EFFECT OF CALCIUM SOAP SUPLEMENT ON RUMINAL METABOLISM AND FATTY ACID COMPOSITION OF LONGISIMUS MUSCLE IN LOCAL SHEEP

G. Joseph[1)], A. Parakkasi[2)], T.R. Muchtadi[3)] & R. Priyanto[2)]
[1)]**Department of Animal Husbandry, Faculty of Agriculture, Pattimura University, Ambon**
[2)]**Faculty of Animal Husbandry, Bogor University**
[3)]**Faculty of Agriculture Technology, Bogor University**
Penulis korespondensi e-mail: godliefjoseph@gmail.com

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Abstract

The experiment was carried out to study an effect of lipids in form of Ca-Soup which based on fish oil on ruminants. 15 local male sheep were devided into 3 treatments, namely: RA (basal diet without Ca-Soap) as control; RB (control diet + 5% Ca-Soap); and RC (control diet + 10% Ca-Soap). The basal diet was in pellet form which consisted of 40% field grass and 60% concentrate. The experiment design used was Randomised Block Design with 3 diet treatments and 5 replications. The results showed that the supplementation of Ca-Soap which using fish oil had significant effect on increasing of VFA total production, it could also improve the carcass quality and fatty acid ratio. Ca-Soap with fish oil base was effective as energy and polyunsaturated fatty acid sources in sheep diets. It was indicated by normal rumen metabolism and good performance.

Keywords: *Ca-Soap, fish oil, sheep, fatty acid*

INTRODUCTION

Productivity of livestock in the tropics, including in Indonesia is very low so it can not sufficient consumer demand. One reason is forage of high nutritional value is less available. For ruminants, like cows, buffaloes, goats and sheep, forage is the main energy source. Fish oil, a byproduct of the industry, which still contains high lipids mainly polyunsaturated fatty acids so it can be used as animal feed sources of energy and essential fatty acids.

The use of a high lipids in ruminant diet is necessary to watch out because it can have negative effects in animals, especially in the process of fermentation in the rumen such as: reduce digestability of fiber, toxic to cellulolytic bacteria, decrease the activity of the enzyme and reduce the absorption of some cations (Parakkasi, 1995).

Rumen microorganisms can also be hydrogenated poly unsaturated fatty acids causes the fatty acids entering the small intestine contains high saturated fatty acid (Lloyd et al., 1978). It can cause the ruminants meat has a saturated fatty acid content is high which can increase cholesterol. Cholesterol can cause narrowing and even blockage of blood vessels, called atherosclerosis causes coronary heart disease (CHD).

Parakkasi (1995) found that characteristics of fat in ruminants can be affected if it can be change microbial reactions or lipids provided that do not have the processes in the rumen that is the mechanism: the rumen by pass. Technology

calcium-soap (ca-soap) is one of the lipids protection technology in recent years has been developed.

Research Objectives:

1. To study an effect of lipids in form of ca-soap which base on lemuru fish oil on ruminant diets
2. To investigate the use of technology calcium soap to protect poly unsaturated fatty acids from biohydrogenated rumen microorganisms
3. Study the extent to which the use of calcium soaps (ca-soap) on ruminant meat production both in quantity and quality.

MATERIALS AND METHODS

The experiment was carried out to study an effect of lipids in form of Ca-Soup which based on lemuru fish oil on ruminants. 15 local male sheep (body weight 9-22 kg) were devided into 3 treatments, namely: RA (basal diet without Ca-Soap) as control; RB (control diet + 5% Ca-Soap); and RC (control diet + 10% Ca-Soap). The basal diet was in pellet form which consisted of 40% field grass and 60% concentrate (table 1). Rations are given in limited amounts at 3.8% of body weight and adjusted every week in line with needs. Parameters were measured: the consumption of dry matter and organic matter, digestibility of dry matter and Volatile Fatty Acid (VFA), and NH_3-N.

After 3 months of fattening period is finished,the sheep was slaughter without stunning. To evaluate the quality of carcass and meat as well as studying the incorporation of poli unsaturated fatty acids on lamb carcass, the left side of longisimus dorsi was analyzed. The parameters observed were:body weight, hot carcass weight, carcass percentage, rib eye area, intramuscular fat (marbling), and fatty acid content of meat.

