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EFFECT OF DIFFERENT ENZYMATIC COAGULATION ON QUALITY OF CHEESE FROM GOAT MILK

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Abstract

Cheese from goat milk with enzymatic coagulation of 0.025% (v/v) calf rennet (R) and ripened for 30 days at 10°C, was compare with cheese with enzymatic coagulation of 0.20% (v/v) abomasum extract from sheep (D) and ripened at the same temperature. Chemical composition (water soluble nitrogen – WSN, fat, fatty acids) were determined by AOAC methods (1995) and hardness determined by Lloyd instrument. There were no differences attributable to enzymatic coagulation treatment on chemical composition and hardness of cheese. The cheese ripened at 10°C for 30 days showed higher level of WSN ($P<0.05$) than cheese without ripened (unripened), but no differences on fat level. Profile fatty acids indicated that short chain fatty acids of cheese with enzymatic coagulation (R) showed higher than cheese with (D). Enzymatic coagulation (R) and (D) can produced the same quality of cheese from goat milk

Key words: Cheese, Goat milk, Enzymatic coagulation

Introduction

Goat milk is a good substitute for cow's milk and is often recommended when bovine milk proteins bring about allergic responses in certain human subject. Besides, it is often consumed for its dietetic properties and consumer taste preference. Because of its high nutritive value and the amount of consumption, milk (bovine or caprine) is one of the most important primary components of the diet. In addition to protein, fat, carbohydrate, and calcium, it is also an important source of many vitamins and trace elements (Lavigne *et al.*, 1989). Bulk goat milk had low casein content, that in casein of goat milk the same four proteins (αs_1, αs_2, β and κ casein) are present as in casein of cow milk (Ambrosoli *et al.*, 1988). One of the more significant differences between bovine and caprine milks is in the composition and structure of the lipids. The fat globule membranes in goat's milk are more fragile, which may be related to their greater susceptibility to the development of off- flavour then cows' milk. The fatty acid composition of caprine milk fat is

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apparent that the volatile water-soluble fatty acids are approximately double those in cow's milk. C_{10} and C_{12} and also C_{14}, $C_{16:0}$, $C_{18:0}$ and $C_{18:1}$ are the principal fatty acid in goat's milk (Jaubert and Kalantzopoulos, 1996). Many products can be made from the goat milk, but cheeses are the well known. While there are wide variations in the flavour, body, texture and specific nutritional qualities of goat cheese, they have some characteristics in common. The traditional rennet used to coagulate milk for most cheese varieties are prepared from the stomachs of young calves, lambs or kids by extraction with NaCl (c. 15%) brines. Due to increasing world production of cheese and the declining supply of young calf stomachs, the supply of calf rennet has been inadequate for many years. This has led to a search for suitable substitutes. Many proteinases are capable of coagulating milk, which is from extract of sheep abomasum (Fox and Sweeney, 1998).

The aim of this work was to evaluate the effect of different enzymatic coagulation, calf rennet and extract of sheep abomasums, on quality of cheese.

Materials and Methods

Cheese Manufacturing

Raw goats milk was added Calcium Chloride 0.05% (wt/v) and pasteurised at 63°C for 30 minute. The milk was then cooled to a ripening temperature of 37°C. Starter with double strain of *Streptococcus thermophyllus* and *Lactobacillus bulgaricus* (1:1) was inoculated into cheese milk at a rate of 2% (wt/wt). Calf rennet (R) was added at the rate of 0.025% (v/v) and extract of sheep abomasums (S) was added at the rate of 0.2%. The time from adding R and S was 15 minute to form coagulum and ripened for 30 minute. The coagulum was cut and followed by heating until the temperature of the curd slurry was raised 35 to 38°C over 25 minute. After reaching cooking temperature, the whey was slowly drained. Curd was salted at a rate of 2.0% (wt/wt) and followed by pressed the curd for 4 hour at ambient temperature. Cheese blocks were weighed, packed and aged at 10°C during 30 days.

