



## EFFECT OF ADDITIONING MICROENCAPSULE PRODUCT OF NONI FRUIT EXTRACT (*MORINDA CITRIFOLIA* LINN.) AS FEED ADDITIVE ON SLAUGHTER WEIGHT, EDIBLE WEIGHT AND INEDIBLE WEIGHT OF SENTUL CHICKEN

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### ABSTRACT

*Sentul chicken is a native Indonesian chicken breed originating from the Ciamis Regency area that has the potential to be an egg and meat producer. Utilization of bioactive compounds contained in noni fruit is expected to increase the weight produced through increased absorption of feedstuff nutrients. This study involved 100 Sentul chickens divided into four treatment groups with five repetitions, using microencapsulated feed containing noni fruit extract at doses of 0, 75, 150, and 225 mg/kg MNFE. The microencapsulation method in this study used maltodextrin as the coating and spray drying as the drying method. The research findings indicated that the use of microencapsulated noni fruit extract significantly affected the slaughter weight and edible weight. The most effective dose was found at 75 mg/kg MNFE, which resulted in an optimal increase in slaughter weight and edible weight but did not reduce inedible weight. Therefore, the use of microencapsulated noni fruit extract not only contributes to the increase in weight, but also has the potential to become an alternative natural feed additive in the livestock industry, especially in an effort to reduce dependence on Antibiotic Growth Promoter (AGP).*

**Keywords :** *Sentul chicken, microencapsules, noni extract, edible, inedible, AGP alternative.*

### Introduction

Genetic resources of native chickens in Indonesia have great potential to support the independence of food provision as a source of national animal protein (Fitriati et al., 2021). Sentul chicken is one of the indigenous chicken species that has high potential as a source of meat and egg producers. This chicken, which originated from Ciamis Regency, has good productivity and relatively good resistance to disease compared to other free-range chickens (Sudrajat & Isyanto, 2018).

One of the efforts to improve feed utilization efficiency is by adding feed additives to the livestock ration (Widianto et al., 2015). The addition of feed additives in the ration is intended to increase the productivity of Sentul chickens towards nutrient absorption, reduce mortality, and increase growth acceleration. One of the herbal plants that can be a natural feed additive is noni fruit extract (*Morinda citrifolia* Linn).

Noni fruit contains several active compounds that can improve the absorption of nutrients in the

intestine. The bioactive compounds contained include proxeronine terpenoid alkaloids, scopoletin, ascorbic acid, polyphenols, saponins, and anthraquinones that will have an impact on slaughter weight, edible weight, and inedible weight. In addition, these compounds also act as antifungal and antibacterial agents that can stimulate the immune system. This fruit has the ability to replace the use of AGP in rations because it contains many antioxidants as well as high phenolic and flavonoid compounds. (Krishnaiah et al., 2015). The provision of noni fruit extract in animal feed is expected to increase the absorption of nutrients from feed ingredients, while suppressing the growth of bad bacteria. Thus, the feed conversion value can be better..

Microencapsulation works by encapsulating the active ingredient using a protective layer that can keep the material from the effects of light, moisture, pH changes, and high temperatures. This method is very effective for maintaining the stability of compounds that are susceptible to environmental conditions. With this protection, active ingredients can

avoid damage due to external factors and increase the bioavailability of these compounds (Pratama et al., 2021).

Although various studies have reported the use of noni fruit extract and other herbal ingredients as feed additives in poultry, most of these studies used liquid forms or forms without microencapsulation and were conducted on commercial poultry such as broiler chickens and laying hens. In addition, differences in the microencapsulation process and the type of coating material can affect the stability and effectiveness of bioactive compounds. However, information on the use of microencapsulated noni fruit extract applied through solid feed, especially in local chickens such as Sentul chickens, is still limited. Therefore, this study was conducted to fill the research gap by evaluating the use of microencapsulated noni fruit extract with different approaches and coating materials on Sentul chickens, as well as its effect on slaughter weight, edible weight, and inedible weight.

