

Free Fatty Acids and Quality of Domiati Cheese Made From Dried Milks as Affected by Added Lipase

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ABSTRACT

Domiati cheese was made from skimmed or whole dried milk with and without an added lipase preparation (Italase).

Dried milk cheeses differed from fresh milk cheese in showing less flavour intensity and lower levels of free fatty acids with chain lengths of C₂ to C₁₈. Treatment of reconstituted milk with Italase, at a level of 0.02%, enhanced the formation of free fatty acids and this was associated with an improvement in cheese flavour. Thus the levels of free fatty acids and flavour intensities of dried milk cheeses with added lipase approached or even exceeded those of fresh milk cheese of the same pickling period.

INTRODUCTION

The gross chemical composition and nitrogen fractions of Domiati cheese made from dried milk were reported by the authors in a previous work (Omar *et al.*, 1983). The liberation of free fatty acids during the ripening of Domiati cheese made from dried milk took place at a relatively slow rate compared with fresh milk cheese.

Many investigators have shown that free fatty acids are essential contributors to cheese flavour and that a controlled acceleration of cheese fat hydrolysis by the addition of lipases to cheese milk or curd could be used as an effective means of enhancing flavour development in cheese, with little effect on the chemical composition (El Neshawy *et al.*, 1983; Rabie *et al.*, 1984; Omar & El Zayat, 1985; Omar *et al.*, 1986).

The present work was carried out to assess the development of free fatty acids and flavour quality of Domiati cheese made from dried milk as they are affected by an added lipase preparation (Italase).

MATERIALS AND METHODS

Fresh cows' milk for the manufacture of control cheese was obtained from the herd of the Faculty of Agriculture, and dried milks were purchased from the Misr Food and Milk Company. A commercial lipase preparation (Italase) was obtained from the Dairy Land Food Laboratory, USA.

Cheese making

Whole or skimmed dried milks were reconstituted in warm water at a ratio of 1:8. Fat percentage of cheese milk was adjusted to 4% by the addition of fresh cream where necessary. Cheese milk in each case was divided into two parts, the first was treated with Italase at a level of 0.02% while the second was left without additives. The cheesemaking process was completed as described by Fahmi & Sharara (1950) for fresh and reconstituted milks. Resultant cheeses were pickled in their own drained whey after adjusting the salt content to about 10%. Cheese was stored at room temperature (20°–25°C) for twelve weeks. Trials were conducted in triplicate.

Free fatty acid composition

Sodium soaps of the free fatty acids were released from cheese by the method of Kuzdzal & Kuzdzal Savoie (1966). Volatile fatty acids were prepared as described by Roos *et al.* (1963). Methyl esters of free fatty acids were prepared by the method of Kuzdzal Savoie & Kuzdzal (1967). Free fatty acids were separated on a Pye Unicam Series 104 gas liquid chromatograph using a 1.5 m glass column, inner diameter 3 mm, packed with 10% dimethylglycol succinate on Chromosorb A W/80/100, with 2% H₃PO₄ added. The carrier gas was argon, at 40 ml/min, the detector at 250°C.

Sensory evaluation

The organoleptic properties of cheese were examined according to the scoring sheet proposed by El Koussy *et al.* (1970), with maximum score points of 60 for flavour and 40 for body and texture.

RESULTS AND DISCUSSION

Free fatty acid composition

The pattern of free fatty acids reveals that the number and sequence of identified fatty acids of cheese made from fresh or dried milk, with or without added lipase preparation, were similar. The concentrations of all identified free fatty acids were lower in dried milk cheeses than in fresh milk cheese. Total volatile fatty acids (C_2 to C_8) and nonvolatile fatty acids (C_{10}

TABLE 1
Free Fatty Acids of Dried Milk Cheese as Affected by Added Lipase
(average of three replicates)

