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# Technical Evaluation of the Utilization of Moringa Leaf Flour in Substituting Commercial Feed for Pigs

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**ABSTRACT:** This study aims to determine the effect of commercial complete feed substitution with moringa leaf flour on feed consumption, water consumption, and weight gain in pig farmers. This study is also expected to produce useful scientific information in the development of more economical and sustainable feed formulas for pig farmers. In addition, it can support efforts to diversify quality local feed ingredients to reduce dependence on imported commercial feed. The materials used were 12 male castrated landrace pigs aged 3-5 months with an initial body weight ranging from 38-55 kg, an average of 45.17 (CV = 13.31%). This study used an experimental method with a Completely Randomized Design (CRD) consisting of 4 treatments with each treatment repeated 3 times so that there were 12 experimental units. The treatments were $P_0$: 100% commercial complete feed, $P_1$: 90% commercial complete feed + 10% moringa leaf flour; $P_2$: 85% commercial complete feed + 15% moringa leaf flour; $P_3$: 80% commercial complete feed + 20% moringa leaf flour. The data obtained were tabulated and statistically analyzed using the ANOVA analysis of variance procedure using IBM SPSS 21 software. The results of the study showed that the substitution of commercial complete feed with moringa leaf flour up to 20% had no significant effect ($p>0.05$) on ration consumption, water consumption and daily weight gain. This study concludes that moringa leaf flour can substitute 20% of commercial complete feed in pig farmers' pigs.

**KEYWORDS:** commercial feed, moringa leaf flour, pigs, substitution, technical evaluation.

## INTRODUCTION

Fulfillment of quality feed needs is one of the main challenges in the livestock sector, especially in pigs farms that have a high demand for nutritious feed sources to support optimal growth. Complete feeds on the market for the growth phase of pigs contain protein in the range of 15-20%. However, based on the standard needs of growing pigs, the protein requirement varies depending on body weight and pig species as recommended by the [1], the protein requirement for growing pigs (growers) based on body weight 1-5 kg 27%, 5-10 kg 20%, 10-20 kg 18%, 20-35 kg 16%, 35-60 kg 14%, 60-100kg 13% with an energy range of 3100-3400 kcal / kg ME. Commercial feeds that are generally used contain several types of conventional ingredients that are imported to complete the nutritional needs in the ration, with prices that continue to increase, so that they can increase production costs for farmers, especially small and medium farmers which will have an impact on income because production costs are not comparable to the selling price of livestock. This is in line with the statement of [2] which states that providing complete (commercial) feed in the form of pellets can cost 60-70% of the total production cost, so more farmers use feed ingredients from their formulation using non-conventional ingredients to reduce ration costs without paying attention to the aspect of nutritional adequacy at each phase of pig growth.

This phenomenon, if left unchecked, will disrupt economic stability because high feed prices are not balanced with the selling price of pigs because the bargaining position of farmers is low by buyers so currently an alternative to local feed ingredients that are affordable, easy to obtain, and have balanced nutritional content. Between protein in the form of amino acids, energy, minerals, and vitamins and almost equivalent to commercial feed. Moringa leaves *(Moringa oleifera)* have long been known as a plant that is rich in nutrients and has great potential to be used as alternative feed. Moringa leaf flour contains high levels of protein, essential amino acids, vitamins, and minerals that can meet the nutritional needs of livestock, including pigs. Based on the results of phytochemical tests conducted by [3] found 18 types of essential amino acids in moringa leaves, including threonine, lysine, leucine, isoleucine, phenylalanine, valine, methionine, tryptophan, while non-essential amino acids include histidine, proline, tyrosine, aspartic acid, glycine, arginine, alanine, glutamic acid, serine, and cysteine. Specifically, glutamic acid is the amino acid with the highest concentration while the lowest is cysteine. [4] added that moringa leaves also contain alkaloids, hydroquinone phenols, flavonoids, steroids, tannins, and saponins which have the potential as antioxidants, so they can substitute some commercial feed in rations and can help reduce dependence on commercial feed.

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Although the various potential benefits of moringa leaves have been known, their use as commercial substitute feed for pigs still requires further study, especially in terms of technical aspects and evaluation of field practices. This technical evaluation includes parameters of feed consumption, water consumption, weight gain, and feed conversion. Therefore, this study will examine the extent to which the substitution of moringa leaf flour can be applied in commercial feed and provide competitive results for pig farms. This study aims to determine the effect of the substitution of commercial complete feed with moringa leaf flour on feed consumption, water consumption, weight gain in pig farmers. This study is also expected to produce scientific information that is useful in the development of more economical and sustainable feed formulas for pig farmers. In addition, it can support efforts to diversify quality local feed ingredients to reduce dependence on imported commercial feed.

