NONI FRUIT EXTRACT (*MORINDA CITRIFOLIA* LINN) WITH SUPPLEMENTED BY CU AND ZN MINERALS AS FEED ADDITIVE TO IMPROVE CONVERSION MEAT PROTEIN OF SENTUL CHICKEN

T. Widjastuti[1*], A. Abun[1], L. Adriani[1], L. Nurlaeni[1]

[1]*Faculty of Animal Husbandry, University Padjadjaran, Indonesia*

Abstract

The purpose of this study was to determine the optimal level of noni fruit extract supplemented with Cu and Zn (ENF) as feed additives in the meat conversion of Sentul chickens. The study used 100 DOC Sentul chickens that were kept until 12 weeks old. The experimental design used was a completely randomized design (CRD) with 5 treatments and 4 replications, namely basal ration (PO), basal ration added with 50 mg/kg Bacitacin Zn (P1), Basal ration added with 125 mg/kg ENF (P2), Basal ration was added with 250 mg/kg ENF (P3), and Basal ration was added with 375 mg/kg ENF (P4). The parameters observed were protein consumption, body weight gain, carcass weight, protein conversion, and meat protein conversion. The results showed that the five treatments had a significant effect on all treatments in Sentul chickens. It can be said that providing a basal ration that was added up to a level of 375 mg/kg of noni fruit extract supplemented with Cu and Zn (P4) quantitatively had results that were close to the positive control results (P1) so that the noni fruit extract with Cu and Zn supplements was expected substitute for antibiotics that can improve livestock performance.

Key words: *Conversion meat protein, carcass weight, feed additive, noni fruit extract, Sentul chicken*

INTRODUCTION

The native chicken (Sentul) is raised as dual-purpose chicken and can be productive in a harsh environment as well as in low-quality diets, and have good adaptations to the environment. Consumer demand for local chicken meat is increasing every year. To support the high productivity of native chickens, one of them is by providing good quality feed so that it can meet the needs of producing eggs and optimal body weight. Efforts are made to improve the performance and maintain the health of Sentul chickens, generally improving the quality of feed by including additives in the feed. One of the additive materials used is AGP (Antibiotic Growth Promoter). AGP functions as a feed additive in animal feed that can reduce stress, produce ammonia, reduce infection, reduce toxins, and optimize the absorption of nutrients from feed to the intestinal wall. The dose of AGP used in poultry varies depending on the type and method of use of AGP itself.

The maximum dose of Bacitracin Zn antibiotics is 20-100 ppm which is used in poultry. While Pennicylin, Spiramycin, Tetracycline, and virgiamycyn have a maximum dose of 20-50 ppm (Castanon, 2007). With the existence of government regulations concerning the prohibition of mixing feed with antibiotics, the use of AGP has been minimized, because AGP has a negative impact in the form of antibiotic residues which ultimately results in resistance to the livestock body, if consumers consume these products it can endanger their health, besides that they are also resistant to pathogenic bacteria (Graham et al 2007).

One of the potential substitutes for AGP that can be used as a feed additive is the noni fruit (*Morinda citrifolia* Linn). Noni fruit contains some phytogenic compounds and

[*]Corresponding author:
tuti.widjastuti@unpad.ac.id
The manuscript was received: 15.10.2022
Accepted for publication: 07.05.2023

active substances that function as antibacterial, antioxidant, antihelmintic, and anticholesterol and can increase the digestibility of food substances (Krishnaiah et al, 2015). These compounds are anthraquinone, scopoletin, proxeronin, and xeronin. Noni fruit contains flavonoid and phenolic compounds that are antimicrobial, so it can be used as an alternative to the use of antibiotics in poultry (Kurniawan, 2018). The use of noni fruit as a feed additive in poultry must be processed first because it is constrained to contain high levels of crude fiber and anti-nutritional substances, which can increase the rate of digestion, resulting in stunted digestion and decreased absorption of nutrients. Therefore, to extract bioactive compounds and reduce the content of antinutrients, an extraction process is necessary. The extraction process is carried out to obtain the desired active compound optimally, as well as efforts to reduce the tannin levels in the noni fruit extract. Cu and Zn are catalysts that can be added to plant extracts. The catalyst will lower the activation energy, so the reaction can run quickly (Utomo and Laksono, 2007). ZnO nanoparticles can be used as biosensors, antimicrobials, antioxidants, assisting drug penetration in the body, and bioimaging materials (Rezapour and Talebian, 2011). In addition, zinc (Zn) is also known to promote growth and can support the formation of metalloenzymes which are useful in the metabolism, synthesis, and degradation of carbohydrates, fats, proteins, and nucleic acids (Ackland ML, Michalczyk AA, 2016; Gilbert R, et al. 2019). The addition of Zn and Cu as catalysts into an extract is important because basically, it accelerates the rate of reaction of compounds in the body of livestock.

