

Effect of Ripening on Some Maturing Parameters of Egyptian Gouda Cheese

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Abstract: Gouda cheese was manufactured under the Egyptian marketing conditions by the standard method in Deina Dairy Factory; and ripened for 2 months. All samples were periodically analyzed for TS, TN, salt and SN. The obtained results indicated that, as ripening process was progressed; the values of TS, TN, SN and salt contents of all samples were increased. On the other hand, free amino acids (FAA), free fatty acids (FFA) & saturated and unsaturated carbonyl compounds (SCC & USCC) contents were also periodically estimated during 2 months. The concentration of FAA was gradually increased upon ripening period except Pro and Cys. However, Ala, Leu, and Val. concentrations were sharply increased. Short chain fatty acids were also increased as ripening time prolonged as well as long chain saturated fatty acids. On the other side, both SCC and USCC were increased during ripening, however the increase in USCC was markedly pronounced. [Journal of American Science. 2010;6(10):292-295]. (ISSN: 1545-1003).

Key words: Egyptian Gouda cheese, FAA, FFA, SCC, USCC

1. Introduction

Gouda cheese is a yellowish cheese named after the city of Gouda in Netherland; it is one of the primary Dutch type cheese varieties produced worldwide. It is a famous semi-hard cheese with eye; manufactured from bovine milk ; although ovine or caprine milk can be used (Hoorde et al., 2008). This type of cheese ripens for 1-20 months during which, the flavor changes from mild to strong, and it can be consumed at any several stages of maturity depending on required product characteristics, the flavor preferences of consumers and economics factors (Walstra et al., 1993).

At the last decade, various researches were done to study the production and the properties of Gouda cheese; under different conditions and by different attitudes. Someone studied the influence of starter type (Hoords et al., 2008; Kimura 2009). Another examined the ripening conditions and producing process (Bertola et al., 2000; Yu-LiBin et al., 2006). Others estimated the formation of organic acids (Califano and Bevi laque 2000), Lactones (Alewijin et al. 2007); Fat-derived flavor volatile compounds (Alewijin et al. 2006); aroma characterization compounds (Leuven et al., 2008) ; glutamyl-peptides (Toolstede and Hofmann, 2009).

Now, Gouda Cheese has been produced in some national dairy factories; one of these factories is DEINA dairy factory.

The target of the present research is determined the compounds affected the quality and acceptability of the consumed Gouda cheese ; which produced in Deina Factory ; such as FAA, FFA, SCC and USCC as well as the gross chemical composition (TS, TN, SN and salt). All parameters were periodically determined through two months of ripening.

2. Material and Methods

Gouda cheese was manufactured under the Egyptian marketing conditions in DEINA dairy factory according to the method described by Scott, (1981).

Methods of analysis:

Total solids (TS), total nitrogen (TN), salt and soluble nitrogen (SN) contents of different cheese samples were determined according to the method described by A.O.A.C. (2000).

Free amino acids pattern:

Cheese samples were de-proteinized with 9% sulphoric acid. The supernatant was filtered through 0.45 μ m Millipore membrane filter. A 25 μ L of filtrate was derivatized and injected according to the method described by Cohen et al (1989) .

Free fatty acids pattern:

Total cheese lipids were extracted according to the method of A.O.A.C. (2000). Fatty acids were separated by saponification according to the method

described by Farag et al. (1986). Methylation of the resulted free fatty acids was conducted according to Vogel (1975).

The fatty acids methyl esters were fractionated using GLC apparatus. Coiled loss column (1.5m x 4mm) packed with 10% polyethylene glycol adipate (PEGA) was used. The column oven temperature was programmed at 80 °C / min from 70 °C to 190 °C then isothermally at 190 °C for 45min with nitrogen at 30ml/min.

Total carbonyl compounds:

Saturated and unsaturated carbonyl compounds were spectrophotometrically determined by the methods described by Berry and MecKerrigan (1958).

