EFFECT OF SPIRIT-WINE COMPOSITIONS AND CARBOHYDRATE COMPONENTS ON PHYSICAL, CHEMICAL AND BIOCHEMICAL INDICES OF SMOKED DRY SAUSAGES

A. B. Lisitsyn , V. I. Liubchenko , G. P. Goroshko , T. N. Korshunova , All-Russian Meat Research Institute, Talalikhina 26, 109316 Moscow, Russia

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During last years the search for methods to intensify technological processes was directed to the control of inner factors (degree of cutting, diametre of casing, content of sodium chloride, sugar, and fat in sausage emulsions, as well as types and doses of additives and starter cultures applied, and so on) (1,2,3,4).
All-Russian Meat Research Institute carried out studies with the aim of improving technological processes of smoked dry sausages (SDS) ensuring higher production efficiency based on:
- shorter time of ageing,
- shorter time of drying,
- use of available compositions,
- higher quality of finished products.

In this paper, the effect of carbohydrates (CH) and spirit-wine compositions (SWC) on the changes of physical, chemical and biochemical indices, during ageing , smoking, and drying of salami dry sausages (SDS) was analyzed.
Results of the study were reported.
To study the effect of carbohydrate compositions on the ageing process of SDS, combinations of crystal hydrated glucose and maltodextrine with various glucose equivalent (13 % and 20 %) were used. To facilitate the analysis of CH effect on biochemical indices, all test samples were divided into groups according to the total quantity of carbohydrates: group I - CH content < 1% ; group II - CH content 1.1< CH< 1.5%; group III - CH content > 1.5%. Samples containing various spirit-wine compositions (0.5%, 1.0%, 1.5%) were used in experiments.
Control and experimental samples of SDS were processed under similar technological conditions. Sausage links were setted for 5 days at 4°C, 85-90 % of relative humidity, and up to 0.1 m/s of air speed. Samples were smoked in "Maurer Sohne" climatic chamber for 6 days following the specific program worked out for the given chamber and type of product. During first 7 days the process of drying was carried out under following conditions: temperature - 12° - 14°C, relative humidity - 80-85% air speed - up to 0,1 m/s. Then the temperature was 10° - 12°C and the relative humidity - 74-78%. Studies showed that weight losses had the highest value at the smoking stage (on the average 1,8 % a day) and the least value at the setting stage (0,6% a day). Carbohydrates intensified weight losses ,starting from the setting stage; the difference was marked, but it was still not statistically reliable (t_{max}=1,10); at the stage of smoking it became reliable at confident probability P < 0,80. At the end of the drying stage, it was evident that the quantity of carbohydrates present in the emulsion rendered the effect on weight losses of SDS.
The comparative analysis of control and experimental samples with spirit-wine compositions showed that at increasing the dose of SWC added to SOS emulsion, the acceleration of drying process became evident. Thus, weight losses at the end of drying process were: 25.89 % in control samples, 26.25 % in samples with 0.5% of SWC, 27.65 % in samples with 1.0% of SWC, 27.35% in samples with 1.5% of SWC. At the end of drying process, weight losses in experimental samples were by 1,5 - 2,0% higher than in control ones.
Analysis showed that pH values changed in a similar way both in control and in experimental samples with carbohydrate components. Sharp drop of pH values was observed in samples after the smoking (up to 4.82 - 4.85) achieving the minimal value (4.51) at 7-10 days of drying. pH values of all samples increased gradually from 14-th day to the end of ageing process. No differences were observed in regularity of changes of pH values in control and experimental samples.
The higher were SWC doses in experimental samples of SDS, the more rapid drop of pH values took place from the beginning of the process. Thus, after the smoking, pH values decreased by: 0.68 unit in control samples, with 0.5% of SWC, by 0,72 unit, by 0.76 unit in samples with 1.0% of SWC, and by 0.91 unit in samples with 1.5% of SWC - comparing to the initial pH value.
When pH reached allowable values (4.86 - 4.96) in emulsion of experimental samples with SWC 1% and 1.5%, they did not change for a long time, thereby creating the conditions for their normal ageing and hygiene.
Data on the effect of CHC and SWC on biochemical indices of SDS were showed in Figs 1 and 2.

