

QUANTITATIVE ANALYSIS OF METHYL KETONES IN BLUE CHEESE FAT

This note reports the qualitative and quantitative analysis of the methyl ketone fraction in the fat phase of three commercial samples of Blue cheese. The analysis was done in conjunction with a study on the methyl ketone precursor of milk fat (2, 5), the objective being to determine if the precursor per se is intimately involved in methyl ketone formation in Blue cheese.

Two investigators have determined the methyl ketone content of Blue cheeses on a semiquantitative basis using the distillation technique for isolation (1, 3). Since our method involves no distillation, no heating, and recovers nonvolatile, poorly volatile, and volatile methyl ketones in the fat phase to the same extent, results are of interest for comparison.

METHODS

The cheese samples were purchased commercially and analyzed the following day. Fat was recovered from the cheese by grinding a quarter pound of wax-free cheese with 80 g of dried (150 C, 24 hr) Celite 545¹ in a mortar. The slightly damp powder was then extracted with a total of 200 ml of carbonyl-free hexane (5) by swirling in a flask to give a near-theoretical yield of fat, although the yield was not considered critical. An aliquot of the solution was then quantitatively analyzed for methyl ketones following the procedures outlined by Schwartz et al. (4) for forming, isolating, and fractionating the resulting 2,4-dinitrophenylhydrazones.

RESULTS AND DISCUSSION

Results of the analyses are reported in Table 1. The data yield the following information: (1) Heptanone is the major ketone present in all cheeses investigated, (2) only relatively

¹The use of trade names is for the purpose of identification only, and does not imply endorsement of the product or its manufacturer by the U. S. Department of Agriculture.

small amounts of ketones above C₆ are present, (3) no definite ratio of methyl ketones is produced when all three cheeses are considered, (4) the ketone content of different brands varies considerably, and (5) the age of a cheese may not necessarily reflect its ketone content.

All of the ketones found below C₁₃ have been reported previously (1, 3). The C₁₃ and C₁₅ ketones had not been reported, but this is understandable in view of their low concentration and relatively high boiling points. The existence of the C₁₃ and C₁₅ ketones in Blue cheese is probably due to their formation from the natural breakdown of the ketone precursor rather than to microbial action.

No definite ratio of ketones seems to be present when the three cheeses are compared. Thermal decomposition of the methyl ketone precursor of milk fat results in a definite ratio of one ketone to another (6).

Results here agree with the findings of Morgan and Anderson (1), that the individual ketones in Blue cheeses vary considerably. There is a marked difference in the concentrations of ketones in the cheeses. Thus, Brand A (which is also probably the youngest) contained approximately eight times the concentration of ketones that Brand B contained. There is over a twenty-fold difference in the pentanone concentration of these two cheeses.

The amount of methyl ketones found in the fat phase of the cheeses virtually eliminates the natural methyl ketone precursor of milk fat as the direct and only source of the ketones in the cheeses. The concentration of methyl ketones found in Brands A and C is far above the maximum potential concentration which can be thermally produced from the methyl ketone precursor (6).

It is not known from the data whether any of the ketones produced arise as a result of microbial activity on the methyl ketone precursor. It is certain, however, that if part of the C₆, C₇, and C₈ ketones arise from microbial

TABLE 1

Concentration of methyl ketones in the fat extracted from various commercial Blue cheese

Cheese	[C ₁₅ + C ₁₃]	C ₁₁	C ₉	C ₇	C ₆	C ₅
			(μm per 10 g of extracted fat)			
Brand A (aged at least two months)	1.1	1.7	7.6	30.2	20.0	5.1
Brand B (aged at least three months)	0.8	0.7	2.5	3.4	0.9	Trace
Brand C (aged at least four months)	1.3	1.7	8.5	12.4	7.2	Trace

decomposition of the precursor, then the organisms show a high specificity toward the glycerides (2, 7) containing the corresponding β -keto acids.

To determine whether the ketone precursor had been subjected to microbial action, cheese fat from Brand C was sealed in ampules in a N_2 atmosphere and heated at 100 C for 40 hr; the fat contained sufficient water to insure complete decomposition of the precursor (6, 7). Analysis of the heated fat showed that no carbonyls were produced by the heat treatment, thus indicating that the ketone precursor had been completely utilized by the microorganisms in their metabolism.

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