MILK PEPTIDE MAPPING OF GOAT FED COMPLETE FEED WITH HIGH LINOLEIC ACID CONTENT

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Abstract

Linoleic acid content of complete feed was increased when using corn oil in the processing of complete feed, and it's around 2.691 to 4.736 %. The declined of crude fiber in the complete feed influence by fibrolytic enzyme and or Cellulomonas sp. bacteria adds as the catalyst and or starter during fermentation of complete feed.

Feed intake more efficiently when goat consumed complete feed which containing corn oil and fermented by fibrolytic enzyme and or innoculant Cellulomonas sp. bacteria, and the milk productions and conjugated linoleic acid contents in milk were significantly increased at level about 535,06 to 570,31 ml/h/d and 3,4345 to 4.48%, respectively. Based on isolation of milk peptide, it showed that milk peptide profile of goat fed complete feed with high linoleic acid content has a molecular weight more than 42 kda.

Key words: Complete feed, linoleic acid, molecular weight, goat milk peptide

INTRODUCTION

Goat milk is a natural perfect food and it's contain some healthy nutritious for human. The bioactive peptides have been defined as specific protein fragments that have a positive impact on body functions or conditions, and may influence health, such as antimicrobial, antioxidative, antithrombotic, antihypertensive and immune-modulator (Atanosova and Ivanova, 2010). Milk protein is comprised of about 80% caseins and 20% whey proteins, and these biological activities are mainly due to the peptides and proteins in milk. Caseins are compose of α-, β- and k-caseins. Whey protein is divided to β-lactoglobulin, α-lactalbumin, immunoglobulins, glycomacropeptides, bovine serum albumin and minor proteins such as lipo protein, lysozyme and lactoferyne (Haque and Chand, 2006).

The other essential nutrient in goat milk as Conyugated Linoleic Acid (CLA). CLA is a mixture of positional and geometric isomers of linoleic acid (C-9, c-12 C18:2 LA) with two conjugated unsaturated double bonds at various carbon positions and the CLA concentrations are differences base on the animal species (Kritchevsky, 2000; Haug et al, 2007). CLA is potential health benefits for human health such as anti-carcinogenic, anti-diabetic (Belury, 2003).

Linoleic acid is unsaturated fat content in natural plant oil, like soybean oil, sunflower oil, corn oil and canola oil. These resources of linoleic acid influence the level of linoleic acid content in ruminant feed, when it's used as complete feed ingredient (Romziah et.al, 2008). Based on this factor, ruminant ration could be manipulated to a great extent for enhancing the concentration of Conjugated Linoleic Acid (CLA) in food product like in milk fat, tissue fat and to a lesser extent in egg yolk (Khanal and Olson, 2004). Level and activity of peptide bioactive and CLA in goat milk depend on the goat management system that include of feeding program, feed processing and rearing management of goat. To produce goat milk which have a high peptide bioactive due to balancing formula and using innovative technology by using fibrolytic enzyme and Cellulomonas sp. Bacteria inoculants (Romziah, 2010). Therefore every goat that consumed these complete feed might be increase their milk production as well as milk

nutritive values, bioactive peptide and CLA content in milk (Romziah, 2010).

Learn about peptide bioactive and CLA in goat milk, the present research was aimed to observe of the goat milk production and quality by measuring the effects of complete feed with high linoleic acid content on milk production, CLA content in milk, and the profile of molecular weight of goat milk peptide.

MATERIAL AND METHOD

The experiment consisted of two stages.

The first stage: the experiment used Complete Randomized Design which consisted of four complete feed formulas (F1: conventional feed; F2: complete feed with fibrolytic enzyme and 0,01% corn oil; F3: complete feed with innoculant Cellulomonas sp. bacteria and 0,01% corn oil F4: complete feed with combination of fibrolytic enzyme and innoculant Cellulomonas sp. bacteria and 0,01% corn oil, with four replications. Each type of complete feed was analyzed on chemical compositions that include, Linoleic acid, Neutral Detergent Fiber and Acid Detergent Fiber content.

Second stage: 16 Ettawa female goat in production stage (1-4 months milking period) with averaging 45 kg of body weight and about 2 years old were used as the experimental animals. The animals were divided into four groups (F1, F2, F3 and F4), therefore each group consisted of four animals as replications. Animals in group F1 receiveing conventional feed, Group F2 receiveing complete feed with 0.05% fibrolytic enzyme and 0,01% corn oil, group F3: receiveing complete feed with innoculant 0.05% Cellulomonas sp. bacteria and 0,01% corn oil, and group F4: receiveing complete feed wich is containing fibrolytic enzym combine with innoculant Cellulomonas sp. bacteria and 0,01% corn oil The experiment was designing on Complete Randomized pattern (4 treatments x 4 replications). Feeding trial was implemented into three weeks periode and milk sample was collected everyday for measuring milk production and to be anaylyzed the nutritive values, and CLA content in milk. Milk peptide was isolated by elution technique and ditermination and mapping of the molecular weight profile of milk peptide using electrophoresis and SDS-PAGE method.

