

The effect of protected sardine fish oil as feed supplement on ruminal fermentation

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Abstract. The research aims to evaluate the influence of protected sardine fish oil as feed supplement on ruminal fermentation (pH rumen fluid, ammonia concentration and volatile fatty acids production in the rumen). Protected feed supplement was produced from sardine fish oil and soybean meal, through two protection methods, they were saponification and microencapsulation. The experiment consists of two treatments i.e. P0: basal diet (control) and P1: basal diet + 3 % protected feed supplement. Each treatment was repeated 10 times. The kinetics observation of the pH rumen fluid, ammonia concentration and volatile fatty acids production were performed at incubation times 0, 2, 4 and 6 hours respectively. Data were analyzed using independent samples t-test. Results in cow with protected feed supplement showed that kinetics of pH rumen fluid: 7.23; 7.13; 6.90 and 6.76 respectively; ruminal ammonia concentration: 26.70; 31.06; 19.75 and 15.52 respectively; and volatile fatty acids production: 22.75; 26.08; 29.19 and 25.79 respectively. The results could be concluded that the effect of supplementation of protected sardine fish oil have an optimal of pH rumen fluid, ammonia concentration, and volatile fatty acids production so it did not interfere the ruminal fermentation in the rumen.

1. Introduction

Energy and protein are nutrients as needed for growth, milk production and reproduction in dairy cows [1]. Increasing the energy intake for ruminant livestock can be conducted by increasing the energy density of feed by using fat (oil). One of potential energy source that widely available and cheap is sardine fish oil. Sardine fish oil contains high unsaturated fatty acid. Unsaturated fatty acid supplementation is proven to be able to increase energy efficiency through increasing energy density and sustain the efficiency improvement of milk protein synthesis through increasing the flow of nitrogen (N) non-ammonia into the duodenum [2].

Protection treatment is needed to gain the real benefit from the presence of energy source supplementation or protein in feed. In the unsaturated fatty acid supplementation, protection is required to prevent unsaturated fatty acids from ruminal microbes biohydrogenation. Protection is also useful to eliminate the negative effects of high concentration of unsaturated fatty acid supplementation, and reduction in fiber degradability [1]. Based on the above statement this study aim to evaluate the effect of the protected sardine fish oil as feed supplement on ruminal fermentation (pH rumen fluid, ammonia concentration and volatile fatty acids production in the rumen).



2. Material and Methods

2.1 Sample preparation

This research was used two cows with fistula. The requirement of dry matter intake for each cow was calculated 3% of their weight. The balance of forage and concentrate is 70:30 (control). The diet containing for 12% crude protein and 60% total digestible nutrients. Feed materials used to construct the concentrate consist of concentrate, bran pollard, urea and mineral. King grass was used as forage in this research. Feed giving of protected fat as a supplement feed was 3% of dry matter intake. Comparison for forage : concentrate : feed supplements was 70 : 27 : 3. Feed is given twice daily at 08.00 and 15.00 WIB, unless protected fat is given once at 08.00 am, while drinking water for livestock is given ad libitum. The rumen fluid intake for pH, NH₃ and VFA was performed using an aspirator to represent the entire rumen portion. Sampling was done in 4 times that is divided to before feeding (at 8.00 AM) and after feeding, that time is: 8.00 AM, 10.00 AM, 12.00 AM, and 2.00 PM, so the total of 4 samples to be analyzed. Each treatment was repeated for 10 times observation.

2.2 Measurement of pH rumen, NH₃ and VFA

pH of rumen was measured immediately after sampling of the rumen using pH meters. Ammonia nitrogen (NH₃) content was calculated using the Conway method. Finally, VFA was determined using gas chromatography method.

2.3 Data analysis

Data obtained in the current study were analyzed by independent Student's t-test using SPSS version 22.

3. Results and Discussion

3.1 pH kinetic of rumen fluid

The comparison of *pH kinetic* of rumen fluid between treatment (control vs protected) is shown in Figure 1. There were no significant different between treatment.

