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Effect of Including (*Sauropus Androgynus L. Merr)* Leaves Meal in The Diet on Performance and IOFC of Grower Landrace Crossbred Pig

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ABSTRACT

The study was carried out in Desa Baumata Timur, Kecamatan Taebenu, Kabupaten Kupang, for 8 weeks: June 23 to August 18, 2018. The study aimed at evaluating effect of including *Sauropus Androgynus L. Merr* leavs meal on the performance and *Income Over Feed Cost* (IOFC) of grower landrace crossbred pig. There were 12 landrace crossbred barows 4-5 months old with 26.5-55.5kg average 42,29 kg (CV = 19.69%) initial body weight used in the study. Completely randomized block design 4 treatments with 3 replicates procedure was applied in the study. The 4 treatment diets offered in the trial were : R0: 100% basal diet without *Androgynus* (control); R1: 97% basal diet + 3% *Androgynus* leaves meal; R2: 94% basal diet +6% *Androgynus* leaves meal; and R3: 91% basal diet 9% *Androgynus* leaves meal. Variable evaluated were: feed intkae, weight gain, feed conversion, and *Income Over Feed Cost* (Rp. 593.195/ekor). Statistical analysis shows that effect of treatment is not significant (P>0.05) in increasing either feed intake, weight gain, feed conversionor IOFC of the pig. The conclusion is that including 3%, 6%, and 9% *Sauropus Androgynus L. Merr* leaves meal into basal diet performs the similar results in feed intake, daily weigtht gain, feed conversion and *income over feed cost*.

KEYWORDS: pig, performance, IOFC, *Androgynus*.

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I. INTRODUCTION

Feed costs in the pig farming business reach 60-80% of the total production cost (Nguru, et al., 2024). The feed that has been used to be given to pigs is a commercial feed that is expensive and competitive with human needs, so it greatly affects farmers in the preparation of pig rations (Frida et al., 2020). Therefore, efforts are made to reduce the use of competing feed ingredients by looking for alternative feed ingredients. The type of alternative feed ingredients used must be easy to obtain, affordable, not competitive with human needs and have good nutritional content. Thus, one of the feed ingredients used as an alternative feed ingredient for pig feed is by utilizing katuk leaf flour *(Sauropus Androgynus L.Merr*).

Katuk is a vegetable plant that is abundant in Southeast Asia. The characteristics of the katuk plant are rather soft branches, leaves arranged alternately on one stalk, oval to round in shape with a length of 2.5 cm, and a width of 1.25-3 cm. Katuk is a traditional medicinal plant that has high nutrients, as an antibacterial, and contains beta carotene as the active substance of carcass color (Maryati et al., 2019). The phytochemical compounds contained in it are: *saponins, flavonoids*, and *tannins, isoflavonoids* that resemble estrogen are able to slow down the reduction of bone mass (*osteomalacia*), while *saponins* have been proven to be efficacious as anticancer, anti-microbial, and improve the immune system in the body (Tanggur et al., 2019). *Flavonoids, saponins, and tannins*. has properties to lower fat accumulation. In addition, the high content of vitamin C also plays a role (Noer et al., 2018). Katuk leaves are also high in fat content (Erdiyawati & Astuti, 2020). It is suspected that katuk leaf fat contains a lot of unsaturated fatty acids that have the effect of reducing fat accumulation (Rahayu & Ardigurnita, 2021). Katuk leaves contain 91% dry matter,

2593 kcal/kg of metabolic energy, 28.68% crude protein, 4.2% crude fat, 12.02% crude fiber, 1.65% calcium and 0.29% phosphorus (Saragih, 2016).

Based on the results of previous research on the provision of 3% old katuk leaf flour in broiler chicken rations, it turns out that it can increase growth and increase the efficiency of ration use (Santosssso et al., 2022). The addition of old katuk leaf flour by 3% in the ration affects the consumption of broiler chicken rations (Bidura et al., 2007). Feeding katuk leaf flour at the levels of 3%, 6% and 9% in the ration has an effect on weight gain and conversion of broiler chicken rations (Nasution et al., 2014).