Data were analyzed by using analysis of variance and Duncan's Multiple Range Test method which was used SPSS software application.

RESULTS AND DISCUSSIONS

Table 1 showed about the chemical composition data of various complete feed. Base on the proximate analysis, the crude fiber content was decreased when complete feed fermented by fibrolytic enzyme and or Cellulomonas sp inoculants, because of the stretch-out of linkage between lignin and cellulose in the cell wall of forages ingredient. Linoleic acid content in complete feed was increased on complete feed F2, F3 and F4 that containing corn oil. It can say that corn oil may influence the linoleic acid content in various complete feed with the range about 3.206 to 4.7357 %. However fat content was lower in both complete feed F3 and F4. Protein content range about 13.31 to 14.89%, there was as standard value of ruminant feed. The standard value of protein and the lower crude fiber content in complete feed will improve the digestibility rate and feed efficiency.

Table 1. Chemical Composition of Various Complete Feed

Type of Complete feed	DM 105^0 (%)	DM 60^0 (%)	Ash (%)	Crude Protein (%)	Fat (%)	Crude Fibre (%)	Ca (%)	BETN (%)	NDF (%)	ADF (%)	Linoleic Acid (%)
F1	96.8215	46.1678	11.1089	14.1238	13.8761	17.0742	1.0081	34.779	49.2754	38.8529	2.691
F2	88.2032	80.2032	9.5516	13.3132	11.9683	15.6969	0.9746	37.6732	59.3345	20.9303	3.206
F3	86.374	78.3379	9.4038	1.8946	7.1354	14.2179	1.5738	40.6853	60.9108	19.445	4.7524
F4	85.2957	79.2997	9.7306	13.5657	8.6603	13.969	1.3758	39.374	51.8918	22.1797	4.7357

Table 2 showed the average of feed consumption of complete feed by Ettawa Goat was significantly different ($p<0.05$). Conventional and F4 complete feed (containing 0.05% fibrolytic enzym combine with 0.05% innoculant Cellulomonas sp. bacteria and 0,01% corn oil) were higher consumed by Ettawa goat. However, complete feed F2 (complete feed with 0.05% fibrolytic enzyme and 0,01% corn oil), and F3 (complete feed with innoculant 0.05% Cellulomonas sp. bacteria and 0,01% corn oil) were more efficiently (<0.05) consumed by Ettawa goat, with feed consumption level about 2.125 to 2.138 g/hd/d) compare to goats receiveing conventional feed and or F4 complete feed. Many factors could influenced the goat feed intake such as: nutritive values of feed, palatability of feed, stage of growth, productivity level, and climate change. In this case, the feed efficiency doe to the increasing level of hemicellulose in F2 (39%) and F3 (41%) complete feeds, as known that hemicellulose is a source of energy for producing volatile fatty acid. So, the Ettawa goat will stop for consumed complete feed whenever energy source in the blood streems was high. The hemicellulose of F4 was higher (49%), but it consumed more by Ettawa goat compared to F2 and F4 groups. If coventional feed contained about 10.42% of hemicellulose, so the Ettawa goat in this group have higher feed consumption compare to F2 and F3 groups, but this group have the same level of feed consumption with F4 group. Why the group F4 have a higher feed intake, eventhought the hemicellulose content in this complete feed is higher, the reason is unexplained.

Table 2.The Average of Feed Consumption of Complete Feed by Ettawa Goat

Type of Complete Feed	Feed Consumption (kg/hd/d)
F1	$3.000^{a} \pm 0,408$
F2	$2.138^{b} \pm 0,722$
F3	$2.125^{b} \pm 0,625$
F4	$3.350^{a} \pm 1,73$

[a and b] Superscript in the same column is significantly different ($p<0,05$).

Milk production of goat fed complete feed with high linoleic acid were increased significantly ($p<0.05$), and it range about 519-570 ml/h/d. By using these complete feed with high linoleic acid may increased milk yield up to 147.8%.

