Supplementation of papaya leaf extract in drinking water to optimize broiler chicken carcass production

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Abstract. The papaya plant (*Carica papaya* Linn.) is regarded as an alternative option that is believed to have the potential to reduce fat accumulation in broiler chickens. In society, papaya leaves are well-known as ingredients in traditional medicine due to their content of alkaloid compounds and proteolytic enzymes, namely papain and chymopapain, which play a significant role in digestion and facilitate intestinal activity. The impact of adding Papaya Leaf Extract (PLE) to drinking water on parameters such as final body weight, carcass weight, carcass percentage, abdominal fat weight, and abdominal fat percentage is sought to be assessed in this study. Eighty-seven-day-old chicks, irrespective of gender, constitute the subjects of the research. Commercial feed, papaya leaves, research facilities and equipment, and manual and digital scales are utilized in the study. An experimental approach with a Completely Randomized Design (CRD) is followed in the research methodology. Five treatments, each repeated four times, are included in the study: T0 (control with 1 liter of drinking water), T1 (T0 + 5 ml of PLE), T2 (T0 + 15 ml of PLE), T3 (T0 + 25 ml of PLE), and T4 (T0 + 35 ml of PLE). Chicken slaughtering is performed after 35 days of rearing, with samples taken randomly from pens 1-20 and subsequently processed, adhering to Islamic principles. Measured parameters include final body weight, carcass weight, carcass percentage, abdominal fat weight, and abdominal fat percentage. Analysis of variance (ANOVA) in a Completely Randomized Design is employed for data analysis. The research findings suggest that providing papaya leaf extract to broiler chickens up to 35 days of age does not significantly affect final body weight, carcass weight, carcass percentage, abdominal fat weight, or abdominal fat percentage. Based on the results

obtained from the broiler chicken carcass production in this study, the administration of PLE to broiler chickens can be conducted.

1. Introduction

The maintenance of broiler chickens, both on a small and large business scale, relies on synthetic drugs. The use of these synthetic drugs has the potential to cause the development of microbial resistance and leave residues on livestock products. Consumption of livestock products containing such residues can have a negative impact on human health [1]. In order for the use of chemicals in the maintenance of livestock to be reduced, it is more advisable to switch to using natural medicines [1]. For the use of chemicals in the maintenance of livestock to be reduced, it is more advisable to switch to using natural medicines [1]. One alternative is to use medicinal plants, which are generally used as restorative materials and medicinal raw materials. The use of medicinal plants as an alternative can be a good choice because medicinal plants often have healing properties and beneficial medicinal qualities for health. Additionally, the use of medicinal plants can also be a more natural and sustainable solution compared to chemical drugs that may have negative side effects on poultry and consumers who consume the products [1]. This medicinal plant is usually used in various forms, such as roots, leaves, fruits, and seeds [2].

Papaya plant (*Carica papaya* Linn.) is one plant option that is considered to have the potential to reduce fat accumulation in broilers [3]. This reduction in fat accumulation occurs through the action of the proteolytic enzyme papain, which can increase fat metabolism and reduce fat absorption in the body of broiler chickens [4]. This means that consumed fats are processed more efficiently and used as a source of energy, thereby reducing the absorption of unnecessary fats in the body [4]. Therefore, with more efficient fat metabolism and reduced fat absorption, the accumulation of fat in the body of broiler chickens can be reduced, resulting in the production of leaner chicken meat [4].

Papaya leaves have been known in the community as an ingredient in traditional medicine because they contain alkaloid compounds as well as proteolytic enzymes such as papain and chymopapain [3]. These enzymes play an essential role in the digestive process and ease the work of the intestine [4]. Papain also has a role in regulating amino acids and helping in the elimination of toxic substances from the body [5]. According to Kadiri et al. [6], papain, as a proteolytic enzyme, can break down proteins and convert them into arginine. Arginine, in its original form, has been shown to affect the production of human growth hormone produced by the pituitary gland.