3. Results and Discussion

Effect of ripening period on gross chemical composition of Gouda cheese:

Table (1) reflected the gross chemical composition of Gouda cheese samples; which indicate that fresh Gouda cheese had TS content of 47.8% which largely increased to reach 60.3% after 2 months. TN and salt contents were also increased to each 4.55 and 3.2% respectively at the end of ripening. With regard to SN content; it is obvious that its values were progressed during ripening. The value was 0.28 freshly and reached 0.36, 0.48 and 0.58 after 15, 30 and 60 days. SN/TN content were markedly increased where its value was 8.14 freshly and 12.75 after 60 days. This obtained data is in agreement with the trend obtained by El-Shibiny., et al (1998); Califano and Bevilacquer (2000).

Table (1): Chemical composition of Gouda cheese during ripening period.

Ripening period (days)	Gross Chemical composition					
	TS %	TN %	Salt %	Salt/DM	SN %	SN/TN
Fresh	47.8	3.44	2.70	5.65	0.28	8.14
15	49.1	3.63	2.90	5.91	0.36	9.92
30	55.0	4.29	3.05	5.54	0.48	11.20
60	60.3	4.55	3.20	5.22	0.58	12.75

TS=total solids; TN=total nitrogen; DM= dry matter; SN= soluble nitrogen.

Effect of ripening on free amino acids (FAA) content of Gouda cheese:

Data presented in Table (2) recorded the amount of each of the free amino acids (mg/100g) of Gouda cheese samples. It is clear that all FAA were increased during ripening process except pro and cys were pronouly decreased. On the other hand, quantity of Glu and Alawere wisely increased, while Ile, leu and val were sharply increased.

The increase of FAA is a result of proteolysis process occurred during ripening which shared in the flavour and quality of cheese. Marilley and Casey (2004) reported that the enzymatic degradation of AA during ripening of Gouda cheese lead to formation of flavour impact volatiles. The obtained results are in the trend of those obtained by El-Shibiny et al. (1998); Bockelmann et al.,(2005);Toelstede et al., (2009) and X-Y Hongttua et al., (2008).

Table (2): Amino acids concentrations (mg/100g) of Gouda cheese during ripening.

Amino acids	Ripening period (days)			
	Fresh	15	30	60
Asp.	3.90	4.00	4.03	7.57
Glu.	12.55	17.01	22.31	20.21
Ser.	1.31	2.47	3.45	11.61
Gly.	1.80	1.93	2.23	6.32
Hist.	5.01	5.32	4.27	8.93
Thr.	11.94	12.77	14.13	17.63
Arg.	13.75	12.21	17.65	20.31
Ala.	9.01	16.92	23.83	24.24
Pro.	44.12	40.31	39.31	20.73
Tyr.	28.44	28.73	29.23	33.21
Val.	15.15	19.25	22.89	50.22
Met.	6.10	7.50	9.17	14.97
Cys.	2.91	2.58	2.11	2.38
Ile.	2.74	3.11	3.95	9.4
Leu.	16.01	20.11	24.82	56.21

Effect of ripening on free fatty acids (FFA) content of Gouda cheese:

Table (3) showed that the amount of free fatty acids FAA (%) of Gouda cheese samples during two months of ripening process. The data demonstrated that the amount of capric (C_{10:0}) was sharply increased, it ranged from 1.95% freshly to be 6.29% after 2 months. Short chain FA (C₈ and C₁₂) were also wisely increased. The long chain FA was increased except C_{18:3} disappeared after 15 days of ripening. Leuven et al., (2008) reported that fatty acids are the main precursors of the secondary fat-derived compounds such as methyl-ketones, FFAs, aldehydes, lactones and ethyl esters. The obtained results are in line with those obtained by Bockelmann et al., (2005) and Cichosz et al., (2006).

Table (3): Fatty acids concentrations (%) of Gouda cheese during ripening .