## RESEARCH MATERIALS AND METHODS

This study used 12 male castrated pigs of Landrance crossbreed in the grower phase aged 3-5 months with an initial body weight of 38-55 kg with an average of 45.17 kg (CV = 13.31%). The cages used in this study were individual cages, with an enternit roof, a rough cement floor, and cement walls with 12 compartments measuring 2x1.8 m each and a floor slope of 2° and equipped with food and drinking water containers. The feed used was commercial complete feed circulating on the market, produced by PT. Gold Coins with the code classic 1. The nutritional content of the feed ingredients used in the experimental feed is shown in Table 1.

**Table 1. Nutritional content of feed ingredients**

| Feed Ingredients | Nutritional content (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | EM (Kka/kg) | CP | ET | CF | DM | OM | Ca | P |
| Complete commercial package [a)] | 3252,20 | 15,00 | 3,00 | 7,00 | 87,00 | 92,00 | 1,20 | 0,45 |
| Moringa leaf flour [b)] | 1318,20 | 30,30 | 8,49 | 11,40 | 90,47 | 92,36 | 3,65 | 0,30 |

Description: a) Label on classic 1 feed sack, PT Gold Coin product, b) Kantja et al., (2022).

### Research Methods

The research method used is the experimental method. Furthermore, the experimental design used is a Completely Randomized Design (CRD). The treatments in this study were:

$P_0$: 100% commercial complete feed
$P_1$: 90% P0 + 10% moringa leaf flour
$P_2$: 85% P0 +15% moringa leaf flour
$P_3$: 80% P0 +20% moringa leaf flour

**Table 2. Composition and nutritional content of research rations*)**

| Bahan pakan | Perlakuan | | | |
|---|---|---|---|---|
| | $P_0$ (%) | $P_1$(%) | $P_2$ (%) | $P_3$ (%) |
| Complete commercial package | 100 | 90 | 85 | 80 |
| Moringa leaf flour | 0 | 10 | 15 | 20 |
| Total | 100 | 100 | 100 | 100 |
| Gross energi (kkal/kg) | 4.210,05 | 4.154,93 | 4.196,48 | 4.271,08 |
| Metabolis energi (kkal/kg) [b)] | 3.321,73 | 3.278,24 | 3.311,02 | 3.369,88 |
| Dry matter (%) [a)] | 88,79 | 87,85 | 87,60 | 88,03 |
| Organik matter (%) [a)] | 90,58 | 90,58 | 90,63 | 90,94 |
| Crude protein (%) [a)] | 15,40 | 16,11 | 16,31 | 16,70 |
| Extra Eter (%) [a)] | 5,10 | 16,11 | 4,93 | 6,77 |

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| | | | | |
|---|---|---|---|---|
| Crude fiber (%) [a)] | 5,18 | 5,20 | 5,61 | 6,07 |
| Ca (%) [c)] | 1,11 | 1,20 | 1,24 | 1,27 |
| P (%) [c)] | 0,77 | 0,78 | 0,79 | 0,79 |

Description: [a)] Results of the faculty of Animal Husbandry, Marine And Fisheries, Feed Chemistry Laboratory analysis 2024
[b)] Results of the Sihombing (1997) recommendation calculation, ME=78.9% GE
[c)] Results of the Faculty of Agriculture, Soil Chemistry Laboratory analysis 2024

**Procedure for Making Moringa Leaf Flour**

Moringa leaf flour is made from fresh leaves, old leaves number five and below, not yellow ones, obtained around Kupang City and Kupang Regency. The process of processing moringa leaves into flour is as follows: 1) fresh moringa leaves that have just been harvested are separated from their twigs, and 2) moringa leaves that have been cleaned are then watered. The way to find out which leaves are dry is by squeezing the leaves (if squeezed the leaves will be easily crushed), 3) the dried moringa leaves are then ground or milled until smooth.

**Research Variables**

The variables observed in this study were

1. The amount of feed consumption (g) per pig per day calculated from the amount of feed given minus the amount of remaining feed
2. Drinking water consumption: the amount of drinking water given minus the amount of remaining drinking water
3. Body weight gain : body weight (g) obtained from the final body weight minus the initial body weight each week of weighing.

**Data Analysis**

The data obtained were tabulated and statistically analyzed using the ANOVA analysis of variance procedure using IBM SPSS 21 software.

**RESULTS AND DISCUSSION**

In livestock maintenance, especially pigs, it is necessary to conduct a technical evaluation related to the utilization of rations through measurement and assessment of feed usage to ensure that the rations meet the nutritional needs of livestock. This aims to increase production efficiency and maintain livestock health so that they can produce optimally according to their growth phase. The following is the average consumption of rations, water consumption, weight gain, and conversion of pig rations due to the use of moringa leaf flour, substituting commercial feed presented in Table 3.