One way to assess the quality of the ration is to calculate the value of protein conversion and meat protein conversion. Protein conversion is defined as protein consumption divided by weight gain. Meanwhile, the conversion of meat protein determines the level of efficiency of protein in changing every gram of protein to how much meat is produced. This research is aimed to study the noni fruit extract supplemented with Cu and Zn (ENF) as a feed additive to improve the conversion of meat protein Sentul Chicken.

(1)

(2)

Fig. 1 Sentul Chicken (1), Noni fruit (2)

MATERIAL AND METHOD

The study used 100 DOC Sentul Gray chickens (unsexed) with an average initial body weight of 29.44 grams (KV = 9.82%) which were reared for 12 weeks. Chickens were placed in cages with a size of 100 cm x 70 cm x 60 cm for 5 birds, totaling 20 experimental units.

The basal ration formula consisted of yellow corn, fine bran, soybean meal, fish meal, bone meal, and CaCO3. Noni fruit extract is made from ripe noni fruit, sliced, then dried in the sun to dry and made into flour. Noni fruit flour was macerated with methanol solution for 48 hours, then filtered. The results of the filtrate were concentrated using an evaporator to obtain a thick extract

of the noni fruit. The extract obtained was stored in the refrigerator. Cu and Zn supplementation was carried out by making 5 ppm Cu solution from Cu SO_4 and 40 ppm Zn from Zn O in 500 ml of distilled water. Each treatment of noni fruit extract was supplemented with the Cu and Zn solutions.

The feed ingredients used for basal ration consist of yellow corn (57 %), soybean meal (10%), fish meal (8.25%), rice bran (23%), bone meal (0.75%), and CaCo3 (0.5%). The rationing for Sentul chicken contains 17 % protein and 2850 kcal/kg of metabolic energy. The experimental design used was a CRD with 5 treatments and 4 replications, namely basal ration (PO), basal ration added with 50 mg/kg *Bacitacin* Zn (P1), Basal ration added with 125 mg/kg ENF (P2), Basal ration was added with 250 mg/kg ENF (P3), and Basal ration was added with 375 mg/kg ENF (P4). The parameters observed were protein consumption, body weight gain, protein conversion, and meat protein conversion. Data were analyzed using Variance Analysis and differences between treatments using Duncan Multiple Test. The study was conducted in the research cage, poultry laboratory of the Faculty of Animal Husbandry Universitas Padjadjaran, Jatinangor.

RESULTS AND DISCUSSION

The protein consumption, body weight gain, protein conversion, and meat protein were influenced significantly by additional feed additive. The average effect of giving feed additives can be seen in Table 1 and Figure 2 and 3.

Protein consumption

In Table 1 and Fig. 2. protein consumption P1, P2, P3, and P4 was significantly lower than treatment P0, but P1 resulted in protein consumption equal to P2, P3, and P4. The results obtained showed that the administration of noni fruit extract (ENF) at the levels of 125 mg, 250 mg, and 375 mg could produce the same protein consumption as the treatment given AGP (zinc bacitracin). According to Varianti et al (2017) Factors that affect protein consumption are ration consumption, live weight, temperature, humidity, and age of chickens. One of the factors that affect the consumption of rations is palatability. This is due to the bitter taste and the pungent odor so that the palatability of the ration decreases resulting in decreased ration consumption and protein consumption. Noni fruit has a bitter taste so it can affect the palatability of the ration given to Sentul chickens. According to Situmorang, et al (2013), chicken does not like a bitter taste so it can reduce ration consumption and protein consumption. The bitter taste of the noni fruit is caused by the content of polyphenol compounds in the noni fruit. Nurhayati (2008) in the noni fruit contains polyphenolic compounds. Polyphenol levels will decrease as the noni fruit matures.