The success of microencapsulation is greatly influenced by the type of coating material used. Maltodextrin is one of the commonly used coating materials in this process. Maltodextrin is easily soluble in water, so it can form a stable emulsion during the microencapsulation process. In addition, maltodextrin has a low viscosity even at high concentrations, which facilitates the spray drying process. Another advantage is that maltodextrin has good oxidation resistance, so it can protect active ingredients that are sensitive to oxidation (Rismawan et al., 2025). Thanks to these various advantages,

microencapsulation can maintain stability and protect important components in the extract while preventing a decrease in the content of active substances (Wati et al., 2022).

This research aims to assess the effect of giving microencapsulated noni fruit extract on slaughter weight, edible weight, and inedible weight in Sentul chickens. In addition, this study also aims to determine the level of addition of microencapsulated noni fruit extract products in feed that is most effective in producing optimal slaughter weight, edible weight, and inedible weight in Sentul chickens.

## Materials and Methods

### Experimental Livestock

The livestock used in this study were 100 Sentul chicken DOC (Day Old Chicken) which were reared for 12 weeks without gender separation. In this study there were 4 treatments and each treatment was repeated 5 times so that there were 20 experimental units. Each cage contained 5 chickens that were placed randomly and labeled with a number on each chicken feet. The temperature and humidity during the maintenance period are around 24-35°C with humidity at 45-60%.

### Experimental Diet

In this research, the feed components consisted of yellow corn, soybean meal, coconut meal, anchovy meal, rice bran, bone meal, and coconut oil. The nutrient composition and metabolic energy of these feed ingredients are presented in Table 1.

Table 1. Ingredients of basal ration

Feed Ingredients	Nutrient Content							
	Crude Protein	Crude Fat	Crude Fiber	Ca	P	Lys	Met	ME
	.....%							(kkal/kg)
Yellow Corn	8.35	6.47	4.59	0.00	0.02	0.10	0.26	3454.41
Soy Bean Meal	38.09	2.74	5.67	0.22	0.29	2.70	0.66	2425.31
Anchovy Fish Meal	51.69	8.44	0.00	5.50	2.80	6.10	1.70	3009.47
Coconut Meal	22.44	12.97	15.00	0.20	0.20	0.48	0.32	1519.00
Rice Brain	12.40	6.45	14.95	0.12	0.21	0.81	0.26	2042.73
Bone Meal	0.00	0.00	0.00	24.00	12.00	0.00	0.00	0.00
Coconut Meal	0.00	93.97	0.00	0.00	0.00	0.00	0.00	8600.00

Source: Laboratory of Ruminant Livestock Nutrition and Animal Food Chemistry, Faculty of Animal Husbandry, Padjadjaran University (2024)

Furthermore, the composition of the basal ration, along with its nutrient content and metabolic energy, can be found in Table 2 and Table 3.

Table 2. Basal ration formulation

Feed Ingredients	Ratio Composition (%)
Yellow Corn	56
Soy Bean Meal	11
Anchovy Fish Meal	10
Coconut Meal	15
Rice Brain	5
Bone Meal	2
Coconut Oil	1
Jumlah	100

Source: Calculation Results Based on Table 2 with Trial and Error method using Microsoft Excel

Table 3. Content of nutrition and metabolic energy of used basic rations

Nutrient	Contents	Requirements
Metabolism Energy (kkal/kg)	2918.19	2850*
Crude Protein (%)	18.00	17-18*
Crude Fat (%)	7.98	Max 8**
Crude Fiber (%)	6.19	Max 8**
Calcium (%)	1.09	Min 0.9**
Phosfor (%)	0.60	Min 0.3**
Lysine (%)	1.08	0.9**
Methionine (%)	0.45	0.3**

Source: Results of Proximate Analysis

\*Needs Based on Widjastuti (1996)

\*\*BSN (Badan Standarisasi Nasional) (2013)

## Methods

This research uses a direct experimental method on Sentul chickens aged 0-12 weeks. The research utilized a Completely Randomized Design consisting of 4 treatments with 5 replicates each, resulting in a total 20 experimental units. The treatment of the research ration is:

T0: Basal Ration

T1: Basal Ration + 75 mg/kg MNFE

T2: Basal Ration + 150 mg/kg MNFE

T3: Basal Ration + 225 mg/kg MNFE

## Procedure

### Preparation of Microencapsulated Noni Fruit Extract (MNFE)

The making of noni fruit extract starts from washing the noni fruit, thinly sliced, then dried in the

sun to dry which is then ground to produce noni fruit flour. Extraction was carried out by maceration method using 96% methanol solvent for 48 hours. The resulting solution was filtered and evaporated to produce a thick extract which was then given maltodextrin dressing with a ratio of 30% maltodextrin and 70% noni fruit extract. The drying process used the spray drying method to produce MNFE in the form of dry powder.

