4-62 THE SPECTRA IN THE UV-REGION AS A CRITERION FOR THE EVALUATION OF LIPID CHANGES DURING REFRIGERATIVE PRESERVATION OF MEAT

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The organoleptic quallitative parameters of meat are determined, to a large extent by the existing lipids. The good comercial reception depends not only on their own condition after a deffinite period of storage, but the next technological treatment es well, due tu eventual changes in meat as: colour changes, decrease of solubility /. 7/ etc. Even to a larger extent the lipids are responsible about the biological and the flavour characteristics of meat which is due to desintegration of phospholipids /9/, losses of specific aminoacids /7/ or creation of oxide products with unfavourable influences upon human being /8/.

From the statements above it follows that the precise estimation of the state condition of meat and meat products during refrigerative storage tirns to be of particular importance.

It is well known, that UV-spectroscopy can be successfully applied for an estimation of the degree of oxidation of plant cils and animal fats /2,4, 11/. This method is also applicable to the comparative evaluation of lipid changes in canned meat at different temperature-regimes of sterilization and pasteurization/ 1, 6 /.

Looking through the available literature, we were not able to find any facts concerning the characterization of the state condition of muscular lipids during refrigerative storage of meat by the use of UV-spectroscopy. The last statement outlines the object of the elaboration at hand.

Material and Methods

For the purposes of these experiments we used muscular lipids of veal and lamb meat - round and shoulder, taken out of the regular production and also corresponding to the medical requirements of hygiene. The meat was salted by dry method and there has been foreseen a controlled probe of unsalted meat shown below as follows:

1. Controlled probe - unsalted meat;
2. Salted with 0,5 % sodium chloride;
3. Salted with 0,5 % potassium chloride.

The material had been kept at -25°C in the course of 6 months. There had been samples taken out of each experimental batch every month for test-experiments. The meat had been minced and then there had been a triple lipid extraction using ethylic ether in the presence of nonaquaous sodium sulphate at room temperature. The ether elluates had been filtrated, the solvent had been destillated under vacuum. The spectra had been taken out in a 0,1 %-iso-octan solution with an apparatus SPECORD VIS having a quartz cuvette of 1 cm in dimension. Parallel to this the peroxide /12/ and tiobarbituric /3/ values as well as the presence of epihydraldechide had been determined.

Results and Discussion

The absorption region at 230 - 235 nm is of particular interest. The absorption in this wavelength region occurs at the initial stages of lipid oxidation together with the formation of peroxides. It is due tu the origin of conjugated dienic structures in the nonsaturated lipids containing dienogenerating fatty acids /lynolic, lynolenic etc./ 2,4,10/.

From the obtainned data concerning lipids in veal stired at -25° C and shown graphycally on figure 1, it can be seen that absorption increases proportionally tu the period of storage. This kind of a tendency is strongly expressed after 4 - 5 months of camping, i.e. the formation of a system with conjugated double bondage turns out tu be spontaneous, nevertheless of the storage at low temperatures. This process is more intensive with lipids in nonsalted veal as compared tu the samples salted with sodium chloride /curve 2v/ and with potassium chloride /curve 3 v/. Parallel th this the existence of the initial /first / oxidation products / i.e.the peroxides / can be detected. Their quantity, as seen from figure 2, increases considerably avan after the second month of storage.

Contrary to the increase of absorption at 232 nm the accumulation of peroxi-

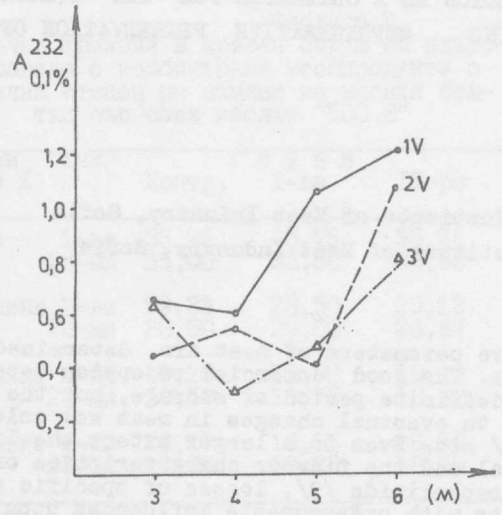

Figure 1

Changes in absorption at 232 nm wavelength in lipids of veal in course of 6 months period of storage at - 25°C:
1 v - unsalted meat probe;
2 v - salted with 0,5 %NaCL meat probe;
3 v - salted with 0,5 % KCl meat probe

des is faster in lipids of meat treated with the salting mixtures - curves 2 v and 3 v on fig.2. It can be presumed that during refrigerative storage of meat the generation of compounds with conjugated double bondage in lipids is obstressed by the salts present while, at the same time, the formation of peroxides is stimulated.

The other region of the UV-spectrum which acquires more attention is that of 270 - 273 nm.In this range we registrated an increase in absorption and the appearance of a pick in the spectrum describing the more advanced stages of oxidation when in fats there are also secondary carbollyc compounds with an unsaturated thrienic structure, which comes as a result of degeneration of peroxides / 2, 4, 10/.

