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THE COLOUR OF UNCOOKED BACON

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SUMMARY

The conversion of the fresh meat pigments to the cured meat form in 72 sides of uncooked bacon has been followed. A significantly better conversion was obtained when the bacon had been matured for 10 days subsequent to curing, than when it had only 3 days maturation.

Negative correlations between pH of the bacon and nitroso pigments, and between pH and the pigment conversion, were demonstrated in uncooked bacon, similar to those previously found with cooked gammon.

The importance of distinguishing between colour differences due to total pigments (depth of colour) and those due to pigment conversion (tint of colour) is stressed.

INTRODUCTION

In a paper published in 1959, (1) we investigated the colour of raw pork and of cooked gammons. In the cooked cured pork, an increase of pigment conversion with the more acid pH values was demonstrated. With raw pork however, the evidence of the Cystein/cystine system appeared to indicate that in uncooked bacon, meat of high pH would yield the best pigment conversion. This however was only an indirect inference and had to be conferred or denied by the examination of uncooked cured pork.

The following examinations of uncooked bacon are therefore presented in order to confirm or deny this point with certainty. The effect of maturation time after cure, on the pigment conversion, has also been investigated.

EXPERIMENTAL

In the first experiment, sixteen paired sides of Danish Wiltshire cured bacon were used. One side from each pair was matured for 3 days after cure, the other for ten days. After smoking, the lean 'eye' of the cut middles was minced and examined for total pigments, nitroso pigments and pigment conversion. The methods of extraction used, were those adopted previously. (1,2)

In the second experiment, 72 sides of Danish Wiltshire cured bacon were used. 36 Had been matured for three days and 36 for ten days, after cure. All 72 were then smoked, the gammons removed, and the minced lean from the gammon end of the through-cut examined for pH, total pigments, nitroso pigments, and pigment conversion. Zero order correlation coefficients were calculated between pH and each of the other values.

Visual assessments of the quality of the sides both before and after smoking, were made by experienced examiners.

Results & Discussion

MATURATION

From the results of the 1st experiment shown in Table 1 there appears to be a significantly better conversion of pigments to the nitroso form with the 10 days maturation.

In the 2nd experiment, visual examination of the sides before smoking showed a preference for those which had undergone 10 days maturation. The 3 day matured bacon was regarded as being a little soft in texture, rather wet, and generally immature.

The values of pigment conversion shown in Table 2, give mean values of 39% for the 3 day maturation, and 48% for the 10 day maturation. The standard error of the mean was 2 in both cases. In addition the calculated 't' value was 3.4 which for 70 degrees of freedom, shows a difference in the means that is significant at the .001 level of probability.

pH & Pigments

From the correlation coefficients shown in Table 3 which are calculated from the data of Table 2, there appears to be a significant negative correlation between pH and the nitroso pigments, and also between pH and the pigment conversion. i.e., the conversion of pigments to the nitroso form is greater when the pH of the meat is more acid. This result is similar to the findings previously reported for cooked gammons, (1) and not to those for raw pork, where it was inferred indirectly from the cystein and pH relationship that more alkaline meat should yield the better conversion in uncooked bacon.

It would appear that the greater concentration of free nitrous acid at the lower pH values, is the over-riding influence on pigment conversion, and outweighs the opposite influence of such redox systems as cystein etc.

Pedersen and Riemann have reported colour scores in relation to pH for pasteurised hams, which show an increase in colour score for the more alkaline meats. They state that the differences were not due to differing concentrations of nitrosomyoglobin, but were probably the visual effect of the lower degree of coagulation of protein at the high pH values.

We would agree that this effect is present, but there is a trend for the higher pH vlaues of cooked cured pork to be associated with higher total pigment concentrations, although the percentage colour conversion to the nitroso form is lower. This therefore gives rise to the paradox of alkaline meat being darker because of possibly increased total pigments, and the transparency of its protein; but of a poorer tint of colour because of its lower percentage proportion of nitroso pigment. This interplay of 'depth' of colour, and 'tint' or 'hue' is one which we feel is not stressed enough in most test panel assessments of cured meats. The eye would integrate these two variables together when assessing the colour of a meat product, with differing degrees of individual preference. Also it is apparent that chemical examination should always include total pigment estimations as well as those of the nitroso pigments. Thus 'depth' of colour, represented by total pigments, is governed by the original composition of the pig, and as such is not alterable in curing or processing. The 'tint' of the colour, represented by the percentage conversion of the pigments to the cured meat form, is however directly dependent on the curing and processing.

Thus it is apparent that faults due to 'depth' of colour, for example, extreme paleness or over pigmentation ('beefiness') should not be confused with a partially controllable factor such as conversion or tint.

CONCLUSIONS

With only 3 days maturation, the conversion of pigments to nitroso form (39%) was significantly less than was obtained after 10 days maturation (48%).

