JURNAL PENELITIAN PROGRESSIF
Vol 5 No 1 (2026): SEPTEMBER 2025 - FEBRUARY 2026 | DOI: https://doi.org/ 10.61992/jpp.v5i1.314 | E-ISSN:2963-4369

ANALYSIS OF PRODUCTION COSTS OF BROILER CHICKENS GIVEN *MORINGA OLEIFERA* LEAF FLOUR SUBSTITUTION

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Abstract

Broiler chickens are a poultry commodity that has promising business prospects due to their short rearing time, rapid growth, and high demand for meat. However, high feed costs, which reach 60–70% of total production costs, are a major obstacle in this business. One alternative to reduce feed costs is to utilize local feed ingredients with high nutritional value, such as moringa leaf flour (Moringa oleifera). Moringa leaves contain protein, vitamins, minerals, and antioxidants that are beneficial for the growth of broiler chickens, so they have the potential to be an economical feed substitute. This study aims to determine the economic feasibility of a broiler chicken business with moringa leaf flour substitution in feed, through analysis of production costs, revenue, income, R/C ratio, and Break Even Point (BEP). The research was conducted at the Experimental Garden of the Faculty of Agriculture, Abulyatama University, Blang Bintang District, Aceh Besar Regency, for four weeks in February–March 2025. The method used was a Completely Randomized Design (CRD) with four treatments and four replications, namely: P0 (100% commercial feed), P1 (97% commercial feed + 3% moringa leaf flour), P2 (94% commercial feed + 6% moringa leaf flour), and P3 (91% commercial feed + 9% moringa leaf flour). The results showed that production costs between treatments were relatively similar and not statistically significantly different. Descriptively, the highest income, revenue, and R/C ratio values were obtained in treatment P3, while treatment P1 showed the lowest results. The lowest BEP value was also found in treatment P3, which indicates a better level of business efficiency. The results of the analysis of variance showed that the substitution of moringa leaf flour did not have a significant effect on all observed economic parameters (P>0.05). However, the use of moringa leaf flour up to 9% in broiler chicken rations shows more profitable economic potential and can be used as an alternative feed in an effort to increase the efficiency of broiler chicken farming businesses.

Keywords : Production Costs, Moringa Leaves, Broiler Chickens

INTRODUCTION

Broiler chicken farming is one of the leading sectors in the livestock subsector in Indonesia. Based on the Decree of the Minister of Agriculture No. 472/Kpts/TN.330/6/1996, broiler chicken farms with a population of no more than 15,000 chickens per period are categorized as cultivation businesses run by individuals or joint business groups (cooperatives). Meanwhile, to be categorized as a livestock company, the minimum number of chickens kept is 65,000 chickens per production period (Suharno, 2004).

With the increasing demand for chicken meat in Indonesia, broiler chicken farming has significant potential for growth. However, challenges such as fluctuating feed prices, livestock health management, and market competition are also factors that must be considered when running this business.

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Broiler chicken farming offers excellent prospects for development, both on a large and small scale (smallholder farming). The government is also striving to improve the performance of the poultry sector by improving the investment climate, developing infrastructure, and providing trained human resources. These efforts are expected to attract public and investor interest in the broiler chicken farming business. Furthermore, technological advances in livestock farming increasingly support production efficiency, from feed management systems and disease control to product marketing. With the right technology and government policy support, broiler chicken farming has the potential to significantly contribute to national food security and improve the welfare of livestock farmers.

This allows for more efficient use of available land. This short production cycle is attractive to farmers because it allows for faster capital turnover. This means that invested capital can be quickly recovered, allowing for profits to be realized in a shorter time. This situation encourages farmers to continue producing broiler chickens. However, the challenges faced in the broiler chicken farming sector continue to increase, particularly in terms of feed costs, which account for approximately 60-70 % of total production costs. High feed raw material prices are often a major obstacle to the sustainability of broiler chicken farming businesses. If left unaddressed, this situation can reduce farmer profitability and impact the stability of the poultry industry as a whole. To address these issues, innovations in feed formulation are needed that are not only more economical but also able to increase the productivity and growth efficiency of broiler chickens.

