Optimization of Feed Formulation to Enhance Pig Performance During Lactation And Weaning Phases In Manggarai Regency, East Nusa Tenggara

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Abstract. Pigs are a livestock commodity with great potential in Indonesia, especially in East Nusa Tenggara (NTT), although the pig population in Manggarai Regency remains low. Pig farming in Manggarai relies on feed made from banana stems and rice bran, which do not meet the nutritional requirements, particularly during the critical lactation and weaning phases. This study aims to develop a feeding strategy to improve pig performance during these phases. The feed formulation containing ground corn, rice bran, fish meal, and concentrate showed improvements in feed quality, although analysis revealed an imbalance in nutrients, such as protein and crude fiber levels not meeting the standards. Improved feed formulation, with a more balanced nutritional profile, is expected to enhance milk production in sows and support the growth of piglets, thus boosting pig population in Manggarai.

Keywords: Pig farming, feed formulation, lactation phase, weaning phase

1 Introduction

Pigs are one of the livestock commodities with significant potential for development due to their advantageous biological characteristics. Some of the benefits of pigs include a high growth rate, a large litter size, high feed conversion efficiency (70-80%), and a relatively high carcass percentage (65-80%). Additionally, pigs can utilize agricultural by-products and food waste as feed sources, thereby producing high-quality meat. In terms of reproduction, pigs exhibit distinct characteristics compared to cattle, sheep, and horses, as they are prolific animals with a high number of offspring per birth (10-14 piglets) and a relatively short interval between parturitions [1].

Badan Pusat Statistik (2024) reported that East Nusa Tenggara (NTT) has the highest pig population in Indonesia, reaching 2,132,124 heads in 2023. In addition to serving as a source of animal protein, pig farming is an integral part of the socio-cultural life of local communities, particularly in Manggarai Regency, East Nusa Tenggara Province, making it highly promising for further development [2]. However, the pig population in Manggarai accounts for only 2% of the total pig population in NTT.

Pig farming in Manggarai Regency is predominantly practiced by small-scale farmers who rely on banana stems as the primary feed ingredient, supplemented with rice bran. However, this feed is prepared without considering the nutritional requirements of the livestock, which is believed to be a key factor contributing to the low pig population and suboptimal performance

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in the region. Moreover, banana stems and rice bran are known to have inadequate nutritional value to support optimal pig growth.

In Manggarai Regency, feed management during the lactation and weaning phases remains unchanged from other phases, relying on a mixture of banana stems and rice bran. However, these two phases are critical in determining the growth and population increase of pigs. During lactation, inadequate nutrition for sows can lead to low milk production, directly affecting piglet growth. Meanwhile, during the weaning phase, piglets are highly susceptible to mortality due to various factors such as disease and environmental conditions. Additionally, poor nutrition can hinder growth, resulting in prolonged weaning periods and delayed attainment of market weight.

One of the key strategies to increase the pig population in Manggarai is to establish supportive conditions during the lactation and weaning phases. This can be achieved by enhancing feed quality through formulations that meet the energy, protein, and micronutrient requirements specific to each developmental stage. This study aims to develop a feed optimization strategy for pigs during the lactation and weaning phases to improve their growth performance in Manggarai Regency.

2 Method

This The feed ingredients used in this study include ground corn, rice bran, fish meal, and concentrate. The nutritional composition of these feed ingredients is presented in Table 1 below. These four ingredients were selected due to their widespread availability and ease of procurement in Manggarai Regency.

Table 1. Chemical composition of feed ingredients

Feed Ingredients	DM (%)	Ash (%)	CP (%)	CF (%)	EE (%)	Ca (%)	NFE (%)	ME (kcal)
Ground corn	87.9	2.4	8.8	3.9	4.1	3.8	68.8	3126.1
Rice bran	91	14.1	8.8	23.7	7.2	0.3	38.2	2297.0
Fish meal	88.3	7.8	39.3	5	7.3	0.4	28.9	2999.0
Concentrate	90.5	7.7	13.3	13.8	8.9	0.5	46.9	2839.0

Source: Proximate Analysis Results from the Veterinary Testing Unit and Feed Analysis Laboratory, Faculty of Veterinary Medicine, Airlangga University (2017) in [3].

Next, the rations for lactating pigs and weaning pigs are formulated with the percentage composition as illustrated in Table 2 below.

Table 2. Formulation of rations for lactating pigs and weaning pigs

Feed Ingredients	Lactation phase (%)	Weaning phase (%)
Ground corn	50	50
Rice bran	35	30
Fish meal	5	5
Concentrate	10	15
	100	100

The feed formulation presented in the table was implemented at a farm in Manggarai Regency. This formulation is a recent development derived through a trial-and-error approach and has been tested on pigs at the farm. Descriptive observations indicate improved livestock performance compared to the previous feed formulation. Further analysis was conducted to assess the feed's dry matter, ash, crude protein, and crude fat content. The results of this analysis were then processed and presented descriptively.

3 Results and Discussion

The main objective of this study was to develop a feeding strategy to improve pig performance at that stage. The results of the data analysis are presented in Table 3 below.