A negative correlation between pH and pigment conversion was found, confirming that for uncooked bacon, as well as cooked bacon, meat of low pH gives the better conversion to nitrosomyoglobin. This result is contrary to the view suggested previously which was based on the results obtained for raw pork.

It is interesting to note that the percentage conversion to the cured meat pigment rarely exceeds 50% in Wiltshire cure. Studies to elucidate the causes are continuing in our laboratories and form the basis of a further contribution.

J. Sainsbury Ltd.,
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REFERENCES

(1) Hornsey, H.C. J.Sci. Food & Agriculture (1959) 10.114

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TABLE 1

PIGMENTS & % CONVERSION IN SMOKED UNCOOKED WILTSHIRE CURED BACON

USING PAIRED SIDES

MINCED LEAN OF LOIN

	3 day maturation			10 day maturation		
	TOTAL PIGMENTS	NITROSO PIGMENTS	PIGMENT CONVERSION %	TOTAL PIGMENT	NITROSO PIGMENTS	PIGMENT CONVERSION
No.1 L	-	-	-	39.5	18.5	47
R	43.5	15.5	35	-	-	-
2 L	39.0	14.0	36	-	-	-
R	-	-	-	40.5	22	55
3 L	-	-	-	48	26	54
R	49	25.5	53	-	-	-
4 L	37	17	45	-	-	-
R	-	-	-	37	25	68
5 L	-	-	-	41	17.5	42
R	39	17	43	-	-	-
6 L	35	17	48	-	-	-
R	-	-	-	31.5	19.5	61
7 L	-	-	-	34	22	64
R	36	19	53	-	-	-
8 L	40	8.5	21	-	-	-
R	-	-	-	40	19.5	49
MEAN	40	17	42%	39	21	55%

TABLE 2

SMOKED UNCOOKED WILTSHIRE CURED BACON

AFTER 3 DAYS MATURATION				AFTER 10 DAYS MATURATION			
pH	NITRO PIGMENTS	TOTAL PIGMENTS	PIGMENT CONVERSION	pH	NITRO PIGMENTS	TOTAL PIGMENTS	PIGMENT CONVERSION
5.55	15.9 ppm	40.5ppm	39%	5.37	21.2 ppm	37.7 ppm	56%
5.61	12.8	36.7	35	5.38	21.7	42.5	51
5.98	10.4	35.3	29	5.30	19.1	36.0	53
5.61	7.0	32.9	21	5.33	18.0	32.9	55
5.29	13.9	44.6	51	5.25	21.5	39.4	55
5.31	19.7	45.3	43	5.30	21.5	39.4	55
5.32	23.2	50.1	46	5.47	17.4	41.1	42
5.49	13.0	48.0	27	5.63	18.3	45.6	40
5.85	18.0	62.8	29	5.28	22.3	37.0	60
5.85	18.5	54.9	34	5.32	18.3	35.0	52
5.17	27.2	70.3	39	5.54	13.9	37.0	38
5.25	33.3	63.1	53	5.56	13.5	36.7	36
5.32	28.4	47.0	60	5.29	15.1	32.6	46
5.31	19.1	39.8	48	5.37	15.1	32.2	47
5.24	29.9	50.1	60	5.65	13.6	35.7	38
5.24	25.2	48.7	52	5.52	11.0	26.7	41
5.21	27.3	48.7	56	5.20	26.7	43.9	61
5.18	24.7	42.9	58	5.29	25.5	48.0	53
5.35	12.2	52.1	25	5.32	25.2	40.5	62
5.61	13.9	60.4	23	5.31	25.8	41.5	62
5.17	15.0	38.7	34	5.36	18.0	42.2	43
5.30	16.2	31.2	52	5.43	21.8	50.1	44
5.39	20.6	46.0	45	5.20	28.4	48.4	59
5.20	18.5	50.8	36	5.21	21.1	47.3	45
5.24	15.1	40.5	37	5.37	19.7	43.9	45
5.30	16.8	36.0	47	5.31	15.4	34.6	45
5.32	13.3	50.4	26	5.50	6.4	32.6	20
5.39	20.0	45.3	44	5.27	13.6	41.5	33
5.47	16.2	45.6	36	5.32	14.5	40.1	36
5.50	13.9	41.5	34	5.37	16.8	36.3	46
5.56	9.6	40.5	24	5.40	28.1	51.1	55
5.46	11.3	40.5	28	5.38	28.7	49.8	58
5.34	17.7	52.8	33	5.35	20.3	51.5	39
5.49	22.0	45.3	49	5.48	23.5	47.3	50
5.26	23.2	47.3	49	5.22	29.3	50.2	58
5.90	8.1	47.0	17	5.65	8.1	37.4	22
5.41 MEANS:	18.2	46.5	39%	5.38	19.5	40.6	48%

TABLE 3

ZERO ORDER CORRELATION COEFFICIENTS

pH and Total Pigments	-0.06 not significant
pH and Nitroso Pigments	-0.47 sig. at P=.001
pH and Pigment Conversion	-0.51 sig. at P =.001