EFFECT OF LOW DOSES IRRADIATION AND ACUTE ORGANOPHOSPHOROUS PESTICIDE POISONING OF SWAINS ON THE QUALITY OF LARD OBTAINED

S. G. DRAGOEV*, N. S. NIKOLOVA#, and B. N. TODOROV#

* - *Higher Institute of Food and Flavour Industries, Dept. of Meat and Fish Technology, 26 Maritsa blvd. Plovdiv 4002, Bulgaria*
# - *Thracian University, Dept. of Radiobiology and Radioecology, St. Zagora 6000, Bulgaria*

BACKGROUND

Recently an increasing greater numbers of chemical compounds applied in agriculture. In various reasons, these substances or their derivatives are introduced into the soil and water, and from there by means of food in live stock. It is known those organophosphorous pesticides (in particular phenitrothion) lead to a number of changes in the structure and functions of different organs and systems of lamb and poultry. It has also been proved that these compounds can be deposited in the fatty tissue of swine and cattle mainly (Frank et al., 1983).
Having in mind that pork and lard occupy a practical share of worldwide meat products consumption, the problem concerning the effect of low dose's irradiation, combined by organophosphorous pesticide poisoning upon their quality has remained actual and unclear yet.

OBJECTIVES

The objective of the study is to determine the changes in physical characteristics of lard obtained from swains treated with low dose's gamma rays in combination with phenitrothion acute poisoning. To realize this aim we have set ourselves the tasks to determine the colourness, transparency, light refraction coefficient (refraction), melting point, moisture content and solid threeacylglycerols levels of lard.

MATERIALS AND METHODS

The experiments carried out with 27 swains - crossbreed "Big White" by "Landras". The animals weaned at one months' age and after a week period of adaptation they divided into three groups - 9 animals each. The first and the second group irradiated on the irradiator "Rokus-M" ^{60}Co, at power of dosage 0.005 Gy/s. The first group was acute poisoned, one week after the irradiation, with organophosphorous pesticide phenitrothion, at dose of 150 mg/kg live weight and slaughtered at two months' age. The meat produced used as an experimental sample P. The second group of animals did not treat by phenitrothion. It was slaughtered at two mounts' age and the meat produced used as a control only irradiated, sample Kgr. The third group of animals was grown up to two months' age with at any pesticides or irradiation treatment and slaughtered as a control sample Ko, obtained from clinical health pigs.
Immediately, after the slaughtering of each group of animals, the hypodermic fatty tissue from the carcasses was staffed. It was minced on a grinder. The mean laboratory samples prepared from this fatty tissue mix. The three mean laboratory samples homogenized. The lipid faction extracted immediately with a mixed solvent chloroform : menthol by the method of Bligh & Dayer. The chloroform fractions collected and evaporated on a vacuum rotational evaporator at - 0.95 kg/cm^2 and temperature 25^{o}C. The lipid fractions extracted in that way from the three samples used in our further investigations. The chrominance of lard determined spectrophotometrically using apparatus "Specol 11-11" (Russia) by a colour iodine scale at 15^{o}C. The transparency of lard estimated on Abe's refractometer at 60^{o}C. During the experiments we regarded the yellow line of sodium at optical density of the water. The light refraction coefficient (refraction) of lard used as an index giving indirect information about their structure. The measurements were made on a refractometer of Karl Zeiß (Jena, Germany) at two temperatures: 40^{o}C and 60^{o}C. The melting point determined using spherical capillary by the method of felling sphere. This index gives an information about degree of saturation of fatty acids coming into the composition of triacylglycerols. The moisture content of lard determined by drying the samples to constant weight at 105^{o}C. The amounts of solid threeacylglycerols evaluated by differential thermal analysis (Wochs, 1961).The method bases upon the fractionating of solid threeacylglycerols with dry ice (CO_2) in the process of their linear expansion at temperature from 0 to 50 ^{o}C. The obtained results processed statistically at 15 repetitions for each one of the samples. The intervals of confidence and the presence of statistically significant differences between mean values evaluated by Neuman and Keuls's method (Brandt, 1980) at level of confidence of $p < 0,05$.

RESULTS AND DISCUSSION

The three examined samples have identical colour (chrominance - 1 mg I_2). On that index they have levels very close to that of water (chrominance - 0 mg I_2). These results have witnessed that low dose irradiation and acute phenitrothion poisoning have not had any effect upon accumulation of colour compounds as carotenoids or melanoidines in the pork fatty tissue. The transparency of the three examined samples has not been statistically different ($p < 0,05$). The control sample Ko has a mean statistical transparency of 0.1500 ± 0,0059, in comparison with those of the samples Kgr - 0.1539 ± 0.0047, and of the sample P - 0.1533 ± 0.0049. The lowest melting point has control sample Ko (24.6 ± 0.8 ^{o}C). The melting point of the sample Kgr is higher by about 6^{o}C (30.4 ± 0.5^{o}C). The highest is the one - of the experimental sample P (31.5 ± 0.5^{o}C). The control sample (Ko) refraction is lower than that of the samples Kgr and P at 40^{o}C as well as 60^{o}C. The refraction of the samples Kgr and P are not statistically different ($p < 0,05$) at two examined temperatures (Kgr 40^{o}C - 1.4735 ± 0.0053, Kgr 60^{o}C -1.4811 ± 0.0057; P 40^{o}C - 1.4738 ± 0.0049, P 60^{o}C - 1.4815 ± 0.0054). This one of the sampe Ko is lower - Ko 40^{o}C - 1.4696 ± 0.0057, and Ko 60^{o}C - 1.4777 ± 0.0058. The water content of the experimental sample P is the lowest and is not statistically different ($p < 0,05$) in comparison of those of the sample Kgr (Fig. 1). The water content of the control sample Ko is by about twice higher.

