

Formation of cholesterol oxides in meat – in dependence of preparation, treatment and storage

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Summary

Studies on hazardous cholesterol oxides with a newly developed method showed, that raw, lean pork and beef samples yielded 7-Ketocholesterol up to a concentration of 150 µg/kg, while the content of other cholesterol oxides (7 α -Diol, 7 β -Diol, α -Epoxid, β -Epoxid, Triol, 25-Diol) was well below 100 µg/kg. 20 α -Diol was not detectable. Fresh cooked or fried lean pork or beef contained in most cases rarely increased levels. After one week of storage (8°C) significant changes were observed. Whereas the CO-contents in raw pork changed only slightly, they increased in the fried samples with 7 β -Diol by about a factor of 30. Also 7 α -Diol, α -Epoxid, β -Epoxid and 7-Keto increased noticeably. The largest changes were observed after refrigerated storage of cooked meat. After seven days the concentration of 7 β -Diol in pork raised by about a factor of 100. Considerable increases were also noticed with all other cholesterol oxides. After a normal household refrigerator storage of one or two days a considerable increase was found.

Introduction

Several cholesterol oxides (CO) are attributed to hazardous biological effects. They could act cytotoxic [1], angiotoxic [2], cancerogenic [3] and mutagenic [1]. A connection is supposed between the absorption of CO with the food and cardio vascular disorders [4]. It was proofed in animal tests that CO could initiate atherosclerotic lesions of blood-vessels [5]. There is evidence, that CO act much more effective in this manner than cholesterol itself[6].

Materials and methods

Pork and beef samples were trimmed of all visible fat. Raw and freshly cooked and fried samples were respectively analysed. Moreover, the heated samples were stored at 8°C in the refrigerator for 1, 2 and 7 days with access of oxygen. The developed method includes cold extraction, transesterification, enrichment, derivatisation, gaschromatographic separation and mass-spectrometric detection of the CO.

Results and discussion

Influence of cooking and frying

The CO-concentrations in raw meat were surprisingly not distinguishable from that of the freshly cooked and fried samples – in spite of the loss in weight due to heating.

Influence of refrigerated storage

There was no essential influence on the CO-concentrations during refrigerator storage of the **raw** pork chops.

After one week of refrigerator storage of the **fried** meat the CO-content had increased strongly. The concentration of 7 β -Diol reached 1100 $\mu\text{g}/\text{kg}$ and was enhanced by about a factor of 30 after seven days of storage compared to the values immediately after frying. 7 α -Diol, 7-Keto, β -Epoxid and α -Epoxid also showed considerable increased concentrations. Those oxidised at position seven exhibited the greatest increase. Only small increases were found at Triol and the two side-chain oxides 20 α -Diol and 25-Diol, 20 α -Diol was only found at the seventh day of storage.

After **cooking** the strongest influence of refrigerated storage was noticed – in comparison with the fried or raw meat. This was found with all CO's. 7 β -Diol reached a concentration of 3700 $\mu\text{g}/\text{kg}$ after seven days which is an increase of about a factor of 100 against nonstored cooked meat. 20 α -Diol was already found at the second day of storage and also 25-Diol clearly increased. Interesting is also the fact, that not only after seven days, but already after a normal household refrigerator storage of one or two days considerably CO-increases were noticed and the 1 mg/kg level was passed already after one day of storage.

Conclusions

The results raises a number of questions: Which CO-concentrations exist in prepared and chilled stored meat? What does happen in ready to eat chilled meals which rejoice an increasing popularity? Which influence could ingredients have in convenience food have, especially spices with antioxidative behaviour? Meat dishes were not analysed yet under these conditions. Also the CO-contents in preserves of meat and meat products are interesting, which could be stored at ambient temperatures for long times. The health critical CO require further research.

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