INVESTIGATION OF THE INFLUENCE OF CARBOHYDRATE ADDITIVES ON PROCESSES OF MASS EXCHANGE IN BEEF MUSCLES DURING CURING

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The present report contains results of investigations carried out aimed at studying the influence of carbohydrate additives on changes in muscle mass during curing and on the yield of the finished product.

Beef muscle M.triceps served as an object of investigations.

In the first series of experiments the influence of the type of a carbohydrate additive (sugar, maltodextrin or glucose) was studied, quantity of an additive being determined based on the equality to the glucose equivalent (1 % sugar /code S/ was replaced by 1,3 glucose /code G/ or by 3,0 % maltodextrin /code M3/).

In the second series of experiments the influence of a quantity of maltodextrin added (1 % /code M1/ and 2 % /code M2/) on the cu process and on the yield of a product was investigated.

The brine prepared had a specific volume of 1.077 g/cm, it contained a carbohydrate additive, the content of sodium nitrite in it was 0.07 The meat raw material was was brine injected with a one-needle injector in the quantity of 20 % brine to the mass of meat and massag Then it was dipped into the brine, the quantity of the latter was 50 % to the mass of meat raw materials, and cured there at the temperatur 2-4 C for 1-3 days.

After every twenty-four hours beef muscles were weighed (with three-minute pre-draining) and their samples were taken. The finis products were manufactured from samples cured in the brine for 1-3 days.

The heat treatment was performed in a steam-air medium with the temperature of 85-88 C up to 76 C inside the muscle.

Mass losses were evaluated according to the formula:

$$P(t) = 100^* [GH - G(t)]/GH,$$

where GH is an initial mass of a sample, g;
GK is a final mass of a sample, g.

For an initial mass, either a mass of a sample by the beginning of the stage being analyzed (i.e. after brine injection, in 1,2 or 3 days of cur or a mass of raw materials after brine injection was taken. For a final mass, a mass of a sample after a proper stage (in 1,2 or 3 days of cu and cooling the finished product) was taken.

The yield of products was evaluated by the ratio of a mass of the finished product to an initial mass of a sample before brine injection.

Experimental findings are presented in Tables 1 and 2.

Table 1. Changes in parameters of beef muscle M.triceps samples during curing with the use of carbohydrate additives

No. of experiment and of sample	Parameter values in the different stages of treatment					
	initial	after injection	after curing 1 day	after curing 2 days	after curing 3 days	finished product
1	2	3	4	5	6	7
	Mass losses, % to the mass of samples after injection					
1 S	0	6,7	-	-		30,2
2 S	0	6,0	8,0	-		34,0
3 S	0	5,8	8,2	8,5		28,9
4 G	0	5,8	-	-		28,7
5 G	0	4,7	9,4	-		31,5
6 G	0	5,9	7,04	5,92		28,2
7 M3	0	4,30	-	-		28,4
8 M3	0	6,67	10,0	-		33,3
9 M3	0	5,90	7,24	5,86		26,6
10 M1	0	2,87	-	-		27,0
11 M1	0	4,17	4,17	-		32,5
12 M1	0	0,56	1,11	-2,78		25,0
13 M2	0	2,20	-	-		27,7
14 M2	0	1,18	0,0	-		32,4
15 M2	0	1,52	1,52	1,14		24,6
	Losses (-), gain (+) in total solids, % to total solids in the initial raw material					
1 S	6,1	10,9	-	-		0
2 S	8,75	12,5	13,2	-		0
3 S	5,1	6,74	5,0	13,3		8,0
4 G	6,0	14,2	-	-		-2,3
5 G	8,5	9,1	7,2	-		-7,1
6 G	5,9	4,5	9,7	16,1		-2,4
7 M3	5,8	13,4	-	-		6,9
8 M3	8,6	9,4	6,8	-		2,4
9 M3	6,1	9,0	10,6	21,9		-2,4

1	2	3	4	5	6	7
10 M1		5,6	7,2	-	-	5,1
11 M1		8,3	7,4	8,3	-	-6,3
12 M1		5,7	6,6	9,3	17,5	8,5
13 M2		8,7	8,9	-	-	15,2
14 M2		9,5	12,3	13,6	-	1,8
15 M2		6,4	13,6	14,6	33,1	22,3
			Moisture content in samples, %			
1 S	75,9	78,7	76,1	-	-	71,2
2 S	77,6	79,7	76,7	77,0	-	71,7
3 S	76,7	79,4	78,0	77,8	74,9	70,5
4 G	76,0	78,8	75,8	-	-	72,6
5 G	76,2	78,5	77,3	76,5	-	73,1
6 G	75,7	78,6	77,5	76,1	75,0	72,5
7 M3	75,4	78,3	75,7	-	-	69,4
8 M3	76,2	78,5	76,8	75,1	-	69,6
9 M3	76,4	79,1	77,2	76,5	74,7	70,0
10 M1	75,0	78,0	77,0	-	-	70,0
11 M1	75,8	78,2	77,4	77,2	-	71,3
12 M1	76,4	79,1	77,2	76,5	74,7	70,0
13 M2	76,3	79,0	78,5	-	-	69,2
14 M2	76,6	78,9	78,1	78,0	-	72,1
15 M2	77,0	79,6	77,9	77,7	75,2	70,0
			Salt content in samples, %			
1 S		1,33	2,30	-	-	2,20
2 S		1,33	2,30	2,80	-	2,50
3 S		1,33	2,40	2,85	2,95	2,60
4 G		1,33	2,45	-	-	2,30
5 G		1,33	2,40	2,90	-	2,60
6 G		1,33	2,36	2,85	3,00	2,70
7 M3		1,33	2,45	-	-	2,35
8 M3		1,33	2,57	2,90	-	2,65

1	2	3	4	5	6	7
9 M3		1,33	2,50	2,80	2,96	2,75
10 M1		1,33	2,70	-	-	2,40
11 M1		1,33	2,60	3,10	-	2,72
12 M1		1,33	2,65	3,00	3,20	2,90
13 M2		1,33	2,70	-	-	2,45
14 M2		1,41	2,70	3,30	-	2,70
15 M2		1,35	2,65	3,20	3,30	2,85

Table 2. Yield of the finished product, % to the mass of non-cured raw materials

Curing time, days	Yield of the finished product in samples with:				
	sugar	glucose	maltodextrin		
	S	G	M3	M1	M2
1	83,8	85,6	86,0	87,5	88,6
2	79,2	82,2	80,0	81,1	82,0
3	85,3	86,2	88,0	90,0	90,5

Mass losses during the heat treatment were lower in samples with carbohydrate additives as compared with samples containing sugar (mean values in % to the mass of raw materials brine injected were as follows for samples with: sugar - 31,03, glucose - 29,47, maltodextrins - 29,4, 28,17 and 28,23).

Taking into account that a gain in total solids of samples during their curing is mainly the result of salt penetration from brine, it can be concluded that the use of carbohydrate additives increases the speed of salt diffusion into muscles. It is also confirmed by a higher salt content and by a higher gain of total solids in samples containing carbohydrate additives after one day of curing.

The mean salt content after 1 day of curing was the following: in samples with sugar - 2,33 %, with glucose - 2,40 %, with maltodextrins - 2,51,2,65 and 2,68 % respectively.

The data analysis (Table 2) showed that the yield of a product after 2 days of curing and applying the massaging process was lower than after 3 days of curing (in samples with sugar by 6,1 %, in samples with maltodextrins by 8,0, 8,9 and 8.5 % respectively).

Investigations carried out allow to draw a conclusion that carbohydrate additives accelerate salt penetration into beef muscles and increase the yield of the finished product.