## Stage of Rearing

Sentul chickens were reared from 0 to 12 weeks of age. The MNFE product was administered by mixing it into the poultry ration. Feed was provided twice daily, with the amount adjusted according to the chickens' age, and distributed in a 50%:50% ratio between morning and evening feedings. Drinking water was given ad libitum. The microencapsulated noni extract was mixed into the ration during the feed preparation process.

## Data Collection

At 12 weeks of age, 20 chickens were harvested after an 8-hour fasting period before slaughter. The chicken samples were then weighed to determine the slaughter weight. Slaughter was performed using the halal killing method by severing three main channels in the neck: the carotid arteries, jugular veins, and esophagus. The weight of empty carcasses and giblets consisting of heart, liver and gizzard are calculated as edible weight. While the weight of blood, feathers, head, neck, feet, offal without giblets is calculated as inedible weight.

## Observed Variable

### Slaughter Weight (grams)

Slaughter weight is the body weight of chickens in a state of life that is weighed after undergoing fasting for 6 – 8 hours with a unit measurement of grams.

### Edible Weight (grams)

The edible weight consists of the weight of the empty carcass (without blood, feathers, neck, head, foot, and the entire contents of the abdominal cavity) and giblets (heart, liver, and gizzard) with a unit measurement of grams.

**Inedible Weight (grams)**

The inedible weight consists of the weight of the head, neck, foot, blood, feathers and offal without giblets with a unit measurement of grams.

**Data Methods and Analysis**

In this study, a Completely Randomized Design was used, and the data analysis used was Analysis of Variant (ANOVA) to evaluate the treatment of the observed variables. Furthermore, to test for mean differences among treatments, the Duncan Multiple Range Test (DMRT) method was used.

**Results and Discussion**

Table 4. Slaughter weight, edible weight and inedible weight in the treatment of addition MNFE

Variables	Treatments			
	T0	T1	T2	T3
Slaughter Weight (gram)	1021.00 <sup>a</sup>	1148.00 <sup>b</sup>	1105.00 <sup>ab</sup>	1042.00 <sup>a</sup>
Edible Weight (gram)	696.64 <sup>a</sup>	772.54 <sup>b</sup>	739.80 <sup>ab</sup>	681.18 <sup>a</sup>
Inedible Weight (gram)	324.36	375.46	365.20	360.82

**Slaughter Weight**

The effect of microencapsulated noni fruit extract (MNFE) supplementation on the slaughter weight of Sentul chickens is presented in Figure 1.

Ration + 75 mg/kg MEBM) and P2 (Basal Ration + 150 mg/kg MEBM) treatments were significantly higher ( $p < 0.05$ ) than P0 (Basal Ration) and P3 (Basal Ration + 225 mg/kg), meaning that P1 and P2 were significantly different in increasing the slaughter weight of Sentul chickens.

Slaughter Weight (g)

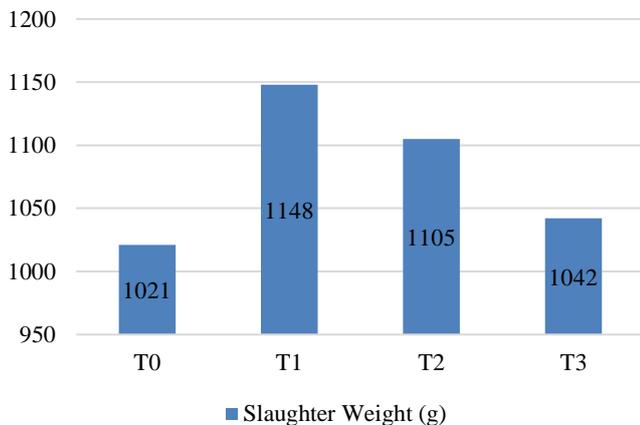


Figure 1. Average slaughter weight

Based on the data in Figure 1, it shows that the average slaughter weight has increased in the range of 1042 - 1148 grams/head compared to without MNFE. Furthermore, to determine the effect of treatment on slaughter weight, statistical analysis of variance was conducted. The results of analysis of variance (ANOVA) showed that the addition of microencapsulated noni fruit extract (MNFE) product into the ration gave a significant effect ( $p < 0.05$ ) on the slaughter weight of Sentul chicken.