Statical analysis

The experiment design used was Randomised Block Design (RBD) with 3 diet treatments and 5 replications. . Mathematical model is as follows:

$$Y_{ij} = \mu + \tau_i + \beta j + \varepsilon_{ij}$$

Furthermore, processed data obtained by analysis of variance (ANOVA) and differences between treatments were tested with Orthogonal contrast test (Steel and Torrie, 1991)

Table 1. Material composition and nutrient content of rations research

	Rations A (RA)	Rations B (RB)	Rations C (RC)
Ingredient (%)			
Grass	40	40	40
Yellow corn	12.5	10	7
Soybean meal	21	22.5	24.3
Pollard	7	7	7.7
Rice bran	13	9	4.5
Palm oil	5.5	5.5	5.5
Premix	1	1	1
Calcium Soap	0	5	10
Nutrient			
Dry material (%)	87.03	86.50	87.28
Crude Protein (%)	16.7	16.64	15:15
Crude fiber (%)	17:30	15:04	17.85
Crude Fat (%)	7:53	9:18	10.67
Ca (%)	00:51	1:21	1:27
P (%)	12:30	0.80	0.75
Energy (kcal / kg)	3790	3956	4069

Sources: Primary Data

RESULT AND DISCUSSION

Preliminary results of calcium-soap preperation and in-vitro experiments concluded that the content of poly unsaturated fatty acid (PUFA) in lemuru fish oil higher compared with the CPO. The technology of calcium soap effectively protects the poli unsaturated fatty acid from biohydrogenated microorganism in the rumen. Further research was apply to calcium soap based on lemuru fish oil.

The results of the analysis of the average consumption of dry matter (DM) and orginic matter (OM), digestibility of DM and OM, pH of rumen fluid, total VFA, NH_3-N, daily weight gain, feed efficiency and feed cost/gain are presented in Table 2.

Analysis of variance showed that the rate of consumption of dry matter there was no significant effect (P> 0.05). This is because the provision of rations for sheep in this study are the same at 3.8% of live weight. Although dry matter intake was not significantly different but the consumption of dry matter in the RC and RB treatment tend to be higher, compared to RA. This suggests that supplementation of calcium soaps was found to increase the quality of rations so that its consumption increased. Parakkasi (1995) stated that the ration of good quality resulting higher consumtion than inferior quality rations.

Similar results occurred in the consumption of organic matter. Analysis of variance showed that consumption of organic matter is no significant effect (P> 0.05). Increased consumption of dry matter and organic matter that occurs in RB and RC treatment allegedly due to the supplementation of calcium soaps. This shows that the addition of lipids in the form of calcium soaps may increase palatability so that consumption increase. Parakkasi (1995) also reported that one of the positive

nature of the addition of lipids in the ration of ruminants are able to increase the ration palatability, thus the level of consumption ration can be improved with all their consequences for the animal.

Quality is also determined by the digestibility of ration nutrients contained in the ration. The addition of lipids in ruminant rations could negatively impact and interfere with digestion. Results of analysis of variance showed that the level of digestibility of dry matter and organic matter there is no significant effect (P> 0.05). This means that supplementation of lipid in the form of calcium soap can protect lipid from the digestive system in the rumen, thereby increasing the consumption and digestibility of rations.

Table 2. Effect of treatment of the average consumption of dry matter (DM) and orginic matter (OM), digestibility of DM and OM, pH of rumen fluid, total VFA, NH_3-N, daily weight gain, feed efficiency and feed cost/gain.

PARAMETERS	RA	RB	RC
Consumtion of DM (g/day)	525.51	645,74	650,42
Consumtion of OM (g/day)	479.41	562.95	555.10
Digestibility of DM (%)	58.24	61.63	60.51
Digestibility of OM (%)	59.29	63.0	61.15
pH of rumen fluid	6.24	6.68	6.56
Total VFA (mMol)	122.8	141.6	170.0
NH_3-N	7.66	8.35	7.27
Daily weight gain (g/day)	74.29	104.0	106.23
Feed efficiency	0.1454	0.1653	0.1593
Feed cost/gain (IDR)	14.787	17.065	20 615

Sources: Primary Data

Ruminal pH has an important in supporting the growth of rumen microbes and produce volatile fatty acid (VFA) and ammonia (NH_3-N). Ruminal pH range is ideal for the digestion of cellulose is 6.4 to 6.8 where the ruminal pH lower than 6.2 then the process of fiber digestion began to fail. Analysis of variance showed that the pH of rumen fluid were not significant effect (P> 0.05).