One alternative that is starting to be developed is the use of moringa leaf flour as a feed substitute. Moringa leaves are known to contain protein, vitamins, and minerals that are beneficial for chicken growth. In addition, the use of alternative feed ingredients such as this can also reduce dependence on imported raw materials, thereby helping to increase the independence of the domestic livestock sector. With appropriate research and application of technology, this innovation has the potential to become a sustainable solution in the poultry industry. (Fariz, 2010) revealed that moringa leaf flour contains up to 30% protein, but its protein digestibility is relatively low due to its high fiber content.

Moringa plants are known to have good nutritional content, but also contain antinutritional compounds such as tannins and quite high crude fiber, which is around 12% (Muhaiyaratun, 2018) . Feed with a high crude fiber content is difficult for broiler chickens to digest. Therefore, special treatment is needed to reduce the crude fiber content while increasing the availability of moringa leaf protein (bioavailability). One method that can be done is by drying and milling the leaves to become flour. This treatment is expected to reduce the crude fiber content in moringa leaves, increase protein digestibility in feed, and support improved broiler chicken performance.

Problem Statement

The formulation of the problem in this research is: Can substitution of moringa leaf flour provide benefits to broiler chicken businesses?

Research Objectives

This study aims to determine the analytical value of broiler chicken farming businesses that are given additional feed containing moringa leaf flour.

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MATERIALS AND METHODS

Place and Time

The research was conducted at the Experimental Garden of the Faculty of Agriculture, Abulyatama University, Blang Bintang District, Aceh Besar Regency for 4 weeks, starting from February to March 2025.

Research Tools and Materials

The following tools and materials will be used in this research:

Research Tools

The tools used in this study are: Equipment The chicken coops used are 16 wooden cages. Each cage is 70 cm long, 50 cm wide, and 60 cm high. A digital *kern new scale.* Lighting equipment: 4 incandescent lamps (40 watts), food and water containers, medicines, and sanitation equipment. As well as stationery, tarpaulin, calculator, grinder, digital camera, and used newspapers to collect feces.

Materials

The materials used in this study include : 60 Day Old Chicken (DOC) broiler chickens . The feed provided consists of commercial starter phase rations used in the first to second week, as well as commercial finisher phase rations given in the second to fourth week. The feed ingredients used include ready-to-use commercial feed available on the market and moringa leaf flour as an additional ingredient.

Research Methods

The design used was a Completely Randomized Design (CRD) with 4 treatments and 4 replications. The research ration treatments consisted of:

P0 = 100% Commercial Ration + 0% Moringa Leaf Flour
P1 = 97% Commercial Ration + 3% Moringa Leaf Flour
P2 = 94% Commercial Ration + 6% Moringa Leaf Flour
P3 = 91% Commercial Ration + 9% Moringa Leaf Flour

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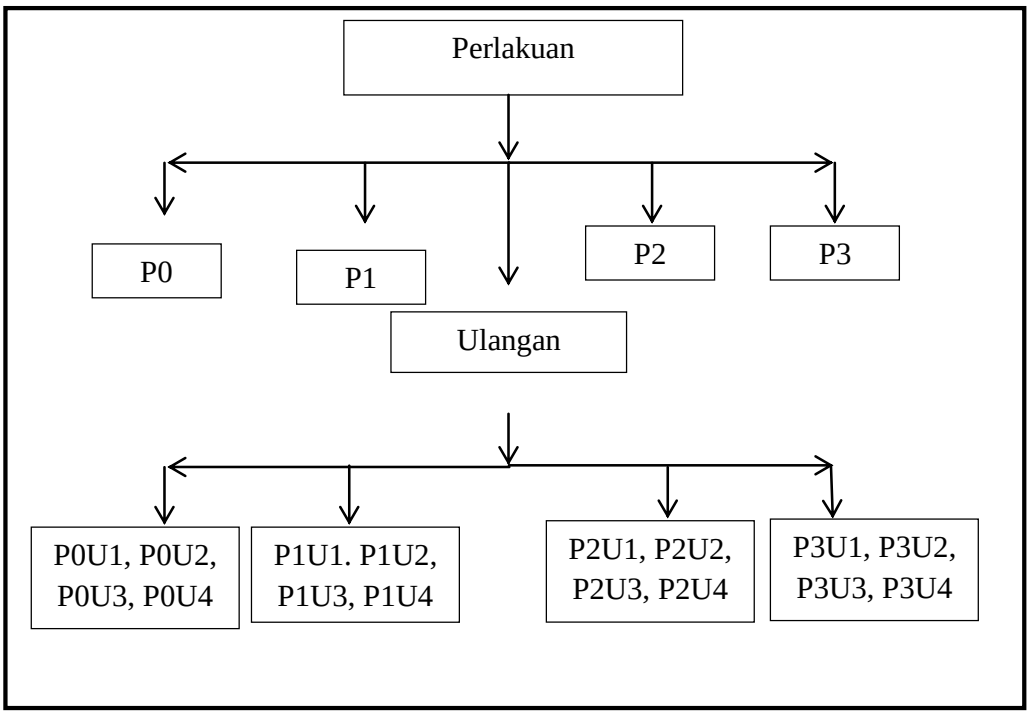

