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Growth Performance, Serum Biochemical, Physical and Sensory Evaluation of Broiler Chickens Supplemented with Leilem (*Clerodendrum minahassae* Teijsm & Binn) Leaves Juice in Drinking Water

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Abstract. This feeding trial was conducted to investigate the effects of leilem leaves juice in drinking water on growth performance, serum biochemical, and physical and sensory quality of broiler chickens. Two hundred broiler chicks were assigned to 4 dietary treatments for 5 weeks. The birds were randomly allocated into four treatments with five replicates, and each replicate containing 10 broiler chicks. The treatments contained 0 ml/L drinking water, 10 ml/L drinking water, 20 ml/L drinking water, 30 ml/L drinking water inclusion levels of leilem leaves juice to broiler chicks, respectively. The based diet consisted of commercial diet 70%, yellow corn 27%, and coconut oil 3%; and the chemical composition of based diet were crude protein 19.47%, crude fiber 3.18%, fat 2.94%, Ca 5.07%, P 0.55% and gross energy 4101.0 Kcal/kg. The variables were growth performance, carcass profile, giblet, serum biochemical, proximate component of meat, and physical and sensory quality of meat. Data were analyzed by one-way analysis of variance. The treatment means were compared using Duncan's multiple range test. Results showed that birds drank leilem leaves juice had similar feed intake, BWG, FCR, abdominal fat percentage, carcass percentage, giblet, and sensory evaluation though that of control, however had significantly different on SGR, GE, serum biochemical, proximate component of meat, Water Holding Capacity (WHC) and tenderness of meat. It can be concluded that leilem leaves juice can be included up to 30 ml/L in the drinking water of broiler chicken for improved the performance of broiler chickens.

INTRODUCTION

Research efforts are increasingly directed towards using natural agents with similar beneficial effects of growth promoters [1], because of a high risk antibiotic resistance emergence of poultry. Botanical products are referred to as phytochemical feed additives (PFA) consisting of many bioactive molecules with antioxidant and antimicrobial properties and stimulating effects on the digestive system. Herbs, spices, and various other plant extracts are being evaluated as alternatives to antibiotics and some do have growth promoting effects, antimicrobial properties, and other health-related benefits [2]. PFA derived from plants, herbs and spices are used to improve animal performance. They have been very successful because of their positive effects on growth, improved immune system and reduced stress response [1].

Catmint (*Nepeta racemosa*) and bitter (*Vernonia amygdalina*) leaf extracts at 25 ml/L enhances carcass performance, reduced blood cholesterol, have positive effect on gut morphology and organ characteristics of the birds [3]. Birds received various level of papaya extract had no effect on serum biochemistry and hematology parameters except triglyceride levels which were significantly lower in commercial diet and commercial diet + 2% papaya extract. That papaya leaf extract may be used in broiler diet as commercial antibiotics replacement [4].

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Chickens receiving the phytobiotic in the amount of 0.25 ml drinking water had better growth performance, which was linked to the beneficial effect of the preparation on the microbiome of the small intestine, metabolism was increased; and a decreased level of total cholesterol, as well as triacylglycerols [5]. Dey et al. [6] found lower serum cholesterol in neem leaves fed laying pullet which also justify our findings.

Clerodendrum is a medicinal plant for various diseases. Several species of the genus Clerodendrum are a source of important compounds for treatment that have been carried out for years and have been intensively investigated for their chemical content. But not all species in this genus have been studied. North Sulawesi is known for its diversity of plant species, including the leilem plant (*Clerodendrum minahassae* Teijsm & Binn), which belongs to the genus Clerodendrum. Leilem is an endemic plant in North Sulawesi which is consumed by the Minahasa people as a vegetable. In Indonesia there are 16 plants from genus Clerodendrum: *C. calamitosum*, *C. colebrookianum*, *C. deflexum*, *C. disparifolium*, *C. haematolasiun*, *C. indicum*, *C. infortunatum*, *C. intermedium*, *C. japonicum*, *C. laevifolium*, *C. minahassae*, *C. myrmecophila*, *C. nutans*, *C. paniculatum*, *C. umbratile*, dan *C. villosum* [7].

Research to explore the utilization, identify the content of compounds possessed and the biological activity of leilem plants have been carried out by several researchers, which proved that this plant mainly contains phenol and flavonoid compounds with antioxidant and antibacterial activity against *Streptococcus mutans* and *Escherichia coli*. The ethanol extract of leilem leaves contains alkaloids, steroids, flavonoids and tannins [8]. Kairupan et al. [9] reported that obtained from their study support the previous finding that the extract of leilem leaves has beneficial antihyperlipidemic and antiatherosclerotic effects and can be used as an alternative to synthetic antioxidants. The minimum inhibitory concentration (MIC) of leilem leaf extract (*Clerodendrum minahassae* L.) against *Streptococcus mutans* is in the concentration of 12 % [10].

