



# Production of Volatile Fatty Acids from Complete Feed Fermentation Containing Palm Pith In Vitro

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**Abstract.** This study aims to determine the effect of using complete ration pith as a substitute for forage on VFA production in vitro. The experimental design used was a completely randomized design with four treatments and four replications. The treatments were P0 = 75% forage + 25% concentrate, P1 = (25% palm pith + 75% forage) + 25% concentrate, P2 = (50% palm kernel + 50% forage) + 25% concentrate and P3 = (75% palm pith + 25% forage) + 25% concentrate. Parameters measured were the molar proportions of acetate, propionate, butyrate and total volatile fatty acids. The results showed that the treatment was significantly different ( $P < 0.05$ ) in the molar proportion of acetate. In treatment P1 the molar proportion of acetate was significantly lower ( $P < 0.05$ ) compared to treatment P0, P2 and P3 and there is no significant difference between P0, P2 and P3. The molar proportions of propionate, butyrate and total volatile fatty acids were not significantly different between treatments. It can be concluded that there was a decrease in the proportion of molar acetate and an increase in propionate at 20% palm pith content.

**Keywords:** Fermentation · palm kernel · volatile fatty acids

## 1 Introduction

Palm pith is obtained from old, non-yielding palm trees which are usually thrown away. Palm pith has the potential to be used as ruminant animal feed because the nutritional content of palm pith is relatively the same as that of forage, except for the higher cellulose and lignin content in palm pith compared to forage (Noersidiq et al., 2018). However, the nutritional quality of palm pith can be improved by fermentation. Besides that, it can also increase rumen microbial fermentation which in turn increases digestibility. There is not much information about rumen microbial activity with the addition of nipah pith in ruminant rations.

Fermentation of feed is a process of ammoniating animal feed so that the nutrients contained in forage can be stored and last a long time. The main goal of breeders is to provide fermented feed to livestock so that when storing fodder that is available in large

quantities it can last a long time without reducing the nutrients in the feed. So this is very helpful for goat breeders in providing forage (fiber) in the dry season.

Volatile components are a group of volatile compounds which affect the taste characteristics and their overall acceptability by consumers because of their influence on the characteristics. This study aims to determine the effect of using palm pith as a substitute for forage in complete rations on the production of volatile fatty acids *in vitro*.

## 2 Method

### 2.1 Complete Feed

The feed ingredients used in this study consisted of pith, forage and concentrate with the following composition, namely P0 = 75% forage + 25% concentrate, P1 = (25% palm pith + 75% forage) + 25% concentrate, P2 = (50% palm kernel + 50% forage) + 25% concentrate and P3 = (75% palm kernel + 25% forage) + 25% concentrate. To improve the quality of the rations, each ration was fermented with EM 4 for 21 days. After 21 days, the rations were dried in an oven at 600 C for 24 h, ground through a 2 mm sieve and stored until use.

### 2.2 In Vitro Procedures

The In Vitro procedure was carried out according to Tilley and Terry (1963). The rumen fluid that has been filtered is mixed with a buffer solution in a ratio of 4:1. Fifty milliliters of this mixture was transferred into a serum bottle (100 ml capacity) containing 1 g of feed sample. The vials were closed with rubber stoppers and incubated for 72 hours at 400 C. The incubated inoculum was sampled for analysis of volatile fatty acids (VFA). VFA (acetate, propionate, butyrate and total VFA) determined by Gas Chromatography (Shimadzu GC-14A).

### 2.3 Statistic Analysis

The molar proportions of acetate, propionate, butyrate and total VFA were analyzed by one-way analysis of variance using the SAS program.

## 3 Results and Discussion

The molar proportions of acetate, propionate, butyrate and total VFA are shown in Table 1. The results showed that the treatments were significantly different ( $P < 0.05$ ) in the molar proportions of acetate. In treatment P1 the molar proportion of acetate was significantly lower ( $P < 0.05$ ) compared to treatments P0, P2 and P3 and there was no significant difference between P0, P2 and P3. The molar proportions of propionate, butyrate and total volatile fatty acids were not significantly different between treatment.

The results of this study showed that a complete ration containing 25% palm pith resulted in a decrease in the molar proportion of acetate and an increase in the proportion of propionate and butyrate but the increase was not significant as shown in Fig. 1. This

**Table 1.** Molar proportions of acetate, propionate, butyrate and total concentrations of VFA from complete ration fermentation in vitro

Treatments	Acetate	Propionate	Butyrate	Total VFA(mM/L)
P0	56.03a	33,413	7.01	76.75
P1	41.88b	34,650	8.66	62.68
P2	58.37a	31,390	5.55	61.83
P3	56.04a	31,003	6,883	60.46

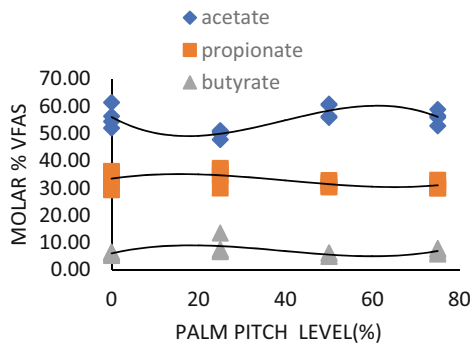
P0 = 75% forage + 25% concentrate; P<sub>2</sub> = (50% palm pith + 50% forage) + 25% concentrate  
 P1 = (25% palm pith + 75% forage) + 25% concentrate; P<sub>3</sub> = (75% palm pith + 25% forage) + 25% concentrate

is presumably due to the presence of easily digestible carbohydrates in palm pith such as starch. Pi et al. (2019) and Sanjeeva et al. (2019) also reported a sieve fermentation pattern for a decrease in acetate and an increase in the proportion of propionate and butyrate.

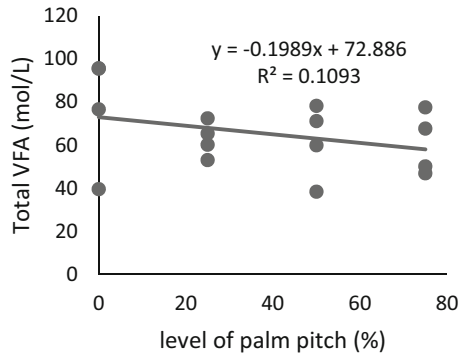
Total VFA tended to decrease with increasing content of palm pith from 0 to 75% in the ration as shown in Fig. 2. This was probably due to the increase in lignin content in the ration. Tseu et al. (2020), stated that lignin can affect microbial activity in producing VFA.

**Conclusion**

It can be concluded that there was a decrease in the proportion of molar acetate and an increase in propionate at 20% palm pith content.



**Fig. 1.** Molar proportions of acetate, propionate, and butyrate in complete in vitro rations



**Fig. 2.** Complete ration total volatile fatty acids in vitro

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**Author's Contribution.** Darlis drafted the script and designed the figures. Yurleni processed the experimental data. Adriani and M. Afdal contributed to the final version of the manuscript.

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