The average slaughter weight research results are higher than the results of Fitriati et al. (2021) with an average slaughter weight of 854.76 - 862.79 grams at the same slaughter age of 12 weeks. In addition, the results of this study also produced a higher average slaughter weight than the results of Aziz et al. (2022) who got the average slaughter weight of 722.65 - 785.48 grams with a slaughter age of 12 weeks. The increase in slaughter weight is due to the content of bioactive compounds in noni fruit such as anthraquinones, alkaloids and saponins that can inhibit the growth of pathogenic bacteria, thus making the condition of the digestive tract more acidic and accelerating reactions that expand the surface of the intestinal villi. In acidic conditions, protein-breaking enzymes such as pepsin found in the proventriculus can work more effectively so that the absorption of ration protein increases and supports optimal growth (Aziz et al., 2022). In addition, flavonoid compounds are able to increase the height of the duodenal villi of poultry which has a positive effect on the efficiency of nutrient absorption so that the slaughter weight of livestock increases (Setiawan et al., 2018).

Based on the Duncan test results in Table 4, it can be seen that the slaughter weight of P1 (Basal

**Edible Weight**

The effect of microencapsulated noni fruit extract (MNFE) supplementation on the edible weight of Sentul chickens is presented in Figure 2.

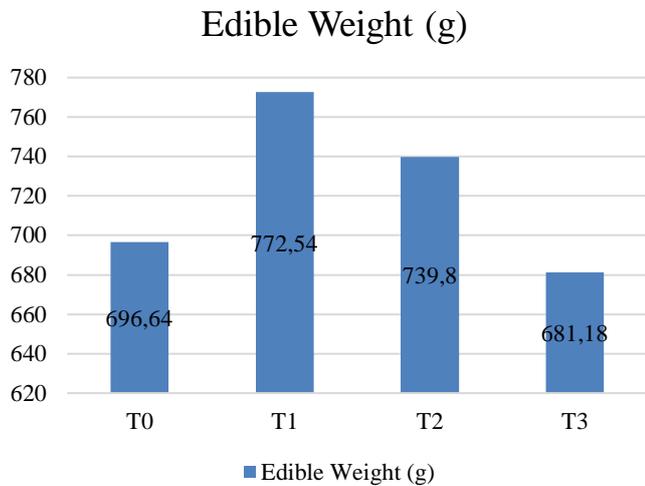


Figure 2. Average edible weight

Based on the data in Figure 2, the average edible weight of Sentul chicken results ranged from 681.18 grams to 772.54 grams. To determine the effect of treatment on the weight of edible parts, the data were analyzed using analysis of variance (ANOVA). ANOVA results showed that the addition of microencapsulated noni fruit extract (MNFE) products in feed had a significant effect ( $p < 0.05$ ) on edible weight in Sentul chickens. Furthermore, to compare differences between treatments and determine the most effective level of MNFE addition, a Duncan test was conducted, the results of which can be seen in Table 4.

The average edible weight obtained in this study was higher than the results of Aziz et al. (2022), who reported weights between 472.78 to 548.35 grams at the same slaughter age of 12 weeks. Some compounds that have been identified in noni fruit through phytochemical screening include alkaloids, saponins, polyphenols, steroids, flavonoids, and tannins (Sogandi & Rabima, 2019). The enzyme proxeronase and proxeronine alkaloids play an important role in the formation of the active substance xeronine in the body. Xeronine has a function to activate previously inactive proteins and improve the structure and function of cell proteins that are impaired (Mushawwir et al., 2019). Xeronine will modify the structure of protein molecules so that the process of absorption of food substances becomes

better and faster (Setyoko et al., 2020). Wahyudi et al. (2015) added that saponins are able to clean the material attached to the intestinal wall and increase intestinal permeability. Thus, large molecules can be absorbed better, increasing the absorption of nutrients in the body of Sentul chickens. There is a positive correlation between final body weight and edible weight, meaning that the higher the final body weight produced, the higher the edible weight (Fathoni et al., 2017).