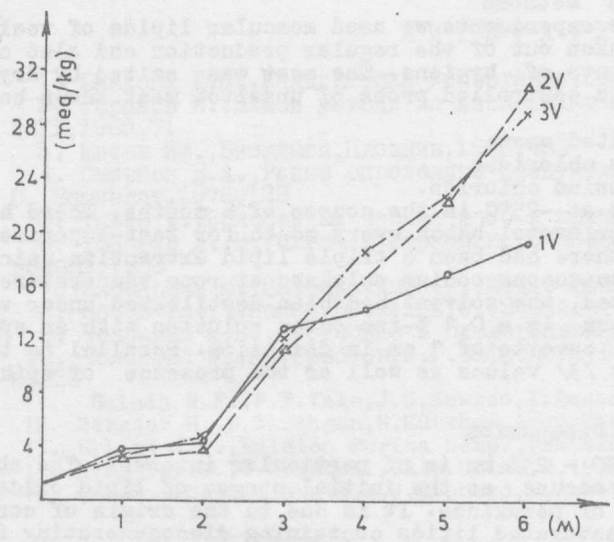

Figure 2

Increase of peroxide value in lipids of veal,stored at - 25°C in the course of 6 months:
1 v - unsalted meat probe;
2 v - salted with 0,5 % NaCL meat probe;
3 v - salted with 0,5 % KCL meat probe

Using lipids extracted from vaal there is no pick registrated in this particilar wavelength range - fig.3. As it is with the KCl and NaCl salted probes, as well as with the controlled probe of nontreated meat, there is no increase in the absorption at 272 nm even after 6 months of storage. The last conclusion correlates only partially with the results obtained from the chemical analysis namely: presence of epihydrine aldehyd as a secondary product of lipid oxidation is proved by fluoroglucine scarcely after 6 months of camping; the increase of the tiobarbituric value during the whole period of observation is negligible, although being regular for all probes.

The obtained data about the absorption in the UV-region, and about the

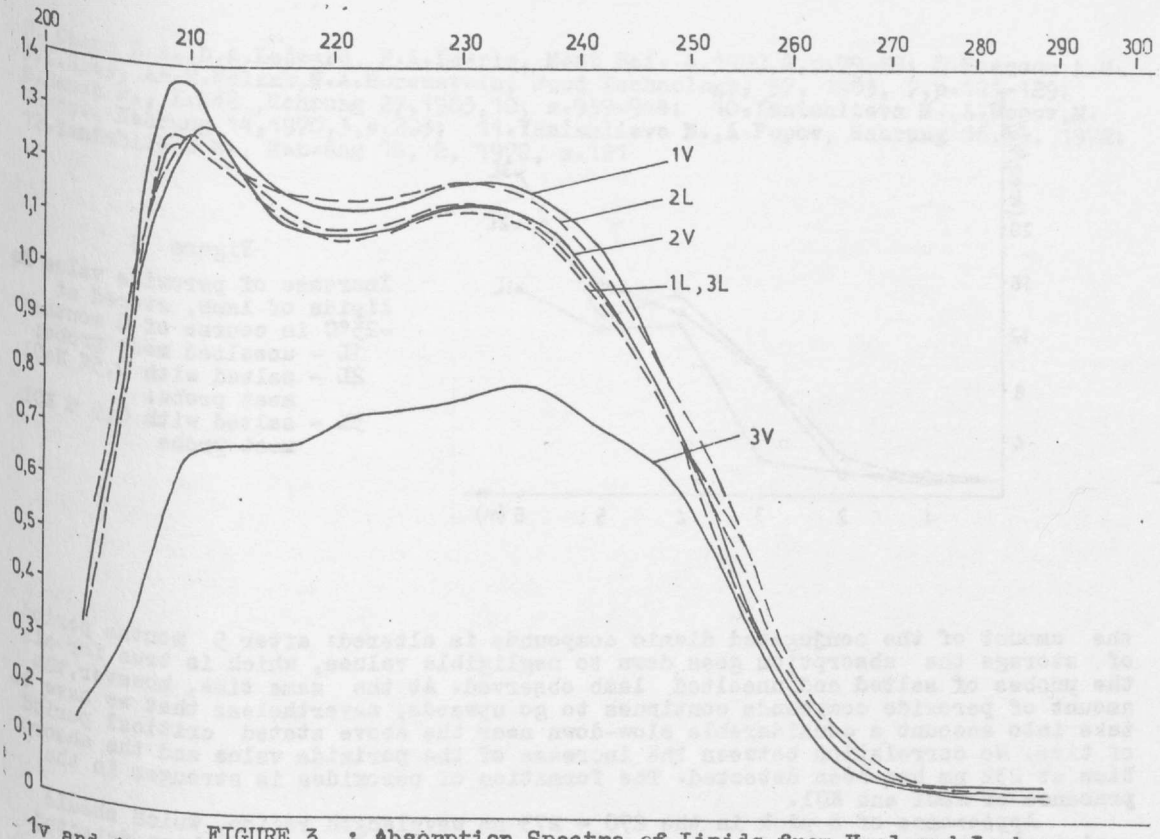

FIGURE 3 : Absorption Spectra of Lipids from Veal and Lamb:
1v and 1L- unsalted veal and lamb; 2v and 2L - salted with NaCl; 3v and 3L-withKCl

peroxide and the tiobarbituric values testifies the fact, that during refrigerative storage of meat there are some oxidation processes in lipids of veal which tend to be more intensive in the presence of NaCl and KCl in regard to the unsalted meat. The present data confirms our previous investigations / 5 /.