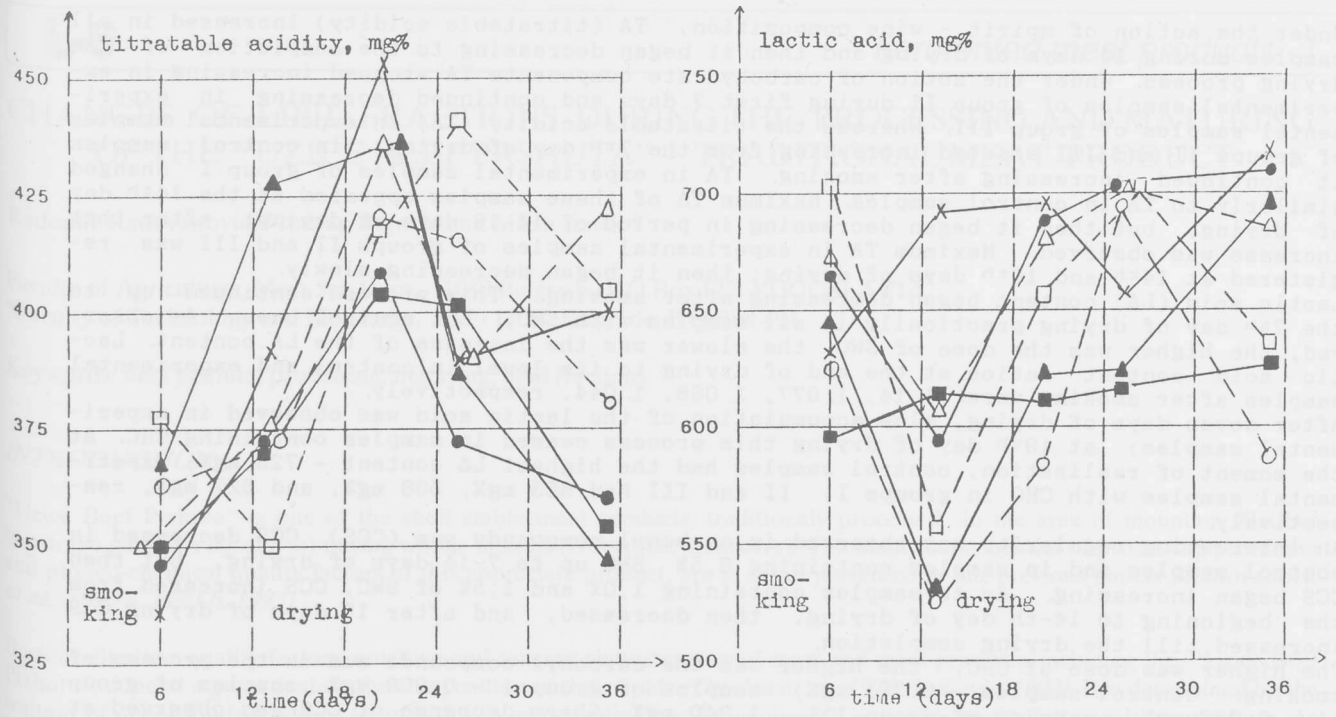

Fig 1. Changes in contents of titrated acidity (TA) and lactic acid (LA) in the process of SDS production