Figure 1 Completely Randomized Design (CRD) Layout

Research Procedures

Cage Preparation

Before the research began, cage preparation was carried out to ensure a clean and hygienic environment. The preparation phase began with cleaning the cage, followed by a liming process to reduce the risk of bacterial and fungal infections. Furthermore, equipment such as feeders and waterers were thoroughly cleaned. The cages were cleaned using a disinfectant solution such as Rodalon or detergent to minimize microbial contamination.

To meet the lighting and heating needs of the cages, 40-watt incandescent lamps were used. Each cage floor level was equipped with one incandescent lamp, so in this study, with four cage floors, a total of four lamps were required. These lamps were strategically installed on each cage level to provide even lighting and warmth.

Cage assignment was randomized to minimize research bias. Each cage was assigned a code based on the treatment it received, facilitating observation and data recording. Additionally, ventilation and air circulation were carefully managed to maintain animal health.

Preparation of Moringa Leaf Flour (TDK)

The moringa leaves used in this study were obtained from two locations: Seureumo and Lambeutong Villages in Indrapuri District, and Bung Sidom Village in Blang Bintang District, Aceh Besar Regency. The plants were planted in local gardens. The selected moringa leaves

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were dark green, with a hard, stiff texture from the third to sixth leaflets from the tip, as this section contains the highest bioactive compounds.

After selection, the moringa leaves are collected and separated from the branches. They are dried naturally by being exposed to the sun for 2-3 days until the leaves become brittle, preserving their nutritional and bioactive properties. Once dry, the moringa leaves are processed into flour using a grinder. The resulting moringa leaf flour is then sieved to achieve a fine, uniform texture.

Additionally, moringa leaf powder is stored in an airtight container to prevent moisture exposure and maintain its quality. This step is crucial to ensure the final product remains hygienic and has an optimal shelf life before use in research or other applications.

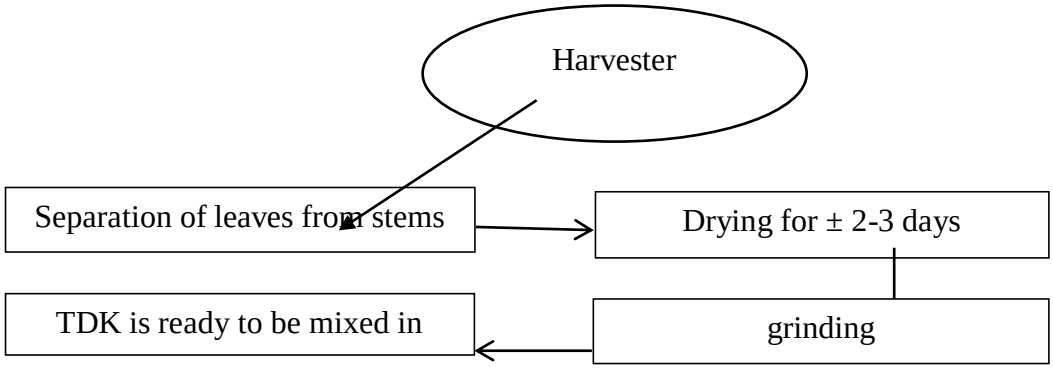

Figure 2 1 Manufacturing Scheme

Provision of Rations

Feeding is based on the broiler chicken's age, in accordance with established broiler maintenance standards. If feed (rations) run out, the amount of feed added is always weighed to ensure accuracy. Clean drinking water is provided ad libitum, so the chickens can drink whenever they need it.

