

The effects of Using Nano-Meniran (*Phyllanthus niruri*) Extract on the Feed Economic Value and Income Over Feed Costs of Broiler Chicken Farm

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ABSTRACT: This study aims to determine the effects of using nano-meniran (*Phyllanthus niruri*) extract on the feed economic value and income over feed costs of broiler chicken farms. This research method was an observational study with a sample of one-day-old *Cobb strain* broiler chicken at PT. Haraka Kitri Endah. A total of 79.600 day-old-chicken were divided into 4 groups of treatments and eight replications, each group of treatments consisted of 19.900 day-old-chicken. Treatments are given for 14 days – from the chickens are 21 days old until the chickens reach 35 days old consisted of T0, as the control group, was not given nano-meniran extract and was only given mineral feed; T1 was given nano-meniran extract 5%; T2 was given nano-meniran extract 10%; and T3 was given nano-meniran extract 20%. The administration of nano-meniran (*Phyllanthus niruri*) extract on the feed's economic value and income over feed costs showed a significant difference ($p < 0.05$). Research results showed the feed economic value of the broiler chickens are T0 = IDR 13.345,21; T1 = IDR 12.315,57; T2 = IDR 13.057,11; and T3 = IDR 13.476,69. Income over feed costs calculations showed that T0 = IDR 8.942,13; T1 = IDR 11.276,63; T2 = IDR 8.848,44; and T3 = IDR 8.299,44. T1 with nano-meniran extract 5% gives the best result. This research showed that nano-meniran extract has an immunomodulatory activity that positively impacts broiler chickens because it reduces the feed's economic value and increases the income over feed costs.

Keywords: Broiler chickens; Feed economic value; Income over feed costs; Meniran

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INTRODUCTIONS

Broiler chickens are one of the primary sources of animal protein with fast body growth (Adli, 2021). The fast growth of broiler chickens can be seen from the rapid body weight gain. At the age of 6-7 weeks, the weight of broiler chickens could reach 1.5-2 kg (Mafruchati, Wardhana, and Ismail, 2022). The broiler's weight gain is determined by their feed consumption, which also determines the nutrient intake needed for growth (Adedokun and Olojede, 2019). Feed consumption and weight gain affect feed use efficiency. If the feed use is inefficient, there will be economic losses in the livestock business (Parolini, Ganzaroli, and Bacenetti, 2020).

Feed use efficiency is an important parameter in a poultry farm. The level of feed efficiency can be seen from the feed conversion ratio (Muharlieni et al., 2020). A low feed conversion indicates good feed use efficiency (Mulatu, Ameha, and Girma, 2019). Feed economic efficiency or feed economic value could be obtained by the feed conversion ratio multiplied by the feed price per kg (Abdel-Hafeez et al., 2017). One of the efforts to increase the efficiency level of feed is by providing feed additives that aim to improve livestock's health and growth (Alagawany et al., 2019).

Income over feed costs is a concept to determine profit as an early indicator of a farm business analysis in a short term (Priyanti et al., 2012). The calculation of income over feed costs can be seen from the difference between the income and feed costs during the livestock rearing period (Zulfan et al., 2021). Income calculation is obtained by multiplying the final body weight and the selling price of broiler chickens (Tavares et al., 2022). The livestock raising business's highest component is the feed cost, so it is necessary to reduce the cost of the feed by utilizing the quality of feed ingredients at relatively affordable prices (Martins et al., 2016). Feed cost is the main cost for broiler chickens production and accounts for 60-80% of the total production cost (Natsir et al., 2013).

Feed additive is a feed ingredient given to livestock in small quantities through feed mixing (Mulatu, Ameha, and Girma, 2019). One of the feed additives sourced from natural ingredients comes from plants, one of which is meniran (*Phyllanthus niruri*) (Tayo et al., 2022). Meniran (*Phyllanthus niruri*) contains bioactive compounds, including flavonoids, saponins, terpenoids, alkaloids, and tannins (Hidanah et al., 2022). This plant has a natural antioxidant, antimicrobial, and immunomodulator, which will increase the immune system's components and improve the immune system's function (Hidanah et al., 2018).

In efforts to optimize the content of plant extracts, creating a formulation that can increase solubility, stability, bioavailability, and systems that focus on effectiveness in simple applications is a must. Nanotechnology is often used to observe the effectiveness of simple applications (Sabdoningrum, et al., 2020). If the bioactive compounds in meniran (*Phyllanthus niruri*) are quickly absorbed by the body, this could affect the broiler's feed consumption level and weight gain, possibly to improve the feed use efficiency so that it can reduce feed economic value and increase income over feed costs for farmers. According to the statement above, the purpose of this study was to determine the effects of using nano-meniran (*Phyllanthus niruri*) extract on the feed economic value and income over feed costs of broiler chicken farms.