Analysis

All compositional tests were in duplicate. Milk and cheese samples were analysis for fat by Babcock method, Water Soluble Protein (WSP) by Lowry method, moisture, fatty acids by Gas Chromatography and Hardness analysis by Lloyd Instrument.

Statistical Analysis

Statistical analysis consisted of Student's t test (to compare (R) and (S) as enzymatic coagulant on quality of cheese).

Result and Discussion

Table1. Presents the mean for pH, total solid, fat, water soluble protein (WSP) and hardness of cheese

Variable	Enzymatic Coagulant	Time of Ripened	
		0 Days	30 Days
Moisture (%)	R	53.75	54.32
	S	53.61	53.13
WSP (% Dry Basis)	R	28.43	34.95
	S	27.16	33.80
Fat (% Dry Basis)	R	35.48	35.09
	S	34.98	35.09
pH	R	5.5	4.6
	S	5.3	4.8
Hardness (N/mm^2)	R	4.84	1.57
	S	5.08	2.26

During the 30 d ripening, total solids increase because of the surface evaporation. The pH of the cheese decrease from 5.5 to 4.6 by (R) and 5.3 to 4.8 by (S). This decrease maybe explained by the salt content influences cheese ripening through its effect on the growth and activity of microorganism and the enzymatic activity. WSP of the cheese increase from 28.43% to 34.95% by (R) and 27.16% to 33.80% by (S). This increase maybe explained by proteolysis throughout ripening of cheese. The proteolytic enzymes in cheese are calf rennet, indigenous milk proteinase and proteolytic enzymes from starter lactic acid bacteria. Proteolytic action of the coagulant and the protease from the starter culture transform the insoluble casein into acid soluble Nitrogen fragment (Schlesser *et al.*, 1992).

Table 2. Relative percentage fatty acids of cheese

Sample Code	Ripened (Days)	C4:0	C6:0	C8:0	C10:0	C12:0	C14:0	C14:1	C16:0
Milk		1.25	8.77	4.54	0.16	10.71	0.74	1.18	25.36
R	0	1.49	9.51	4.71	0.13	10.35	0.68	1.2	25.66
S	0	0.8	6.98	3.98	0.15	9.62	0.77	1.11	27.27
R	30		9.74	8.72	1.28	9.36	0.29	0.88	23.69
S	30		10.25	5.26	2.45	10.23	0.47	1.32	25.06

During ripening cheeses undergo numerous biochemical changes, which lead to development of the appropriate texture, flavour and aroma. Cheese ripening involves three primary processes: glycolysis, lipolysis and proteolysis, the relative importance

of which depends on the variety. The most important type of lipids in cheese is the triglycerides, upon which lipases act to give mono- and di-glycerides; and ultimately free fatty acids (FFAs). The release of FFAs is an important facet of maturation. FFA and their degradation products contribute to the complex sensory properties of cheese. FFAs contribute to flavour in many type of cheese. Hard cheeses such as Roquefort (goat cheese) owe their characteristic flavours to the relatively high FFA levels produced during ripening by lipases present in the unpurified rennet pastes used. Thus, profile of the short and medium chain FFA can be regarded as an index that can be very helpful in characterizing cheeses over the ripening period. Salt plays a multifaceted role in cheese ripening with an influence on the physical, chemical and biological attributes of the mature cheese. NaCl content influences cheese ripening through its effect on the growth and activity of microorganism, the enzymatic activity and the sensory characteristic of the cheese. Salt concentration exerts a major effect on lipase production and activity as well as on fatty acid metabolism (Sanchez *et al.*, 2001).

Conclusion

No significant difference was found in the over all variable between cheese with coagulant calf rennet and extract of sheep abomasums. During ripening of goat cheese, the protein fraction underwent hydrolysis on the production of WSP. Profile of the fatty acid showed difference between cheese with R and S.

Quality of cheese with different enzymatic coagulation between calf rennet and extract of sheep abomasums showed no difference.

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