The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Development of Halal Goat Cheese using Rennet Like from Vegetable Source to Replace Commercial Rennet Source

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ABSTRACT: The production of milk in Indonesia is very low, mainly from Holstein Friesian cows, and still ignore other sources of milk (goat,sheep, buffalo and mare). The purpose of this study was to replace uncertain halal rennet which normally used commercial rennet by rennet like from vegetable sources. Milk from Bligon goat reared by small farmer in mountainous region of Sleman district was used as raw material. Rennet from commercial sources and rennet like from extract leaves of tin (*Ficus carica*) were used to develop goat cheese and analogue goat cheese. Commercial rennet as well as rennet like has not contained material from pork origin detection using specific kit. Despite it, commercial rennet was still considered uncertain for development of halal goat cheese due to not completely halal certificate and should be replaced by certain halal rennet like sources. Both milk that was used as raw material for making cheese using either commercial rennet as rennet like contain 14.95%; 3.65%; 4.65%; and 85.06% of total solid, fat, protein, and water percentage respectively. Analogue goat cheese have presented 730.1 gr; 30.02%: and 11.97% of curd weight, total solid and protein respectively while commercial rennet cheese have shown 335.5gr; 42.59%; and 15.12% curd weight, total solid, and protein respectively. It was concluded that extract leaves of tin (*Ficus carica*) could be use as substitution of commercial rennet.

Keywords: Development of Halal Cheese, Goat Milk, Commercial Rennet, Rennet Like

INTRODUCTION

Cheese is the most complex of the dairy products, involving chemical, biochemical and microbiological processes. The steps in all cheese making include milk acidification, milk coagulation, whey removal, packaging and storage. Most cheese making also includes heating the cheese curd and salting the curd. Even slight changes in these processes can lead to significant differences in the final cheese (Christina Coker, Craig Honoré 1997).

The use of animal rennet may be limited for religious reasons (e.g. Judaism and Islam), diet (vegetarianism), or being against genetically engineered foods (e.g. Germany and the Netherlands forbid the use of recombinant calf rennet). More recently, the incidence of bovine spongiform encephalopathy (BSE) has reduced both supply and demand for bovine rennet (Roseiro *et al*., 2003). Muslims consumer always consider halalness of products since processing stage and as a consequency it is important to pay attention of muslim consumer on the use of halal rennets. It is therefore vegetable source of coagulants could be used.

In spite of animal source rennet to coagulate milk, several plant extracts have reported having the capacity to proteolyse milk. These proteases, such as papain from Carica papaya, ficin from *Ficus sp*., and cardosins (also called cynarases or cyprosins) from *Cynara sp*., are sometimes

constituents of latex, fruits, roots, seeds and/or sap (Roseiro *et al*.,2003). But mainly of their leaves or flowers are commonly used.

Rennet substitutes of plant origin have been increasingly used to manufacture cheese, especially at the artisanal level in Mediteranian areas (Gupta & Eskin, 1977). Application of plant coagulants allows target cheese production, and hence contributes to improve the nutritional input of those populations on whom restrictions are imposed by use of animal rennets (Silva & Malcata 2005).

The aim of this study was to replace uncertain halal rennet which normally used in commercial with rennet like from vegetable sources.

MATERIALS AND METHODS

Milk from Bligon goat reared by small farmer in mountainous region of Sleman district used as raw material. Rennet from commercial sources and rennet like from extract leaves of tin (*Ficus carica*) were used to develop goat cheese and analogue goat cheese (figure 1). Commercial rennet which applied as well as rennet like were tested using kit (Xema) and found negatively from material pork origin after detection using specific kit of immunoassay before used as coagulant agent. Despite it, commercial rennet still considered uncertain for development of halal goat cheese due to not completed by halal certificated and should be replaced by certain halal rennet like sources.

(a) (b)

Figure 1. Image of rennet sources (a) leaves of tin (*Ficus carica*); (b) Commercial rennet

Strain of probiotic bacteria *Bifidobacterium longum* ATCC 15707 belonging to the Food and Nutrition Culture Collection (FNCC) of Universitas Gadjah Mada were used in this study. Before commercial rennet and rennet like added to the milk, fermented Bligon goat milk culture was prepared by heating raw milk at 110°C for 15 minutes. The culture and cheese developed in Dairy Science and Milk Industry Laboratory (ISO 17025:2008) Universitas Gadjah Mada. The culture cultivated as 10% v/v and incubated at 40°C until the pH 5,7. Each milk was added rennet and extract leaves of tin (*Ficus carica*) at 40°C until the whey separated from the curd. The total solid, fat, protein, and water content of Bligon goat milk were measured using proximate analysis.

Curd weight and total solid of analogue goat cheese and commercial rennet cheese were measured at 0 month of ripening time at temperature around 2 to 4oC. The pH, protein percentage and soluble protein of cheese were detected each 1 month of ripening time until 3 month. The pH was measured with a pH meter while protein was measured using Kjeldahl method. Cheese and whey soluble protein were measured by the method of Lowry using a formula as below. The result of protein and soluble protein were planned using a model of statistic factorial design and analysed using t-test.