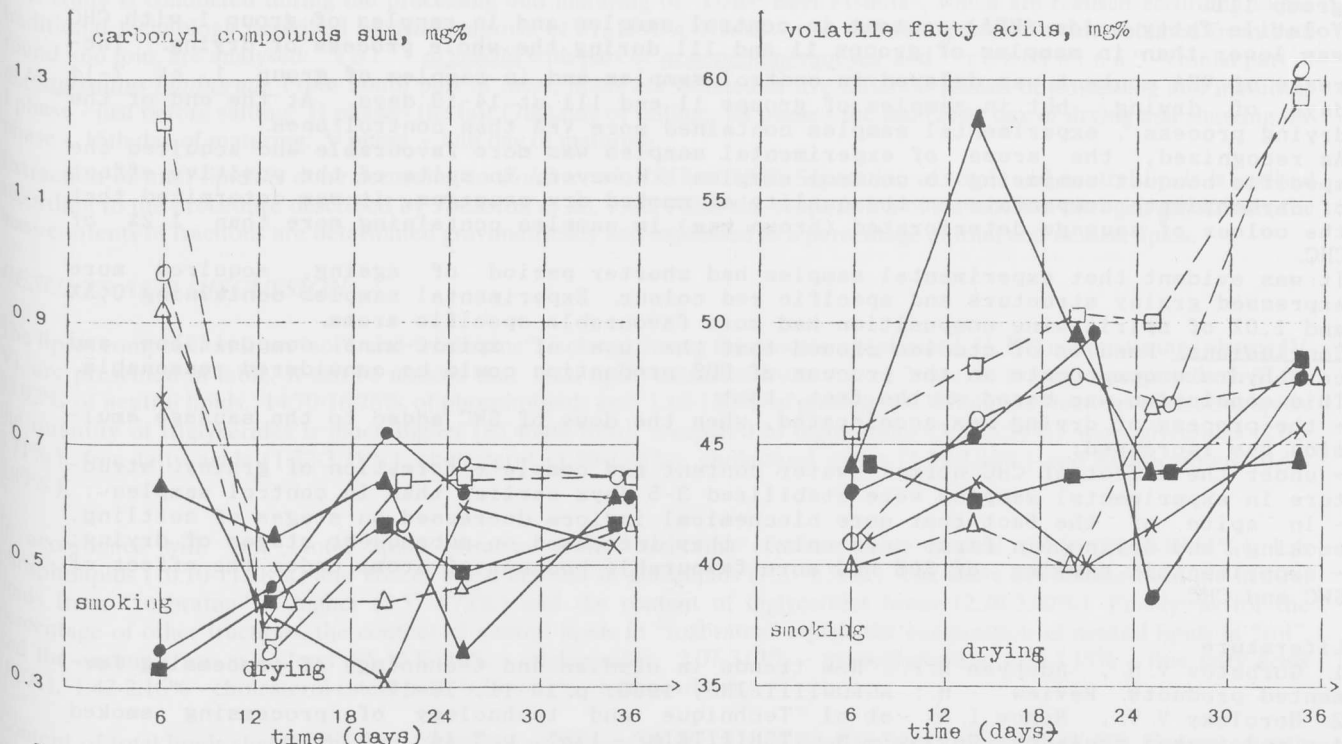

Fig 2. Changes in contents of carbonyl compounds sum (CCS) and volatile fatty acids (VFA) in the process of SDS production.

-x-x- control sample
-□- -□- samples with CHC > 1,5%
—■— samples with SWS = 1,5%
-△- -△- samples with CHC < 1,0%
-▲---▲- samples with SWS = 0,5%
- 0 ---0 - samples with CHC = 1,0÷1,5%
- ● ---● - samples with SWS = 1,0%

Under the action of spirit - wine composition, TA (titratable acidity) increased in all samples during 14 days of drying and then it began decreasing to the completion of the drying process. Under the action of carbohydrate components TA stopped increasing in experimental samples of group II during first 7 days and continued decreasing in experimental samples of group III. Whereas the titratable acidity (TA) in experimental samples of groups II and III started increasing from the 7th day of drying, in control samples it continued increasing after smoking. TA in experimental samples of group I changed similarly to TA in control samples. Maximum TA of these samples appeared at the 14th day of drying, but then it began decreasing in period of 14-19 days of drying; after that increase was observed. Maximum TA in experimental samples of groups II and III was registered at 14th and 19th days of drying; then it began decreasing slowly.

Lactic acid (LA) content began decreasing after smoking. This process continued up to the 7th day of drying practically in all samples with SWC, but control ones. As observed, the higher was the dose of SWC, the slower was the increase of the LA content. Lactic acid content ratios at the end of drying to its level in control and experimental samples after smoking were: 1.14, 1.077, 1.066, 1.044, respectively.

After seven days of drying, slow accumulation of the lactic acid was observed in experimental samples; at 19th day of drying this process ceased in samples containing CHC. At the moment of realization, control samples had the highest LA content - 723 mg%, experimental samples with CHC in groups I, II and III had 685 mg%, 588 mg%, and 627 mg%, respectively.

An interesting regularity was observed in carbonyl compounds sum (CCS). CCS decreased in control samples and in samples containing 0,5% SWC up to 7-14 days of drying, but then CCS began increasing. As to samples containing 1,0% and 1,5% of SWC, CCS increased from the beginning to 14-th day of drying, then decreased, and after 19 days of drying CCS increased till the drying completion.

The higher was dose of CHC, the higher was the carbonyl compounds sum in the process of smoking: control samples - 0,781 mg%, samples of group 1 - 0,909 mg%, samples of group 11 - 0,986 mg%, samples of group 111 - 1.240 mg%. Sharp decrease of CCS was observed at the beginning of drying process, and continued for 7 days in experimental samples and 14 days in control samples; the level of decrease in experimental samples was lower than in control ones. Later on (till 19 days) the steady accumulation of CCS was observed to the end of drying; all differences between samples were smoothed down. At the end of drying, CCS was distributed in the following way: 0.518 mg% - in control samples, 0.572 mg% - in samples of group 1, 0.601 mg% - in samples of group 11, and 0.594 mg% - in samples of group 111.

Volatile fatty acids (VFA) content in control samples and in samples of group 1 with CHC was lower than in samples of groups 11 and 111 during the whole process of drying. Increase of VFA content was delayed in control samples and in samples of group 1 at 7-14 days of drying, but in samples of groups 11 and 111 at 14-19 days. At the end of the drying process , experimental samples contained more VFA than control ones.

As recognized, the aroma of experimental samples was more favourable and acquired the specific bouquet comparing to control samples. However, in spite of the positive effect of carbohydrate components on the quality of smoked dry sausages, it was determined that the colour of sausage deteriorated (brown hue) in samples containing more than 1,2% of CHC.

It was evident that experimental samples had shorter period of ageing, acquired more expressed grainy structure and specific red colour. Experimental samples containing 0,5% and 1,0% of spirit-wine composition had more favourable specific aroma.

Conclusions. Results of studies showed that the use of spirit-wine compositions and carbohydrate components in the process of SDS production could be considered reasonable. This conclusion was based on the fact, that:

- the process of drying was accelerated, when the dose of SWC added to the sausage emulsion was increased;
- under the effect of CHC normal water content and complete formation of grainy structure in experimental samples were stabilized 3-5 days earlier than in control samples ;
- in spite of the fact that more biochemical indices decreased on stages of settling, smoking, and drying (in first days only), they increased on subsequent stages of drying;
- experimental samples of SDS had more favourable bouquet of aroma under the effect of SWC and CHC.

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