Rumagit et al [11] obtained that ethanol extract of leilem stem with concentration of 5%, 10% and 15% can provide an analgesic effect in rats. Leilem leaf extract has an antibacterial effect against *Streptococcus mutans* bacteria [12]. Ethanol extract of leilem leaves 150 mg/kg BW and 300 mg / kg BW could reduce the levels of ureum, creatinine and uric acid in rats with ethylene glycol treatment. Ethanol extract of leilem leaves 150 mg/kg BW was better in reducing levels of urea, creatinine and uric acid in rats compared with a dose of 300 mg/kg BW [13]. Matel leaf juice (*Clerodendrum minahassae* L.) and spiny amaranth juice (*Amaranthus spinosus* L.) could give a great effect on increasing hemoglobin level and RBC of rat (*Mus musculus*) [14].

So far, no literature has been found about the benefits of leilem leaves as an alternative feed for poultry, also for other livestock. The available literature does not provide a consistent picture. Therefore, the research was conducted to investigate the effects of leilem leaves juice in drinking water on growth performance, serum biochemical, and physical and sensory quality of broiler chickens.

MATERIAL AND METHODS

The preparation of leilem leaves juice (LLJ) based on Alom et al [15]. After washing, the fresh leaves were cut into small pieces by scissors and then added water at 1:10 ratio. Juice then was prepared by crushing the leaves with a blender. After that, stored in a refrigerator at 4°C to keep the bioactive ingredients from the juice.

A total of 200 D.O.C of broilers were used in this research. The birds were reared under a standard broiler management program until 7 d of age. Then, the birds were randomly distributed into 20 pens. The experiment was conducted as 4 x 5 completely randomized arrangement each of the 4 treatment groups and 5 replications, 10 birds per pen. The experiment lasted 28 days from 8 to 35 d of age. Leilem leaves juice then given to broilers through drinking water in several level: R0 = drinking water without LLJ; R1 = 10 ml LLJ/L of drinking water, R2 = 20 ml LLJ/L of drinking water, and R3 = 30 ml LLJ/L of drinking water.

The treatment started by given to 8 days aged chicken which contain 70% commercial diet, 27% corn, 3% coconut oil and given *ad libitum*. The proximate analysis of leilem leaves were dry matter 95.00%, crude protein 24.05%, crude fiber 14.69%, crude fat 1.65%, ash 13.47%, Ca 2.499%, P 0.183%, gross energy 3994.32 kcal/kg. Consumption of drinking water and feed were calculated every day. On the 35th day the chickens were weighed, then slaughtered, and the carcass weight was calculated after removing the feathers, head, legs and intestines. Gizzard, liver, heart and abdominal fat were weighed.

The variables were body weight gain, feed intake and conversion ratio, carcass, edible organs and abdominal fat percentage, growth efficiency (GE) and specific growth rate (SGR %). Data collected were subjected to one-way analysis of variance, while the differences between the treatment means were compared using Duncan Multi Range Test. Statistical significance was assumed at a value of P<0.05. All statistical analysis was performed with IBM

SPSS Statistics 24 software. Growth performance was determined using live weight and growth rate parameters such as:

$$WG = \frac{LW1 - LW11}{t_1 - t_{11}}$$

where: WG = weight gain; LW1= weight at particular week = t₁; LW11 =weight for the previous period t₁₁

$$SGR (\%) = \frac{\ln(LW1) - \ln(LW11)}{t_1 - t_{11}} \times 100\%$$

Where SGR is specific growth rate; ln (LW1) is natural log of live weight at week t₁; ln (LW11) is natural log of live weight at week t₁₁

$$GE = \frac{WG}{LW}$$

Where GE is growth efficiency for time period; WG is weight gain for specific time period; LW is initial weight as a covariate [16]. Sensory characteristics of samples were investigated to evaluate color, flavor, texture, and taste of chicken meat appearance. A panel of seven judges trained in chicken evaluation performed sensory analysis. Panelists were asked to evaluate the color, flavor, texture, and taste of the chicken breast meat samples. The samples were randomly presented to the 35 untrained panelist. Acceptability as a composite of color, flavor, texture, and taste was estimated using a 7-point hedonic scale.