Papaya leaves contain ß carotene, which acts as a natural source of xanthophyll. In addition, every 100 grams of papaya leaves also contain 140 grams of vitamin C, 136 grams of vitamin E, 0.15 grams of vitamin B1, 35 grams of calcium, and 63 grams of phosphorus [7]. The composition of papaya leaves includes crude protein of as much as 20.9%, calcium of as much as 0.99%, phosphorus of as much as 0.47%, and energy of around 2912 Kcal/kg [9]. Vitamin C and malondialdehyde (MDA) levels in the blood can help cope with stress, improve carcass quality, and provide benefits such as preventing excessive fat accumulation in the chicken belly area [10]. According to Rylian et al. [11], giving papaya leaf infusion as much as 25 mL/L of drinking water can affect the productivity of broilers, but giving papaya leaf extract in feed has no impact on cholesterol and total fat of broilers [7]. The effect of providing papaya leaf extract in drinking water on broiler chicken carcass production is still not widely known. This study aims to determine the impact of adding PLE in drinking water on final body weight, carcass weight, carcass percentage, abdominal fat weight, and abdominal fat percentage.

2. Materials and Methods

2.1. Research Ethics

This experiment followed research ethics guidelines pertaining to livestock, in accordance with the Ethical Poultry and the Bioethics of Poultry Production This experiment followed the ethical guidelines for research relating to farm animals, in accordance with Poultry Ethics and Bioethics of Poultry Production by Macer (2019) [8].

2.2. Materials

The livestock used are chicks aged seven days, as many as 80 heads without distinguishing sex. Fresh papaya leaves are obtained from papaya plantations in Tanjung Rambutan Village, Kampar. The ration used in the form of 311 Vivo commercial rations is given to day-old chicks (DOC) aged 1-18 days, and then 511 Vivo until harvest. The nutritional composition of such rations is presented in Table 1.

Table 1. Nutritional Composition of Commercial Rations 311 Vivo and 511 Bravo

Nutrients	Nutrient composition (%)	
	Vivo 311	Vivo 511
Water contains	Max 14	Max 14
Crude protein	19-21	21-23
Crude fat	5-8	5-8
Crude fiber	4-5	3-5
Ash	Max 7	4-7
Calcium	Min 0,90	0,90-1,20
Phosphor	Min 0,70	0,70-1,00

Source: PT. Charoen Pokphan Indonesia

2.3. Methodology

Making papaya leaf extract is done every day to maintain freshness and prevent contamination from outside. Papaya leaves are washed, cut into pieces of about 1-2 cm, weighed 500 g, then mixed with 1 liter of water, after blended until smooth and filtered to get the extract. Rationing is based on the period of keeping life that refers to the standards of maintaining broilers. Drinking water is given ad libitum, starting at the age of 8-35 days. The slaughter of broilers is carried out after maintenance for 35 days.

2.4. Parameter Measured

The study used a Complete Randomized Design with five treatments and four repeats as follows: adding papaya leaf extract to drinking water, each as much as 0 mL/L (T1; control), 5 mL/L (T2), 15 mL/L (T3), 25 mL/L (T4), and 35 mL/L drinking water (T5). The parameters observed include final body weight (g/head), carcass weight (g/head), carcass percentage (%), abdominal fat weight (g/head), and abdominal fat percentage (%). The research data were analyzed using fingerprint analysis if the real difference was continued with the Duncan test.

3. Results and Discussion

3.1. Carcass production

The results of the variety analysis in Table 2 showed that PLE up to the level of 35 mL/L of drinking water did not have a significant effect ($P>0.05$) on final body weight, carcass weight, carcass percentage, abdominal fat weight, and broiler abdominal fat percentage. Final body weight, carcass weight, and carcass percentage at P1 (control) tended to decrease. The addition of PLE in drinking water relatively increased final body weight, carcass weight, and carcass percentage at P2, P3, P4, and P5 but tended to decrease final body weight at P3 and carcass percentage at P5. The average final body weight, carcass weight, carcass percentage, abdominal fat weight, and abdominal fat percentage of broilers from this study were around 1562 g/head, 991 g/head, 63.5%, 27 g/head, and 2.72%, respectively.