The results showed that the total VFA in the treatment of RB and RC is higher than the treatment of RA (control). Analysis of variance showed that there is a significant effect (P <0.01). Orthogonal contrast test showed that the total VFA production in the treatment of RA is lower than the RB and RC, is between RB and RC no significant level. Koock, et al., (2002) also reported that the Korean cattle that get extra rations of fish oil in VFA production have a higher total of 70.20 (mmol) than those which do not get add fish oil (control) is 49.86 (mmol). In addition alleged increase in total VFA production because there is an increase in VFA fractions of acetate, propionate and butyrate.

The concentration of NH_3-N among others determined by the level of protein feed consumed, degree degrabilitasnya, old

food in the rumen and pH of the rumen (Ørskov, 1982). NH3-N levels in this study are still within the normal range. Analysis of variance showed that the levels of N-NH 3 were not significantly effect (P> 0.05). Thus the addition of animal fat in rations of sheep in the form of calcium soap, no effect on the growth of microbes so that the process of deamination of amino acids and forage fermentation can take place optimally.

Analysis of variance showed that no significant effect in average daily gain (ADG). Nevertheless ADG on treatment received additional calcium soap (RB and RC) that tend to provide better ADG is 102 and 106 (g /head/day) compared to controls (RA) is 72 (g /head/day). The high ADG at RB and RC treatments associated with the consumption and digestibility of dry matter and organic matter are high. In addition of supplementation calsium soap to RB and RC can increase the supply of high energy so it can deliver growth or better production.

The results showed that the feed efficienci ratio (FER), is no significant effect (P> 0.05). This FER value if converted would obtain the feed conversion value were: 6.88; 6.05 and 6.28 respectively for the treatment of RA, RB and RC. Sunaryadi (2006) reported on the local sheep fed supplements mineral proteinat, khitosan and brown seaweed extract that the FER ranged from 0.94 to 0156. Although the EPR value is not significantly effect but feed conversion value in the treatment of RB and RC is better than the treatment of RA. This suggests that supplementation of calcium soaps can increase the efficiency of the use of rations.

Feed cost per gain (FC / G) in this study was to RA (IDR 14,787, -/kg), RB (IDR 17 065, -/kg) and RC (IDR 20,615, -/kg). RB and RC treatment is higher because the price of fish oil and chemicals are expensive, so for makeing of calcium soap 1 kg needed to IDR 11,720, -. Value FC / G is almost identical to those reported Sukadi et al., (2002), Rp 11,232, -; IDR 17,940, - and IDR 21,068, - one each for the control treatment and addition of hyper growth phytogenik 0.5 and 1 gram / heat.

Average body weight, carcass weight, carcass percentage, rib eye area and backfat presented in table 3. The results show that there are no significant effect (P > 0.05). However a high percentage of carcasses at RB and RC treatment is in accordance with body weight and carcass weight are also high. Romans et al., (1994) reported that the percentage of carcasses of sheep is 50%.

Table 3. Average body weight, carcass weight, carcass percentage, rib eye area and backfat thickness between treatments.

Items	RA	RB	RC
Body weight (kg)	19.40	23.68	24.24
Carcas weight (kg)	8.0	10.24	11.16
Carcas percentage (%)	40.82	52.24	56.93
Rib eye (cm2)	7.48	7.84	11.83
Backfat (mm)	2.20	2.875	2.40

Sources: Primary Data

In determining quality grade according to the USDA the intramuscular fat (marbling) is one important factor and is usually associated with the maturity level. At the same maturity level, quality grade can still be different from the differences in the degree of marbling. The results showed that the average intramuscular fat is no significant effect (P > 0.05). However quality grade on the treatment of RA Chois categorized into classes being on the treatment of RB and RC higher quality grade that are categorized into the super class (Figur 1).