Changes in lipids of lamb are shown graphycally. On fig.4 we have the absorption at 232 nm in the course of 6 months of storage, while on fig.5 - the amount

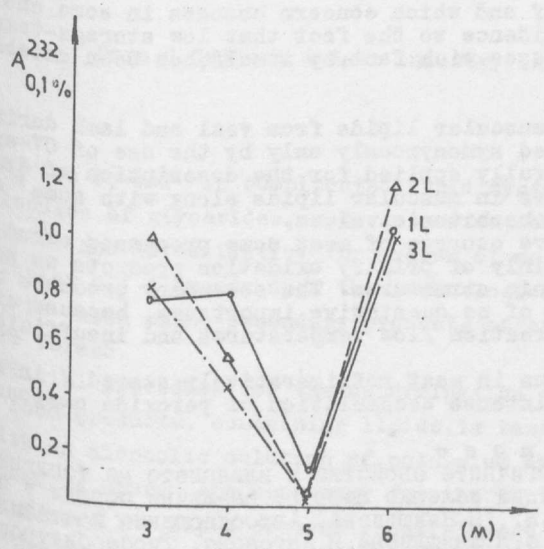

Figure 4

Changes in absorption at 232 nm wavelength in lipids of lamb in the course of 6 months period of storage at - 25°C:
1 L - unsalted meat probe;
2L - salted with 0,5 % NaCl meat probe;
3L - salted with 0,5 % KCl meat probe

of peroxides. We have to bare in mind the character of the curves, which expresses the modification of the absorption at 232 nm. The tendency for an increase in

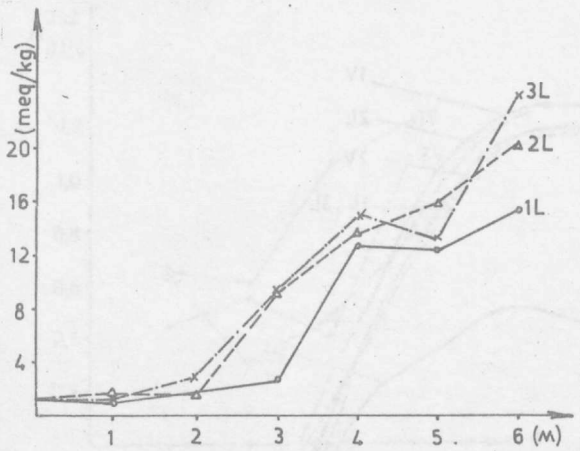

Figure 5

Increase of peroxide value in lipids of lamb, stored at -25°C in course of 6 months:
1L - unsalted meat probe;
2L - salted with 0,5% NaCl meat probe;
3L - salted with 0,5 % KCl meat probe

the amount of the conjugated dienic compounds is altered: after 5 months period of storage the absorption goes down to negligible values, which is true for all the probes of salted and unsalted lamb observed. At the same time, however, the amount of peroxide compounds continues to go upwards, nevertheless that we have to take into account a considerable slow-down near the above stated critical period of time. No correlation between the increase of the perixide value and the absorption at 232 nm has been detected. The formation of peroxides is stronger in the prasance of NaCl and KCl.

Appearance of a pick in the 270 - 273 nm wavelength region, which should registrate the existence of unsaturated trienic compounds, had not been detected in lamb lipids. In this case, too, in analogy to veal, some secondary oxidation products, proved by tiobarbituric value /malone-aldehyd/ show continuous, although quite a small, an increase in absorption with all the probes obsarved. The Kreis-Reaction testifiing the presence of epihydrine aldehyd, is slightly possitive after 6 months period of storage.

During refrigerative storage of lamb the UV-spectra of muscular lipids do not show good correlation as compared to the other ariterions concerning freshness as the peroxide and the tiobarbituric value.

The results given an account of and which concern changes in some characteristic features of lipids give true evidence to the fact that low storage-temperatures do not prevent from oxidation processes, wich fact, by itself, has been established by other authors, too /5/.

Conclusions

1. The degree of oxidation in muscular lipids from veal and lamb during refrigerative storage can not be evaluated synonymously only by the use of UV-spectroscopy. This technique can be successfully applied for the description of dynamics and the degree of oxidation processes in muscular lipids along with some other characteristics as peroxide and thiobarbituric values.

2. During 6 months refrigerative storage of meat some processes occur in lipids, which lead to the formation mainly of primary oxidation products as peroxides and compounds having conjugated dienic structures. The secondary products of oxidation with carbonylic character are of no quantative importance, because of the unfavourable conditions for their creation /low temperatures and insufficient aeration/.

3. The presence of K and Na ions in meat refrigératively stored / in our case veal and lamb/ favours to the more intense accumulation of peroxide compounds.

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