The microencapsulation process also helps to increase the effectiveness of the compound by protecting the bioactive compound from oxidation, degradation, and environmental influences and allowing its release to take place gradually. Thus, the stability of the active ingredient is maintained and the bioavailability of the compound is also increased (Muharam et al., 2025). However, the decrease in edible weight at the level of 225 mg/kg is thought to be caused by the dose of MEBM given too high. Shalan et al. (2017) mentioned that noni fruit extract given in high doses can cause hepatotoxicity.

**Inedible Weight**

The effect of microencapsulated noni fruit extract (MNFE) supplementation on the inedible weight of Sentul chickens is presented in Figure 3.

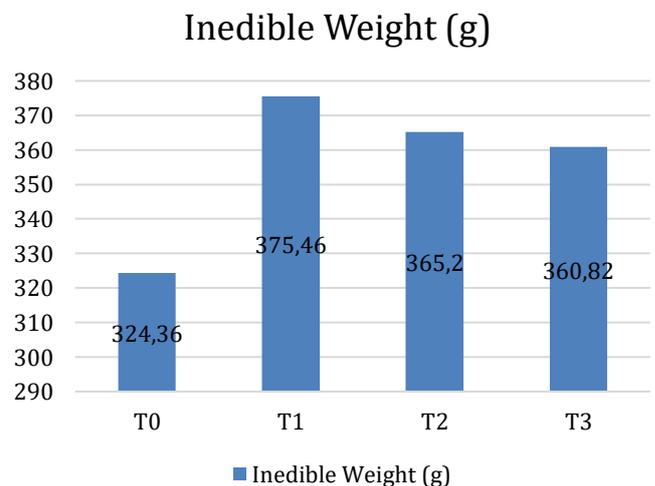


Figure 3. Average inedible weight

Based on the data in Figure 3, the average inedible weight of Sentul chicken results ranged from 324.36 grams to 375.46 grams. Furthermore, to determine the effect of treatment on inedible weight, the data were analyzed using analysis of variance. The results of analysis of variance (ANOVA) showed

that the addition of microencapsulated product of noni fruit extract (MNFE) into the ration did not give a significant effect ( $p>0.05$ ) on the inedible weight of Sentul chicken.

The average weight of inedible parts in this study was higher than the results reported by Aziz et al. (2022), which was between 230.45 to 249.87 grams at the same slaughter age of 12 weeks. Physiologically, this indicates that bioactive compounds in noni fruit such as flavonoids, iridoids, and scopoletin play a role in increasing metabolic efficiency and organ function, thus supporting the growth of tissues that can be utilized as edible parts compared to inedible tissues. Research by Utami et al. (2023) showed that the provision of noni fruit extract was able to increase feed consumption and body weight of broiler chickens, but did not have a significant effect on the weight of internal organs, especially organs included in the inedible part. Liamirdi et al. (2016) mentioned that the peak growth of Sentul chickens occurs at the age of 6-8 weeks, during which period inedible organs such as the head and legs experience early maturation. In addition, the provision of microencapsulated noni fruit extract products in feed does not have a significant effect on the volume and blood weight of Sentul chickens. This is in line with the statement of Ermawati et al. (2022) which states that although bioactive compounds in noni fruit such as iridoid and xeronin can improve blood circulation, they do not significantly increase blood volume.

## Conclusion

The use of microencapsulated noni fruit extract in Sentul chickens resulted in a significant increase in slaughter weight and edible weight. The optimal level of MEBM addition to the Sentul chicken diet was 75 mg/kg MEBM. At this dose, slaughter weight and edible weight were at optimal levels even though inedible weight did not decrease. The bioactive compounds contained in noni fruit play an active role in increasing slaughter weight and edible weight. Therefore, the addition of MNFE products as feed additives in rations can be used as an alternative solution to antibiotic growth promoters (AGPs) to support the growth of Sentul chickens.

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