

IN VITRO DIGESTIBILITY STUDY OF FRACTIONATED REFINED, BLEACHED AND DEODORIZED PALM STEARIN

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Abstract. In vitro digestibility study was conducted to determine the effects of supplementing fractionated Refined, Bleached and Deodorized Palm Stearin (RBDPST) on ruminal digestion. Fractionated RBDPST was soaked in incubation medium consisting of distilled water, buffer solution, trace element solution, micro and macro mineral solution, as well as rumen liquor that was collected from slaughtered cattle. This experiment was conducted at 39°C with an incubation period of 24 hours. Dried napier grass was used as control treatment. Gas produced was recorded and collected to measure the methane gas produced. Methane gas produced from fractionated RBDPST was found to be relatively lower than control. This indicates that fractionated RBDPST had the ability to function as rumen bypass fat as it was not fully digested in the rumen.

Keywords: fat supplement, in vitro, rumen digestibility, triglyceride, fatty acid, animal feed, palm oil

INTRODUCTION

Nutrient requirements of dairy cattle during early lactation often exceed the amount of energy that is available from ruminal fermentation and protein synthesis. Without the addition of extra energy in their diet, the cattle will mobilize body nutrient reserves, particularly body fat which can result in weight loss, acetonemia and reduced fertility (L Hartati *et al.*, 2012). Therefore by considering the energy density, one important area of nutrition to focus on is fats, as fats provide more energy than carbohydrates (Frank B Hu, 2010).

The energy density of dairy cattle diet can be enhanced by incorporating fats in their feeding program. However, there is a limitation to use high levels of fats in the ration, as it will give negative impact to rumen fermentation. High levels of fat can depress both dry matter intakes and milk components. (Miriam *et al.*, 1998). The negative impact of fat on rumen metabolism can be avoided by protection method (Naik *et al.*, 2009). There are several

methods applied to produce the protecting fats including prilled, hydrogenated and calcium salts of fatty acids (*Carrol et al.*, 1990, *Cannace et al.*, 1990, *Jenkins and Jenny*, 1992) whereas, *Chalupa et al.*, (1984) reported that increasing saturation of fatty acids component can lessen the inhibitory effects of lipid supplements on ruminal fermentation.

Palm oil consists about 45-50% of saturated fatty acids, made up of 44% palmitic acid and 5% stearic acid. Refined, Bleached and Deodorized Palm Stearin (RBDPST) is the solid fraction of palm oil, which is produced by fractionation of palm oil after partial crystallization at controlled temperature. RBDPST is further fractionated to increase saturated fatty acid from 60.67% to 85.7% (*Norliza et al.*, 2012). As a result, fractionated RBDPST has higher melting points and lower iodine value. These characteristics fulfilled the fat supplement requirement for dairy cattle to improve milk production, fertility and minimize body weight loss.

Blummel and Orskov (1993) reported that the *in vitro* gas production technique developed by *Menke et al.* (1979) can be used to determine gas production at various incubation periods and these values could be used to describe the course of fermentation of the feeds. Laboratory *in vitro* method was conducted to evaluate the digestibility of fractionated RBDPST which was formulated in combination with napier grass and napier grass alone as a control sample (*M.H. Palizdar*, 2011).

MATERIALS AND METHODS

RBDPS was obtained from Sime Darby Jomalina Sdn Bhd. Chemicals for the analyses were purchased from Merck (M) Sdn Bhd.

Fractionation of RBD Palm Stearin

Fractionation of RBDPS was conducted with a 50 kg pilot plant scale crystallizer and membrane filter. RBDPS was first heated to 80°C to destroy crystals that may be present in the material. The melted RBDPS was then fractionated according to a specified cooling program (*Norliza et al.*, 2012).

In vitro Digestibility

A total of 0.5 g fat sample was used in this experiment and was incubated in rumen liquor that was collected from a slaughtered cattle at temperature 39°C for 24 hours. A treatment with guinea grass was used as control treatment.

Gas volume was recorded every 4 hours. After 24 hours of incubation, gas produced was collected into tubes filled with distilled water by displacement. Culture samples were then filtered through ANKOM filter bags for dry matter digestibility determination. The filtrate samples were then analyzed for volatile fatty acid composition.

The significance of difference between means was determined by Duncan's Multiple Range Test ($P < 0.05$)

using SAS statistical programme (Version 9.1). Values are expressed as means \pm SE

RESULTS AND DISCUSSION

Results obtained are presented in Table 1. Degradability rate of fractionated RBDPST is 6.42% compared with the control 42.56%. This indicates that fractionated RBDPST samples have ability to function as fat supplement as it was not fully digested in the rumen.

Gas produced by fractionated RBDPST samples was relatively lower than the control ($P < 0.05$) This is a good indication as the lower gas production indicates that less methane was released by the fat sample. Fractionated RBDPST produced 1975.23 ppm of methane, 49% lower compared to control treatment 3877.76 ppm.

In rumen, glycerol and the sugars released from glycolipids are fermented to Volatile fatty acid (VFA). In vitro VFA production is presented in Table 2. Total VFA concentration for fractionated RBDPST treatment was significantly lower ($P < 0.05$) compare to napier grass. Individual concentrations of VFA were higher compare to the fractionated RBDPST. These results showed fractionated RBDPST have a little or no effect of on rumen fermentation process. It was due to high melting point of fractionated RBDPST, resulting low solubility (Norliza *et al.* 2012) of fat in rumen.

CONCLUSION AND RECOMMENDATION

Methane emission in fractionated RBDPST is significantly reduced compared with to Napier grass. Therefore, fractionated

Table 1: In vitro dry matter digestibility, methane production and volatile fatty acids of fractionated RBDPST and guinea grass

Sample	Parameter	
	Degradability rate (%)	Methane production (ppm)
Napier grass	42.56 ^a	3877.76 ^a
Fractionated RBDPST	6.42 ^b	1975.23 ^b

^{ab} Min values with different superscript are significantly different

Table 2: Volatile fatty acids of fractionated RBDPST and Napier grass using in vitro technique

	Acetic acid	Propionic acid	isobutyric acid	n_butyric acid	iso_valeric acid	n_valeric acid
Fractionated RBDPST	5.9555	1.5281	0.1061	0.5858	0.188	0.0888
Napier grass	13.2686	4.7136	0.3558	3.2299	1.2047	0.3785

RBDPST can be used as fat supplement in dairy cattle. The study showed the fat did not alter the digestibility in rumen and can provide high energy to increase milk yield with high content of acetic acid.

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