The amount of feed was recorded at each feeding, and any remaining feed was recorded daily to calculate daily feed consumption. Furthermore, weekly weighing of the chickens was performed to monitor their growth and development throughout the rearing period. Feeding and drinking areas were also regularly inspected to ensure cleanliness. This was done to prevent contamination that could affect the chickens' health. Data collected from feed and weight recordings will be used to evaluate feed efficiency and broiler growth performance.

Preparation of Rations

The rations given to the livestock during the study consisted of a commercial ration mixed with moringa leaf meal. The ration formulation was prepared using a trial and error method to obtain the optimal composition. The nutritional content of the commercial ration and moringa leaf meal used can be seen in Tables 1 and 2, while the treatments and nutrient content in the rations are listed in Tables 3, 4, and 5.

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Table 1 Food Nutrient Content of Commercial Rations

Food Substances	Rations for Starter Phase (BR 1)	Rations for Finisher Phase (BR 2)
Water Rate (%)	12	12
Protein Country (%)	21	19
Fat (%)	5	5
Crude Grain (%)	5	5
Abu (%)	7	7
Calcium (%)	0.95	0.95
Phospor (%)	0.5	0.5
ME (kkal/kg)	3000	3100

Table 2 1 Content of Moringa Leaf Flour

Nutritional Content (%)	Percentage (%)
Air	10,56
BETN	38,49
Protein Country	30,3
Crude Fat	6,13
Crude Fiber	12.48
Abu	12,6
That	2,66
P	0,95

Source: Proximate Analysis Results at the Animal Feed Chemistry Laboratory, University Hasanuddin (Panjaitan, 2023)

Table 3 Composition of Treatment Rations

Treatment Feed	P0	P1	P2	P3
Commercial Rations	100	97	94	91
Moringa Leaf Flour	0	3	6	9
Amount	100	100	100	100

Table 42 Nutrient Content of Rations for the Starter Phase

Food Substances	P0	P1(3%)	P2(6%)	P3(9%)
Water Rate (%)	12	11.95	11.91	11.87
Protein Country (%)	21	21.28	21.55	21.83
Fat (%)	5	13.04	5.06	5.1
Crude Fiber (%)	5	5.22	5.44	5.67
Abu (%)	7	7.16	7.33	7.5
Calcium (%)	0.95	0.99	1.04	1.09
Phospor (%)	0.5	0.50	0.52	0.53
ME (kkal/kg)	3000	2.911	2.823	2.734

Note: Multiplication results of Tables 3.1, 3.2 and 3.3

Table 5 Nutritional Content of Rations for the Finisher Phase

Food Substances	P0	P1(3%)	P2(6%)	P3(9%)

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Water Rate (%)	12	11.95	11.91	11.87
Protein Country (%)	19	19.33	19.67	20.01
Fat (%)	5	13.04	5.06	5.1
Crude Fiber (%)	5	5.22	5.44	5.67
Abu (%)	7	7.16	7.33	7.5
Calcium (%)	0.95	0.99	1.04	1.09
Phospor (%)	0.5	0.50	0.52	0.53
ME (kkal/kg)	3100	3.008	2.917	2.825

Note: Multiplication results of Tables 3.1, 3.2 and 3.3

Research Implementation

Data Collection Techniques

The data collection techniques used in this research include:

Observation, namely data collection carried out through direct observation of the conditions of the research location, as well as various activities of farmers in carrying out broiler chicken farming.

Data Analysis

The data obtained were analyzed using a Completely Randomized Design (CRD). The mathematical model of the experimental design follows the Steel and Torrie model as follows:

$$Yij = \mu + \alpha i + \varepsilon ij$$

Where :

Yij = Observation value of treatment i with replication j
μ = Average of observations
α_i = Effect of the ith treatment
ε_{ij} = Error / treatment error from the i-th treatment and i-th replication
i = 1,2,3,4 (Treatment)
j = 1,2,3,4 (Repeat)

Observed Parameters

The parameters observed are: Cost Analysis, Revenue Analysis, Income Analysis, R/C ratio Analysis and Even Point Analysis (BEP).