MATERIALS AND METHODS

Ethics

This study was approved by the ethics committee of the Faculty of Veterinary Medicine, Airlangga University (approval No.: 2.KE.142.08.2018).

Experimental animals

A total of 79.600 day-old-chicken (*Cobb strain*) were divided into 4 groups of treatments and eight replications, each group of treatments consisted of 19.900 chicks reared at PT. Haraka Kitri Endah.

Broiler chickens are kept in a close house cage system.

Nano-meniran (*Phyllanthus niruri*) extract

Nano-meniran (*phyllanthus niruri*) extract that has been used is a finished product. It has been made in a previous study by Sabdoningrum et al. (2021) with patent number: P00202206199. The nano-meniran (*phyllanthus niruri*) extract's manufacture uses a ball mill method consisting of 5%, 10%, and 20% meniran extract's concentrations.

In addition, there is a bloom and grow mineral content consisting of vitamin A, vitamin D3, vitamin E, vitamin K, vitamin B1, vitamin B2, vitamin B6, vitamin B12, vitamin C, folic acid, pantothenic acid, niacin, potassium chloride, sodium sulfate, sodium chloride, magnesium sulfate, copper sulfate, zinc sulfate, manganese sulfate, lysine, and methionine.

Feed and nano-meniran (*Phyllanthus niruri*) extract's treatment in broiler chickens

The broiler chickens are given BR1 *Benefeed*[®] commercial feed for the starter phase (1-21 days) produced by PT. Japfa Comfeed Indonesia Tbk and continued with BR2 *Hi-Pro-Vite*[®] commercial feed produced by PT. Charoen Pokphand

Indonesia Tbk for finisher phase (22-35 days). Treatments adaptation were carried out in broiler chickens aged 14 to 20 days by providing minerals to the control group and nano-meniran extract to the treatment group in the feed, starting from 0.025%, 0.05%, to 0.1% of total feed (one tonnes).

The treatments group consisted of T0 as the control group was not given nano-meniran extract and which was given 1 kg of minerals, T1 as the treatment group which was given nano-meniran (*Phyllanthus niruri*) extract 5%, T2 as the treatment group which was given nano-meniran (*Phyllanthus niruri*) extract 10% and T3 as the treatment group which was given nano-meniran (*Phyllanthus niruri*) extract 20%. Each treatment uses the ratio of 1 kg nano-meniran (*Phyllanthus niruri*) extract: one tonnes of commercial feed, ranging from broiler chickens aged 21 to 35 days.

Parameters observed

The measured variables include the feed economic value and income over feed costs. The data collected on the 35th day consisted of consumption of feed, average body weight, feed conversion ratio and the cost of feed, which consisted of nano-meniran extract and commercial feed. The variables were measured according to the calculation below:

1. Feed economic value

Feed economic value = feed conversion ratio x feed price per kg (IDR)

$$\text{Feed conversion ratio} = \frac{\sum \text{Feed consumption}}{\text{Body weight gain}}$$

Feed consumption = \sum total feed given during rearing – \sum feed refusal

Body weight gain = final body weight - initial body weight

2. Income over feed costs

Income over feed costs = income (IDR) - total feed costs (IDR)

Income = final body weight (kg) × selling price per kg (IDR)

Total feed costs = feed consumption (kg) × feed price per kg (IDR)

Table 1. Nutrient content of commercial feed

Nutrients content	Composition	
	Starters (1-21 days)*	Finishers (22-35 days)**
Water content %	Max. 12	Max. 13
Crude protein %	Min. 21	19 – 21
Crude fat %	Min. 5	Min. 5
Crude fiber %	Min. 5	Max. 5
Ash %	Max. 7	Max. 7
Calcium %	0.8 – 1.1	Min. 0.9
Phosphor %	Min. 0.5	Min. 0.6
Aflatoxin, ppb	-	Max. 50
Metabolizable Energy, Kcal/kg	-	3000 – 3100

*Based on the analyzed value of PT. Japfa Comfeed Indonesia Tbk.

**Based on the analyzed value of PT. Charoen Pokphand Indonesia Tbk.

Experimental design

The data obtained were analyzed statistically using MANOVA test, and then ANOVA test was carried out because there were significant differences and it was known that there were still significant differences ($p < 0.05$) between treatment

groups, so Duncan's multiple range test was continued.

