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SOME FACTORS INFLUENCING THE COLOUR IN CURED HAM MUSCLES

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The problem of the intensity, the stability and the uniformity of colour in cured hams is still the subject of many research studies in spite of the visible progress that has been achieved so far in the field of curing techniques. In literature one may read reports on the role of all pickle ingredients, on the influence executed by the age factor, nutrition form and by the premortem treatment of animals for the colour of meat (1, 4, 8, 11). When referring to the improvement of colour in cured hams we in the very first place have in mind its stability and intensity. The way of how to reach the uniformity of colour in some muscles or in groups of muscles in cured hams is still a great problem in itself. Well is known the fact that the difference in colour between semimembranosus and m.quadriceps may be considerable in both raw and cured states. The intensity of the colour in meat may be improved by corresponding nutrition of animals. There is also the possibility of obtaining more intensive and more stable colour in hams through cures by appropriate curing mixtures. But nevertheless, the difference in colours between the two mentioned muscles belonging to het same ham will always be noticable.

The reasons for the aforementioned phenomena should well be sought for in the function of the muscles themselves as well as in their iron viz. myoglobine contents. Iskandaryan asserts in his report (3) that the colour of cured meat depends on the colour of meat i.e. on its myoglobine content. He likewise emphasizes the fact that the myoglobine content in muscles may be increased by adding iron salts during the nutrition period of animals.

In our series we have noticed that also in pigs fed with nourishments containing iron preparations there were considerable differences in colour in the muscles compared for.

Bearing this in mind our task was set up as to research: a) factors influencing upon the differences in colour between m.semimembranosus and m.quadriceps and b) to find out whether there are possibilities to decrease them.

EXPERIMENTS

In our series used were pigs of the Yugoslav domestic white race, 1o months of age weighing up to 1lo kgs. Portions they were fed with were added iron salts. After killing and cooling semimembranosus and m.quadriceps were prepared. One portion of the muscle was used for the determination of the iron content by thiocyonate method whereas the second portion was cured. Used have been seven sorts of pickles differing from each other in ingredients as follows:

1. 2o% sodium chloride; o,o7% sodium nitrite; o,o5% sodium nitrate; o,5% glucose and 4% phosphate,

2. 2o% sodium chloride; o,1% sodium nitrite; o,o5% sodium nitrate; o,5% glucose and 4% phosphate,

3. 2o% sodium chloride; o,2% sodium nitrite; o,1% sodium nitrate; o,5% glucose and 4% phosphate,

4. 2o% sodium chloride; o,2% sodium nitrate; o,5% glucose in 4% phosphate,

5. 2o% sodium chloride; o,2% sodium nitrite; o,1% sodium nitrate and 4% phosphate,

6. 2o% sodium chloride; o,o7% sodium nitrite; o,o5 sodium nitrate; o,65% sodium oscorbate; o,5% glucose and 4% phosphate.

7. M.semimembranosus was cured in pickle of the following ingredients: 2o% sodium chloride, o,2% sodium nitrite, o,1% sodium nitrate, o,5% $FeSO_4 \times 7\ H_2O$ (which is 1 mg% with regard to the meat,) o,5% glucose and 4% phosphate, m.quadriceps cured with pickle Nr.1.

8. In the eighth batch the m.semimembranosus was cured with the pickle Nr.3, i.e. with the highest concentration of sodium nitrite and sodium nitrate whereas the m.quadriceps with pickle Nr.1, i.e. with the lowest concentration of these ingredients.

For each combination prepared were four samples - from four different pigs - out of both muscles involved. The weight

of the slice taken amounted to 150 g. The pumping pickle was 10% of the green weight. The cover pickle was of the same composition as the pumping pickle. The rate meat: pickle was 2:1. The operation lasted for 48 hours at +4°C. Drainage 48 hours. After sealing cans the samples were pasteurized for 20 minutes at 72°C. Ready products were examined after one week storage period. Organoleptic examinations were limited to the comparison of colour in both muscles and chemical analyses to the determination of the free nitrite quantity by Griess method by means of Lovibond comparator. Out of samples taken for organoleptic examination made were intermediate specimen for the determination of nitrite in each group of experiments separately for the one and separately for the other muscle.

RESULTS AND DISCUSSION

Iron content (mg%) in uncured muscles

Table 1.

Nr.	m.semimembranosus	m.quadriceps
1.	0,54	0,81
2.	0,57	0,94
3.	0,57	0,88
4.	0,5	0,81
5.	0,56	0,86
6.	0,51	0,92
7.	0,54	0,98
8.	0,54	0,99

The results shown constitute the average value from four samples in each group of experiments. Individual values with

the m.semimembranosus varied from o,48 mg% up to o,6 mg% and with the m.quadriceps from o,78% to 1,1 mg%. This practically means that in neither case even the highest m.semimembranosus iron content did reach the lowest m.quadriceps values. Our results also show the colour intensity in muscles involved to be a function of their iron centont. Against reports in literature the meat of pigs that have been given iron salts is possessing a more prominent and extensive colour. The fact, however, is that in all cases examined by the authors there was a remarkable difference in colour between the m.semimembranosus and the m.quadriceps noticable already by simple observation and confirmed by results shown in Table 1.

