THE PERCENTAGE OF DIFFERENT TAMARIND SEEDS IN LIQUID FEED ON THE CONTENT OF MINERALS AND ENERGY DIGESTIBILITY

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ABSTRACT

Abstract. One of the unconventional feed ingredients used with liquid feed fermentation technology as pig feed is tamarind seeds. The study aimed to determine the mineral quality and energy digestibility of liquid feed containing different percentages of tamarind seeds. This study was undertaken in May-July 2021. The study consisted of 4 treatments, namely; R0: Fermented liquid feed of 0% tamarind seeds, R10: Fermented liquid feed of 10% tamarind seeds, R20: Liquid feed of 20% fermented tamarind seeds, and R30: Liquid feed of 30% fermented tamarind seeds. The research variables were minerals content (Ca, P, and Mg) and energy digestibility (gross energy, digestible energy, and metabolic energy). Data were analyzed using analysis of variance and Duncan's multiple follow-up tests. The results showed that the percentage of the use of tamarind seeds in the feed up to 30% significantly affected ($P<0.01$) minerals Ca, P, and Mg and gross energy, but did not significantly affect ($P>0.05$) digestible energy and metabolic energy. In conclusion, the percentage of using tamarind seeds up to 30% in fermented liquid feed increased the mineral content of Ca but decreased the content of P, Mg, and gross energy.

*(*Keywords: Fermentasi, Biokoversi, nutrien, babi, fraksi serat*)*

Introduction

The productivity of good pigs is strongly influenced by the feed given. Pig feed ingredients that compete with human needs require farmers to look for alternative feed ingredients. One of the alternative feed ingredients that can be used is tamarind seeds.

The nutrient content of tamarind seeds commonly used by the people of East Nusa Tenggara (NTT) is 92.19% dry matter, 14.93% crude protein, 6.75% crude fiber, 5.58%

crude fat, 2.39% ash, 0 0.41% Ca, 0.07% P, and 5000.49 Kcal/kg energy, but also has limitations in its use, namely hard seed coats and anti-nutritional tannins, namely 2.47%.

The availability of anti-nutritional tannins requires the processing of tamarind seeds before being given to livestock. One of the processing technology that can be done is liquid feed fermentation. Sukaryana *et al.* (2011) stated that fermentation can improve the quality of the original material. This is done because the presence of tannin which is a phenolic component can interact with other nutrients such as protein to form insoluble complex bonds (Narsih *et al.,* 2018).

Wea *et al*. (2019) stated that fermentation of liquid feed with a water ratio of 1:3 affected the dry matter content but had no impact on crude protein, crude fat, crude fiber, extracts without nitrogen (BETN, ash, and tannins. Likewise, the results of Wea *et al*. (2020) research showed that fermented liquid feed made from whole tamarind seeds with a water ratio of 1:3 and a fermentation time of 14 days provided nutritional value and fiber fraction (increased hemicellulose and decreased lignin).

Tamarind seeds fermented using palm sap can be fed up to 30% and produce good growth and quality pork (Wea, 2019). However, to produce good pig productivity, the nutrient content of the feed given must be known in addition to mineral content and energy digestibility. This is because the supply of nutrients sourced from the feed consumed, both minerals and energy greatly affects the energy digestibility of the livestock that consume it. Therefore, research was conducted on mineral quality and energy digestibility of liquid feed using different percentages of tamarind seeds. The aim is to examine the mineral quality, gross energy, and energy digestibility of liquid feed made from tamarind seeds using a 1:3 ratio of feed and water and 14 days of fermentation.

Materials and Methods

This Research Design

The design used was a completely randomized design with 6 replications. The treatments consisted of R0 = fermented liquid feed without tamarind seeds, R1 = fermented liquid feed containing 10% tamarind seeds, R2 = fermented liquid feed containing 20% tamarind seeds, and R3 = fermented liquid feed containing 30% tamarind seeds.

Research Feed Manufacture

Feed ingredients such as rice bran, corn, soybean meal, and meat and bone meal are mixed with tamarind seeds. The tamarind seeds used are those that have been sorted from foreign objects such as stones and tamarind peel and have gone through a floating test process to determine the quality of the tamarind seeds. The number of tamarind seeds used was following the research treatment. Then the tamarind seeds are mixed with other feed ingredients whose nutritional composition has been calculated (Table 2). A mixture of feed ingredients with tamarind seeds mixed with water in a ratio of 1:3. Liquid feed is fermented for 14 days. The fermented products were dried in an oven at 600C for 48 hours, and the samples were prepared for analysis of minerals content, fiber fraction, and energy digestibility.