Free fatty acids	Fresh milk cheese (control)		Skimmed dried milk cheese, Italase				Whole dried milk cheese, Italase			
			0		0.2%		0		0.02%	
	a	b	a	b	a	b	a	b	a	b
C_2	0.11	0.49	0.11	0.86	1.26	3.30	0.16	0.36	0.81	1.96
C_3	Trace	0.01	0.00	Trace	0.26	0.43	0.01	0.02	0.18	0.23
C_4	0.12	0.48	0.32	0.70	0.96	3.11	0.07	0.34	0.66	2.01
C_5 iso.	Trace	Trace	Trace	0.01	Trace	Trace	Trace	0.01	0.01	0.06
C_5	Trace	0.01	0.30	0.40	0.30	0.56	Trace	0.02	Trace	0.14
C_6	0.12	0.41	0.51	0.79	1.08	2.56	0.11	0.31	0.73	1.96
C_8	0.61	1.07	0.52	1.86	1.19	3.52	0.30	0.91	0.96	3.12
C_{10}	0.98	1.96	2.27	3.54	1.68	10.34	1.78	3.22	3.10	8.46
$C_{10:1}$	0.51	0.69	0.42	0.89	1.30	2.11	1.98	1.26	1.04	1.81
C_{12}	1.95	4.16	5.02	9.11	7.15	12.28	3.46	8.01	4.16	9.30
$C_{12:1}$	0.29	0.43	0.24	0.63	0.86	1.50	0.52	0.79	0.71	1.08
C_{14} iso.	Trace	0.17	0.36	0.48	0.63	0.81	0.19	0.33	0.31	0.66
C_{14}	3.54	6.63	7.2	11.8	9.32	19.3	6.93	10.4	9.45	17.9
$C_{14:1}$	Trace	Trace	0.52	0.63	0.69	0.96	Trace	0.26	0.38	0.83
C_{15}	0.34	0.76	1.13	1.98	1.87	3.01	0.59	1.06	0.98	2.08
C_{16} iso	0.10	0.38	0.14	0.23	0.36	0.52	0.17	0.37	0.21	0.31
$C_{16:0}$	12.6	21.2	21.4	30.3	26.2	55.9	20.0	28.4	23.3	40.4
$C_{16:1}$	0.39	0.62	0.67	0.93	1.76	2.11	0.51	0.86	0.96	1.61
$C_{17:0}$	Trace	0.13	0.92	0.16	0.19	0.25	0.08	0.18	0.32	0.49
$C_{17:1}$	Trace	0.12	0.17	0.42	0.46	0.64	0.01	0.30	0.22	0.39
$C_{18:0}$	2.69	3.95	0.44	8.42	6.13	11.3	3.01	5.20	0.86	8.21
$C_{18:1}$	8.22	11.8	14.6	18.3	18.6	25.2	10.8	13.0	17.2	23.1
$C_{18:2}$	0.39	0.83	0.76	1.50	0.94	2.19	0.98	1.66	1.04	1.96
$C_{18:3}$	Trace	Trace	0.41	0.58	0.63	0.95	Trace	0.42	0.12	0.49

a and b: pickling periods of six and twelve weeks respectively.

to C_{18:3}) ranged from 2.96–4.62 and 75.7–89.9 mg/100 g cheese in twelve-week-old dried milk cheese without added lipase. The corresponding values for fresh milk cheeses of the same age were 2.47 and 53.8 mg/100 g of cheese, respectively (Table 1).

The addition of lipase to the reconstituted milk accelerated the formation of free fatty acids, whereas their levels in dried milk cheese with added lipase were similar to or even higher than those of fresh milk cheese of the same age. Total volatile and nonvolatile fatty acids of dried milk cheese with added lipase ranged from 9.48–13.4 and 119–153 mg/100 g of cheese after a pickling period of twelve weeks.

The general trend of the obtained results agreed with those of El Neshawy *et al.* (1983), Omar & El Zayat (1985) and Omar *et al.* (1986) who reported that the addition of lipases to milk cheese accelerated the liberation of free fatty acids and improved flavour quality of the resultant cheese.

Sensory evaluation

Cheese made from dried milk without the addition of lipase showed a poor flavour intensity during the whole period of pickling compared with the control cheese made from milk (Table 2). Addition of Italase (0.02%) to the reconstituted milk enhanced the flavour intensity of the resultant cheese to be comparable with or even more pronounced than that of fresh milk cheese of the same age. These results are in full agreement with those of investigators who have shown that accelerated lipolysis in cheese enhanced the flavour development and improved cheese quality (Peppler, 1975).

TABLE 2
Sensory Evaluation of Dried Milk Cheese as Affected by Added Lipase

Pickling period (weeks)	Fresh milk cheese	Skimmed dried milk cheese, Italase				Whole dried milk cheese, Italase			
		0		0.02%		0.0		0.02%	
		TS	FI	TS	FI	TS	FI	TS	FI
6	86	65	+	78	++	70	+	76	++
12	91	77	+	81	++	78	+	84	+++

TS Total score.

FI Flavour intensity.

+ Flat.

++ Medium.

+++ Strong.

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