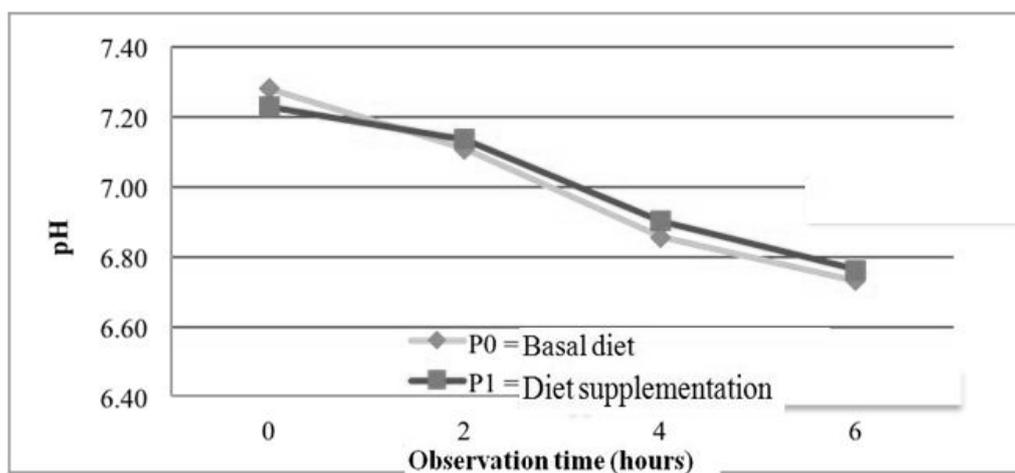


Figure 1. pH of rumen

Changes in pH occurring in the rumen are affected by the type of feed given [3]. The results indicate that the provision of protected sardine fish oil supplementation (P1) does not give a negative effect on the rumen microbial environment, because the pH value of rumen fluid 6.76 to 7.23 in this study is still within the normal condition. Kinetic pH of rumen fluid, after feeding tends to decrease gradually, because of fermentation in the rumen. The crude fiber will be degraded by cellulotic

bacteria in the rumen resulting VFA. The decrease of pH in the rumen is due to VFA is an acidic compound [4].

3.2 Amonia (NH₃)

The concentration of NH₃ in rumen fluid of basal diet and protected sardine fish oil supplementation (P1) can be seen in Figure 2.

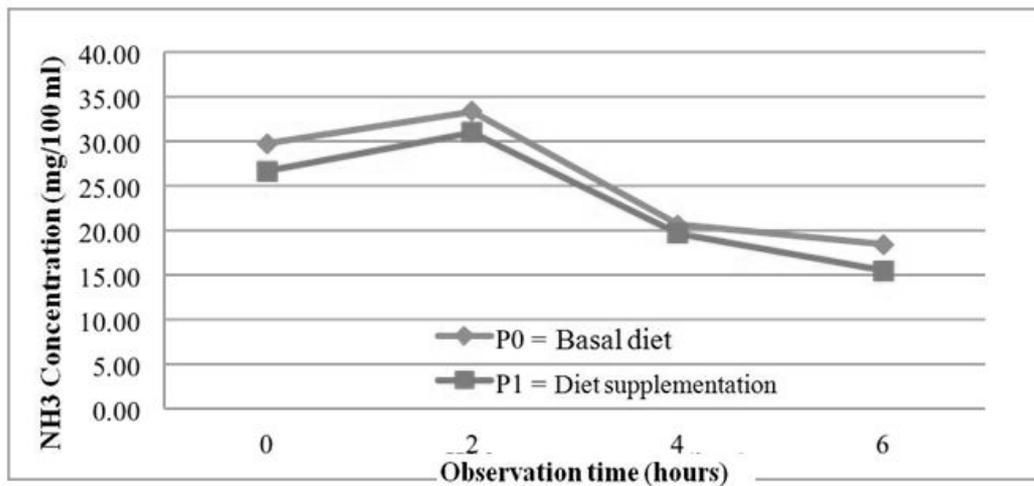


Figure 2. Concentration of NH₃

NH₃ concentration of rumen fluid in P1 is lower than P0. This is presumably because soybean meal protein as microencapsulation agent of Sardine fish oil is also protected then it is not degraded completely lead to the less concentration of NH₃. Feeding of protected proteins will decreasing NH₃ rumen concentrations [5]. Moreover, protecting soybean meal protein with formaldehyde is also shown to decrease protein degradation [6].