Amino acids	Ripening period (days)			
	Fresh	15	30	60
Caprylic C _{8:0}	0.33	0.41	0.71	0.54
Capric C _{10:0}	1.95	2.7	4.22	6.29
Lauric C _{12:0}	3.04	4.09	4.31	4.56
Myristic C _{14:0}	9.28	10.21	11.23	12.81
Plamitic C _{16:0}	0.26	0.28	0.31	0.83
Plamitolic C _{16:1}	3.06	3.09	3.18	3.26
Stearic C _{18:0}	10.5	12.3	12.04	11.08
Oleic C _{18:1}	26.1	28.9	30.38	33.28
Linoleic C _{18:2}	2.6	4.1	4.53	5.46
Linolenic C _{18:3}	0.39	0.45	-	-

Effect of ripening on saturated (SCC) and unsaturated (USCC) carbonyl compounds of Gouda cheese:

Figure (1) reflected the data of SCC and USCC of Gouda cheese samples. All samples showed an increase in both SCC and USCC during ripening. It is obvious that the increase rate of USCC was more

markedly higher than that for SCC values (*U* mole/Kg fat). The values were 4, 6 and 8 after 15, 30 and 60 days of ripening; while the corresponding values for USCC were 33, 35 and 37 (*U* mole/Kg fat). These data were in agreement of those obtained by Kimura (2009) and Hoord et al., (2008).

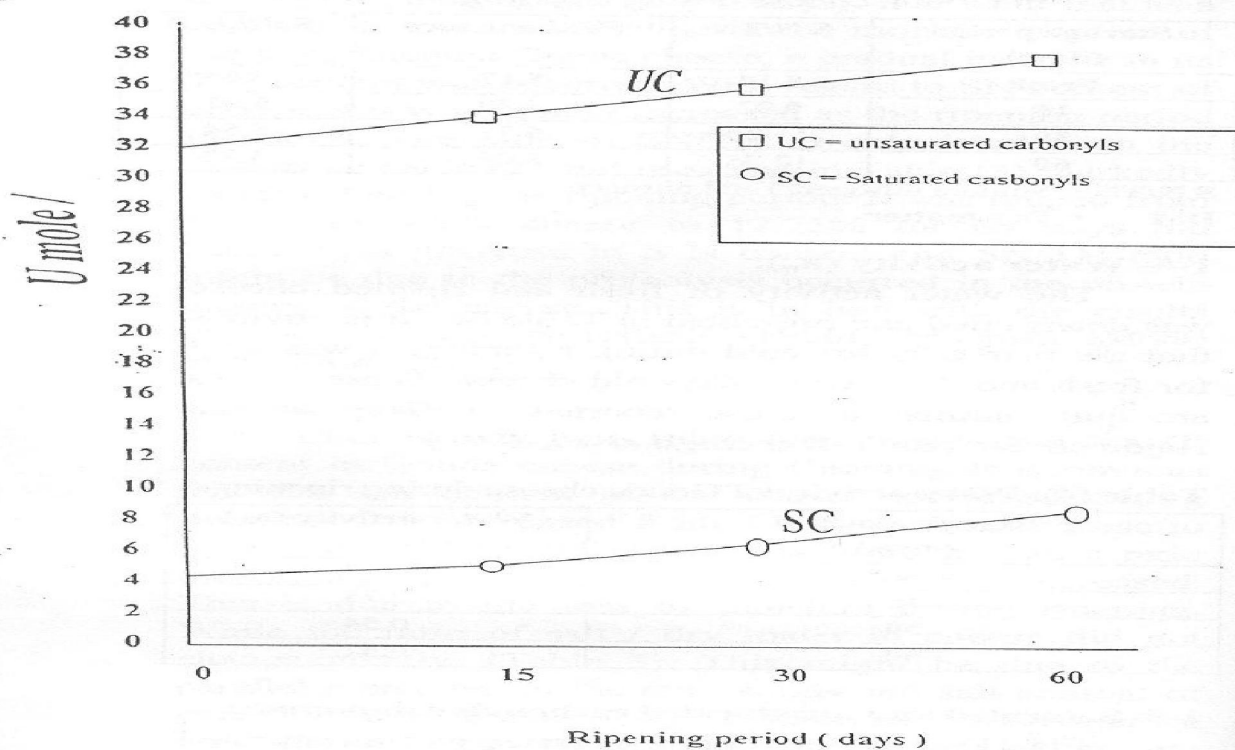


Fig.1 Effect of ripening period on carbonyl compounds of Goud cheese

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