FORMATION OF BIOGENIC AMINES IN FRESH MEAT PACKED IN OXYGEN PERMEABLE FOIL

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Subject of this paper is to examine the content of biogenic amines in fresh meat packed in oxygen permeable foils bought on the market. Furthermore a shelf life study was carried out in order to stimulate the formation of biogenic amines of different cutter beef and pork at different temperatures and to investigate the micro-organism which are responsible for their formation.

Biogenic amines were separated by an amino acid analyser and detected fluorimetrically as their o-phthalaldehyde derivatives. Enumeration of micro-organisms were carried out according their ISO or DIN standard procedures. The examination of the ability of the detected micro-organisms to form biogenic amines was carried out by incubation the isolated micro-organism in a nutrient media containing different amino acids. If the micro-organisms have the ability to decarboxylate the corresponding amino acid the resulting amine was detected by reversed phase high performance chromatography of its dansyl derivative.

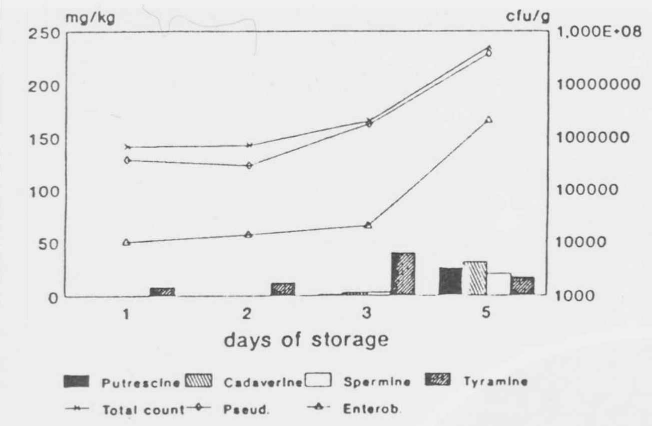
The contents of biogenic amines of the samples from the market examined at the day of sampling and the date of expiration are shown in Table 1. About one quarter of the 69 samples was considered not suitable for human consumption, 10 % even before the date of expiration. The examined amounts of biogenic amines did not reach levels which might be toxic. In contrast to raw fermented sausages the concentration of the single biogenic amines did not exceed 100 mg /kg although some of the samples are judged sensorially as spoiled and the count of micro-organisms was over 10^8 in some cases.

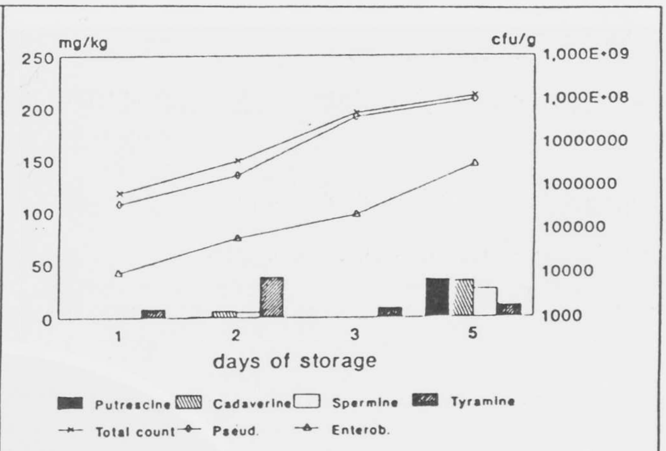
Kind of sample	n	Put	His	Cad	Spd	Tyr	Spe	Phe
Minced Meat (beef and pork)*	3	57	5	35	8	31	27	<1
Beef in cubes, 2-3 cm edge length	3	1	3	2	2	19	6	<1
Beef in cubes, exp. date	3	<1	<1	<1	<1	11	3	<1
Beef, pieces > 200g	19	<1	10	5	2	8	8	<1
Beef, pieces > 200g, exp. date	19	3	3	8	2	9	8	3
Beef, escalopes	6	<1	<1	2	<1	5	12	<1
Beef, escalopes , exp date	6	2	2	14	2	21	16	<1
Pork, pieces > 200g	11	<1	<1	2	2	6	10	<1
Pork, pieces > 200g, exp. date	11	15	2	8	3	22	6	4
Pork, escalopes	27	<1	22	<1	<1	9	11	<1
Pork, escalopes , exp date	27	38	15	66	2	34	35	9

Tab. 1. Maximum amounts of biogenic amines in mg/kg in different fresh meats at the day of sampling and the date of expiration

