



Research Article

Potential of Andaliman Fruit Extract (*Zanthoxylum acanthopodium*) as a Natural Feed Additive on the Income Over Feed and Chick Cost (IOFCC) of Broiler Chickens

Melia Afrida Santi*, Nurhayati, Heni Suryani, Gusma Gama Maradon, Desi Maria Sinaga, Vindo Rossy Pertiwi, Elvan, Fadhila Nurul Karima

Department of Animal Science, Feed Technology Study Program, Politeknik Negeri Lampung, Lampung- Indonesia

Corresponding author: meliaafnida@polinela.ac.id

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Abstract

Background: The increase in feed and DOC costs has become the main factor squeezing the profit margins of broiler chicken businesses. Various phytogetic feed additives have been reported to improve production performance, but most studies still focus on biological parameters such as weight gain and feed conversion. Studies evaluating its impact on economic indicators, particularly Income Over Feed and Chick Cost (IOFCC), are still limited, especially regarding the use of local plants such as andaliman (*Zanthoxylum acanthopodium*). **Objective:** This study aims to analyze the effect of adding Andaliman extract in the feed on the IOFCC value of broiler chickens as an indicator of production economic performance. **Method:** The research was conducted over 28 days using a Completely Randomized Design (CRD) with five treatments and four replications: P0 (without extract), P1 (0.5%), P2 (0.75%), P3 (1%), and P4 (1.25%). The observed parameters include feed price, ration cost, final weight, selling price, income, and IOFCC value. Data were analyzed descriptively quantitatively based on actual economic evaluation. **Results:** The addition of Sichuan pepper extract increased final weight, income, and IOFC value. The highest IOFCC value was obtained in P4 at Rp 23,805.65/head, followed by P3 at Rp 22,994.75/head, while the lowest was in P2 at Rp 14,575.50/head. The 1-1.25% level shows the best economic efficiency, which is suspected to be related to the activity of bioactive compounds such as flavonoids and terpenoids. **Conclusion:** Andaliman extract at levels of 1-1.25% has the potential to serve as a natural feed additive based on local resources to enhance the efficiency and sustainability of broiler chicken farming.

Keywords: income over feed and chick cost; phytogetic feed additive; *Zanthoxylum acanthopodium*

INTRODUCTION

Broiler chickens are a strategic poultry commodity in providing high-nutritional-value animal protein for the Indonesian population. The demand for broiler meat continues to increase along with population growth and changes in consumption patterns (Elpawati et al., 2022; Saud et al., 2023), as well as the increase in national population and production (Dewantari et al., 2023; Mayulu et al., 2019). However, the high cost of feed, which can reach more than 70% of the total production cost, remains a major challenge in maintaining the efficiency and sustainability of broiler farming

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(Budiarto et al., 2025; Nggena et al., 2019). This condition demands innovative strategies to reduce costs without compromising the performance and economic benefits of the farmers.

The use of phytogetic feed additives is developing as an alternative to synthetic antibiotics, which are restricted due to the risk of residues and bacterial resistance (Alhur et al., 2023; Gustina et al., 2023; Putri et al., 2020). One of the potential local plants is andaliman (*Zanthoxylum acanthopodium*), which contains alkaloids, flavonoids, terpenoids, and essential oils (Santoso et al., 2023). These compounds have been reported to possess antibacterial activity (Sibero et al., 2020), antimicrobial properties (Chiuman, 2024), antioxidant effects (Maulidza et al., 2024; Arsiati et al., 2022), as well as immunomodulatory effects (Hutapea et al., 2025), which have the potential to improve digestive health and nutrient utilization efficiency.

Various studies have shown that extracts of aromatic plants can improve gut microbial balance and broiler growth performance. However, these studies generally focus on biological parameters such as weight gain and feed conversion, while the economic implications are rarely analyzed comprehensively. Income Over Feed and Chick Cost is a key indicator of business feasibility because it reflects the difference between income and the costs of feed and chicks. Few data are available regarding the influence of Andaliman extract on IOFCC, and its contribution to production economic efficiency is still not well understood.

Therefore, the economic evaluation of the use of andaliman extract becomes relevant to address the challenges of sustainable broiler business efficiency. This study aims to analyze the effect of adding Andaliman extract at various levels in the feed on the Income Over Feed and Chick Cost value of 28-day-old broiler chickens as an indicator of production economic performance.

MATERIALS AND METHODS

Materials

This research was conducted from July to September 2025 in the Teaching Factory experimental pen, Animal Husbandry Department, Lampung State Polytechnic. A total of 100 day-old chicks (DOC) of the MB 202 Platinum broiler strain (PT Japfa Comfeed Indonesia, Indonesia) were used in this study. The chickens were kept for 28 days with an ad libitum feeding and drinking system.