RESULTS AND DISCUSSION

Research data on the feed economic value and income over feed costs can be seen in table 2.

Table 2. Average ± standard deviation of feed economic value and income over feed costs in each treatment

Treatment	Feed economic value (IDR)	Income over feed cost (IDR)
T0	13.345,21 ^b ± 663,87	8.942,13 ^b ± 1.666,14
T1	12.315,57 ^a ± 262,33	11.276,63 ^a ± 901,74
T2	13.057,11 ^b ± 801,82	8.848,44 ^b ± 1.898,94
T3	13.476,69 ^b ± 722,60	8.299,44 ^b ± 1.771,41

^{a,b} different superscripts in the same column show significant differences ($p < 0,05$).

Feed economic value

Based on the study results above, feed economic value of broiler chickens on the 35th day was T0 = IDR 13.345,21; T1= IDR 12.315,57; T2 = IDR 13.057,11; and T3 = IDR 13.476,69. Figure 1 shows a comparison of the feed economic value in each treatment. The administration of nano-meniran (*Phyllanthus niruri*) extract on the feed economic value showed a significant difference ($p < 0.05$) between treatments T1 with T0, T2, and T3.

The average feed economic value at T0 did not show a significant difference ($p > 0.05$) when compared to T2 and T3. The lowest feed economic value was in the T1 group by providing nano-meniran (*Phyllanthus niruri*) extract 5% and highest in the T3 group by providing nano-meniran

(*Phyllanthus niruri*) extract 20%. Feed economic value is considered good if the numbers obtained are as low as possible, which means that from an economic point of view, the use of feed is more efficient and profitable because the amount of feed consumed by the livestock is less (Zampiga, Calini, and Sirri, 2021). The results showed that the nano- meniran (*Phyllanthus niruri*) extract administration in the smallest concentration treatment group had an effect on decreasing the feed economic value for broilers.

The state of feed economic value is influenced by the feed conversion ratio and feed prices. In conditions of fixed feed prices, the smaller the feed conversion ratio, the better the feed economic value (Abdel-Hafeez et al., 2017). The feed conversion

ratio measures how well livestock converts their feed consumption into their weight. The smaller the feed conversion value is proportional to the low feed economic value, showing good efficiency of feed (De Verdal et al., 2017; Seabury et al., 2017). Similar results were reported by Omasaki et al. (2017) the lower the feed economic value, the more efficient use of feed. Feed efficiency is a crucial factor in achieving economic profitability.

The provision of herbal plants as feed additives can increase the efficiency of the feed given (Alagawany et al., 2019). Meniran (*Phyllanthus niruri*) is a feed additive containing flavonoid

phytochemical compounds. The flavonoid's content can increase the intestinal mucosa's permeability, encouraging a more optimal absorption of nutrients which plays a significant role in increasing the broiler's weight gain (Hidanah et al., 2022). Particle size affects the broiler's ability to absorb nutrients in the feed. Nano-sized particles have a larger surface area, so at low doses, the ingredients in plant extracts are easily soluble and their bioavailability increases, causing high feed absorption efficiency in the intestine (Martin-Gomes, Souto, and Silva, 2022). Huang et al., (2022) stated that high feed absorption is proportional to a high level of feed efficiency.