The growth of chickens can be affected by the rate of ration consumption during rearing [12]. According to Sugiharto et al. [13], ration consumption is directly related to growth; this means that high ration consumption will result in high final body weight and vice versa. Broiler ration consumption was relatively the same, around 1769-1877 g/head [14], but was not significantly affected by the addition of papaya leaf extract. According to Sugiharto et al. [15], consumption of the same ration will result in the same nutrients being absorbed. This condition will be seen in the production of carcasses and abdominal fat.

Based on this condition, the average final body weight and carcass weight of broilers given PLE were higher than the standard provided by Cobb-Vantress (2022) for the Cobb strain, which was around 1397 g/head and 950 g/head, respectively. According to Scanes and Christensen [16], feed consumption, carcass production, and abdominal fat can also be influenced by genetic factors, sex, growth, cutting age, and strains.

Table 2. Carcass and Abdominal Fat Production of 35-Day-Old Broilers Given EDP

Parameter	P1	P2	P3	P4	P5
Final Body Weight (g/head)	1543±96.7	1571±167	1534±130	1581±146	1582±115
Carcass Weight (g/head)	973±66.3	1016±97.8	984±39.8	1002±118	980±75.5
Carcass Percentage (%)	63.2±5.42	64.8±2.46	64.4±3.07	63.3±1.78	62.0±1.92
Fat Weights Abdominal (g/head)	26.9±2.20	27.4±3.92	27.1±4.12	24.5±4.03	29.1±6.53
Fat Percentage Abdominal (%)	2.77±0.29	2.70±0.35	2.75±0.36	2.44±0.22	2.96±0.66

T1: PLE 0 mL/L (control), T2: PLE 5 mL/L, T3: PLE 15 mL/L, T4: 25 mL/L, dan T5: 35 mL/L

3.2. Abdominal fat production

The production of carcass and abdominal fat of broilers who consume papaya leaf extract is not natural between treatments because the active substances contained in PLE have not worked optimally, so the achievement of final body weight between treatments is the same. The active substances in question are vitamins C and E, which function as antioxidants and other antioxidant compounds. Furthermore, the rations employed in the study are similar, both in terms of quantity and nutritional content. The abdominal fat production of broilers (weight & percentage) in this study was around 24.5-29.1 g/head and 2.44-2.96%, respectively.

According to Muazu and Aliyu-Paiko [17], vitamins C and E contained in papaya leaf extract act as an antioxidant protects the chicken's body from free radical damage and increases the body's resistance to infection. Nideou et al. [5] revealed that PLE supplementation in drinking water can improve broiler performance by inhibiting the impact of free radicals and increasing endurance. In addition to non-nutrient components, papaya leaves also contain nutrient components [5]. According to Chew et al. [18], the crude protein content of papaya leaves is about 20.9%. According to Onyimonyi and Ernest [19], papaya leaves contain a water content of 10.2%, crude protein of 30.1%, crude fiber of 5.60%, and other extracts of about 1.20%. As reported by Ogbuokiri et al. [20], papaya leaves comprise approximately 32.6% crude protein and 7.20% crude fiber, which led to enhancements in performance, feed consumption, weight gain, feed conversion ratio, as well as carcass and organoleptic measures, respectively.

McDonald et al. [21] state that the function of protein is as an energy producer and new tissue formation, besides maintaining old tissue and replacing damaged tissue so that it will be directly related to the growth rate of chickens. According to Scanes and Christensen [16], the optimal growth rate of broilers will be in harmony with the production of carcass and abdominal fat of broilers. This means that optimal growth in broiler chickens aligns with their meat and abdominal fat production, resulting in well-grown chickens with optimal meat proportion and controlled abdominal fat [21].