3.3 Volatile fatty acid (VFA)

Kinetics of total VFA concentration of cow rumen fluid at 0, 2, 4, and 6 hours after feeding can be seen in Figure 3.

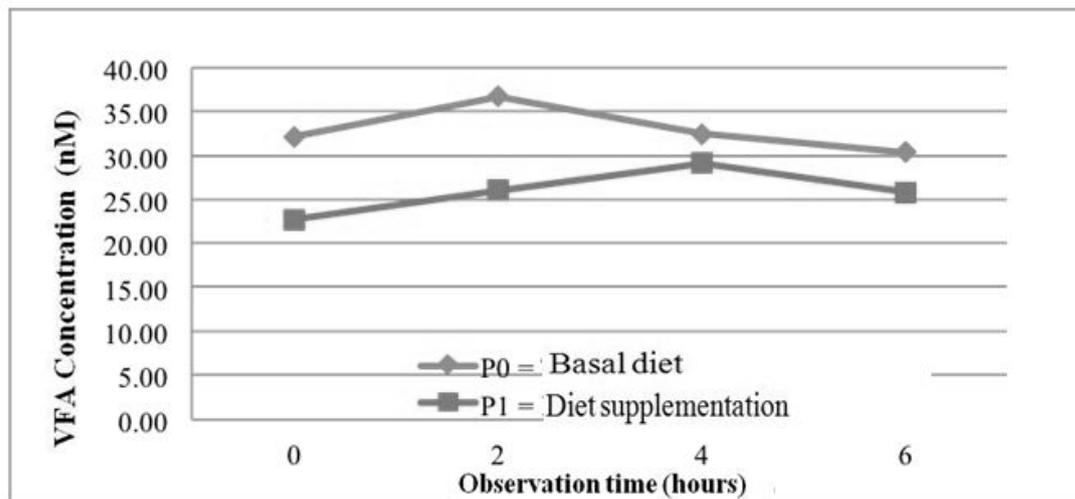


Figure 3. VFA Concentration

VFA concentration of rumen fluid in P1 shown to have lower total VFA concentration than P0, although there was no significant difference ($P>0.05$). This indicated that protected of sardine fish oil supplementation able to decrease rumen microbial activity in producing VFA and NH_3 in the rumen fluid. The protected feed treatment may reduce/limit the ability of rumen microbial cell surface to contact with feed [7].

4. Conclusion

It is concluded that effect of supplementation of protected sardine fish oil has an optimal of pH rumen fluid, ammonia concentration, and volatile fatty acids production, therefore did not interfere the ruminal fermentation in the rumen.

References

- [1] Pramono A, Handayanta E, Widayati D T, Putro P P and Kustono 2017 Dietary protected feed supplement to increase milk production and quality of dairy cows *Proc. International Conference On Food Science and Engineering* Surakarta
- [2] Johnson K A, Kincald R L, Westberg H H, Gaskins C T, Lamb B K and Conrath J D 2002 *J. Dairy Sci.* **85** 1509–15
- [3] Owens F N and A L Goest 1988 Ruminant fermentation. In : D.C. Church (Ed), *The Ruminant animal*. Printice Hall, Englewood Cliifs, New Yersey. Pp: 145 - 171
- [4] Kerley M S, Fahey G S, Berger L L and Merchen N R 1987 Effect of treating wheat straw with pH regulated solution alkaline hydrogen peroxide on nutrient digestion by sheep *J. Dairy. Sci.* **70** 2078 - 2084
- [5] Rodriguez L A, Stallings C C, Herbein J H, and Mc Gilliard M L 1997 Effect of degradability of dietary protein and fat on ruminal, blood, and milk components of Jersey and Holstein cows *J. Dairy. Sci.* **80** 353 - 363
- [6] Utomo R 2010 Modifikasi metode penetapan kecernaan in vitro bahan kering atau bahan organik *Sintesis* **5** 1 - 11
- [7] Schaefer D M 2000 *Potential For Altering Quality Of Muscle And Milk From Ruminants: Antioxidants In Muscle* Wiley Interscience. New York. pp: 293 – 312