The basal feed used is commercial feed for the starter phase (BR1) and finisher phase (BR2). Aquades-based andaliman extract was used as the treatment material. Body weight measurement was conducted using a digital scale with a capacity of 15 kg (AW-15X Multi Purpose Scale, ACIS, Indonesia). The prices of feed, DOC, and the selling price of live chickens were obtained based on the actual market prices in the Lampung region during the study period.

Methods

The andaliman fruit is washed with clean water to remove dirt, then dried in an oven at a temperature of 50–60°C until a constant weight is achieved. The dry sample is ground into a fine powder and sieved to obtain uniform particle size. Extraction is performed using aquades with a powder-to-solvent ratio of 1:10 (w/v) and then heated at a temperature of 50–60°C while continuously stirring. Andaliman extract is

made every week during the broiler chicken maintenance. After the heating process is complete, the solution is cooled to room temperature and filtered using Whatman No. 1 filter paper. The obtained extract is dark brown and stored at 4°C until used in feed treatment. The extract is homogenously mixed into the basal feed according to the treatment levels before being given to the chickens.

Experimental Design

The research used a Completely Randomized Design (CRD) with five treatments and four replications. Each replication consisted of five broiler chickens, resulting in a total of 100 chickens used. The treatments given are: P0 (ration without andaliman extract), P1 (0.5%), P2 (0.75%), P3 (1%), and P4 (1.25%).

The mathematical model used is:

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$$

Y_{ij} : the observation value in the i -th treatment and j -th replication,

μ : the overall mean,

τ_i : the treatment effect,

ε_{ij} : the experimental error

Data analysis

The main parameter observed is IOFCC as an indicator of the economic efficiency of broiler farming. The calculation is performed using the following equation:

- 1) Feed Cost = Feed Consumption (kg) × Feed Price (Rp/kg)
- 2) Total Cost = DOC Price + Feed Cost
- 3) Revenue = Final weight (kg) × Selling price (Rp/kg)
- 4) IOFC = Revenue – Total Costs

Income Over Feed and Chick Cost data and its component constituents were analyzed descriptively quantitatively to compare values between treatments and determine the level of andaliman extract that yields the highest economic value.

RESULT AND DISCUSSIONS

The Income Over Feed and Chick Cost values of 28-day-old broiler chickens at various levels of Andaliman extract are presented in Table 1. Generally, increasing the level of andaliman extract in the feed raises the feed price and total production costs, but is followed by an increase in final body weight and sales revenue. The highest IOFCC was obtained at P4 (1.25%) amounting to Rp23,805.7/head, followed by P3 (1%) amounting to Rp22,994.8/head, while the lowest was at P2 (0.75%) amounting to Rp14,575.5/head. Compared to the control (P0), the P4 treatment increased IOFC by approximately 53.4%, indicating a substantial improvement in economic efficiency.

The pattern of IOFCC increase visualized in Figure 1 shows a progressive economic response at the 1-1.25% level. Although feed costs increased due to extract supplementation, the increase in productivity and selling price was able to compensate for the additional costs. This indicates that the biological benefits of andaliman extract have a direct impact on business profits. The increase in IOFCC values observed with andaliman extract supplementation indicates a positive economic impact on broiler

production profitability. In particular, supplementation at the 1% level (P3) increased IOFCC from Rp 15,510.6/bird in the control treatment (P0) to Rp 22,994.8/bird, representing an increase of approximately 48.25%. Meanwhile, supplementation at 1.25% (P4) further increased IOFCC to Rp 23,805.7/bird, or about 53.48% higher than the control. This substantial improvement suggests that although feed costs increased due to the inclusion of andaliman extract, the higher body weight gain and improved selling value of broilers were able to offset the additional costs. The results demonstrate that andaliman extract not only functions as a natural feed additive with biological benefits, but also contributes directly to improving the economic efficiency and profitability of broiler production.

Table 1. Income Over Feed and Chick Cost Values of Broilers with Different Levels of Andaliman Extract

Treatment	Feed Prices (Rp/kg)	Chicken Prices in 14 Days (Rp/ekor)	Cost of Rations (Rp/ekor)	Total Cost (Rp/ekor)	Final body weight (g)	Selling Price (Rp/kg)	Income (Rp/ekor)	IOFC (Rp/ekor)
P0	9.000	16.278,0	15.170,4	31.448,4	1.565,3	30.000	46.959,0	15.510,6
P1	9.500	15.825,0	15.986,6	31.811,6	1.549,4	30.000	46.482,0	14.670,4
P2	9.750	16.603,5	16.341,0	32.944,5	1.584,0	30.000	47.520,0	14.575,5
P3	10.000	16.285,5	16.249,0	32.534,5	1.586,6	35.000	55.529,3	22.994,8
P4	10.250	16.513,5	16.639,9	33.153,4	1.627,4	35.000	56.959,0	23.805,7

