International Journal of Life Science Research Archive

ISSN: 0799-6640 (Online)

Journal homepage: https://sciresjournals.com/ijlsra/

(RESEARCH ARTICLE)

Check for updates

Balanced protein efficiency of broiler chickens given rations containing Jengkol peel extract (*Pithecellobium jiringa* (Jack) Prain)

Abun Abun [1,*], Erna Siti Khodijah [2] and Kiki Haetami [3]

[1] *Department of Animal Nutrition and Feed Technology, Padjadjaran University, Sumedang-West Java, Indonesia.*
[2] *Alumni Department of Animal Nutrition and Feed Technology Faculty of Animal Husbandry, Padjadjaran University, Indonesia.*
[3] *Department of Fisheries, Padjadjaran University, Sumedang-West Java, Indonesia.*

International Journal of Life Science Research Archive, 2023, 04(01), 103–107

Publication history: Received on 08 December 2022; revised on 24 January 2023; accepted on 26 January 2023

Article DOI: https://doi.org/10.53771/ijlsra.2023.4.1.0018

Abstract

Background: The research was carried out in the Poultry Cage of the Faculty of Animal Husbandry, Padjadjaran University, Jatinangor, Sumedang. The research objective was to determine the effect and obtain the appropriate level of use of jengkol peel extract in a ration that produces an optimal balance of protein efficiency in broiler chickens.

Materials and Methods: The study used 100 one-day-old broiler chickens (DOC) of the Cobb strain which were placed in 20 cage units for five weeks. The study used an experimental method with a completely randomized design (CRD) consisting of 4 ration treatments, namely R0 (basal ration without jengkol peel extract), and rations with the addition of jengkol peel extract, namely R1 (0.01%), R2 (0.02%), and R3 (0.03%), each treatment was repeated five times. The variables observed were body weight gain, protein consumption, and protein efficiency balance. Data were analyzed using variance and continued with Duncan's Multiple Range Test.

Results: The results of the statistical analysis, of the balance protein efficiency (BPE) for broiler chickens, found that between treatments there was no significant difference ($P>0.05$) in BPE. However, was a significantly different ($P<0.05$) in body weight gain. The addition of jengkol peel extract (JPE) to the ration resulted in a chicken body weight gain that was as great as the ration treatment without JPE (R0), except the ration with the addition of 0.02% JPE (R2) resulted in a significantly higher broiler body weight gain than the treatment other. This is because the content of the active compound JPE is at the right dose so that it can function optimally.

Conclusions: The use of jengkol peel extract in rations influences body weight gain, but does not affect protein consumption and protein efficiency balance. The use of jengkol peel extract at a level of 0.02% resulted in an optimal balance of protein efficiency in broiler chickens.

Keywords: Balance of protein efficiency; Broiler; Jengkol skin extract; Optimal; Protein consumption; Ration; Weight gain

1. Introduction

Balance of protein efficiency (BPE) is a way of testing the quality of protein in a ration that is expressed as a ratio between body weight gain and protein consumption. The greater the BPE value indicates the more efficient livestock is in converting each gram of protein into several body weight gains. Optimum use of protein is very important in the

* Corresponding author: Abun Abun

maintenance of broiler chickens, therefore supplemental feed is often given to livestock to improve the efficiency of ration use.

Feed additives that are often given to livestock are antibiotics as an antibacterial which are used to inhibit pathogenic microorganisms so that the activity of microorganisms that synthesize growth factors can increase. The use of antibiotics for a long time can cause residues in the body of livestock, thus endangering consumers who consume them. Therefore, it is necessary to develop natural antibacterial, and one of them is herbal ingredients in the form of jengkol peel extract.

Jengkol (*Pithecellobium jiringa* (Jack) Prain) is a medicinal plant that has long been known in Indonesia. The potential for jengkol fruit production is quite abundant in Indonesia. In 2009, jengkol production reached 62,475 tons per year [1]. Jengkol skin is a waste in traditional markets that do not yet provide economic value. According to [2] states that the active (bioactive) chemical compounds contained in jengkol peel include alkaloids, flavonoids, tannins, saponins, glycosides, and steroids/triterpenoids, which are anti-nutrients that can inhibit growth. But on the other hand, these compounds have a positive effect when given at levels that can be tolerated by the livestock body, such as the limit for the use of saponins in the ration is 3.7 g/kg [3] and the limit for the use of tannins in the ration is 0.33 percent [4]. Saponins have properties that are like soap (foaming) can clean the material attached to the intestinal wall and increase the permeability of the intestinal wall so that it will make it easier for large molecules to be absorbed in the body and there will be an increase in nutrients deposited in the body and affect body weight gain [1]. Tannins and flavonoids are a group of polyphenolic compounds that have antibacterial properties [4][5].