Table 3. Nutritional composition of lactating sow and weaning pig feed

Feed type	DM (%)	Ash (%)	CP (%)	CF (%)	EE (%)	NFE (%)
Lactating Sow	11.34	12.23	11.26	15.2	4.74	56.57
Lactating Sow (SNI Standard)	max. 14	max. 8	min. 15	max. 7	max. 8	
Starter	11.3	12,29	11.89	14.56	5.65	55.61
Starter (SNI Standard)	max. 14	max. 7	min. 17	max. 5	max. 7	

The results of the nutritional analysis presented in Table 3 indicate significant differences between the actual nutrient composition and the standards set by the Indonesian National Standard (SNI). These differences directly impact the performance of both lactating sows and weaning pigs, potentially hindering overall growth and productivity. The dry matter content of lactating sow feed, measured at 11.34%, is within a safe range as it does not exceed the SNI limit of 14%. Maintaining optimal moisture levels is essential for feed stability and preventing microbial growth. However, the ash content in lactating sow feed is 12.23%, surpassing the SNI maximum limit of 8%. This may indicate an excessive presence of minerals or indigestible substances, potentially reducing nutrient absorption efficiency. The crude protein (CP) content in lactating sow feed is only 11.26%, significantly lower than the SNI minimum standard of 15%. This protein deficiency adversely affects milk production, which directly impacts piglet growth. According to [4] and [5], low weaning rates are often associated with high pre-weaning mortality, which is primarily caused by insufficient milk production and environmental factors. Furthermore, [6] highlights the critical role of colostrum in early lactation, as it provides essential immune factors, growth factors, and other vital nutrients.

The crude fiber (CF) content in lactating sow feed, measured at 15.2%, significantly exceeds the SNI maximum limit of 7%. This excessive fiber level may reduce digestibility and feed energy value, leading to an energy deficit in sows during lactation. The crude fat content of 4.74% remains within the safe range (≤8% as per SNI); however, a lower fat level can decrease the energy density of the feed, which is crucial for meeting the sow’s energy demands during lactation. The nitrogen- free extract (NFE) content in the feed reaches 56.57%, indicating a relatively high proportion of non-fiber carbohydrates. However, despite this, the low crude protein (CP) content fails to meet the protein requirements necessary to

maximize milk production. This nutritional imbalance— particularly the combination of low protein and high fiber content—results in suboptimal milk production. Consequently, piglets receive low-quality milk, which may lead to stunted growth, reduced immune function, and an increased risk of mortality. Furthermore, [7] and [8] state that lactation failure in sows can also be influenced by extreme environmental conditions, diseases such as mastitis, incomplete feed formulations, and genetic factors.

In the starter feed for weaned piglets, the moisture content of 11.3% remains within the maximum SNI limit (14%), ensuring feed quality during storage. However, the ash content reaches 12.29%, significantly exceeding the SNI maximum (7%), indicating high levels of indigestible inorganic minerals that may disrupt piglet digestion. The crude protein (CP) content of 11.89% falls well below the SNI minimum standard (17%), potentially hindering early post-weaning growth, a critical phase requiring high protein intake for muscle and tissue development. According to the [9], adequate energy and protein intake during the weaning phase is essential for optimal growth. The crude fiber content of 14.56% exceeds the SNI limit (5%), which can impair digestion, leading to diarrhea or reduced energy utilization efficiency. Meanwhile, the crude fat content of 5.65% remains within the safe range (maximum 7% per SNI) and serves as an additional energy source during the post-weaning adaptation phase. The nitrogen-free extract (NFE) content of 55.61% provides sufficient non-fiber carbohydrates to meet energy needs, although it cannot fully compensate for the low protein levels. The imbalance between low CP and high fiber content in the starter feed may slow piglet growth, particularly during the transition from milk to solid feed. This nutritional inadequacy increases susceptibility to weaning stress and disease risks. [4] reported that high pre- weaning mortality due to inadequate milk supply and unfavorable environmental conditions is a primary factor in low weaning rates. Consequently, piglets exhibit lower weaning weights, prolonging the time required to reach market weight.

The performance of both lactating sows and weaned piglets is highly dependent on the nutritional balance of their feed. Non-compliant feed formulations that do not meet SNI standards can lead to various issues, including low milk production, significant body weight loss, and reduced reproductive performance in sows, as well as stunted growth, weakened immunity, and metabolic stress in piglets. Proper mammary gland development and milk production in sows require nutritionally adequate feed. According to [6] colostrum is rich in immune factors, hormones, and essential nutrients that are crucial for piglet development. [10], further explains that during pregnancy, 75-85% of a sow's energy intake is allocated to maintaining body functions and supporting fetal development, highlighting the critical need for balanced nutrition throughout gestation and lactation. [4] and [5] emphasize that appropriate feed formulation is essential for optimizing milk production and piglet health. [7] and [8] add that nutritional imbalances can exacerbate livestock conditions, particularly when facing environmental stress, disease, or metabolic disorders. Therefore, feed reformulation is necessary to ensure compliance with SNI nutritional standards, thereby enhancing productivity and efficiency in pig farming in Manggarai, East Nusa Tenggara.

4 Conclusion

This study highlights the need for better feed formulations to improve pig farming in Manggarai Regency, East Nusa Tenggara. The current feed, mainly banana stems and rice bran, does not meet nutritional standards, leading to low milk production in sows and slow growth in piglets. While a new feed formulation using ground corn, rice bran, fish meal, and

concentrate showed improvements, it still requires adjustments to meet protein and fiber requirements. Reformulating feed with a balanced nutrient composition is essential to enhance sow productivity, piglet survival, and overall farm efficiency. Future research should focus on optimizing feed using local ingredients to support sustainable pig farming in the region.

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