II. RESEARCH MATERIALS AND METHODS

Research Location and Time

This research was carried out in Neketuka Hamlet, East Baumata Village, Taebenu District, Kupang Regency on a farm owned by Mr. Ir. I Made. S Aryanta, MP. For 8 weeks. This study consisted of 2 periods, namely 2 weeks of adjustment period for livestock to feed, cages and 6 weeks of data collection.

Research Materials

Livestock and Research Cages

A total of 12 landrace growth phase Peranakan pigs with an age range of 4-5 months were used in the study. The cages used in this study are individual cages, with an enternite roof, with a rough cement floor and cement walls with 12 plots each measuring 2 m x 1.8 m and a floor slope of 2° and equipped with feed and drinking water containers.

Equipment

The equipment to be used consists of:

1. The dacin scale has a capacity of 100kg, the smallest scale is 100g for weighing livestock.
2. Needle sitting scales capacity 15kg, sensitivity 50g for weighing feed.
3. The bucket holds water and a skewer, to clean the cage.

Feed Ingredients

The feed ingredients that make up the research pig ration consist of rice bran, yellow corn flour, KGP-709 concentrate, mineral -10, coconut oil and katuk leaf flour. The preparation of the research ration is based on the nutritional needs of pig livestock in the growth phase, namely 18-20% protein and metabolic energy of 3160-3400 kcal/kg (NRC, 1979). The composition of the basal ration and the nutritional content of the feed ingredients that make up the basal ration are shown in Tables 1 and 2.

Table 1. Nutritional Content of Feed Ingredients That Make Up Research Rations

Feed Ingredients	Nutritional Content						
	EM	PK	SK	BK	LK	Ca	P
	Kkal/kg	%	%	%	%	%	%
Cornstarch[a]	3.420	9,40	2,50	89,00	3,80	0,03	0,28
Rice bran[a]	3.100	12,00	12,90	91,00	1,50	0,11	1,37
KGP 709 Concentrate[b]	2.700	36,00	7,00	90,00	3,00	4,00	1,60
Mineral-10[c]	-	-	-	-	-	43,00	10,00
Coconut oil	9.000	-	-	-	-	-	-
TDK [d]	2.593	28,68	12,02	91,8	4,2	1,65	0,29

Source: a. NRC (1998) b. Label on concentrate feed sack KGP 709c. Nugroho(2014). d. Yasni (1999)

Table 2. Composition and Nutritional Content of Basal Ration [(2)]

Bahan pakan	Kandungan nutrisi							
	Komposisi (%)	EM (Kkal/kg)	PK (%)	SK (%)	BK (%)	LK (%)	Ca (%)	P (%)
Cornstarch	37,00	1265	3,47	0,92	32,93	1,40	0,01	0,10
Rice bran	30,00	930	3,60	3,87	27,30	0,45	0,03	0,40
KGP 709 Concentrate	31,00	837	11,16	2,17	27,90	0,93	1,24	0,49

Mineral 10	0,50	-	-	-	-	-	0,21	0,05
Coconut oil	1,50	135	-	-	-	-	-	-
Jumlah	100	3167	18,23	6,96	88,13	2,78	1,49	1,04

Remarks: [(2)] Nutrient content is calculated based on Table 1

Research R&D Prices

The price per kg of feed ingredients that make up the research ration is: rice bran Rp 3,500, corn flour Rp 5,000, coconut oil Rp 5000, mineral-10 Rp 8,000, KGP-709 concentrate Rp 9,200 and katuk leaf flour Rp 6000.

Research Methods

This study uses an experimental method with an experimental design adjusted to the variation in pig body weight, namely using a Complete Random Design (RAL) if the KV is ≤ 15% and a group random design if the KV is ≥ 15%. The number of treatment rations to be used is 4 treatments with 3 replications so that there will be 12 experimental units.

These treatments are:

R0 :100% basalt ration without katuk leaf flour.
R1 :97% Basal ration +3% katuk leaf flour.
R2 :94% Basal ration + 6% katuk leaf flour.
R3 :91% Basal ration + 9% katuk leaf flour.

Research Procedure

Manufacture of Katuk Leaf Flour

The procedure for making katuk leaf flour is as follows:

1. Fresh katuk leaves that have been separated from the stem and stalk are then dried for 1-4 days in the sun.
2. Dried katuk leaves are ground or ground into flour, then the flour is filtered using a fine sieve so that fine katuk leaf flour is obtained to be used as a feed ingredient.