Body weight gain

The average effect of giving feed additives can be seen in Table 1 and Fig 2. Body Weight gain in treatments P0 and P1 did not give a significant effect, but the treatment of P2, P3, and P4 were significantly higher ($P < 0.05$) than the P0 treatment. The body weight gain on treatment P2, P3, and P4 did not show any significant effect. Treatment of addition of noni fruit extract at the level 125 -375 ml/kg ratio, resulted in the highest body weight gain. According to Murdiati (2000), the active compounds of noni fruit were detected, namely alkaloids, anthraquinones, and phenols. Alkaloids contain antibacterial which can inhibit the growth of bacteria in the digestive tract so that the absorption of nutrients becomes easier. The role of alkaloids corresponds to the mechanism of action of antibiotics. According to Parakkasi (1990) in Habibah (2012), the mechanism of absorption of some food substances is a positive influence on giving antibiotics to livestock.

This occurs through thinning of the digestive tract walls of cattle treated with antibiotics. Noni fruit contains anthraquinone compounds as anti-oxidants, anti-viral, anti-fungus, and anti-microbial that can improve the structure of intestinal villi in the absorption of nutrients, and can suppress the growth of pathogenic bacteria in the intestine thus increasing weight gain (Velmurugan and Citarasu, 2010).

In the intestine, the enzyme proxeronase and other substances will convert proxeronine into xeronine. Xeronine is absorbed by body cells to activate inactive proteins and regulate the repair of cell structure and function (Abdillah, 2021). The absorption of nutrients by the intestinal villi can increase due to the activity of the active substance xeronine which helps the small intestine in the absorption process. Xeronine can repair damaged body tissues including intestinal villi so that the absorption process occurs more optimally (Bintang, 2008). Compounds contained in the noni fruit include xeronine and proxeronine which help the intestines in the process of absorption of nutrients (Sunder, et al 2013).

Table 1. Effect of Fruit Noni Extract of the protein consumption, body weight gain, protein conversion, meat protein conservation and carcass weight of Sentul Chicken

Variables	P0	P1	P2	P3	P4
Consumption Protein (g)	476.21 b	458.20 a	460.53 a	452.90 a	449.52 a
Body weight gain (g)	618.05 a	657.28 a	699.89 b	686.83 b	691.67 b
Protein Conversion (index)	0.77 b	0.69 a	0.66 a	0.66 a	0.64 a
Meat protein conversion (index)	1.07 b	0.95 a	0.94 a	0.95 a	0.96 a
Carcass Weight (g)	442.27 a	482.85 b	486.87 b	467.33 b	462.50 b

Note: The similar superscript in the same row show non significant difference (P>0.05).
PO (basal ration), P1(basal ration added with 50 mg/kg Bacitacin Zn, P2(Basal ration added with 125 mg/kg ENF), P3(Basal ration was added with 250 mg/kg ENF), and P4(Basal ration was added with 375 mg/kg ENF).