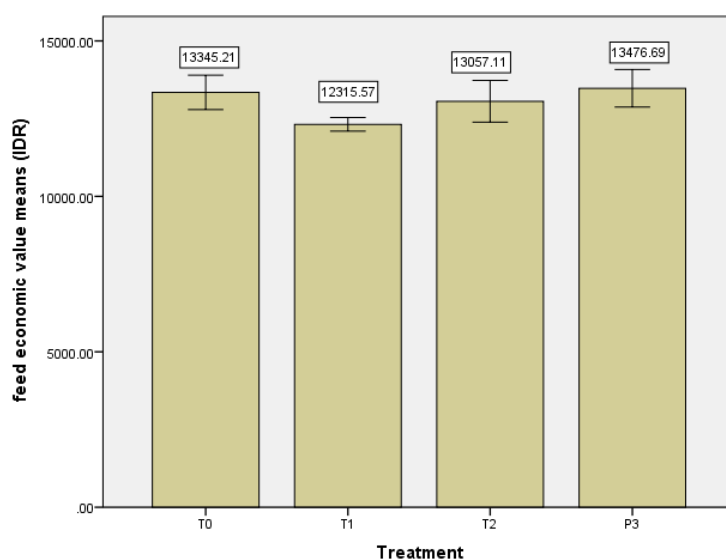


Figure 1. Feed economic value in each treatment

Income over feed costs

Based on the study results above, income over feed costs of broiler chickens on the 35th day was T0 = IDR 8.942,13; T1 = IDR 11.276,63; T2 = IDR 8.848,44; and T3 = IDR 8.299,44. Figure 2 shows a comparison of income over feed costs in each treatment. The administration of nano-meniran (*Phyllanthus niruri*) extract on the income over feed costs showed a significant difference ($p < 0.05$) between treatments T1 with T0, T2, and T3. The average income over feed costs at T0 did not show a significant difference ($p > 0.05$) when compared to T2 and T3. The highest income over feed cost was in the T1 group by

providing nano-meniran (*Phyllanthus niruri*) extract 5%. The lowest was in the T3 group by providing nano-meniran (*Phyllanthus niruri*) extract 20%. The income over feed costs is influenced by income and feed costs during the livestock rearing period. Income over feed costs is considered good if high income is obtained but offset by low feed costs so that a large difference is obtained (Zulfan et al., 2021).

The final body weight and selling price of broiler chickens influence the state of income. High broiler body weight is achieved if the livestock production results are optimal (Al-Sagan et al., 2020). Flavonoids content in meniran has a role as

an immunomodulator. Immunomodulatory activity plays a role in enhancing the immune system and/or suppressing excessive immune system reactions. Meniran extract could affect non-specific immune responses by increasing phagocytosis, macrophage chemotaxis, neutrophil chemotaxis, and complement activation also influencing specific immune responses (Hidanah et al., 2018). Immunomodulators led to increased immune cell performance so that the immune system would increase and livestock production would become optimal. The high production of broilers can increase income. In addition, the content of flavonoids shows inhibitory activity against a number of α -amylase enzymes produced from saliva and pancreas, which play an essential role in breaking down complex

carbohydrates into simpler molecules. Inhibition of the α -amylase enzyme can delay and prolong the digestion time of carbohydrates (De Sales et al., 2012). This causes livestock to be full quickly and not easily hungry for a relatively longer time, decreasing feed intake. The lower the feed consumption, the smaller the feed costs. Lowering feed costs can reduce feed expenses to increase income over feed costs obtained by farmers.

The results showed that the T1 treatment produced the lowest feed economic value but the highest income over feed cost. In contrast, the T3 treatment produced the highest feed economic value but the lowest income over feed cost. Thus, there is a negative correlation between the feed economic value with income over feed costs.

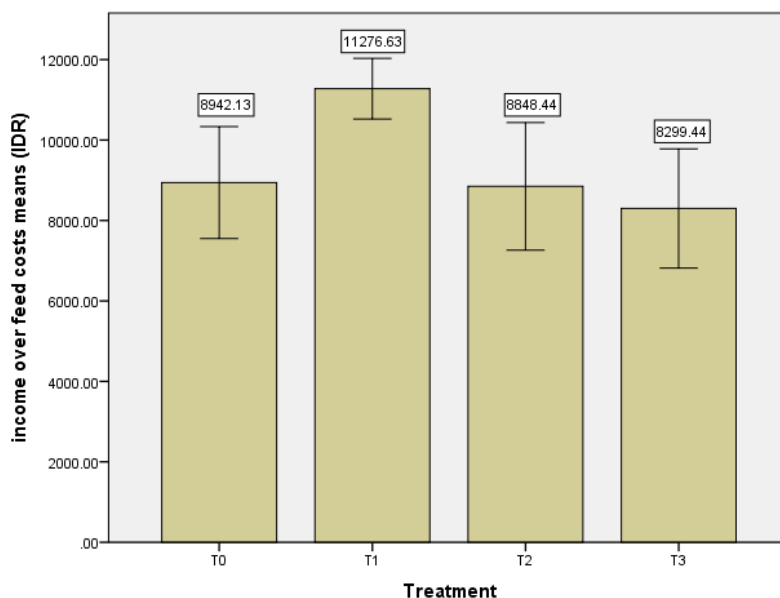


Figure 2. Income over feed costs in each treatment

CONCLUSION

The feed economic value and income over feed costs on broiler chickens farm showed the best results in the administration of nano-meniran extract 5% (T1) IDR 12.315,57 and IDR 11.276,63, respectively. Adding nano-meniran (*Phyllanthus niruri*) extract 5% in feed reduces the feed economic value and increases income over feed costs in broiler chicken farms.

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