THE ROLE OF HYPOXANTHINE IN THE DEVELOPMENT OF MEAT TASTE AND AROMA

For the last 10-15 years much attention has been given to studying compounds responsible for taste and aroma of various foods, including meat and products thereof.

A number of papers on the nature of meat flavour report that nucleotides and the products of their decomposition are present in the active fractions /5, 6, 13/. This served the basis for an assumption concerning the effect of nucleotides decomposition upon meat and meat products flavour.

Inosine monophospate dominates in the meat of fish, poultry and mammals and its solution has a meat flavour. Thus, any process causing changes in IMP content will influence product flavour /14, 18, 21/. During meat heat treatment, when specific flavour is developed, IMP level decreases and simultaneously the content of its ultimate decomposition product - hypoxanthine - grows /1, 14/. Data on the importance of inosinic acid decomposition products in the development of meat flavour are scanty and discrepant.

There are the following assumptions concerning hypoxanthine:

- it does not participate in meat flavour development /2, 16, 23, 24/;
- it influences unfavourably flavour development /15/; IMP decomposition is associated with the loss of perceptible aroma and with the formation of a bitter tine during poultry /10/ and fish /7, 17/ storage;
- the decomposition of adenylnucleotides to IMP and hypoxanthine occurs parallel to the improvement of meat /4, 12/ and meat products /11/ flavour properties;
- the amount of free hypoxanthine should be considered an indirect indication of flavouring substances accumulation in meat /4, 19/.

The object of the present paper was to find out the role of hypoxanthine in the development of meat flavour and its quantitative changes during heat treatment of meat.

L.dorsi and semitendinosus muscles taken from 9 beef carcasses (of castrated, 18-24-month-old Simmenthal animals) after 4-day holding at 0-4°C were studied.

Samples were baked at 180°C for 1.50-1.75 hr up to the internal temperature 75°C.

From the extracts of raw and heated muscle tissue hypoxanthine was isolated as silver salts /8/. The isolated compound was identified by its UV-spectrum and the values of the ratios of optical densities at different wave lenghts: D_{250}/D_{260} and D_{280}/D_{260}. Hypoxanthine amount was determined with a spectrophotometer SF-4A by the value of optical density at 248 nm and calculated by a calibrating graph which represented a linear relationship between optical density value and concentration. In quantitative calculations the coefficient 1.161 was used which allows to think that after a single extraction 100% hypoxanthine was isolation from muscles. This coefficient was obtained by the data of three experiments, in which three consecutive isolations of hypoxanthine were performed from the same sample.

The average results on hypoxanthine in raw and heated muscles are presented in Table 1.

Table 1

Hypoxanthine content in beef muscles prior to and after heat treatment

(mcmole/g)

Samples	Estimated by raw tissue (n=9)			Estimated by non-fat dry solids (n=9)		
	$\bar{x}$	$S\bar{x}$	v	$\bar{x}$	$S\bar{x}$	v
L.dorsi						
raw	1.34	0.21	47.0	6.03	0.94	46.9
heated	1.76	0.31	52.8	5.72	1.02	53.6
Semitendinosus						
raw	2.00	0.24	36.0	9.06	1.17	38.9
heated	2.52	0.37	43.6	8.20	1.16	42.5

The data, obtained by us, on hypoxanthine content in raw beef meat are close to the results of other researchers. Thus, in the meat of mature animals stored at 0°C for 4-5 days it was equal to 1.2-1.8 mcmole/g /3, 16, 20/ and after 8-day storage - 0.61-1.26 mcmole/g /22/.

From the above-said it follows that hypoxanthine content in the muscles of 9 beef cattle is not similar and is highly variable.

Raw and heated semitendinosus muscles contain slightly more hypoxanthine as compared to l.dorsi ($P<0.05$). This difference can be explained by different physiological activity of the mentioned muscles of the alive animals.

Comparing the data, calculated by tissue non-fat dry solids, indicates that in the process of prolonged heat treatment (1.5-1.75 hr) hypoxanthine content is decreased insignificantly (by about 4-10%). This may take place due to hypoxanthine losses with meat juice released during heat treatment of muscles or to the partial conversion of hypoxanthine to xanthine which may be contained in meat and meat products /2, 9/.

To find out the role of hypoxanthine in the development of meat flavour, heated samples were evaluated organoleptically by a 9-point scale in the VNIIMP laboratory of sensory of chemical methods of food quality evaluation (Table 2).

Table 2

Sensory evaluation of flavour; hypoxanthine, water and fat contents and pH of meat after its heat treatment

(n=9)

Indices	Units	L.dorsi			Semitendinosus		
		$\bar{x}$	$S\bar{x}$	v	$\bar{x}$	$S\bar{x}$	v
Hypoxanthine	mcmole/g	1.76	0.31	52.8	2.52	0.37	43.6
Taste	score	6.2	0.15	7.3	6.0	0.30	15.0
Aroma	"	6.6	0.18	8.2	6.2	0.23	11.0
pH		6.1	0.37	6.0	6.1	0.33	5.4
Water	%	65.6	0.72	3.3	66.7	0.29	1.2
Fat	%	3.5	0.27	23.4	2.9	0.18	18.6

As is seen from the Table, significant differences in pH, in water and fat contents between the two muscles are not established. A higher content of hypoxanthine in semitendinosus muscles, as

judged by organoleptical scores, does not affect markedly their taste and aroma. Very low correlation coefficients (r=0.02-0.08) for both muscles also indicate the absence of the interrelationship between hypoxanthine content and the flavour of the sample tested.

Thus, on the basis of the results obtained the following conclusions may be drawn:

- hypoxanthine content in beef semitendinosus muscles is higher, as compared to l.dorsi muscles, after 4-day holding of carcasses at 0-4°C;

- prolonged heating results in a slight decrease of hypoxanthine in both muscles;

- low correlation coefficients are found between hypoxanthine level and organoleptical scores for the taste and aroma of both muscles tested;

- hypoxanthine does not participate in the development of meat taste and aroma during heating and by its quantity one cannot judge the accumulation of flavour substances in meat and products thereof.

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