Apart from being antibacterial, secondary metabolites in plants derived from alkaloids, flavonoids, phenolic compounds, steroids, and terpenoids can function as natural antioxidants [6]. Antioxidants are substances that can slow or prevent the oxidation process. Jengkol peel extract provides an effective inhibition zone for Escherichia coli bacteria with a diameter of 14.67 mm at a concentration of 60 mg/ml [6]. The boundaries of the inhibition area are considered effective if they have a diameter of inhibition of approximately 14 - 16 mm [7]. The inhibition of pathogenic bacteria in the digestive tract will increase the absorption of nutrients and the growth of broiler chickens will be better [8]. The resulting performance is an illustration of the quality of the ration which can be measured by examining the protein efficiency balance. Therefore, a study was conducted to determine the effect and obtain the level of use of jengkol peel extract in rations that produce an optimal balance of protein efficiency in broiler chickens.

2. Material and methods

The study used 100 one-day-old chickens (DOC) Cobb strain (straight run), the average DOC body weight was 36.417 g with a coefficient of variation of 6.85%. The research method used was an experiment using a completely randomized design (CRD) with 4 treatments, namely rations without jengkol peel extract (JPE)/basal ration (R0), rations using 0.01% JPE (R1), 0.02% JPE (R2), and 0.03% JPE (R3). Each treatment was repeated 5 times. The formulation and nutrient content of the trial rations are presented in Table 1.

Table 1 Formulation and Nutrient Content of Experimental Rations

Feed Ingredients	Formulated (%)	Nutrient	Content
Fine bran	0.90	Metabolizable energy (kcal/kg/kg)	3,200
Yellow corn	56.10	Crude protein (%)	23.07
Fish flour	6.84	Ekstrak ether (%)	7.76
Coconut oil	4.00	Crude fiber (%)	3.53
Coconut Cake	3.60	Calcium (%)	0.85
Soybean meal	26.80	Phosphorus (%)	0.53
Bone meal	1.20	Lysine (%)	1.29
premix	0.50	Methionine (%)	0.48
DL-Methionine	0.06		

Note: Ration formulation and nutrient content are arranged based on the feed ingredient content Table [9]

The variables measured are

- Body weight gain (g/bird) = final body weight (g) – initial body weight (g)
- Consumption of protein (g/bird) = consumption of ration X ration crude protein content
- Balance of protein efficiency (BPE) = body weight gain (g)/Protein consumption (g)

3. Results and discussion

The average body weight gain, protein consumption, and balance protein efficiency of broiler chickens from each treatment during the experiment are presented in Table 2.

Table 2 Average Body Weight Gain, Protein Consumption, and Balance Protein Efficiency

Observed Variables	Treatment			
	R0	R1	R2	R3
Body Weight Gain (g/bird)	1.027a	967a	1,185b	968a
Protein Consumption (g/bird)	533.79a	531.57a	564.74a	520.07a
Balance Protein Efficiency	1.94a	1.83a	2.11a	1.91a

Note: Different letters towards the treatment column show significantly different results (P<0.05)

- R0 = basal ration (ration without JPE)
- R1 = basal ration + 0.01% JPE
- R2 = basal ration + 0.02% JPE
- R3 = basal ration + 0.03% JPE

The results of the statistical analysis revealed that between the treatments there was a significantly different effect (P<0.05) on body weight gain. The addition of jengkol peel extract (JPE) to the ration resulted in a chicken body weight gain that was as great as the ration treatment without JPE (R0), except the ration with the addition of 0.02% JPE (R2) resulted in a significantly higher broiler body weight gain than the treatment other. This is because the content of the active compound JPE is at the right dose so that it can function optimally. The active compounds contained in JPE function as antibacterial [10] which can inhibit the growth of pathogenic bacteria in the digestive tract so that the absorption of nutrients and the growth of broiler chickens are getting better. Apart from being an antibacterial, the active compounds in JPE can function as antioxidants [11] which can inhibit or prevent oxidation processes. Oxidation conditions can cause damage to proteins and DNA, and the presence of antioxidants in JPE can protect proteins from the oxidation process so that ration protein can be used by broilers to meet the needs of their growth.