Business Analysis

Cost Analysis

Total production costs are all expenses for the production process during maintenance in a certain period, which are formulated as follows:

$$TC = FC + VC$$

Information :

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TC = Total cost or total production costs (Rp / Period)
FC = Fixed cost or fixed costs of cultivation business (Rp / Period)
VC = Variable cost or non-fixed costs of cultivation business (Rp / Period)

Acceptance Analysis

Total business revenue is all revenue obtained from sales that has not been reduced by production costs, which are formulated as follows:

TR = (TR1 x P)

Information :
TR = Total revenue or total receipts
TR1 = Meat production rate (kg)
P = Selling price per unit (Rp)

Income Analysis

Income is the difference between total receipts and total production costs that have been incurred, which is formulated as follows:

π = TR – TC

Information:
π = Business income (Rp/period)
TR = Total revenue or total business income (Rp/period)
TC = Total cost or total business production costs (Rp/period).

Analisis R/C ratio

The R/C ratio is the comparison between total revenue and total costs. The following is the formula for calculating the R/C ratio.

$$\mathbf{R/C} = \frac{Penerimaan}{total\ biaya\ produksi}$$

Information :
R = Revenue / income (Rp/Period)
C = Cost (Rp/Period)

Break Even Point (BEP)

BEP is a condition where a company does not experience losses or makes profits, which is formulated as follows:

$$\boldsymbol{BEPharga} = \frac{Biaya\ Total\ (Rp)}{Hasil\ Produksi\ (kg)}$$

RESULTS AND DISCUSSION

Production Cost Analysis

Production costs are all expenses incurred in the broiler chicken farming process during the research period. According to Soekartawi (2002), production costs are all cash and non-cash

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expenses incurred to obtain production results during a business period. In this study, production costs consist of fixed costs (FC) and variable costs (VC).

Table 5 Average Cost of Broiler Chicken Production

Treatment	Average Cost of Broiler Chicken Production
P0	156.000 ± 0.000
P1	155.813 ± 0.000
P2	155.625 ± 0.000
P3	155.438 ± 0.000

Note: There was no significant difference between treatments (P>0.05)

Based on the research results shown in the table above, the average results in treatments P0, P1, P2, and P3 showed relatively uniform values. The highest average value was obtained in treatment P0 (156,000) , followed by P1 (155,813) , P2 (155,625) , and the lowest P3 (155,438) . The difference between treatments appears very small, which is only about 0.562 points from the highest value (P0) to the lowest (P3).

When viewed from the total and average values per replication, the results achieved were also consistent, with an overall average of 155.719 . This indicates that the addition of moringa leaf flour at levels of 3%, 6%, or 9% in broiler feed did not provide a significant difference compared to the control feed (100% commercial feed).

The results of the analysis of variance (ANOVA) showed that the treatment had no significant effect (P>0.05) on the observed parameters. Thus, the addition of moringa leaf flour at levels of 3%, 6%, and 9% in broiler chicken rations resulted in relatively similar performance compared to the control feed (100% commercial feed). This lack of significant differences is thought to be due to the nutritional content in the feed still being able to meet the broiler's needs even though some of it was replaced with moringa leaf flour, so that the growth response remained uniform.

CONCLUSION

Based on the results of the analysis of broiler chicken business with moringa leaf flour substitution in feed, it can be concluded that the production costs in all treatments are relatively the same, namely an average of IDR 155,719/head so that the addition of moringa leaf flour does not affect the size of the maintenance costs. The highest income was obtained in treatment P3 at IDR 196,650/head and the lowest in P1 at IDR 154,448/head. The same thing is also seen in income, where treatment P3 produced the highest income of IDR 41,212/head, while treatment P1 actually showed a negative value of IDR -1,366/head. The R/C ratio value in P0, P2, and P3 is greater than 1 which indicates the business is still profitable, with the highest value in P3 at 1.265, while in P1 the R/C ratio value is below 1 which means it is less feasible to run. The results of the BEP analysis show that treatment P3 has the lowest product BEP value (30,295 kg) so it is more efficient than the other treatments. The results of the analysis of variance (ANOVA) showed that the treatment had no significant effect (P>0.05) on all observed economic parameters. However, descriptively, there was a trend towards increased profits at 6% and 9% substitution levels for moringa leaf flour. Therefore, from an economic perspective, the use of moringa leaf flour at levels up to 9% in broiler chicken feed is still feasible and has the potential to increase business efficiency.

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