Milk fat content of Ettawa goat milk tend to be increased when the goat consumed complete feed with high linoleic acid, and its followed by increasing ($p<0.05$) conjugated linoleic acid in milk. Milk fat content varies around 6.0 to 6.93%, these milk fat content of Ettawa goat were quite high, because the fat content of various complete feed and control feed were on high level. So the metabolic products of digestion of fat and carbohydrate of complete feed may produce a high synthesize of milk fat. Bio-dehydrogenation process of linoleic acid of complete feed in the rumen of goat was efficiently to produce a high conjugated linoleic acid. All types of complete feed might influence on the increasing conjugated linoleic acid content in Ettawa goat milk, which were around 3.4345 to 4.4750%. Milk protein of goat fed receiveing complete feed with 0.05% fibrolytic enzyme and 0,01% corn oil tend to be higher compared to other groups. The lactose content in Ettawa goat milk were not significantly different ($p>0.05$).

Table 3. The Average of Goat Milk Production and Quality

Parameter	Treatment Group			
	F1	F2	F3	F4
Milk Production,ml/hd/d	230.00[b]±53,18	570. 31[a] ±79,21	535.06[a] ±62,23	519.38[a] ±74,62
Density Weight	1.0295	1.0269±0	1.0275±0,00	1.0280±0,00
Milk Fat, %	6.00±1	6.83±1,55	6.76±0,68	7.93±0,63
Protein, %	5.78±0,57	6.055±0,66	5.21±0,40	5.027±0,37
Laktose, %	6.09±1,21	5.56±1,30	6.09±0,93	6.18±0,43
Dry Matter, %	16.38±1,26	15.50±2,55	15.25±1,09	17.59±0,03
Solid non Fat, %	9.8±0,09	8.75±0,36	8.75±0,38	9.29±0,03
Conjugated Linoleic acid, %	3.755[b] ±1,63	3.4345[ab] ±0,78	4.4750[a] ±1,21	3.8735[a] ±0,34

[a and b] Superscript in the same column is significantly different (p<0,05).

Molecular weight of Ettawa goat milk peptide were higher on groups F2 and F3 which were received complete feed containing fibrolytic enzyme and or Cellulomonas sp. bacteria inoculants with corn oil, its more than 42 kda. According to the earlier researcher founded the goat milk peptide was around 30 kda. It can be said that complete feed with high linoleic acid content might affect on molecular weight of Ettawa goat milk peptide. The high level of milk peptide molecular weight, it indicated that milk peptide have some potentially as immune-modulator effects to perform as an antibacterial and or anti-carcinogenic. Figure 1, showed the milk peptide profile base on the type of complete feed fed by Ettawa goat according to electrophoresis and SDS-PAGE method.

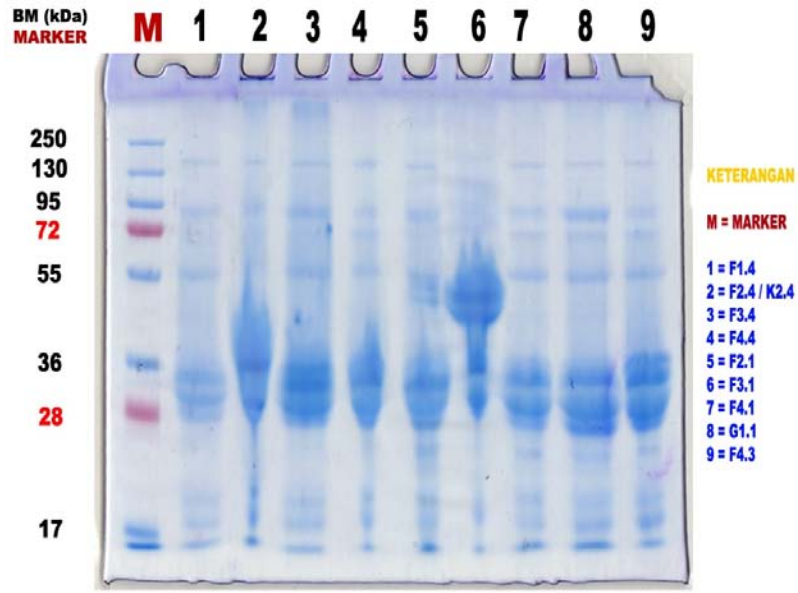

Figure 1. Goat Milk Protein Fragment by Different Consumption of Complete Feed.

CONCLUSION

Complete feed contain fibrolytic enzyme and or Cellulomonas sp. bacteria inoculants with corn oil affect on increasing feed efficiency and linoleic acid content in Ettawa goat milk.

The specific molecular weight of Ettawa goat milk peptide fed complete feed which is containing fibrolytic enzyme and or Cellulomonas sp. bacteria inoculants with corn oil, its more than 42 kda.

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