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Researches Regarding the Dynamics of Some Lipolytic Changes in Beef and Pork During the Storage in Refrigerated or Frozen Form

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Abstract. The lipolytic changes in beef and pork during the storage in refrigerated or frozen form have been monitored in order to optimize the storage time and temperatures in storage rooms.

Keywords: meat, storage, lipolytic changes.

INTRODUCTION

The oxidative rancidity (spontaneous oxidation or aldehydic rancidity) is produced by the action of air oxygen and consists in the formation of free radicals, of hydroperoxides, the transformation of instable hydroperoxides into stabile peroxides and finally the splitting in aldehydes and acids having a specific odour. It involves the oxidation of unsatured fatty acids, especially of polyunsatured fatty acids (PUFA) and produces compounds which affect the food quality by changing the colour, flavour (occurrence of foreign taste and smell), texture, nutritional value and also the food safety.

The chemical mechanism of spontaneous oxidation of lipids may be divided into two stages: the incipient oxidation and the advanced oxidation. During the initial stage of oxidation, the oxygen is fastening in peroxidic form at the level of the double bounds of same molecules of unstatured fatty acids.

The spontaneous oxidation started in this way has an autocatalytic effect and it produces the initiation of chain reactions, so that the energy disengaged from the oxidation of first molecules produces similar chemical reactions in the adjoining molecules and thus the progress is speeded.

The process is much more accelerated by temperature and specific catalysts: light, enzymes, metal oxides and even some amino acids, protein parts or carbohydrates. This first oxidation phase shows its effects by the increase of the peroxide rate value. During the advanced phase occurs the rupture of the peroxidic bridge and in consequence occur many chemical decomposition products: aldehydes, ketones, alcohols, inferior acids, hydroxyl acids, acids-aldehydes, acids-ketones, etc.

The lipids oxidation compounds is involved in the fracture of the biological membranes, inactivation of enzymes and proteins degradation, formation of ageing pigments in destroyed membranes, oxidative hurt of lungs produced by air pollutants and occurrence of cancer. The free radicals resulting from lipids peroxidation have been associated with the aetiology of degenerative diseases as arteriosclerosis, rheumatoid arthritis, retina degeneration, tumours proliferation and ageing. MDA is supposed to have carcinogen effects as it is able to react with the DNA and to produce mutagenic compounds.

MATERIALS AND METHODS

There have been examined 10 beef samples and 10 pork samples taken during refrigeration and freezing.

The examination took place after 5, 10, 15, 20 days for beef and respectively after 3, 6, 9 days for pork.

For at -18°C deep-frozen and stored meat, the sampling and examination took place after 2, 4 and respectively 8 months for pork and 3,6,12 months for beef.

In order to study the evolution of meat lipolysis in refrigerated and frozen meat there has been determined: the acidity, the peroxide rate and the Kreiss reaction from fat samples extracted from meat samples, by using the standard methods.

RESULTS AND DISCUSSIONS

The results get are presented in Tab. 1, 2, 3 and 4.

Tab. 1

The dynamics of lipolytic and oxidative changes during the storage of beef in refrigerated form n=10

Ser. no.	Description	Free acidity g% oleic acid	Peroxide rate g Iodine %	Kreiss reaction
1	Before refrigeration	0.15	0.010	negative
2	After refrigeration	0.20	0.015	negative
3	After 5 days	0.25	0.018	negative
4	After 10 days	0.35	0.025	negative
5	After 15 days	0.56	0.045	negative
6	After 20 days	0.80	0.096	slowly positive

Tab.2

The dynamics of lipolytic and oxidative changes during the storage of pork in refrigerated form n=10

Ser. no.	Description	Free acidity g% oleic acid	Peroxide rate g Iodine %	Kreiss reaction
1	Before refrigeration	0.25	0.018	negative
2	After refrigeration	0.36	0.020	negative
3	After 3 days	0.40	0.035	negative
4	After 6 days	0.58	0.048	negative
5	After 9 days	1.00	0.095	slowly positive

Tab. 3

The dynamics of lipolytic and oxidative changes during the storage of beef in frozen form n=10

Ser. no.	Description	Free acidity g % oleic acid	Peroxide rate g Iodine %	Kreiss reaction
1	Before freezing	0.15	0.010	negative
2	After freezing	0.18	0.012	negative
3	After 3 months	0.30	0.030	negative
4	After 6 months	0.80	0.048	negative
5	After 12 months	0.90	0.060	negative

Tab. 4

The dynamics of lipolytic and oxidative changes during the storage of pork in frozen form
n=10

Ser. no.	Description	Free acidity g % oleic acid	Peroxide rate g Iodine %	Kreiss reaction
1	Before freezing	0.25	0.018	negative
2	After freezing	0.30	0.025	negative
3	After 2 months	0.35	0.030	negative
4	After 4 months	0.48	0.045	negative
5	After 8 months	1.05	0.086	slowly positive

During the storage of beef in refrigerated form, the free acidity expressed in g% oleic acid increases from the values recorded before refrigeration of 0.15 % to 0.2 % after refrigeration and reached the value of 0.8% in 20 days of storage at 0-4 °C.

The peroxide rate changes from 0.01 g iodine to % in very fresh fat, the meat sample taken before refrigeration up to 0.096 g iodine % in fat extracted from refrigerated meat and kept 20 days at 0-4° C. For this acidity values and the peroxide rate recorded at the end of the storage time of the refrigerated meat the Kreiss reaction is slow positive.

For pork the oxidative changes are more intensive as compared to those of the fat extracted from beef. The free acidity changes in the range from 0.25 to 1.0 g% oleic acid and the peroxide rate changes from 0,018 to 0,095 g I %, the Kreiss reaction is positive at these values.

For beef stored in frozen form at -18 C, during the storage time the free acidity of the extracted fat changes from 0.3 to 0.8g % and in the fat extracted from pork it changes from 0.35 to 1.05 g %. The peroxide rate in beef stored in frozen form changes from 0.03 to 0.06 g I%. At these values of the acidity and peroxide rate the Kreiss reaction is still negative.

For pork stored in frozen form the acidity changes from 0.35 and 1.05 g% oleic acid and the peroxide rate changes from 0.03 and 0.086 gI %. At these values of the acidity and peroxide rate the Kreiss reaction is slow positive.

CONCLUSIONS

1. The acidity and peroxide rate is initially higher in fats extracted from pork than in those extracted from beef.
2. The evolution of these parameters during storage in refrigerated form is more rapid in pork than in beef and that shows, one more time, the higher susceptibility of fat extracted from pork to suffer a hydrolyse and oxidation as compared to beef.
3. The acidity and peroxide rate value in fat extracted from refrigerated beef and pork produces a limitation of the storage time at maximum 8 days for pork and 20 days for beef.

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