4. Conclusion

Giving papaya leaf extract to broilers up to 35 days of age has not been able to increase final body weight, carcass weight, carcass percentage, abdominal fat weight, and abdominal fat percentage. However, in broiler rearing, papaya leaf extract is recommended to minimize the use of synthetic ingredients associated with improving broiler performance, especially those related to minimal broiler mortality during the study.

References

[1] Sadarman, Irawan A, Hidayat C, Elfawati, Sholikin MM, Harahap RP, Rusli RK, Solfaine R, Sofyan A, Nahrowi, and Jayanegara A 2021 *Trop. Anim. Sci. J.* **44** 425–33.
[2] Gustina S, Sumardi, and Sinaga K 2022 *J. Ilmu Teknol. Ternak Unggul* **1** 1–21.
[3] Mardiyansyah T, Definiati N, Sunaryadi, and Suliasih 2022 *J. Inspirasi Peternak.* **2** 259–66.
[4] Nunes C, and Kumar V (2018) *Enzymes in Human and Animal Nutrition: Principles and Perspectives*, Academic Press, New York.
[5] Nideou D, N`nanle O, Yaa AEK, Voemesse K, Eddy D, Messanvi, G. Okanlawon O, and Kokou T 2020 *Int. J. Poult. Sci.* **19** 1–9.
[6] Kadiri O, Olawoye B, Fawale OS, and Adalumo OA 2016 *Turk. J. Agric. Food. Sci. Technol.* **4** 1039–52.
[7] Wozerou N, Tiambo C, Sofeu-feigning DD, Sotoing G, Ragheb A, Aziz A, Lisita F, Soares R, and Kuokuo H 2020 *Vet. Parasitol. Reg. Stud. Rep.* **19** 100354.
[8] Macer D 2019 *J. Poult. Sci.*, **56**: 79-83, 2019.
[9] Ikeyi AP, Ogbonna AO, and Eze FU 2013 *Int. J. Life Sci. Biotechnol. Pharma. Res.* **2** 347–51.
[10] Rahman MZ, Rana MM, Monira KN, Sultana N, and Hasan M 2022 *Meat Res.* **2** 1-7.
[11] Rylian AK, Irwani N, and Sukaryana Y 2021 *J. Peternak. Terap.* **3** 53–6.
[12] Romadhon SF, Susanto E, and Qomaruddin M 2021 *IJASC* **4** 91–7.
[13] Sugiharto S, Yudiarti T, Isroli I, and Widiastuti E 2018 *J. Appl. Anim. Sci.* **8** 375–85.
[14] Hamadi 2015 *Pengaruh Suplementasi Ekstrak Daun Pepaya (Carica papaya L.) dalam Air Minum terhadap Performa Broiler* Universitas Islam Negeri Sultan Syarif Kasim, Riau.
[15] Sugiharto S 2020 *Vet World* **13** 1613–9.
[16] Scanes CG, Brant G, and Ensminger M 2004 *Poultry Science. 4th Ed.* Pearson, Prentice Hall, New Jersey.
[17] Muazu U, and Aliyu-Paiko M 2020 *IOSR J. Biotechnol. Biochem.* **6** 8–18.
[18] Chew SK, W.H. T, Hong SL, and Yusoff R 2022 Difference of Rutin Content in the Leaf of Male and Female Carica papaya Linn. using Microwave Assisted Extractive (MAE) Method. In *Proc. Int. Tech. Postgrad. Conf.* Universiti Malaya, Kuala Lumpur, Malaysia.
[19] Onyimonyi AE, and Ernest O 2009 *Int. J. Poult. Sci.* **8**, 995–8.
[20] Ogbuokiri UDE, Iheanacho A, Osuji AL, Okoli IC and Ekenyem BU 2014 *J. Anim. Vet. Adv.* **4** 826-32.
[21] McDonald P, Edwards RA, Greenhalgh J, Morgan C, Sinclair L, and Wilkinson R 2022 *Animal Nutrition. 8th Edition*, Pearson Ltd., Singapore.

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