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The use of Timor Tamarind Seed Meals Supplemented with Probiotics in Starter-Grower Pig Diets

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An experiment was conducted to investigate using of Timor Tamarind seed meals supplemented with probiotics in the diet of starter pigs. A total of 16 crossbred weaning pigs, 4 weeks of age, and initial body weight of 11.3 ± 2.36 kg (CV. 20.85%) were randomly allotted to receive one of four dietary treatments with four replicates. There were four treatments diets offered: basal diets without the addition of tamarind and probiotics (T0); basal diets + 10% tamarind + 2.5% probiotics (T1); basal diets + 20% tamarind + 2.5% probiotics (T2); basal diets + 30% tamarind + 2.5% probiotics (R3). Results of the study showed that life performance, and digestibility of dry matter and organic matter were not significantly reduced (P>0.05) for pigs fed diets containing 10, 20 and 30% tamarind seed meals supplemented with 2.5% probiotics (T1, T2, and T3) than those diet T0 (diet without tamarind seeds and probiotics). It can be concluded that the use of tamarind seed meals of up to 30% and supplemented with probiotics of 2.5% in the diet of starter pigs compared with T0 (diets containing soybean and mungbean meals) on live performances, intake, and digestibility of dry matter and organic matter were similar among the dietary treatments. However, the average mean intake and digestibility of crude protein declined with increasing the tamarind seed meal inclusion. It was recommended that Timor tamarind seed meals at the level of 30% supplemented with probiotics 2.5% in starter pig diets can be proposed without the delayed intake of dry matter and organic matter as well as pig performance.
Keywords: Tamarind seeds, probiotics, starter pigs, performance, intake, digestibility.

INTRODUCTION

Conventional feed such as grains and by-products of rice milling as pig feed are still dominant in Indonesia. Feed ingredients such as corn, soybeans, and mung beans remain the choice in certain proportions in the commercial feed industry. As a result, pig production costs can reach 60 - 80% of total cost. An alternative feed that has the prospect to overcome such problems is using of tamarind seeds (*Tamarindus indica L.*). This can be utilized as an alternative protein source to reduce or replace the use of conventional feeds in diets. Refers to seeds nutrient content and the amount of its availability, it can be well utilized however, there is a constraint in utilization the presence of anti-nutritional factors as in legume in general.

Anti-nutrients such as tannins, sterols, glycosides, quinones, and terpenoids (Krishna *et al*., 2013), polyphenols, alkaloids and saponins (Jamuna *et al*., 2011) hurt the digestive system of pigs. Negative effects on pigs that can arise from consuming the substance include low appetite, poor feed efficiency, low palatability, and ultimately growth retard of animals. However, these negative effects can be reduced by applying the appropriate processing technology to diminish or reduce anti-nutritional content without disrupting the protein value. One method of treatment that is effectively and efficiently carried out mainly in soybeans is a method of heating by roasting (dry roasting) (DeSchutter and Morris, 1990). The available proteins can be optimally utilized by supplying supplement feeds. One of the supplement feeds that have been successful and are widely used is probiotics.

The addition of probiotics in diets has proved successful in increasing the growth of livestock and the digestibility of feed such as in cattle (Nenobais and Saleh, 2006), goats (Syarifudin and Winugroho, 1998), poultry (David, 2005; Widya and Koestanti, 2000; Sabdoningrum *et al*., 2004; Wiryawan *et al*., 2005), and in weaning pigs (Sanam and Sembiring, 2004). Positive response to probiotics in various animal species as reported was generally combined with conventional feeds. The tamarind seeds can be used as a protein source because its cheap and as a by-product from

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harvesting fruit. Investigation in pigs especially as an alternative feed such as Timor tamarind seeds has not been known so the research was conducted to provide adequate information.

MATERIALS AND METHODS

***Materials*:** A total of 16 starter pig crosses from Landrace x Duroc with an initial body weight of 11.3 ± 2.36 kg (KV. 20.85%) and an initial age of four weeks was used. Pigs were housed individually in 1x1 m square and it is completed with feeds and water access.