RESULT AND DISCUSSION

Results showed that birds drank leilem leaves juice had similar feed intake, BWG, FCR, abdominal fat percentage, carcass percentage, giblet, and sensory evaluation compared to the control treatment but had significantly different on SGR, GE, serum biochemical, proximate component of meat, WHC and tenderness of meat (Table 1, 2, 3, 4, 5).

TABLE 1. Effect of Leilem Leaves in Drinking Water on the Growth Performance

Variables	28 Treatments				SEM	pValue
	0 ml/L DW	10 ml/L DW	20 ml/L DW	30 ml/L DW		
Total FI (g·head ⁻¹)	2271.44	2189.24	2166.16	2186.32	27.56	0.578
FI (g head ⁻¹ ·day ⁻¹)	81.12	78.19	77.36	78.08	0.93	0.578
Total Water Intake (ml·head ⁻¹)	4980.88	4762.56	4800.52	4814.40	115.41	0.927
Water Intake (ml·head ⁻¹ ·day ⁻¹)	177.89	170.08	171.45	171.94	4.12	0.927
Initial weight, g	143.76 ^{ab}	141.08 ^a	146.60 ^b	145.12 ^{ab}	0.81	0.087
Final weight, g	1341.40	1298.80	1247.32	1285.04	16.84	0.274
BWG, g	1197.64	1158.68	1100.72	1139.92	16.69	0.230
SGR, %	56.23 ^c	55.10 ^{bc}	53.47 ^a	54.10 ^{ab}	0.36	0.014
GE	2.08 ^b	2.05 ^b	1.87 ^a	1.96 ^{ab}	0.29	0.028
FCR	1.60	1.69	1.74	1.69	0.02	0.628

Initial weight at day 8th; TFI = total feed intake; FI = feed intake; BWG = body weight gain; SGR =specific growth rate; GE = growth efficiency; DW = drinking water

Supplementation of leilem leaves juice (LLJ) in drinking water influenced similar growth performances of broilers, but SGR % and GE were significantly decreased in LLJ 20 ml/L. Inclusion of LLJ did not affect the feed conversion ratio (FCR) however, all FCR is similar (Table 1). Our result was in agreement with the findings of Alabi et al. [17] who reported that aqueous *Moringa oleifera* leaf extract can be included up to 90 ml/liter in the drinking water of broiler chicken for reduced feed intake and improved feed conversion efficiency thus, it can be used to replace synthetic antibiotics as growth promoter.

Plant extracts contain active molecules called pronutrients that can replace antibiotic growth promoters (AGP) to improve gut integrity, optimize feed utilization and consequently, increase productive performance. It is used in

26 animal feed as a growth promoter. Most of the antimicrobial growth promoters in animal feed are banned because of their residual effects, so, plant extracts being an alternative. They have potential as antibacterial, antioxidant, antifungal, and growth promoter potential. This plant extract competes with synthetic drugs. Antioxidant therapy has been shown to be effective in preventing diseases caused by oxidative stress. Natural antioxidants from plants or their extracts have been widely used in livestock because they have lower side effects compared to synthetic antioxidants. With or without beluntas (*Pluchea indica*) leaf extraction water added with sugar showed that addition higher than 10% was significantly reduced body weight gain, final body weight, and increased FCR. That the addition of water extracted beluntas leaf more than 10% into drinking water cannot give greater benefit on performances as an anti-stress of broiler. Sugar addition cannot help the disadvantage due to the bitter taste of higher level of water extracted beluntas leaf addition [18]. The treatments 5 ml papaya leaf juice/liter of water, 10 ml papaya leaf juice/liter of water, 15 ml papaya leaf juice/liter of water showed that the addition of papaya leaf juice up to level 1,5% did not have a significant effect on the performance of broiler chickens [19]. Giving cashew leaf extract in drinking water up to 20% had no effect on the broiler performance, in terms of feed consumption, body weight gain and feed conversion [20].

On the other hand, several studies have shown that plant extracts have a significant effect on the broiler performance. Broilers given olive leaf extract up to 15 mL had a significant effect on feed consumption, total feed consumption, final weight, total weight gain, and FCR. The inclusion of 15 mL of olive leaf extract enhanced the performance of broiler chickens during the hot dry season [21]. Hasan et al. [22] reported that better growth performance could be achieved in broilers supplemented with tulsi leaf extract in drinking water. That *Luffa aegyptiaca* extracts could be orally administered up to 30 mL/litre to broiler chickens without any negative effect on the growth and health performance of the animal [23].