Explanation: P0: Ration without andaliman extract (control); P1: Ration with 0.5% andaliman extract; P2: Ration with 0.75% andaliman extract; P3: Ration with 1% andaliman extract; P4: Ration with 1.25% andaliman extract

Physiologically, this improvement in economic performance is related to the content of bioactive compounds in andaliman such as flavonoids, terpenoids, alkaloids, and saponins which have antioxidant and antimicrobial activities (Adrian et al., 2023; Megawati et al., 2023; Sibero et al., 2020). These compounds have the potential to protect the intestinal epithelium from oxidative stress and modulate the microbiota, thereby increasing nutrient utilization efficiency. Previous studies have reported that phytobiotics and essential oils can enhance the activity of digestive enzymes (trypsin, chymotrypsin, elastase, sucrase) and improve intestinal morphology (Su et al., 2021; Hu et al., 2023), while also suppressing pathogen populations such as *E. coli* and *Salmonella* (Salinas-Chavira & Barrios-Garcia, 2024; Irawan et al., 2021).

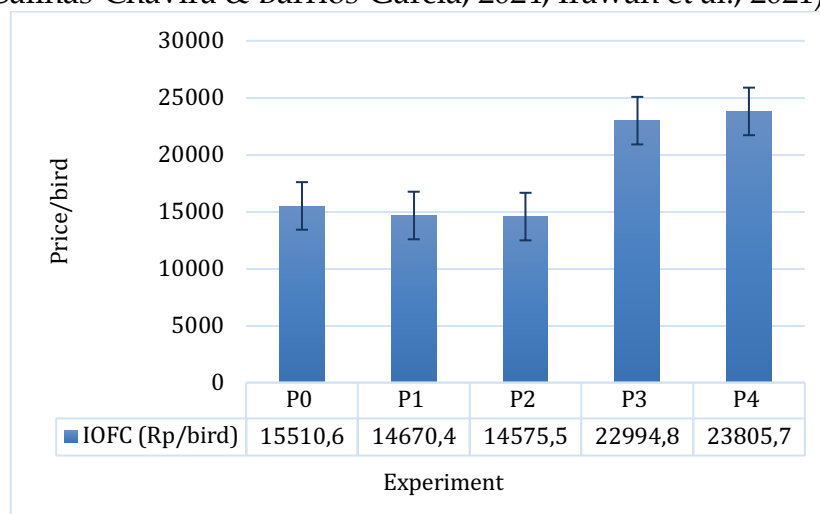


Figure 1. IOFC values of 28-day-old broiler chickens at various levels of andaliman extract

The increase in selling prices in P3 and P4 indicates better carcass quality. Factors such as color, size, and freshness of the meat influence consumer preferences (Fadila et al., 2025), so quality improvements directly impact revenue. Feed efficiency and improved carcass quality also contribute to the increase in net margin and IOFCC (Trapina et al., 2024). Overall, the level of 1–1.25% is the optimal range based on the IOFCC indicator. This result confirms the potential of andaliman extract as a local phytobiotic that supports economic efficiency while ensuring the sustainability of broiler production. The utilization of this endemic plant is also strategic in reducing dependence on imported additives and strengthening the concept of sustainable poultry production.

CONCLUSION

The addition of andaliman extract (*Zanthoxylum acanthopodium*) in broiler feed up to a level of 1.25% can increase the IOFCC Cvalue at 28 days of age. Although there was an increase in feed costs due to the supplementation of the extract, the increase in final body weight and the selling price of the chickens were able to compensate for the additional costs, resulting in higher economic benefits compared to the control group. The optimal level based on the IOFCC indicator is in the range of 1–1.25%, with the 1.25% treatment yielding the highest IOFCC value. This increase in economic efficiency is suspected to be related to the activity of bioactive compounds in andaliman, which play a role in improving digestive health, enhancing nutrient utilization, and contributing to the improvement of carcass quality. Thus, Andaliman extract has the potential to be a natural feed additive that not only supports production performance but also enhances the efficiency of broiler operations and promotes the development of a more sustainable poultry production system.

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AUTHORS' CONTRIBUTIONS

MAS: Conceptualized and designed experiments, conducted investigations, wrote original drafts, visualized, supervised, edited, and finalized the research. HN: Curated data, developed methodology, performed formal analysis, wrote original drafts, and finalized the research. GGM: Investigating, monitoring, reviewing, editing, and finalizing research. DMS and VRP: Review, edit, and finalize studies.

CONFLICT OF INTEREST

All authors have stated that they have no conflicts of interest that could affect this manuscript.

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