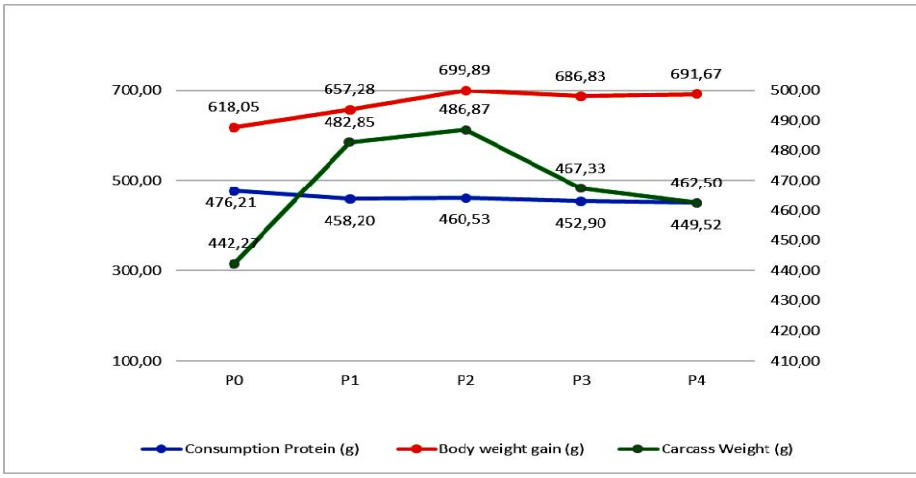

Fig. 2 Average of the protein consumption, body weight gain and carcass weigh

Carcass Weight

The results of the analysis of diversity showed that the addition of noni fruit extract supplemented with Cu and Zn in the ration gave significantly different results (P<0.05) on the carcass weight of Sentul chickens. Table 1 and Fig. 2 show that quantitatively, the carcass weight given the P2 treatment gave a higher mean value than the control (P0) and other treatments (P3, P4) including positive control (P1) with the addition of zinc bacitracin antibiotics and P1 gave the same effect on the treatment given noni fruit extract. It is suspected that the active compound content of the noni fruit as well as the minerals Cu and Zn can help the metabolic process, maintain livestock health, and improve nutrient absorption so that nutrients from the ration can be absorbed optimally and ultimately increase the carcass weight of Sentul chickens. Thus,

noni fruit has the potential to be used as a feed additive to increase livestock productivity. Noni fruit extract contains several chemical compounds of secondary metabolites include anthraquinones, alkaloids (xeronin and proxeronin), and saponins (Sogandi & Nilasari, 2019; Sogandi and Rabima, 2019). Anthraquinone and xeronine compounds in the digestive tract of Sentul chickens can suppress the growth of pathogenic bacteria so that it makes the digestive tract more acidic and helps the reaction occur faster in expanding the surface of the intestinal villi and the absorption of food substances will also increase. According to Adil et al (2010) that the villi in the small intestine play a role in nutrient absorption by increasing the surface area. Thus, the greater the surface area of the villi, the greater the opportunity for absorption from the digestive tract which in turn can have an impact on growth and increased carcass. The content of saponin compounds can also increase the process of protein absorption in the body of livestock. Irwani and Candra (2020) stated that saponin compounds can increase the process of absorption of food substances so that the protein in the feed can be better utilized for the formation of meat.

Protein conversion

Protein conversion values at P1, P2, P3, and P4 were significantly lower than P0, but P1 resulted in the same protein conversion as P2, P3, and P4 (can be seen Table 1 and fig. 3). The level of use of noni fruit extract in chicken rations to a level of 375 mg in the ration affected protein conversion in Sentul chickens. Low protein consumption and high body weight gain can decrease the value of protein conversion. Following the opinion of Fanani, et al (2015) that the factors that affect protein conversion are body weight gain and protein consumption.

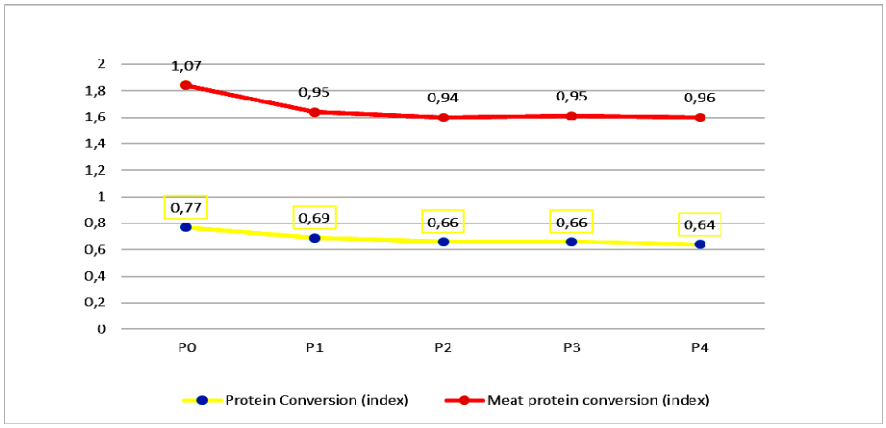

Fig. 3 Average of the protein conversion and meat protein conversion

Treatment P1 (adding Bacitacin Zn) had a protein conversion balance that was not significantly different from treatment P2, P3, and P4 but significantly different when compared to treatment P0. This is because in treatments P2, P3, and P4 there are active compounds in the noni fruit extract in the given ratio. One of the active compounds from noni fruit extract is the presence of proxeronine which forms xeronine in the body. Xeronine is one of the active substances needed by the body. Xeronine functions to move enzymes, improve cell structure and function, and help protein absorption in the small intestine. This is following the opinion of Azizah, et al (2020) Proxeronine compounds help the process of absorption of food substances in the small intestine, then after proxeronine compounds are converted into xeronine compounds will increase the process of nutrient absorption. Sentul chickens that were given noni fruit extract, namely P2, P3, and P4 had better protein absorption compared to P0 treatment which was only