The greatest quantity of solid threeacylglycerols in temperature interval from 0C to 10°C has the sample Kgr. The middle position plays experimental sample P, and the lowest - control sample Ko. In temperature interval from 15°C to 35°C the solid threeacylglycerols of the experimental sample P are more in compression of those, determined in samples Kgr and Ko (Fig. 2). At temperatures higher than 36°C, 37°C practically do not find solid threeacylglycerols in any one of the samples.

The obtained results about chrominance and transparency of the samples are according to the well known fact that pork fatty tissue is free from carotenoides. Consequently, it could accept that the low dose's gamma rays and acute poisoning of the swains with phenitrothion do not influence upon the chrominance and transparency of the lard produced.

There is a good agreement between results about melting point and refraction of lard. The higher levels of the melting points and refraction observed in the samples P and Kgr speak about a probable more saturated and high molecular composition of the triacylglycerols of these samples. This fact shows that irradiation is a more important factor affected on the saturation of the lipids. The acute phenitrothion poisoning of swains does not have any significant effect upon the degree of saturation of the triacylglycerols. That fact and the increasing of the water content could be explained by causing radiolysis to water in the tissue as a result of the irradiation, and by additional dehydration after acute phenitrothion poisoning impact. The results from the differential thermal analysis confirm again the suggestion that the share of solid threeacylglycerols fractions increases when swains are irradiated with low dose's gamma rays and acute poisoned with phenitrothion. That is due probably to intermolecular preesterification.

CONCLUSIONS

The results obtained and their analysis allows us to conclude that the combination of low dose irradiation and acute phenitrothion poisoning of swains: does not lead to changes of the lard chrominance and transparency; causes a decreasing of the water content; increase the melting point, the refraction, and the degree of saturation of the fatty acid remainders including in the molecules of threeacylglycerols.

REFERENCES

Brandt, S., 1979. Statistical and Computational Methods in Data Analysis. Elservier Publishing Co., New York, 59 pp. (GB).

Frank, R., H.E. Braun and G. Fleming, 1983. Organochlorine and organophosphorus residues in fat of bovine and porcine carcasses marketed in Ontario, Canada from 1969 - 1981. Journal of Food Protection, 46: 893 - 900 (USA).

Nikolov, I., N. Grozdeva, N. Nikolova, 1994. Clinical and patomorphological studies at acute radiation sickness of lambs treated with "AGRIA 1050". Veterinary-Medicine Science, 28: 12 - 15 (Bg).

Wochs, W., 1961. ÖIl und Fette. Analyse Nahrunsfette Verlag A.W. Hayne Erban, Berlin.

Figure 1. Water content of the lard, obtained from hypodermic fatty tissue of: clinical health pigs, with any treatment with low doses gamma rays or organophophorous pesticides (Samlpe Ko), irradiated pigs at a dose 0.005 Gy/s (sample Kgr), and both irradiated at a dose 0.005 Gy/s and acuta phenitrothion poisoned pigs (Sample P).

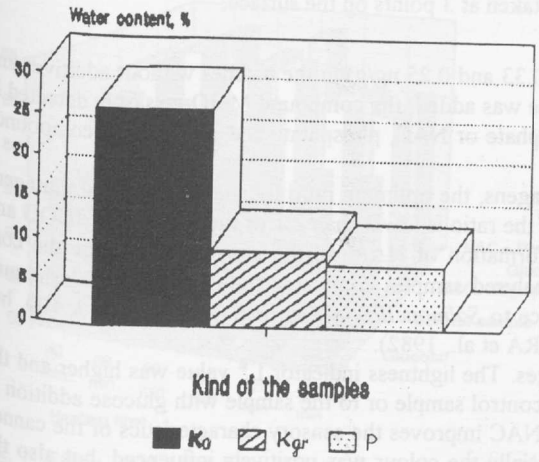

Figure 2. Content of the solid threeacylglycerols in a lard, obtained from hypodermic fatty tissue of: clinical health pigs, with any treatment with low doses gamma rays or organophophorous pesticides (Samlpe Ko), irradiated pigs at a dose 0.005 Gy/s (sample Kgr), and both irradiated at a dose 0.005 Gy/s and acuta phenitrothion poisoned pigs (Sample P).