***Tamarind Seeds and Probiotics*:** The study used tamarind seeds as a local component feed in the diets tested and supplemented with probiotics using cultures of *S. Thermophilus, L. Bulgaricus, L. Acidophilus,* and Bifidobacterium produced commercially in Jakarta - Indonesia. The culture is known able to suppress the growth of microbe pathogens as salmonella and E. coli. in the digestive tract of animals.

***Methods*:** The research method used was the experimental method and used a randomized block design (RBD). Four treatment diets and four replications were used. The four treatments tested were:

T0 = diet without the addition of tamarind seed meals (TSM) and probiotics
T1 = diet containing 10% TSM + 2.5% probiotics
T2 = diet containing 20% TSM + 2.5% probiotics
T3 = diet containing 30% TSM + 2.5% probiotics

The diet was composed of Timor Tamarind seeds as the tested meals, soybean, mung bean, rice bran, corn, fish meal, tofu by-products, cassava starch, coconut oil, salt, and pig mix. Starch and coconut oil are used as adhesive matter in the processing of pellets. Probiotics using skim milk as a source of microbial lactose. The nutrient content in the diets is presented in Table 1.

Table 1. Nutrient content of the diets.

Composition	Treatment diets			
	T0	T1	T2	T3
Dry matter	88.48	85.55	89.16	87.92
Organic matter	92.31	92.84	92.48	93.14
Crude protein	19.05	18.32	17.28	16.35
Crude fibre	6.43	6.18	5.84	5.58
Total carbohidrate	62.27	66.06	66.37	67.72
Nitrogen Free Ekstract	58.84	59.87	60.54	62.14
Crude fat	7.98	8.46	8.82	9.07
Gros Energi (Kcal/kg)	4436.00	4465.00	4448.00	4469.00

Source: Analysis of Feed Chemistry Laboratory Faculty of Animal Science, University of Nusa Cendana, Kupang.

***Processing of Tamarind Seeds and Probiotics*:** Timor tamarind seeds used in this study were by-products of fresh fruit yields obtained from farmers in Baumata village, Kupang district. Tamarind seeds before use were treated as follows: roasting seeds were ground into flour through a 2 mm screen and then mixed with feed ingredients before being processed into pellets by using a pellet machine.

Fermented Lactic Acid Probiotic as a supplement made as follows:

a) Mixing of 1 part skim milk (as a source of lactose) with 5 parts of water (concentration of 20% w/v) was stirred until homogeneous.
b) The mixture was added to the inoculum microbial lactic acid with ratio of 1:50 (concentration of inoculum 2% v/v).
c) Mixture results were incubated at temperatures of 37^0C for 24 hours for fermentation. The probiotics then served as a feed supplement.

***Data collection and measurement*:** The amount of feed consumption including intake of dry matter (DM), organic matter (OM), and Crude protein (CP) was measured by subtracting the daily refusal weight from the weight of the feed offered in the previous day. The digestibility of DM, OM, and CP were computed as the difference between the amount of feed eaten and the amount voided in the feces. The body weight gain of the pigs was achieved by weighing the animal every week or at the commencement of the study and at the end of the study and feed conversion was measured by dividing the daily intake of nutrients from the body weight gain of the pigs.

***Statistical Analysis*:** The experiment data were analyzed by analysis of variance (ANOVA) with treatment as the sole source of variation in the model. The ANOVA was performed using the IBM SPSS statistics for Windows, version 22. Duncan multiple range test was also performed where the level of significance was set at $P < 0.05$.

RESULTS

***Intake and Digestibility of Dry Matter, Organic Matter, and Crude Protein*:** The dry matter and organic matter intake of starter pigs fed the control diets (without the addition of tamarind seed meals and probiotics) were slightly lower than those fed the test diets (Table 2). Results of the study show that no significant difference between the treatment diets ($P > 0.05$) in intake of dry matter, organic matter, and crude protein of pigs fed tamarind seeds diets compared to those fed the control diets.