The saponin compounds contained in JPE have soap-like (foaming) properties so that they clean the materials attached to the intestinal wall and increase the permeability of the intestinal wall. This will make it easier for large molecules to be absorbed in the body, resulting in an increase in nutrients being deposited in the body and affecting body weight gain [12] [13].

The results of the statistical analysis of the effect of treatment on protein consumption resulted in an effect that was not significantly different (P>0.05) for all treatments. The use of JPE in the ration did not show an increase in the amount of protein consumption. This is because the active compound content of JPE is still within the tolerance limits of broiler chickens. Protein consumption depends on the protein level of the ration and the amount of ration consumed [13][14]. The higher the ration consumption and the greater the protein level of the ration, the greater the resulting protein consumption. The protein content of the rations in this experiment was at the same level for each treatment so the experimental results provided the same amount of protein consumed by broiler chickens [15][16].

Based on the results of statistical analysis, the balance protein efficiency (BPE) for broiler chickens found that between treatments there was no significant difference (P>0.05) in balance protein efficiency. Increasing the use of JPE in the ration did not show an increase in BPE. This is because the content of the active compound JPE in its use is still within the tolerance limits of broiler chickens. One of the anti-nutrients contained in JPE, such as tannins, can precipitate proteins, which produce large and complex cross-links, namely protein-tannins [4][5]. These bonds cause the feed to be difficult to digest by digestive enzymes, but the tannins contained in the rations in this experimental treatment were

still within the tolerance limits of broiler chickens [17][18]. This illustrates that the use of JPE up to 0.03% produces the same good BPE value compared to the ration without the addition of JPE.

4. Conclusion

The use of jengkol peel extract in rations influences body weight gain but does not affect protein consumption and protein efficiency balance. The use of jengkol peel extract at a level of 0.02% resulted in an optimal balance of protein efficiency in broiler chickens.

Compliance with ethical standards

Acknowledgments

The researchers would like to thank the Chancellor and Director of Research and Community Service at Padjadjaran University and the Dean of the Faculty of Animal Husbandry at Padjadjaran University for trusting us to conduct research and for granting permission to use the laboratory.

Disclosure of conflict of interest

The authors declare no conflicts of interest.

References

[1] L. Adriani, Abun, and A. Mushawwir, "Effect of dietary supplementation of Jengkol (Pithecellobium jiringa) skin extract on blood biochemistry and gut flora of broiler chicken," Int. J. Poult. Sci., vol. 14, no. 7, pp. 407–410, 2015, doi: 10.3923/ijps.2015.407.410.

[2] R. Yenrina, R. Yenrina, A. Kasim, and W. Delfiana, "Influence of pre-treatments on Jengkol Bean (Pithecellobium lobatum, Benth) toward Sulfuric Content," Asia Pacific J. Sustain. Agric. Food Energy, vol. 3, no. 1, pp. 7–11, 2015, [Online]. Available: http://journal.bakrie.ac.id/index.php/APJSAFE/article/view/885.

[3] WHO-FAO, "Fruit and vegetable for health: report of a joint FAO/WHO workshop, 1-3 september 2004, Kobe, Japan," Handb. Plant Food Phytochem., no. September, pp. 105–137, 2004, [Online]. Available: http://doi.wiley.com/10.1002/9781118464717.ch5.

[4] Jansman A., "Tannins I N Feedstuffs for Simple-Stomached Animals," Nutr. Res. Rev., vol. 6, pp. 20–236, 1993.

[5] M. Marzoni et al., "Effects of Dietary Quebracho Tannin on Performance Traits and Parasite Load in an Italian Slow-Growing Chicken (White Livorno Breed)," Animals, vol. 10, no. 4, p. 684, 2020, doi: 10.3390/ani10040684.

[6] K. N. Seneviratne, C. D. HapuarachchI, and S. Ekanayake, "Comparison of the phenolic-dependent antioxidant properties of coconut oil extracted under cold and hot conditions," Food Chem., vol. 114, no. 4, pp. 1444–1449, 2009, doi: 10.1016/j.foodchem.2008.11.038.