Rout Mixing Procedure

The steps of mixing rations in this study are as follows:

1. The feed ingredients used to make the rations are ground to obtain the same particle size.
2. The feed ingredients that make up the ration are weighed according to the measurements listed in Table
3. All feed ingredients that have been weighed are mixed as follows: starting by mixing large portions of feed ingredients and followed by small portions of feed ingredients. Katuk leaf flour is added in the basalt feed by 3% (R1); 6% (R2); 9% (R3) TDK, while mixing until evenly distributed, then the ration is ready to use.

Randomization

Before randomization begins, pigs are weighed to obtain the initial weight, then numbered from the smallest weight to the largest body weight. Next, the coefficient of variation is calculated to determine the design used. Based on the calculation results, KV was obtained: 19.69%. Randomization was carried out using the lottery method by randomizing the treatment of the units in each group. The results of the randomization of the research livestock are shown in Table 3.

Table 3. Average initial weight of randomized pigs (kg)

Kelompok	R0	R1	R2	R3
I	26,5	29	39	42
II	45	44	43	42,5
III	55,5	51	50	40
Total	127	124	132	124,5
Rataan	42,33	41,33	44	41,5

Provision of Rations and Drinking Water

The rations given are weighed according to the daily needs of the pigs in the grower phase, which is 5% of body weight (Whittemore,1987). The ration is given twice a day, namely in the morning and in the afternoon in dry form, while drinking water is given ad *lidbitum* and is always replaced or added with new water if the drinking water runs out or dirty. Cleaning the cage and bathing the livestock is carried out 2 times a day, namely in the morning and in the afternoon.

Variables studied

The variables studied were :

1. Consumption of Rations

Ration consumption is obtained from the amount of rations given minus the remaining rations for one day of administration.

2. Weight Gain (PBB)

PBB obtained from the final weight minus the initial weight divided by the length of maintenance time with the formula :

$$PBB = \frac{Final\ weight\ (kg) - Initial\ weight(kg)}{Length\ of\ maintenance\ (day)}$$

3.Feed Conversion (KP).

$$KP = \sum \frac{\text{Amount of feed consumed}}{\text{PBB}}$$

4. Income Over Feed Cost (IOFC)

IOFC = Amount of Receipts - Feed Costs

Where: = Receipt is the amount of additional body weight x selling price (Rp) per kg of body weight. Feed cost: amount of feed consumption x price (Rp) per kg of feed.

Data Analysis

The design used in this study was a Group Random Design (RAK) of 4 treatments and 3 replicates. The data analysis used was according to the *Analysis Of Variance* (ANOVA) model of a group randomized design to determine the effect of treatment, and the Duncan multiple distance test to test the differences between averages of treatment according to the instructions Gaspersz (1991). The mathematical model of Group Random Design (RAK) is as follows:

1. Random Group Design (RAK)

$\mathbf{Y_{ij} = \mu + \beta_j + \tau i + \sum_{ij}}$

Y_{ij} = Observation value in treatment i, repeat to j

μ= Common middle values □j = Influence of the j-group $\acute{\imath}_i$ = Effects of treatment on i

ε_{ij} = Random effect (trial error) on treatment to i and repeat to j

t = A lot of treatments n

= Lots of repetitions

III. RESULTS AND DISCUSSION

Nutritional Content of Research Feed

The results of the proximate analysis of the research ration are the results of sampling from the rations given to pigs. The ration used consists of several feed ingredients, namely corn flour, rice bran, KGP-709 concentrate, mineral-10, coconut oil and katuk leaf flour. The arrangement of this ration is quite simple because feed ingredients are easy to get and indeed there are quite a lot of availability.

The ration given to the study pigs is as much as 5% of the body weight. The composition of the four nutritional substances of the research ration as a result of proximate analysis is shown in Table 4:

Table 4. Nutritional Content of Research Rations.