given basal ration, this was indicated by the protein conversion index of P2, P3, and P4 which was lower than P0. The results of the treatment with the addition of noni fruit extract in the ration were not significantly different from the treatment given zinc bacitracin but significantly different from the basal ration. The results were not significantly different, indicating that the administration of noni fruit extract up to a level of 375 mg could replace the use of AGP in the ration.

Meat protein conversion

The addition of noni fruit extract in the ration as a feed additive has a significant effect on the protein conversion value of meat (Table 1 and Fig. 3). The average value of protein conversion in each treatment ranged from 0.94 – 1.07. The treatment of P1, P2, P3 dan P4 was significantly lower compared to (P0). This gives the understanding that P2, P3, and P4 are more efficient in using the protein consumed to produce meat. Noni fruit contains the active substance Anthraquinone can assist in the digestive process by improving the structure of the small intestinal villi in the process of absorption of feed nutrients and being able to suppress the growth of pathogenic bacteria in the small intestine (Velmurugan and Citarasu, 2010). This condition causes the surface area of the villi of the small intestine to become wider so that nutrient absorption can take place better. Through the mechanism of action of anthraquinone, it causes feed nutrients that can be utilized by the body to be converted back into the meat, which proves to be more efficient than controls. The results, which were not significantly different between P1 and P2, P3 and P4, could illustrate that the administration of noni fruit extract as a herbal additive feed up to a level of 375 mg could replace the use of AGP in the ration.

CONCLUSIONS

Research showed that providing a basal ration that was added up to a level of 375 mg/kg of noni fruit extract supplemented with Cu and Zn (P4) quantitatively had results that were close to the positive control results (P1, use of zinc Bacitracin: 50 mg/kg) so that the noni fruit extract with Cu and Zn supplements was expected substitute for antibiotics that can improve livestock performance.

ACKNOWLEDGMENTS

The authors express their sincere appreciation to the Chancellor, Director of Research, Service, and Innovation of Universitas Padjadjaran, and the Dean of the Faculty of Animal Husbandry, Universitas Padjadjaran who have provided funding through the Academic Leadership Grant (ALG) Research Scheme with No. 1959/UN6.3.1/PT.00/2021.

REFERENCES

1. Abdilah, I. Y., Garnida, D., & Widjastuti, T. (2021). The Effect Of Addition Of Noni Fruit Extract (Morinda Citrifolia L.) Supplemented With Cu And Zn On Sentul Chicken Performance In Production Phase. Jurnal Produksi Ternak Terapan (JPTT), 2(1), p. 14-21.
2. Ackland ML, Michalczyk AA. (2016). Zinc and infant nutrition. Archives of biochemistry and biophysics, 611,p. 51-57.
3. Adil, S., Banday, T., Bhat, G.A., Mir, M.S. and Rehman, M. (2010). Effect Of Dietary Supplementation Of Organic Acids On Performance, Intestinal Histomorphology, And Serum Biochemistry Of Broiler Chicken. Vet. Med. Int., 4(3), p. 1-7.
4. Azizah, T. R. N., Singgih, D. P., Setiyatwan, H., Widjastuti, T., & Asmara, I. Y. (2020). Increased Feed Utilization In Sentul Chicken Fed With Noni Fruit Extract (Morinda citifolia) Supplemented With Copper And Zinc, Journal of Tropical Animal Nutrition and Feed Science (JTANFSc), 2(1), p. 25-34
5. Bintang, I.A.K, A.P. Sinurat dan T. Purwadaria. (2008). Performances of broiler supplemented with antibiotic and Morinda citrifolia waste as sources of bioactive compounds. JITV, 13 (1), p. 7-12.
6. Castanon, J. I. R. (2007). History of the Use of Antibiotic as Growth Promoters in European Poultry Feeds. Poultry Science 86, p. 2466 – 2471.
7. Fanani, A.F., Suthama, N., Sukamto, B. (2015). Nitrogen Retention And Protein Efficiency Of Crossbred Local Chicken Fed Inulin Of Dahlia Tubers (Dahlia variabillis). Agromedia. 3 (1), p. 33-39.
8. Gilbert R, Peto T, Lengyel I, Emri E. (2019). Zinc Nutrition and Inflammation in the Aging