[7] S. Chintong, W. Phatvej, U. Rerk-Am, Y. Waiprib, and W. Klaypradit, "In vitro antioxidant, antityrosinase, and cytotoxic activities of astaxanthin from shrimpwaste," Antioxidants, vol. 8, no. 5, pp. 1–11, 2019, doi: 10.3390/antiox8050128.

[8] H. El-Hamid et al., "Single and combined effects of Clostridium butyricum and Saccharomyces cerevisiae on growth indices, intestinal health, and immunity of broilers," Animals, vol. 8, no. 10, 2018, doi: 10.3390/ani8100184.

[9] M. C. N. and R. J. Y. Scott, M.L., Nutrition of the Chicken. .L. Scott and Associate, New York, 1982.

[10] A. Sathiyaseelan, K. Saravanakumar, K. Han, K. V. Naveen, and M. H. Wang, "Antioxidant and Antibacterial Effects of Potential Probiotics Isolated from Korean Fermented Foods," Int. J. Mol. Sci., vol. 23, no. 17, 2022, doi: 10.3390/ijms231710062.

[11] E. M. Coelho, M. E. A. O. De Souza, L. C. Corrêa, A. C. Viana, L. C. De Azevêdo, and M. D. S. Lima, "Bioactive compounds and antioxidant activity of mango peel liqueurs (Mangifera indica L.) produced by different methods of maceration," Antioxidants, vol. 8, no. 4, pp. 1–11, 2019, doi: 10.3390/antiox8040102.

[12] R. Hu, Y. He, M. A. Arowolo, S. Wu, and J. He, "Polyphenols as potential attenuators of heat stress in poultry production," Antioxidants, vol. 8, no. 3, pp. 1–11, 2019, doi: 10.3390/antiox8030067.

[13] F. A. M. Hassan, E. M. Roushdy, A. T. Y. Kishawy, A. W. Zaglool, H. A. Tukur, and I. M. Saadeldin, "Growth performance, antioxidant capacity, lipid-related transcript expression and the economics of broiler chickens fed different levels of Rutin," Animals, vol. 9, no. 1, pp. 1–13, 2019, doi: 10.3390/ani9010007.

[14] T. Castro, D. Martinez, B. Isabel, A. Cabezas, and V. Jimeno, "Vegetable oils rich in polyunsaturated fatty acids supplementation of dairy cows' diets: Effects on productive and reproductive performance," Animals, vol. 9, no. 5, 2019, doi: 10.3390/ani9050205.

[15] T. Widjastuti, A. R, R. Wiradimadja, H. Setiyatwan, and D. Rusmana, "The Effect of Ration Containing Mangosteen Peel Meal (Garcinia Mangostana) on Final Body Weight, Carcass Composition and Cholesterol Content of Sentul Chicken," SSRN Electron. J., 2018, doi: 10.2139/ssrn.3201106.

[16] S. J. Hosseini-Vashan, M. Safdari-Rostamabad, A. H. Piray, and H. Sarir, "The growth performance, plasma biochemistry indices, immune system, antioxidant status, and intestinal morphology of heat-stressed broiler chickens fed grape (Vitis vinifera) pomace," Anim. Feed Sci. Technol., vol. 259, no. August 2018, p. 114343, 2020, doi: 10.1016/j.anifeedsci.2019.114343.

[17] J. H. Park and I. H. Kim, "The effects of betaine supplementation in diets containing different levels of crude protein and methionine on the growth performance, blood components, total tract nutrient digestibility, excreta noxious gas emission, and meat quality of the broiler chic," Poult. Sci., vol. 98, no. 12, pp. 6808–6815, 2019, doi: 10.3382/ps/pez412.

[18] A. Abun, D. Saefulhadjar, T. Widjastuti, K. Haetami, and R. Wiradimadja, "Energy-Protein-Consentrate as Product of Glucosamine Extract from Shrimp Waste on Performance Ofnative Chicken," Int. J. Environ. Agric. Biotechnol., vol. 2, no. 3, pp. 1341–1346, 2017, doi: 10.22161/ijeab/2.3.41.

[19] T. Widjastuti, W. Tanwiriah, Abun, And S. Darana, "Cihateup Female Ducks Performance Growth By Various Protein- Energy Rations Given At Water Minim Housing System.," Sci. Pap. Ser. D, Anim. Sci. - Int. Sess. Sci. Commun. Fac. Anim. Sci., vol. 58, pp. 179–185, 2015, [Online]. Available: http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=118979493&lang=pt-br&site=ehost-live.