The research variables were mineral content (Ca, P, and Mg) and energy digestibility (Gross Energy, Digestible Energy, and Metabolic Energy). Variable mineral content according to the AOAC procedure (1995) while the energy digestibility variables in the form of gross energy content (laboratory analysis), digestible energy, and metabolic energy of liquid feed (prediction using formula). The formula for calculating digestible energy (DE) (May and Bell, 1971) and metabolic energy or metabolic energy (ME) (Noblet and Perez, 1993) for pigs is as follows:

$$DE=4,151 +(122\times\% \text{ Ash})+(23\times\% \text{ Crude protein})+(38\times\% \text{ Extract eter})+(64\times\% \text{ crude fiber})$$

$$ME=\text{Digestible energy}\times(1,012-(0,0019\times\% \text{ crude protein}))$$

Data Analysis

The results of the study will be analyzed quantitatively using the Analysis of Variance (ANOVA). The result with differences between the treatments was further tested with Duncan's test.

Results and Discussion

The use of tamarind seeds in fermented liquid feed with different percentages affects the mineral content and energy digestibility. This can be seen in Tables 3 and Table 4.

Analysis of variance showed that the increase in the percentage of tamarind seeds used in the fermented liquid feed had a very significant ($P<0.01$) effect on the mineral content of Ca, P, and Mg (Table 3). Duncan's test showed that the content of Ca in treatment R1 was significantly different ($P<0.05$) with R0, R2, and R3, and the content of P in treatment R3 was significantly different ($P<0.05$) with R0, R1, and R2, while the content of Mg in treatment R2 was significantly different ($P<0.05$) with R0, R1, and R3. The higher percentage of use of tamarind seeds will increase the Ca content of liquid feed and decrease the P and Mg content of the liquid feed. This shows that the higher the percentage of use of tamarind seeds in the ratio causes the work power of microorganisms in this case lactic acid bacteria in utilizing substrate nutrients for their needs, especially the use of feed ingredients as energy sources for their lives and produces lactic acid and some acetic acid. The presence of organic acids in the substrate causes a decrease in pH so that the fermentation environment becomes acidic and causes mineral dissolution. This is in line with the statement of Wowor *et al.* (2015) that increasing concentrations of organic acids can break down and dissolve mineral bonds. Furthermore, it is stated that the breakdown and solubility of mineral bonds are caused by H ions, therefore all processes that cause changes in the concentration of H ions can cause changes in the rate of mineral dissolution.

The decrease in the content of Ca, P, and Mg is not only used by microorganisms but also because it is soluble in water. It was stated so because immersion also resulted in biological changes, namely the breakdown of various components into simpler compounds (Narsih *et al.,* 2018). Ca, P, and Mg are important minerals for livestock and are the metals that are very important for physiological processes of animals and humans besides Fe and include micro and macro essential minerals (Sholikha *et al.,* 2021) to compose body structures such as bones and teeth (Septyasih *et al.,* 2016).

Based on Table 4, it is known that the results of the analysis of variance showed that the percentage of the use of tamarind seeds in the fermented liquid feed had a very significant effect ($P<0.01$) on the gross energy content but did not significantly affect ($P>0.05$) the digestible energy content and metabolic energy in livestock. grower pig. This shows that grower pigs have the same ability to digest fermented liquid feed containing up to 30% tamarind seeds.

Duncan's test results showed that there was a significant difference ($P<0.05$) in gross energy content between liquid feed without using tamarind seeds using 20% and 30% tamarind seeds, but there was no significant difference ($P<0.05$) with liquid feed using tamarind seeds. 10% tamarind seeds. Likewise, there was a significant difference ($P<0.05$) between fermented liquid feed using 20% and 30% tamarind seeds. Table 5 also shows that the higher the use of tamarind seeds in fermented liquid feed, the lower the gross energy content. This is due to the replacement of the composition of corn and bran as a source of energy in the feed with tamarind seeds in the formulation. According to Despal *et al.* (2011), spontaneous fermentation or using water-soluble carbohydrates will produce epiphytic lactic acid bacteria which ferment water-soluble carbohydrates in plants into lactic acid and a small amount of acetic acid which will lower the pH of the substrate and inhibit the development of harmful pathogenic microorganisms so that nutrients as a source of energy become more available.

