EFFECT OF DIETARY SELENIUM SUPPLEMENTATION ON THE LIPID COMPOSITION AND STABILITY OF PORK MEAT

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SUMMARY

The effect of dietary selenium in the forms of Na-selenite and selenized yeast proteins on the fatty acid composition and level of lipid oxidation in raw pork Longissimus dorsi (LD) muscles and livers were investigated. Fatty acid composition of Longissimus dorsi lipids was influenced by both forms of dietary selenium supplementation, wherein the fatty acid composition of liver lipids was not. The major influence was noticed on the content of linoleic and arachidonic acids and to a lesser extent on the level of oleic acid of LD lipids. Supplementation of the swine diets with Na-selenite and selenized yeast increased the selenium content in pork LDmuscles and liver two times in comparison to the control group. Dietary selenium also stabilized both the LD and liver lipids, and reduced the extent of lipid oxidation .

Introduction

Lipid oxidation is one of the major causes of deterioration inmeat and meat products and it can negatively affect meatnutritional value and safety as well as meat color and flavor.Many studies indicated that peroxidative changes in meat areinitiated at the membranal phospholipids which contain largeamounts of polyunsaturated fatty acids (PUFAs). All processeswhich disrupt the integrity of cell and cell membranes causerapid development of oxidative changes in meat (Sato andHagarty, 1971). Various attempts have been made to reducelipid oxidation in meats through use of dietary antioxidants.

Most studies have centered on the effects of dietary alfa-tocopherol supplementation (Buckley and Connolly,1980 and Mitsumoto et al.,1991). However, the cell contain beside alfa-tocopherol many other natural factors which could be effective in protecting the PUFAs from peroxidation and one of them is enzyme selenium-dependent glutathione peroxidase (Condell and Tappel, 1983).

The objectives of this work were 1) to determine whether the form of dietary selenium (Na-selenite and selenium bounded to yeast proteins) effect the content of selenium in pork muscles and liver, and 2) to determine the effect of two different chemical forms of selenium in swine diets on the fatty acid composition and level of oxidative production in raw pork meat and liver.

Materials and methods

Feeding regimen

Twelve piglets of approximately 7kg weight were divided in three groups. One group was fed basal diet low in selenium (<0.1ppm). The second group was fed basal diet supplemented with 0.3ppm of Na-selenite and the third group received basal diet supplemented with 0.3ppm of selenium which was bounded to yeast proteins. After the animals gained the bacon weight they were slaughtered and the strips of Longissimus dorsi muscles and livers were removed at 6 hours postmortem. The meat cuts and livers were packaged in polyethylene bags and stored for additional 48 hours at 4 C prior further analysis.

Extraction and analysis of lipids

Lipids were extracted from tissue using the extraction procedure by Kates (1972). After the evaporation of the solvent under the stream of nitrogen extracted lipids were saponified with 1.1M ethanol KOH solution fatty acids were separated. The method of Metcalfe et. al. (1964) was used for the preparation of fatty acid methyl

esters. Analysis of fatty acid methyl esters was accomplished on a Varian 1400 gas chromatograph equipped with FID detector.

Lipid oxidation analysis

The extent of lipid oxidation in raw pork muscles and livers was determined by the 2-thiobarbituric test (TBA test) of Tarladgis et al. (1964) as modified by Rhee (1978). The level of thiobarbituric acid reactive substances (TBARS) was expressed as mg malonaldehyde/kg meat.

Selenium determination

Total selenium concentrations were determined in wet ashed samples of pork muscles and livers by atomic absorption spectrofotometry - flow injection hydride generation.

Results and discussion

The amount of total lipids varied from 2.9 to 4.2% in pork meat and from 3.2 to 6.5% in liver samples and was not correlated to the Se supplementation of the diets.

Selenium content in LD muscles varied from 0.11 to 0.33 mg/kg (on a wet weight basis) and in liver from 0.30 to 1.54mg/kg. The levels of selenium content in liver samples from all dietary groups were 3-5 times higher than in LD muscles. The average of selenium concentrations in meat and livers of the animals fed basal diet was significantly lower than in the tissues of the supplemented animals. No significant difference was determined in meat and livers of animals fed supplemented diets depending on chemical form of selenium (table 1).

The oxidative stability of fresh pork meat and livers was evaluated by the TBA test (table 1). Results clearly demonstrate that dietary treatments with Na-selenite and Se-yeast had significantly impact on the stability of pork products. The meat from pigs fed Se supplemented diets had significantly lower TBARS values than those from the control group. Different chemical forms of dietary selenium had the same effect in decreasing the TBARS value in LD muscles.

The fatty acid composition of total lipids from LD muscles and livers are presented in table 2 In both tissues palmitic (16:0), stearic (18:0), oleic (18:1) and linoleic acid (18:2) comprised approximately 80% of the total mass of all fatty acids. in liver lipids arachidonic acid (20:4) was also present in substantial amount (approx. 17.6%). The average amount of polyunsaturated fatty acids (PUFA) in the LD lipids from the control group was only 17%, while in both supplemented groups it was approximately 37%. The LD lipids from supplemented groups contained lower amounts of monounnsaturated fatty acids in comparison to the control group. The composition of liver fatty acids from experimental groups showed similar pattern, with no significant differences depending on presence/absence of additional selenium in the diets.

Conclusions

Dietary Na-selenite and Se-yeast fed to the swines in the amount of 0.3ppm significantly increased level of selenium content in LD muscles and liver. Those feeding regimes also had influence on decreasing the TBARS values in fresh pork muscles and livers. In LD muscles of Se supplemented animals the amount of PUFAs was higher than in control group, while in the liver lipids no similar effect of dietary Se supplementation was detected.

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