Rendement weight (X) = Total solid of cheese % x cheese weight g

Rendement percentage = X x Milk weight in total solid g x 100%

RESULTS AND DISCUSSION

Bligon goat milk which was used as raw materials has a composition as in (table 1). This is considered difference in total solid, fat and protein than Peranakan Etawa (PE) goat milk which have total solid, fat and protein 13.37%, 4.7%, 3.85% respectively (Murti, 2015). Both commercial rennet and rennet like were successfully coagulated Bligon goat milk, which the Bligon goat milk composition in table 1.

Table 1. Bligon Goat Milk Composition

Parameter	Value
Total Solid (%)	14.94±0.0032
Fat (%)	3.65±0.07
Protein (%)	4.66±0.0007
Water (%)	85.06±0.0032
Milk density (g/ml)	1.026

(a) (b)

Figure 2. Image of goat cheese with different coagulant material (a) leaves of tin (*Ficus carica*); (b) Commercial rennet

Rendement weight and rendement percentage of cheese using rennet like from extract leaves of tin (*Ficus carica*) have presented higher than cheese developed using commercial rennet as in table 2. The texture of the cheese are quite same, with cheese using rennet like softer than those of using commercial rennet and shown in figure 2.

Table 2. Cheese Composition

Parameter	Commercial rennet	Rennet like
Weight (g)	355.50	730.1
Total solid (%)	42.59	30.02
Rendement weight (g)	151.41	219.18
Rendement percentage (%)	39.48	57.16

The performance cheese developed using rennet like from extract leaves of tin (*Ficus carica*) was compared with commercial rennet by estimating the development pH and the protein percentage and soluble protein of cheese in various ripening time. The change of pH during ripening time is presented in figure 3, while protein percentage and soluble protein is in table 3.

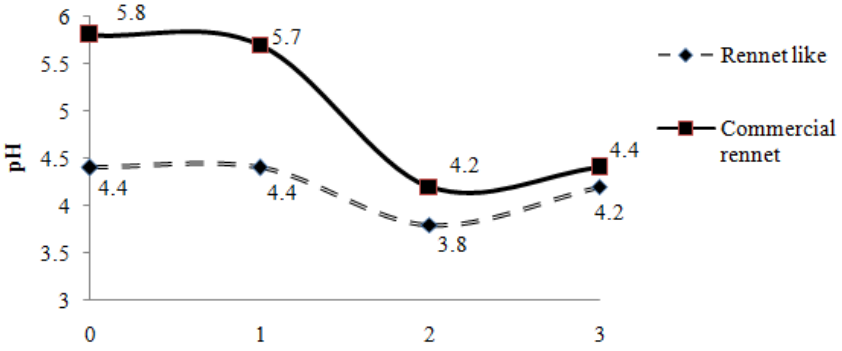

Figure 3. pH value during 0, 1, 2, 3 month of cheese ripening

Activity of ripening cheese can also be represented by a increase of pH. Measuring pH considerable advantage for monitoring or controlling ripening processes. It showed that pH values of cheese was decreased at the 0 to 2 month of ripening time and at 2 to 3 month of ripening time the pH was increased (figure 3). pH values during incubation decrease as a result of bacterial growth that produce lactic acid or acetic acid (Habibah and Kadhafi, 2011). Until 2 month of ripening, the pH of both cheese have decreased, followed raised at 3 month of ripening. Probably due to degradation of protein especially between 1 to 2 month of ripening, as indicated in table 3.

Table 3. Cheese Protein in Different Ripening Time

Cheese	Parameter	Unit	Ripening Time			
			0 month	1 month	2 month	3 month
Commercial Rennet	Protein	%	39.91 ± 0.044	37.45 ± 0,037	34.69 ± 0.009	41.31 ± 0.013
		g	87.47	82.08	76.04	90.54
	Soluble Protein (lowry)	Curd (mg/g)	96.73 ± 0.006	78.2 ± 0.004	90.34 ± 0.012	58.28 ± 0
		Whey (mg/g)	27.25 ± 0.018	36.02 ± 0.006	3.98 ± 0.002	4.05 ± 0.021
Rennet Like	Protein	%	35.49 ± 0.011	42.91 ± 0.029	39.58 ± 0.003	32.84 ± 0.008
		g	53.74	64.97	59.92	49.73
	Soluble Protein (lowry)	Curd (mg/g)	114.44± 0.007	111.73 ± 0.03	109.81± 0.005	32.99 ± 0.005
		Whey (mg/g)	60.17 ± 0.007	78.2 ± 0.003	10.01 ± 0.001	10.05 ± 0.006

CONCLUSIONS

Ficus carica have high potential for developing halal goat cheese and could be used as substituted of commercial rennet.

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