

DYNAMICS OF THE TRANS FATTY ACIDS CONTENT DURING STORAGE OF MEAT CANS

Andrei B. Lisitsyn¹, Valentina B. Krylova¹, Andrei N. Ivankin¹ and Tatyana V. Gustova¹

¹GNU The V.M. Gorbатов All-Russian Meat Research Institute of Rosselkhozacademia.

109316, ul. Talalikhina 26, Moscow, Russia

Abstract – The aim of the study was to detect trans fatty acids in meat cans from pork in pieces after their production and during storage. The research was done using the up-to-date method of quantitative detection of chemical substances – chromatography–mass spectrometry. As a result of the research, trans fatty acids such as elaidic (C_{18:1} n9t) and brassidic (C_{22:1} n9t) acids were identified and quantified in cans. The effect of the sterilization conditions on the detection of trans-isomers of fatty acids was established. In this way, the sterilization of the product using the drastic conditions led to 1.6 times increase in the mass fraction of brassidic acid. The gentle conditions of sterilization reduced its mass fraction from 0.5% to 0.13%. Elaidic acid was not identified after the sterilization. During storage, the reduction (42.9%) of brassidic acid was observed in the cans made under the drastic condition, while in the cans produced under the gentle condition of sterilization, the increase in brassidic acid by 260% in relation to the corresponding results after sterilization was observed; nevertheless, it didn't exceed the established norms.

Key Words – meat cans, sterilization conditions, elaidic and brassidic acids

I. INTRODUCTION

Trans-isomers of fatty acids can be generated naturally and during industrial hydrogenation. Trans-isomers are found in limited quantity essentially in all human organs and tissues (2.4-2.9%) and in human breast milk (2.1-2.3%). Their sources include dairy products, meat and fat of cattle [1].

The World Health Organization and world experts recommend the population to reduce the consumption of trans-fats because numerous research studies indisputably proved the detrimental effect of consumption of trans fatty acids with food even at trace quantities. Nowadays, a limit on trans-isomers content in combined oils of no more than 8% [2] is established in Russia,

while in the EU countries a limit is no more than 2%.

In cannery industry, products are subjected to prolonged exposure to high temperatures that can lead to increase in harmful trans-isomers quantity. Reliable systematic data on the real content of trans-isomers of fatty acids in animal fat [3] and meat products are not available from the literature.

II. MATERIALS AND METHODS

Chromatography–mass spectrometry is an up-to-date method of quantifying of chemical substances allowing for identification of obtained peaks of individual substances according to their mass-spectra.

In this connection, the detection of trans fatty acids was performed using chromatography–mass spectrometry.

Meat cans from pork in pieces produced under various sterilization conditions were a subject of research. Trimmed pork with mass fraction of fat tissue no more than 30% was used in cans production. The cans were sterilized under the drastic condition of sterilization with the value of the attained sterilizing effect F=18 conditional minutes and the gentle sterilization condition with the F value equal to 12 conditional minutes.

Meat cans were analyzed immediately after the thermal treatment and during storage.

III. RESULTS AND DISCUSSION

As a result of the research, trans fatty acids such as elaidic (C_{18:1} n9t) and brassidic (C_{22:1} n9t) were identified and quantified. Elaidic acid is a trans-isomer of oleic acid. Brassidic acid does not metabolize in a mammal organism and accumulates in various tissues. There are literature data that brassidic acid causes the failure of the cardiovascular system, infiltration of the skeletal musculature and myocardium, and hepatocirrhosis.

The dynamics of trans fatty acids content during the cans production and storage is shown in Fig. 1. The obtained data give the evidence of the effects of the sterilization condition on the brassidic acid content in the experimental samples of cans. For example, the sterilization of the product under the drastic conditions led to 1.6 times increase in the mass fraction of the acid. On the contrary, the

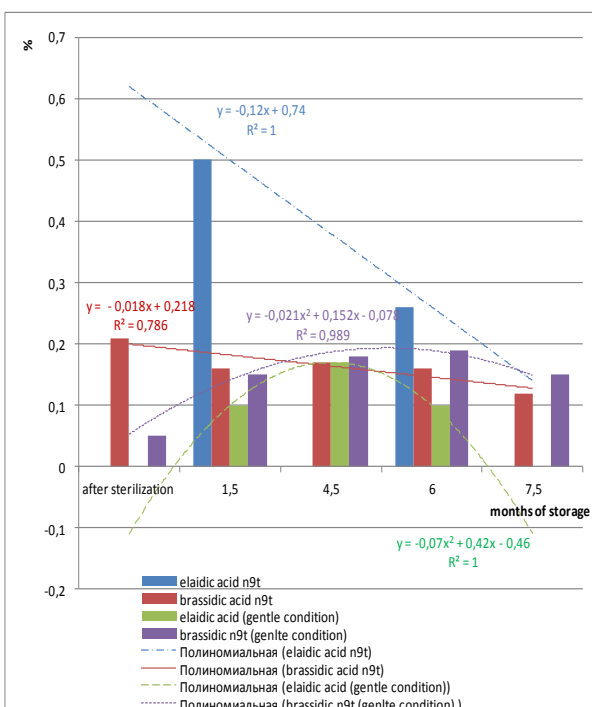


Figure 1. Dynamics of the trans-isomers of fatty acids during storage of cans

gentle conditions of sterilization reduced the mass fraction of brassidic acid from 0.5% to 0.13%.

At the end of 7.5 months of storage, the decrease in brassidic acid was observed in cans produced under the drastic condition; its content was 42.9% in relation to the content after sterilization. Under the gentle sterilization condition the increase in the brassidic acid content was noted, that at the end of the 7.5 months of storage equaled to 260% in relation to the corresponding results after sterilization. However, mass fraction of brassidic acid in cans, which was equal to 0.18% of the total quantity of fatty acids, didn't exceed the established norms for oils.

It can be seen from the data shown in the figure that elaidic acid was identified only after 1.5

months of cans storage. Moreover, the mass fraction of the acid in the cans produced under the drastic condition was 5 times higher than the corresponding indicator for cans produced under the gentle condition. It should be noted that at the end of the 7.5 months of storage elaidic acid was not identified. Apparently, a molecular of the acid elongates by two carbon atoms and no more double bonds are generated in it. Simultaneously, at the end of the cans storage period, the increase in mass fraction of stearic acid ($C_{18:0}$) was detected.

IV. CONCLUSION

The obtained results suggest that the drastic conditions of sterilization cause the generation of brassidic acid in cans from pork and promote the intensive generation of elaidic acid after 1.5 months of storage.

The analysis of the dynamics of the fatty acid content during storage of cans showed their stable reduction which allowed to conclude that the quantity of detected trans-isomers in meat cans from pork pieces will not affect the health of consumers.

REFERENCES

1. Kulakova S.N., Victorova E.V., Levachev M.M. (2008). Trans-isomers of fatty acids in food products. Oils and fats 3: 11-14
2. GOST R 52100-2003 Spreads and melted blends. General specifications
3. Ivankin A.N. (2007). Fats in the composition of modern meat products. Meat Industry, 6: 8-13