KEY FLAVOUR PRECURSORS IN CHICKEN

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Introduction

Flavour and taste are the 'chemical senses' by which most creatures assess the chemistry of the world around them and the wholesomeness of food. The volatile compounds contributing to meat flavours and odours are formed during cooking by numerous reactions, which occur between the components of raw meat. Many volatile odour compounds of importance to chicken flavour have been identified, and the chemical pathways important for their formation studied. A previous paper identified chickens with differing scores for chicken aroma and sweet aroma and investigated the differences in volatile odour compounds (Farmer *et al.*, 2000). The results suggested that the observed differences were largely due to differences in sulphur-containing and other odour compounds. These compounds may be derived from the Maillard reaction between amino acids or proteins and sugars or the sugar-containing nucleotides, or from the thermal breakdown of thiamine. However, the relative importance of each of these pathways for chicken flavour has not been fully elucidated. This paper reports an investigation of the role of selected precursors for odour and flavour formation in cooked chicken.

Materials and Methods

Sugars, sugar phosphates, thiamine, amino acids, nucleotides, inosine and hypoxanthine were determined in chicken breast fillets (*M. pectoralis major*) as described (Aliani and Farmer, 2002; Aliani and Farmer, 2005b). Post-slaughter changes in ATP breakdown products were monitored (Aliani and Farmer, 2005a) in breast meat at intervals post-slaughter, by the same methods (Aliani and Farmer, 2002; Aliani and Farmer, 2005b).

Sensory evaluation of cooked chicken to which precursors had been added was conducted using profiling and paired comparison tests as described previously (Aliani and Farmer 2005c). Precursors were dissolved in water at the required concentration and homogenised with the raw meat. Breast meat from twelve individual chickens that had been analysed for ribose and ribose phosphate was subjected to paired comparison tests between breasts with naturally high concentrations of ribose and those with lower concentrations (Aliani and Farmer, 2005c).

Results and Discussion

Figure 1 shows the odour profile for cooked chicken obtained following addition of selected precursors (Aliani and Farmer, 2005c). Added thiamine, ribose, cysteine and cysteine + ribose gave significant increases odours compared to the control. Glucose (180 mg/100g), glucose-6-phosphate (300mg/100g) and inosine 5'-monophosphate (IMP, 400mg/100g) did not give significantly different odour scores to the control.

Table 1: The natural variation of selected flavour precursors in chicken meat.

Precursor	No. chickens	Mean conc. [a]	CV% [b]	Range[c]
IMP	30	84	45	2
Inosine	30	36	30	2-3
Hypoxanthine	30	12	43	3-4
Ribose	30	25	34	3-4
Glucose	24	40	44	3-4
Ribose phosphate	24	14	50	3-4
Glucose phosphate	24	17	80	3-4
Thiamine	6	0.22	26	1.5
Cysteine	6	trace	trace	-

a: CV = Coefficient of variation; b: mg/100g wet weight; c Range = Max/min values

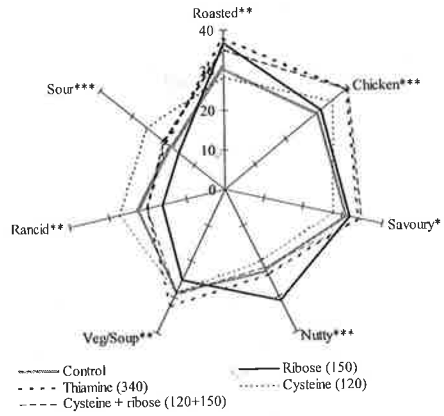

Figure 1: Sensory profiling of chicken meat with precursors added (mg/100g) prior to cooking.

This experiment confirms that many precursors have the potential to contribute to meaty odour and flavour. However, the concentrations added in Figure 1 are, in most cases, based on literature reports which were often conflicting. Analysis of chickens from commercial sources showed that the concentrations of these precursors (Table 1) were often considerably lower than expected. Considerable natural variation between birds (Table 1) and between commercial sources (Aliani and Farmer, 2002; Aliani and Farmer, 2005b) was demonstrated; this variation could be up to 4 fold between the maximum and minimum concentrations determined

On the basis of these data, further sensory studies were conducted to determine whether such differences would be large enough to explain the difference between well-flavoured and bland-flavoured chicken. Sensory studies, using added concentrations of thiamine, IMP and ribose-5-phosphate at low multiples of the natural concentration, did not alter 'chicken' or 'roasted' odour (Aliani and Farmer, 2005c). However, one reducing sugar, ribose, significantly ($P<0.05$) and consistently increased 'roasted' or 'chicken' odour when added at only 2-4 fold the natural concentration, which is close to the natural variation of ribose in meat (Table 1). Similar experiments showed that added ribose could also increase "roasted flavour" (Aliani and Farmer, 2005c).

It is impossible to add precursors into the same biochemical environment that they would naturally occupy in raw meat. Therefore, a sensory comparison was made of chicken breasts with naturally high concentrations of ribose (23-32 mg 100 g^{-1}) and those with lower ribose concentrations (7-12 mg 100 g^{-1}). This 2-3 fold natural difference in ribose concentration was sufficient to significantly increase 'roasted chicken flavour' (Aliani and Farmer, 2005c).

These results confirm that small changes in ribose concentration can affect chicken flavour.

The origin of ribose in meat is generally proposed to be via the breakdown post-slaughter of ATP to ADP, AMP and IMP, then to inosine and further into hypoxanthine and ribose (Lawrie, 1985). Analyses showed that the concentration of ribose gradually increases after slaughter and during chilled storage (Figure 3). However, this reaction does not go to completion and most of the ribose present in meat is present as a component of IMP and inosine, even after 200 hours post-slaughter (Aliani and Farmer, 2005a).

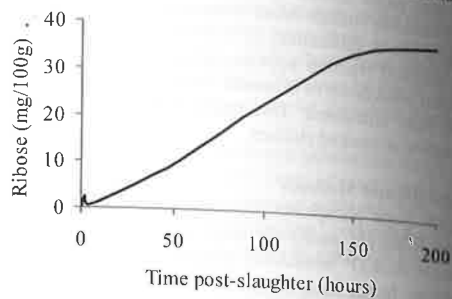

Figure 2: Effect of time post-slaughter on ribose concentration in chicken breast meat.

Conclusions

Sensory and analytical studies have provided strong evidence to suggest that ribose is a key precursor of flavour in cooked chicken meat. Differences in ribose concentration as small as 2-4 fold can cause perceptible differences in odour and flavour of cooked chicken. Concentrations of ribose increase post-slaughter until beyond the 'sell-by date'. Even at this time, a considerable proportion of potential ribose remains 'locked up' as IMP and inosine. Further studies are needed to determine the factors important for the formation of ribose in meat.

Acknowledgements

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