Zat-zat makanan	Treatment			
	R0	R1	R2	R3
EM (Kkal/kg) [a]	2967,66	2909,59	2921,05	2921,12
Gross Energi (Kkal/ kg)[b]	4338,96	4279,68	4296,04	4312,89
PK (%)[c]	17,54	17,89	18,24	18,58
Dry Ingredients (%)[c]	90,13	90,07	90,02	89,96
Organic Ingredients (%)[c]	83,79	83,28	82,76	82,25
Crude Fiber (%)[c]	7,12	7,16	7,18	7,23

Crude Fat (%)[c]	2,44	2,53	2,59	2,64
Ca (%)[c]	1,58	1,59	1,61	1,62
P (%)[c]	1,11	1,09	1,07	1,05

Remarks: [a] Calculation result; bResults of Proximate Analysis of the Polytani Feed Nutrition Laboratory, 2018. cResults of Proximate Analysis of the Soil Chemistry Laboratory of Faperta Undana, 2018

The results of the proximate analysis showed that the nutritional content of each treatment was different. The content of crude protein, crude fat, crude fiber and calcium tends to increase, while dry matter, organic matter, phosphorus, gross energy and metabolic energy decreases. This difference in composition can be caused by several factors such as the difference in food content between the feed ingredients that make up the ration used as a reference for calculation and the feed ingredients used in this study. However, this difference is still in the range of basic nutritional needs of pigs in the growth phase, namely 18-20% protein and 15% crude fiber <(NRC, 1998)

The Effect of Treatment on Ration Consumption.

The average consumption of research livestock rations per head per head per day for 6 weeks of data collection from the study pigs can be seen in Table 5.

Table 5. Average Ration Consumption in Research Livestock (grams/head/day)

Variabel	Treatment				Average
	R0	R1	R2	R3	
ration consumption	3452,78 [a]	3461,11 [a]	3470,83 [a]	3608,33 [a]	3498,26
Body Weight Gain	793,65 [a]	809,52 [a]	817,46 [a]	916,67 [a]	834,33
Conversion of Rations	4,37 [a]	4,28 [a]	4,26 [a]	3,97 [a]	4,22
Income Over Feed Cost	498,42 [a]	553,85 [a]	492,51 [a]	593,19 [a]	534,49

Remarks: Average values with the same superscript on the same line show an intangible difference (P>0.05)

From the data, it can be seen that the highest average feed consumption was obtained in cattle that received R3 treatment (3608.3 grams/head/day) then followed consecutively by cattle that received R2 treatment (3470.83 grams/head/day), R1 treatment (3461.11 grams/head/day) and the lowest average consumption was cattle that received R0 treatment (3452.78 grams/head/day).

The results of the variance analysis (ANOVA) showed that the treatment had an unreal effect (P) on ration consumption (P>0,05). This means that the ration administration of the use of 3%, 6% and 9% katuk leaf flour has an unreal effect on the consumption of research pig rations because the nutritional content in the research ration is relatively equal and balanced. However, the high consumption of R3 rations is influenced by the level of preference of pigs. The results of the Duncan test showed no difference between treatment pairs (P>0.05). The absence of the effect of treatment on ration consumption is suspected to be due to several things, including: palatability, taste, texture, nutritional balance of ration and livestock health (Nguru et al., 2022). Two of the factors affecting ration consumption are palatability and nutritional balance of rations (Murdin et al., 2020). Pigs will have a relatively similar response to their physiological needs to various feeds with relatively similar nutritional content (Tefa et al., 2017). Relatively similar digestive rate as a result of the relatively same rate of feed travel in the digestive tract (Nguru et al., 2024). There is a close relationship between digestibility, digestive speed and feed travel rate in the digestive tract and feed consumption (Mindung et al., 2025). The higher the digestibility of a food ingredient, the higher the rate of digestion in the digestive system so that there is room for food additions so that feed consumption is higher (Ralfan et al., 2021). The consumption rate of the research pig ration every week has increased in line with the increase in body weight gain. Livestock that consume with a change in certain feed doses are efficient in converting feed materials into meat, meaning they also have an increase in body weight (Kabelen et al., 2021).

The Effect of Treatment on Weight Gain.

