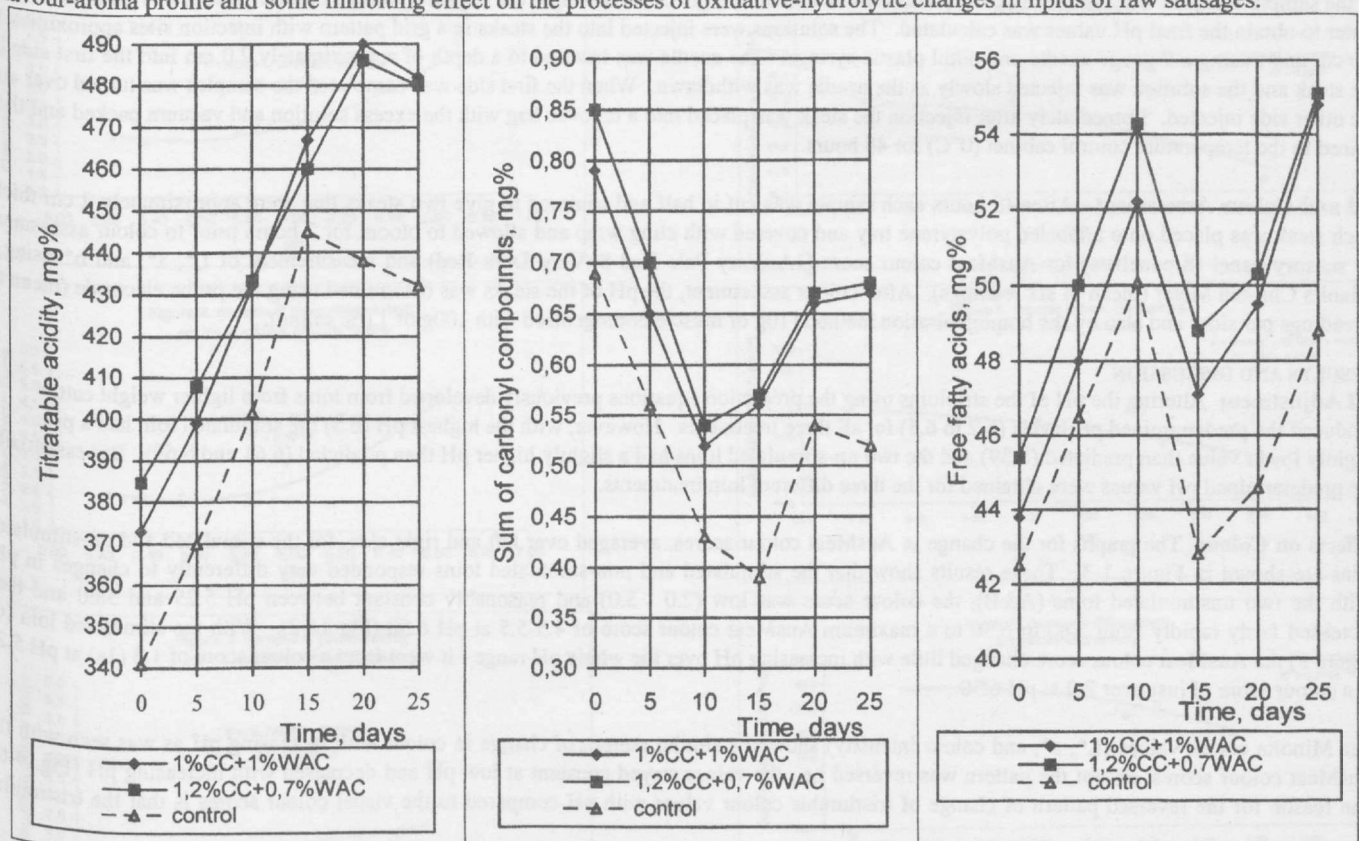


Fig.1. Change of biochemical characteristics in samples of raw sausages during using carbohydrate components in wine-alcohol composition