**Table 3. The average effect of treatment on ration consumption, water consumption, daily weight gain of pig.**

| Variable | Treatment | | | | P-value |
|---|---|---|---|---|---|
| | $P_0$ | $P_1$ | $P_2$ | $P_3$ | |
| Ration consumption (g/h/d) | 1821,667± 231,86 | 1801,66± 302,50 | 1851, 667± 145,11 | 1856,667± 201,89 | 0,99[ns] |
| Water consumption (L/h/d) | 5,28± 546,72 | 5,34± 857,34 | 5,46± 432,94 | 5,64± 537,99 | 0,90 [ns] |
| Daily weight gain (g/h/d) | 658,73± 27,49 | 674,60± 36,37 | 690,48± 47,62 | 714,29± 23,81 | 0,32 [ns] |

Note: [ns] no significant effect, p>0.05

**Effect of Treatment on Feed Consumption**

Based on the results of the ANOVA statistical analysis, it shows that the substitution of commercial feed with moringa leaf flour at a usage level of 10 to 20%, does not have a significant effect (p>0.05) on feed consumption. This shows that the use of moringa leaf flour in rations does not affect the physical characteristics of the ration including taste, aroma, and texture, causing the

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hypothalamus as the nerve center not to respond to changes in the type of ration consumed daily and having an impact on the uniformity of pig ration consumption. This is in line with the opinion of [5] which states that pig ration consumption is influenced by taste and aroma. In addition to taste, aroma, and texture, this is also due to the nutritional content of the feed treatment which is not much different even though some commercial feed is replaced with moringa leaf flour (Table 2) especially protein-containing amino acids and energy, because according to [6] that pigs can detect some amino acid deficiencies and compensate for them by consuming food supplemented with amino acids, but pigs will proportionally reduce the consumption of food supplemented with very high amino acids. The energy content of the relatively same treatment ration will also have an impact on the consumption of rations which are not much different because energy is very much needed to meet the basic living needs of pigs so that livestock will continue to consume feed and will stop if their energy needs have been met. According to [7] the relatively similar energy content of rations and the same level of palatability will be in line with the consumption of pig rations.

**Effect of Treatment on Pig Drinking Water Consumption**

Feed and drinking water are the main resources for animal survival. Freedom from hunger and thirst is recognized as the first of the five freedoms declared for basic animal welfare [8]. Based on the results of the ANOVA statistical analysis, it was shown that the use of moringa leaf flour had no significant effect ($P>0.05$) on pig water consumption. This indicates that the use of moringa leaf flour in the ration does not affect the level of water consumption in pigs because the level of moringa leaf flour replacement does not affect the water content of the ration consumed by pigs. According to [8], water absorption is also influenced by the water content of the food, the absorption of absolute dry matter, and the composition of the food. However, additional drinking water supply is recommended for all species, because an unsatisfactory water supply reduces dry matter intake and can lead to energy deficiency, it is further stated that drinking water consumption is distributed differently in the organ and tissue compartments of animals, water loss occurs physiologically through the excretion of feces and urine and requires continuous placement.

The water consumption obtained in this study is also in line with the consumption of rations which also showed no effect. According to [9]. Water consumption follows the amount of feed consumed, added [10], with higher performance causing an increase in feed intake which will be followed by an increase in water consumption, further stating that several other factors of practical concern have a major influence on water intake: ambient temperature, nutrient intake, which must be excreted through the kidneys (eg electrolytes, nitrogen), as well as the amount of water spent on certain products such as sweat in horses or cows' milk. The importance of adequate water supply is best understood by the consequences of water deficiency (reduced feed intake, urine concentration, thermoregulation, decreased renal excretion of metabolic waste products, and other fluid intake that may be important related to hygiene, and behavioral problems).

**Effect of Treatment on Body Weight Gain**

The results of the ANOVA statistical analysis showed that the use of moringa leaf flour in substituting commercial feed had no significant effect ($P>0.05$) on the daily body weight gain of pigs. This is because the consumption of rations was relatively the same in this study even though there were differences in the level of commercial feed substitution in the ration. According to [11], Body weight gain that was not significantly different was related to the amount of ration consumed and the digestibility of feed nutrients. [12] added that the level of food nutrition is closely related to the growth performance of infants.

This is also related to the eating behavior of pigs when given a different ration from the previous days, so that the livestock will adjust first before increasing ration consumption to convert into meat which has an impact on weight gain. Eating behavior is an animal environment for obtaining nutrients, pig eating behavior has a significant impact on the level of feed nutrient utilization. Eating behavior is one of the main factors affecting growth performance [13]; [14]. The use of moringa leaf flour at the highest level of 20% in this study did not show any difference in weight gain, in contrast to the results of [15] who found increased weight gain in pigs given 9% moringa leaf flour [16] found that plasma insulin concentration affects weight gain, when insulin exceeds a certain threshold, insulin will stimulate protein synthesis, reduce fat synthesis, and thus increase feed conversion efficiency.

## CONCLUSION

Based on the results of the research that has been conducted, it shows that the substitution of commercial complete feed with moringa leaf flour at the highest level, namely 20%, does not show any effect on decreasing or increasing ration consumption, weight gain, and water consumption in pigs.

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