The data in Table 6 shows that the highest average weight gain was obtained by cattle that received R3 treatment (916.67 grams/head/day) followed consecutively by R2 treatment (817.46 grams/head/day), R1 (809.52 grams/head/day) and the lowest weight gain was R0 treatment (793.65 grams/head/day). The results of the variance analysis (ANOVA) showed that the treatment had an unreal effect (P>0,05) on body weight gain. This is because the nutritional content in the treatment ration given to livestock is relatively equal and balanced (Nguru et al., 2022). It appears that cattle that received R3 treatment were empirically higher because the cattle in the treatment had the ability to convert nutrients from the ration consumed into better body weight supplements compared to cattle that received R0, R1 and R2 treatments.

The results of the Duncan test showed no difference between the average treatment pairs. The absence of the effect of treatment on weight gain can be caused by the quality of the ration and the amount of rations consumed is relatively the same. Pigs that consume rations with the same amount of food will give the same response in the form of consumption and weight gain (Ndolu et al., 2024). Pertambahan otot badan seekor ternak ditentukan oleh ketersediaan dan kecukupan nutrisi pakan yang dikonsumsi (Shurson et al., 2015). Optimal nutrition is essential to support muscle growth in pigs. The right choice of feed greatly affects the level of protein and fat, which is on the growth of livestock vehicles.

Effect of Treatment on Ration Conversion

From the data in Table 7, it can be seen that the highest average conversion was obtained in cattle that received the R0 treatment (4.37) followed by a decrease in the R1 (4.28), R2 (4.26) and R3 (3.97) treatment.

The results of the variance analysis showed that treatment had an intangible effect (P>0,05) on ration conversion. This shows that the administration of rations with the use of katuk leaf flour levels of 3%, 6% and 9% has a relatively similar effect on the conversion of the study pig ration. This is assumed because the nutritional content of the ration is generally relatively the same as in table 4. The value of a ration, in addition to being indicated by the value of ration consumption and the rate of weight gain, is also illustrated in the form of the value of the ration conversion. A ration conversion value, where the ration conversion describes the large amount of ration used for its growth (Steinwidder et al., 2016). The lower the conversion rate indicates that the more efficient a cattle is in converting rations into meat (Ruban et al., 2018). The average ration conversion across all treatments was obtained 4.22. This figure is higher than the expected ration conversion rate in pig farming according to the NRC (1998) which is around 3.25. This may be due to the quality of the ration, the genetic quality of the pigs and the management of the rear. Factors that affect ration conversion are nutrition, livestock nation, environment, livestock health and the balance of rations given (Peters et al., 2014). The conversion value of rations can be influenced by several factors, including environmental temperature, the rate of travel of the ration through the digestive tract, physical shape and the level of consumption of the ration (Huynh Tran et al., 2017).

Effect of Treatment on *Income Over Feed Cost*

The data in Table 8 shows that the highest average *Income Over Feed Cost* was obtained in the R3 treatment (593,195/head) followed by pigs with the treatment of R1 (553,854.00/head), R0 (498,423.45/head) and R2 (492,506/head). This shows that economically the R3 treatment is assumed to be more profitable because it has the highest average *Income Over Feed Cost* value. This is because pigs that received the R3 treatment produced higher growth by using relatively the same amount of feed material as other treatments. This condition allows the selling value of cattle that receive R3 treatment to be higher while the expenditure on feed is relatively the same as other treatments, resulting in a difference that is empirically larger than other treatments.

The results of the variance analysis showed that the treatment had an intangible effect (P>0,05) on *Income Over Feed Cost*. It is not surreal that the effect of treatment on *Income Over Feed Cost* is due to the relatively same average ration consumption and average body weight gain even though the R3 is relatively higher empirically. One of the factors that affect the economic value in pig rearing is the amount of feed cost as an input and how much growth as an output (Davoudkhani et al., 2020). Every pig farming business should consider the smallest input for feed costs in order to achieve maximum profits (Šprysl et al., 2018).

IV. CONCLUSION

Based on the results obtained in this study, it can be concluded that:

1. The use of katuk leaf flour in the basal ration of *landrace* pigs with levels of 3%, 6% and 9% has the same effect on ration consumption, body weight gain and ration conversion as well as the value of *Income Over Feed Cost of* pigs that get the greatest benefit are cattle that receive R3 treatment (Rp. 593.195/ekor).
2. An increase in the level of katuk leaves up to 9% tends to improve the higher formations.

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