The organileptic examinations of samples in which attention was paid in the first place to the difference in colour between the m.s. and the m.q.revealed this difference to be constant regardless of the composition of pickle mixtures used. In most cases it was also noticed that the m.semimembranosus itself did not possess a uniform colour varying from the quite pale to the bright rosy nuance in some given spots.

In neither of the cases quoted we might not claim to have achieved the result wanted i.e. the elimination of the difference in colour in these two muscles.

Taken as it is both muscles had, in all combinations, the characteristic colour of the pork meat cured.

On the ground of our own experience as well as acording to the literature reports a more uniform colour of the

muscles of a given ham is not likely to be achieved either by nutrition or by premortem treatment. This was the reason why we decided to study the possibility of eliminating this inconvenient on the meat itself. Our supposition was that one of the eight aforementioned combinations would provide an answer to the problem.

The o,o7% sodium nitrite quantity if only infused as 1o% solution should theoretically provide the quantity necessary for the pork meat cure. In addition, one part of nitrite is being absorbed from the cover pickle.

Variations under 2 and 3 were applied for under belief that by increasing the quantity of ingredients one would come to a more outstanding intensity and perhaps even to a bettercolour uniformity.

The pickle Nr. 4 does not contain sodium nitrate which at least in quick curing techniques does not soundillogical.

The combination Nr. 5 was used to emphasize the role of glucose in regard to the cured meat colour.

Literature contains assertions against which the ascorbic acid i.e. the ascorbates are likely not only to provide a far better constancy and intensity of the cured meat colour but also a more outstanding uniformity - the reason why the pickle Nr. 6 had been added the sodium ascorbate.

As from the Armour USA/Nederland Company patent No 1oo5/6 it results that iron sulphate as reduction means is likely to influence upon the constancy of colour of the meat

cured, we used that salt in the pickle Nr.7 in order to examine its influence on the uniformity of the colour as well.

In the Nr.eight experiment we cured both muscles (m. semimembranosus) with highest viz.with lowest concentrations of ingredients. Should the colour and its uniformity depend on them, on the quantities of ingredients, it must have been proven by this experiment then.

The nitrite, i.e. the azote monoxide interacts with iron in myoglobine providing the cured meat with the colour desired- nitrozomyoglobine.

The quantity of nitrites, found for in ready products constitues unbound nitrites. It depends on quite a series of factors such as: the quantity of nitrites added, the composition of pickle, the microflore, the temperature etc. We thought it worthwhile to examine the question as to whether there is a correlation between the muscles colour intensity and the free nitrite quantity. Here under are the results obtained.

Table 2.

Nrs.of combs. used	m.semimembranosus	m.quadriceps
1.	7	4
2.	11	11
3.	27	11
4.	27	27
5.	14	11
6.	7	7
7.	27	11
8.	27	4

These figures show that the quantity of free nitrites within the m.semimembranosus cured is higher (with the exception of the one sample in which the values were the same) than that within the m.quadriceps. The results might likewise be correlated with the iron quantities contained in these muscles. Wherever the concentration of iron i.e. of myoglobine was higher,more nitrite has been spent on the nitrozomyoglobine production.

If the values obtained are analysied individually for one and for the other muscle it may be seen that highest concentration of free nitrites is present wherever the pickle contained o,2% of nitrite (combinations 3, 4, 7 and 8 for m.s). The m.quadriceps is found to have the highest concentration of these with combination Nr.4 to which no sodium nitrate was added whilst in other cases no results as rules were obtained.

Neither the reductivity means are in a position to influence upon the uniformisation of the colour of ham muscles examined. About glucose as means exerting no influence upon the colour referrence is made to reports by ten Cate (9) Mills and others (4). Our results are in conformity with such findings. In some cases the ascorbic acid influences upon the improvement of the colour and of its stability whereas there is no effect on the uniformity of the colour of the muscles involved. The ferosulphate, at least as far as our results are concerned, produces no effect in efforts to reach the colour uniformity in the ham muscles involved.

CONCLUSION

On the basis of results obtained in our series one may draw the following conclusions:

1. The intensity of colour in raw and cured muscles is proportional to the iron i.e. myoglobine content in them.

2. Maximal quantities of iron found in m.semimembranosus in individual cases are always beyond minimal quantities found in m.quadriceps.

3. The colour in these two muscles may not be equalized through cures with pickle mixtures that have been used in our series.

НЕКОТОРЫЕ ФАКТОРЫ, ВЛИЯЮЩИЕ НА ЦВЕТ МЫШЦ ОКОРОКОВ, ОБРАБОТАННЫХ ПОСОЛОЧНОЙ СМЕСЬЮ

Р Е З Ю М Е

Разница в цвете между m.semimembranosus m. quadriceps существует как в свежем, так и в посоленном состоянии. Ее можно причислить к функции мышц и различному содержанию железа, т.е. миоглобина. Так-как данная разница не устраняется ни кормлением свиней, причем в корма добавляются соли железа, исследовалась возможность достижения одинакового цвета при помощи посолочных смесей различного состава.

На основании результатов, полученных при этой работе можно сделать следующие выводы:

1. Интенсивность цвета свежих и обработанных рассолом мышц пропорциональна содержанию в них железа т.е. миоглобина.

2. Максимальные количества железа, содержащиеся в m.semimembranosus в отдельных случаях всегда меньше количеств, содержащихся в m.quadriceps.

3. Одинакового цвета этих двух мышц невозможно добиться посолочными смесями, применявшимися при этой работе.

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