* According to the Austrian regulations minced meat has to be sold at the day of production

In the shelf life study beef and pork, each sliced as escalopes, cut into cubes with about 2-3 cm edge length and minced, wrapped in oxygen-permeable foil was stored at 2°, 10° and 18°C for 5 to 8 days. The storage duration depends on the Austrian regulations or the recommendations of the hygienic board of the ministry of health respectively. In all test series there was no formation of spermidine. At 2°C storage temperature histamine, spermidine and phenylethylamine were found in concentrations not higher than 5 mg/kg, putrescine cadaverine, tyramine and spermine did not reach 40 mg/kg although sensorial deterioration could be detected, the total count of aerobic micro-organisms exceeds 10^8/g CFU and the number of pseudomonas reached nearly 10^8/g in some cases. The storage at 10°C shows nearly the same results regarding the concentration and species of biogenic amines and the enumeration of micro-organisms. Only a slight increase of the number of the different micro-organisms under investigation and a more intensive spoilage at the last day of storage could be recognised. Only if the samples were stored at 18°C the formation of amounts over 100 mg/kg could be stimulated in the case of putrescine, cadaverine and spermine. Example are given in figures 1 to 3.





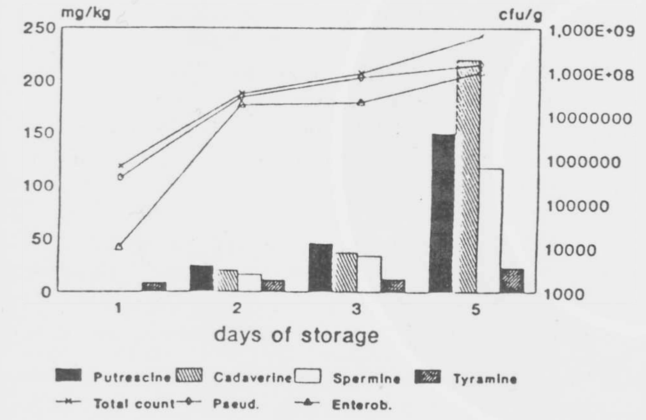


Fig. 1: Formation of biogenic amines and number of different micro-organisms in minced beef at 2°C (above on the left)

Fig. 2: Formation of biogenic amines and number of different micro-organisms in minced beef at 10°C (above on the right)

Fig. 3: Formation of biogenic amines and number of different micro-organisms in minced beef at 18°C (down on the left)

All of the 12 Enterobacteriaceae- and Pseudomonas isolates were identified as cadaverine and putrescine forming micro-organisms, whereas 11 of 12 Enterococci isolates and 6 of 12 Lactobacilli isolates were able to form tyramine. A survey of isolated amine-forming micro-organisms is given in Fig. 4

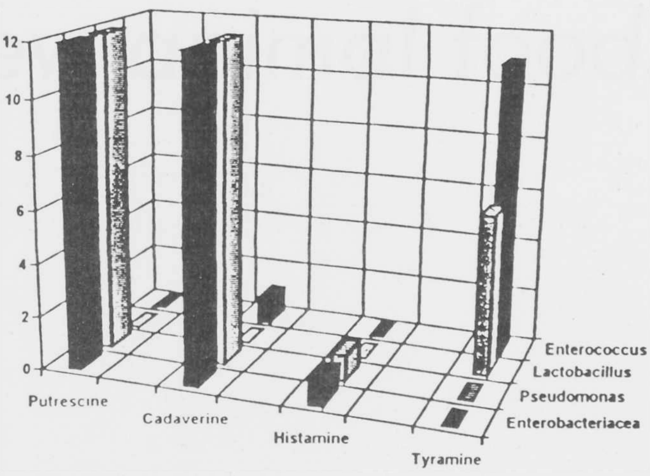


Fig.: 4 Ability of different species of micro-organisms found in the investigated meat samples to form biogenic amines. On the y-axes the number of investigated strains which forms biogenic amines is indicated

It can be concluded that in fresh meat stored refrigerated and not longer than the date expiration biogenic amines were not formed in amounts which can be noxious. Only uncustomary storage as ambient temperature can stimulate the formation of an excessive amount of biogenic amines. But in all cases a sensorial deterioration occurs before the concentration of the biogenic amines increases. So, in contrast to fermented raw sausages the consumer recognises the spoilage and is therefore protected against damage of health sufficiently.

References can be requested by the authors.