Retina. Molecular nutrition & food research, p. 1801049.
9. Graham, J. P., J.J. Boland, dan E. Silbergerld (2007). Growth promoting antibiotics in food animal production: an economic analysis. Public Health Reports, 122(1), p. 79 – 87.
10. Habibah, A. S., Abun dan R. Wiradimadja. (2012). Performan Ayam Broiler yang Diberi Ransum Mengandung Ekstrak Kulit Jengkol (Pithecellobiumjiringa (Jack) Prain). Students e – Journals 1(1), p. 1-7.
11. Irwani, N., dan A. A. Candra. 2020. Binahong (Anredera cordifilia) Leaf Extract Application on the Physiological Condition of Digestive and Viceral Organs in Broiler. PETERPAN, 2(1), p. 22-29.
12. Krishnaiah, D., Bono, A., Sarbatly, R., Nithyanandam, R., dan Anisuzzaman, S. M. (2015). Optimisation of spray drying operating conditions of Morinda citrifolia L. fruit extract using response surface methodology. Journal of King Saud University-Engineering Sciences, 27(1), p. 26–36.
13. Kurniawan, D. (2018). Antimicrobial and antioxidant activity of extract eeave and noni Fruit (Morinda citrifolia) powder. Jurnal ilmu-ilmu perternakan (JIIP), 28 (2), p. 105-111
14. Murdiati, T. B., G. Adiwinata dan D. Hildasari. (2000). To trace the active compound in mengkudu (morinda citrifolia) with anthelmintic acvtivity against Haemonchus contortus. Jurnal Ilmu Ternak dan Veteriner, 5(4), p. 255 – 259.
15. Nurhayati, N. (2010). Effect of noni fruit powder on digestive organs weight of broiler chickens. Jurnal Agripet, 10(2), p. 40-44.
16. Rezapour, M., dan Talebian, N. (2011). Comparison of structural, optical properties dan photocatalytic activity of ZnO with different morphologies: Effect of synthesis methods dan reaction media. Materials Chemistry dan Physics, 129(1–2), p. 249–255.
17. Situmorang, N.A., Mahfudz, L.D., Atmomarsono, U. (2013). The Influence of Seaweed (Gracilaria verrucosa)Meal in the Diet on Protein Utilization of Broiler). Jurnal Animal Agriculture. 2 (2), p. 49-56.
18. Sogandi, S., & Nilasari, P. (2019). Identification of Bioactive Compound from Noni Fruit (Morinda citrifolia L.) Extract and its Potential as Dental Caries Inhibitor. Jurnal Kefarmasian Indonesia, 9(2), p. 73–81.
19. Sogandi; Rabima. (2019). Identification of Active Compound Extractsfrom Noni Fruit (Morinda citrifolia L.) and Its Potential as Antioxidants. Journal of Scientific and Applied Chemistry, 22(5), p. 206–212.
20. Sunder, J., S. Jeyakumar, T. Sujatha, dan A. Kundu. (2013). Effect of feeding of morical (Morinda citrifolia) based herbal supplement on production and egg quality in Nicobari fowl. Journal of Medicinal Plants Research. 7, p. 40--48.
21. Utomo, M. P., & Laksono, E. W. (2007). The study of catalyst deactivation on the heterogeneous catalysis reaction. Prosiding Seminar Nasional MIPA, 2(9), p. 110–115.
22. Varianti, N. I., Atmomarsono, U., & Mahfudz, L. D. 2017. The influence of different protein source on efficiency protein of crossbred local chicken. Jurnal Agripet, 17(1), p. 53-59.
23. Velmurugan, S., Citarasu, T. 2010. Effect of Herbal Antibacterial Extracts on the Gut Floral Changes in Indian White Shrimp Fenneropenaeus indicus. Romanian Biotechnological Letters, 15(6), p. 5709 – 5717.