The average mean intake and the digestibility of dry matter (DM), organic matter (OM), and crude protein (CP) were presented in Table 2.

Intake values of DM, OM, and CP are relatively equal ($P>0.05$) between T0 to T3 diets due to nutrient content especially energy in the feed almost the same (Table 1).

Table 2. Intake and digestibility of diets and the life performance of animals.

Variables	Treatment diets				SEM
	T0	T1	T2	T3	
DM intake (g/day)	1722.8854	1730.8899	1760.8713	1786.1011	16.28
OM intake (g/day)	1588.5003	1598.3037	1625.2842	1658.7521	16.82
CP intake (g/day)	335.4458	322.9841	315.0199	300.7794	3.58
DM digestibility (%)	81.04	84.97	85.41	81.29	1.62
OM digestibility (%)	87.13	89.71	89.85	87.50	1.07
CP digestibility (%)	89.65[a]	92.03[b]	91.25[b]	88.06[a]	0.86
Average Daily Gains (g/day)	420.10	471.38	475.56	397.96	11.74
Feed Conversion Rate	4.75	4.18	4.26	5.03	0.16

Description: Letters with different superscripts showed significant differences (P <0.05)
SEM = Standard Error of Treatment Mean.

OM intake, as well as DM intake, tends to increase with increasing levels of TSM in the diet. However, DM and OM intake were not significantly different (P> 0.05) among treatments T0 (0% TSM) and all the rest of the diets.

The digestibility of OM, as well as DM, tend to be similar despite the use of TSM increased (Table 2). Statistical analysis shows that DM and OM digestibility were not significantly different (P> 0.05) between the treatment diets (T0-T3). Diets containing 10, 20, and 30% TSM (T1, T2, and T3) did not significantly (P> 0.05) reduce the digestibility of either DM or OM compared to the control diet (0% TSM). This result indicates increasing the level of the TSM from 10 to 30% did not reduce the digestibility of DM and OM.

The mean value of CP digestibility, however, declined with increasing the TSM level. The study found a significant difference (P <0.05) in average CP digestibility among treatment diets. Duncan's test showed there were significant differences (P <0.05) among treatments T1 to T3 and T2 to T3. The inclusion of 30% tamarind seed meals (TSM) in the study resulted in decreasing CP digestibility (P<0.05). On the other hand, the mean values of the DM and OM digestibility tend to be similar (P>0.05). The differences in digestibility of CP found were likely due to the diet composition and content of inhibitors in the seeds may affect protein digestion (trypsin) in TSM.

***Effect of Treatment on Starter Pig Performances*:** The average mean of body weight gain (BWG) and feed conversion rate (FCR) were presented in Table 2. Statistical analysis on BWG and FCR showed no difference (P> 0.05) between treatment diets. In other words, the addition of the level of utilization of TSM up to 30% gave the same figures on BWG and FCR. The average value of the lowest conversion of feed use, thus being the best in this study is the T1 followed by each treatment T2, T0, and T3. Statistical analysis showed no differences (P> 0.05) on the average number of use of feed conversion between treatments. This means that the level of 30% TSM inclusion can be administered to starter pigs without lowering the conversion rate of feed. The average feed conversion values obtained are relatively similar between the treatments due to similarities in the nutrient content of the feed.

DISCUSSION

The differences in the pig's growth, the different individual pigs, and the feed sources may influence the feed intake of the pig. Differences in intake figures due to differences in feed ingredients used, although pigs used in the same age or phase. DM intake in this study was consistent with the results of previous studies (Cloutier *et al*., 2015) using growing pigs with a body weight of 25-50 kg, given a diet containing the amino acid lysine as a supplement, proved that intake of DM was 1840 g/day and the mean body weight gain of 802 g/day. The differences in the pig's growth can be due in addition to different types of feed used and also influenced by different individual pigs. Mwesigwa *et al*. (2013) stated that feed sources helped influence feed intake. Differences in intake figures due to differences in feed ingredients used, although pigs used in the same age or phase. Total feed intake can be influenced by the concentration of energy, palatability, nutritional content, breed, and growth rate (Tillman *et al*., 1989; Kyriazakis, 1994; Ngoc *et al*., 2013). The intake of growing pigs at 10 weeks of age; initial body weight of 27 ± 3.92 kg may affected by the types of feed used and also influenced by different individual pigs (Sembiring *et al*., 2021).