Duncan's test on energy digestibility and metabolic energy of livestock was not significantly different ($P>0.05$). This shows that liquid feed with a percentage of up to 30% can be digested and metabolized properly by grower pigs. Narsih *et al.* (2018) stated that the available enzymes are proteases, lipases, and amylase which will digest organic protein, fat, and carbohydrates into simpler compounds so that they can be used as an energy source.

Conclusion

Based on the results and discussion, it was concluded that the percentage of using tamarind seeds up to 30% in fermented liquid feed increased the mineral Ca content but decreased the content of P, Mg, and gross energy and did not affect digested energy and metabolic energy.

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Table 1. Nutrition composition of research feed ingredients

Feed ingredients	Nutrition composition (%)						
	Dry Matter	Crude Protein	Crude Fat	Crude Fiber	Ca	P	ME (Kcal/kg)
	-- % ---						
Corn	89	8.3	3.9	2.8	0.03	0.28	3420
Rice Bran	90	13.3	13	13.9	0.07	1.16	2850
MBM	93	51.5	10.9	5.6	9.99	4.98	2225
Soybean Meal	90	47.5	2.9	5.4	0.34	0.69	3380
Tamarind seeds*	84.87	14.19	5.58	6.75	0.41	0.08	3302

NRC (1998), * Wea et al. (2019), MBM = meat and bone meal, Ca = calcium, P = phosporus

Table 2. Composition and Nutrition Content of Research Feed

Feed ingredients	Feed composition (%)			
	R0	R1	R2	R3
	------------------------ % -------------------------			
Corn	53	49.5	47.5	40.5
Rice Bran	27	21.5	14.5	12.5
Meat and Bone Meal	8	10.2	13.5	11
Soybean Meal	12	8.8	4.5	6
Tamarind seeds	0	10	20	30
Nutrient content of feed:				
Dry Matter	89.71	89.30	88.90	88.39
Metabolizable energy (Kcal/kg)	3165.70	3160.24	3150.63	3179.50
Crude Protein	17.81	17.82	17.80	17.80
Crude Fat	6.80	6.65	6.46	6.25
Crude Fiber	6.33	6.10	5.69	5.84
Ca (%)	0.87	1.12	1.47	1.26
P	0.94	0.96	1.02	0.87

The calculation results, Ca = calcium, P = phosporus

Table 3. Minerals content a fermented liquid feed with different percentages of tamarind seeds in the feed

Treatment	Minerals (%)		
	Calcium	Phosphor	Magnesium
R0	0.86±0.07 ^{a}	1.40±0.06^{a}	0.29±0.02^{a}
R1	0.76±0.01 ^{b}	1.43±0.08 ^{a}	0.25±0.00^{b}
R2	0.87±0.05 ^{a}	1.37±0.06 ^{a}	0.20±0.00^{c}
R3	0.88±0.04 ^{a}	1.08±0.03 ^{b}	0.19±0.00 ^{d}

Note: $^{a, b, c, d}$ Means in the same column with different superscripts differ significantly (p<0.05); R0: Fermented liquid feed of 0% tamarind seeds; R1: Liquid feed of 10% fermented tamarind seeds; R2: Liquid feed of 20% fermented tamarind seeds; R3: Liquid feed of 30% fermented tamarind seeds.

Tabel 4. Energy digestibility a fermented liquid feed with different percentages of tamarind seeds (Kcal/kg)

Treatment	Gross Energy (GE)	Digestible energy (DE)	Metabolisme Energy (ME)
R0	5.342±15.99 ^{a}	2.643±60.17 ^{a}	2.567±59.39 ^{a}
R1	5.374±21.19 ^{a}	2.638±32.81 ^{a}	2.564±31.81 ^{a}
R2	5.092±50.11 ^{b}	2.573±13.14 ^{a}	2.499±11.99 ^{a}
R3	4.825±69.28 ^{c}	2.606±90.17 ^{a}	2.524±96.87 ^{a}

Note: $^{a, b, c,}$ Means in the same column with different superscripts differ significantly (p<0.05); R0: Fermented liquid feed of 0% tamarind seeds; R1: Liquid feed of 10% fermented tamarind seeds; R2: Liquid feed of 20% fermented tamarind seeds; R3: Liquid feed of 30% fermented tamarind seeds.