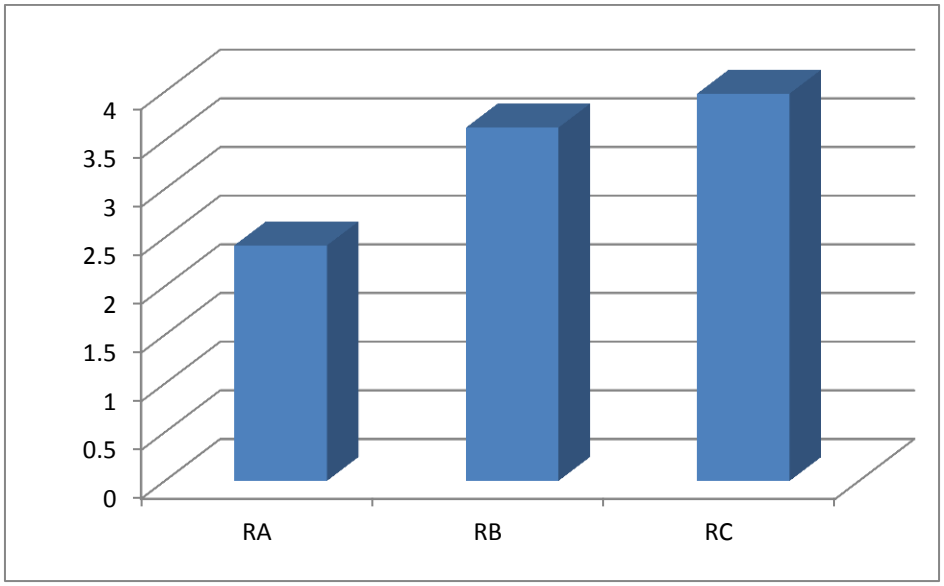

Figure 1. The content of intramuscular fat (marbling) between treatment

The ratio of poly unsaturated fatty acids to saturated fatty acids, is also one important factor in efforts to reduce levels of cholesterol in blood. Based on the results of several studies recently suggested that the ratio of poly unsaturated fatty acids with saturated fatty acids preferably ranges from 1.5 to 2.0. Fatty acid composition between treatments are presented in Figure 2.

The results showed that the ratio of poly unsaturated fatty acids with saturated fatty acids is 0.21; 1.28 and 2.96 respectively for the treatment of RA, RB and RC. This means that the addition of fat in the form of calcium soaps can increase the ratio of poly unsaturated fatty acids with saturated fatty acids. Thus calsium soap effectively protecting polyunsaturated fatty acids from

the biohydrogenated rumen microorganisms so polyunsaturated fatty acids can pass through the small intestine, absorbed, and eventually into the meat inkorporated.

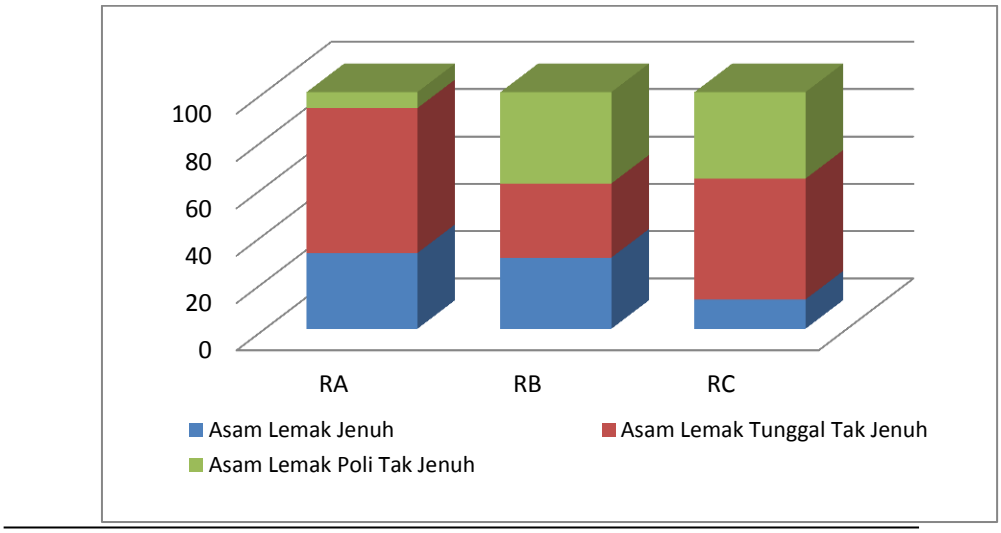

Figure 2. The composition of the fatty acid content between treatments.

CONCLUSION

Technology of Ca-Soap base on lemuru fish oil in sheep diet is effectively as energy and poly unsaturated fatty acid sources in sheep diet. It was indicated by normal rumen metabolism, improving the quantity and quality of meat.

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