Results of previous studies in pigs given feed containing wheat bran can increase the intake of DM, CP, and energy compared to those containing feed mixed with corn bran and corn seeds (Mwesigwa *et al*., 2013). This result implies energy sources may have influenced the consumption figures of pigs. This finding is in line with Hanson *et al*. (2012) state that utilization of available energy and other nutrients may increase the production of feces and excretion of nutrients.

In agreement with previous studies that the CP digestibility of diets will be influenced by the particle size, diet composition, species of animal (ruminant and nonruminant) the amount of feed given (McDonald *et al*., 1988), and also the existence of

anti-nutrients in the diet may cause biological responses in pigs that suppress protein digestibility (Huisman, 1989). Tannin and saponin in tamarind seeds used in the feed composition may decrease the CP digestibility. Tannins in feeds, especially highly condensed tannin in non-ruminant feeds can lead to be less digested and absorbed, less palatable due to bitter taste and the protein bond (Huisman, 1989; Lipsa *et al*., 2012) and also due to binding starch and resistant starch bond (Zeeman *et al*., 2010). Less crude protein digest also may be due to the content of crude fiber and starch contents in TSM. Fibre and starch in the diets may affect the long-term component digesta in the digestive tract becomes shorter (Ngoc *et al*., 2013).

Polysaccharides consisting of starches and non-starch polysaccharides are difficult to digest (Englyst *et al*., 2007; Cummings and Stephen, 2007). The ability of the digestive tract to digest and absorb carbohydrates (polysaccharides) is influenced by the degree of polymerization, starches physical shape, size, and structure of the constituent starch granules (Bijttebier *et al*., 2008). The digestibility of feed containing high starch was affected by the balance level of amylose: amylopectin, the higher the amylose content resulted in the lower the digestibility (Yin *et al*., 2010), the consequence is the value of the glycemic index increase and insulin response (Jun *et al*., 2010). The results of the study were in agreement with (Reeds *et al*., 1993) found growing pig intake and nutrient balance affected the body size and weight of pigs. Differences in feed conversion rate by Rideout *et al*. (2008) are closely connected with the process of fermentation in the intestines, especially high-feed starch. Individual animals can also affect the figures of feed conversion rate (Reeds *et al*., 1993). The average value of feed conversion in the trial showed no differences (P> 0.05) between all diets. This means that the level of 30% TSM can be administered to growing pigs without lowering the feed conversion. The average feed conversion values obtained are relatively similar between the treatment was due to the nutrient content of the feed almost the same (Table 1). Differences in feed conversion rate according to Rideout *et al*. (2008) were closely connected with the process of fermentation in the intestines especially on high starch and resistant starch feeds. Individual animals can also affect the feed conversion and feed with high crude fiber can cause feed conversion to increase.

***Conclusion*:** Utilization of Timor tamarind seed meals in the diets with fermented probiotic supplement on starter-grower pigs given the same effect as the diets composed of soybean and mung bean on the performance (feed intake, body weight gain, feed conversion), dry matter , and organic matter digestibility. The addition of Timor tamarind seed meals at a level of 30% in the diets reduced the digestibility of crude protein. It is suggested more research is needed on the use of Timor tamarind seed meals supplemented with probiotics in growing pigs to obtain optimum production of meat and percentage of carcass weight.

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***SDG's Addressed*:** Zero Hunger, Responsible Consumption and Production, Climate Action .

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