Inclusion leilem leaves juice till 30 ml/L drinking water had no significant difference in abdominal fat compared to control. However, highest abdominal fat content was obtained from the control group and the lowest abdominal fat content was 30 ml/L treatment. Higher level of leilem leaves juice gave reduction of abdominal fat (Table 2). In Camy et al [24] research, the aqueous herbal extract supplementation (10 ppm neem leaves extract or garlic leaves extract or plantain leaves extract) could be an alternative to antibiotic growth promoter to enhance growth performance, plasma lipid profiles as well as to reduce abdominal fat and meat fat of either extract.

TABLE 2. Effect of Leilem Leaves in Drinking Water on Carcass Characteristic

Variables	Treatments				SEM	pValue
	0 ml/L DW	10 ml/L DW	20 ml/L DW	30 ml/L DW		
Carcass weight, g	912.60 ^a	987.20 ^a	990.80 ^a	1119.00 ^b	21.43	0.001
Carcass, %	69.58	70.53	70.79	68.88	0.56	0.880
Breast, %	29.14 ^a	31.93 ^{ab}	32.42 ^b	30.95 ^{ab}	0.512	0.099
Thigh and Drumstick, %	33.05	33.15	32.03	32.17	0.433	0.752
Wing, %	10.74	10.74	10.11	10.80	0.135	0.231
Leg, %	4.83 ^b	4.22 ^a	4.29 ^{ab}	4.67 ^{ab}	0.10	0.066
Abdominal Fat, %	2.87	2.83	2.67	2.29	2.29	0.341
Liver, %	1.87	1.80	1.83	1.87	0.05	0.943
Gizzard, %	1.41	1.31	1.28	1.22	0.03	0.230
Heart, %	0.54	0.50	0.49	0.51	0.01	0.254
Spleen, %	0.11	0.11	0.13	0.13	0.01	0.689
Bile, %	0.14	0.13	0.13	0.12	0.01	0.673

DW = drinking water

46 Islam et al [25] reported that *Aloe vera* extract 5, 10, 15 and 20 ml/liter of drinking water showed higher live weight gain than untreated group, performed the best feed efficiency. The live weight gain and feed efficiency were significantly better in the broilers provided water containing 15 ml/L of leilem leaves juice. Water intake, feed intake and abdominal fat deposition of broilers given aloe extract in drinking water had no different each other.

In this research (Table 2), highest breast meat was found in 20 ml LLJ/L group over all the treated groups. Drumstick and thigh muscle and wing percentage were not comparatively in all group, except percentage of leg was highest than drumstick. Carcass percentage in 10 ml and 20 ml/L DW of the treated groups was higher except for 20 ml/L DW, which was lower to control.

37 On the contrary, Sigolo et al [26] reported that dietary supplementation with thyme extract at 300 mg/L drinking water level improve broiler chicken growth performance as feed intake, gain weight and feed efficiency. This

supplementation improves carcass characteristics and blood serum parameters such as total protein, albumin, urea, total cholesterol and HDL. Leilem leaves are not only the sources of bioactive components but also good sources of proteins (24,05%), which leading to better performance and yield 5^d carcass in broiler.

Compared to our findings several researcher reported: alcoholic extracts from chamomile inflorescence (*Matricaria chamomilla* L.), lemon balm (*Melissa officinalis* L.) or from St. John's wort (*Hypericum perforatum* L.) were added to water drinkers (2 mL⁻¹ water) decrease 38^h cholesterol level [27]. Adding the natural bioactive mixture composed of the juice of lemon, onion, and garlic 1.00, 1.00, and 0.125 mL/L clean water 50^h improved the general health, egg weight, and feed conversion with decreasing the blood cholesterol of laying hens [28].

TABLE 3. Effect of Leilem Leaves in Drinking Water on Serum Biochemical

Variables	Treatments				SEM	pValue
	0 ml/L DW	10 ml/L DW	20 ml/L DW	30 ml/L DW		
Triglyceride, mg·dL ⁻¹	39.00 ^a	77.00 ^b	38.00 ^a	111.00 ^c	6.94	0.000
Total Cholesterol, mg·dL ⁻¹	147.00 ^d	77.00 ^a	144.00 ^c	141.00 ^b	6.68	0.000
HDL-Cholesterol, mg·dL ⁻¹	18.00 ^d	97.00 ^a	104.00 ^c	101.00 ^b	0.95	0.000
LDL-Cholesterol, mg·dL ⁻¹	23.00 ^b	19.00 ^a	36.00 ^c	19.00 ^a	1.61	0.000
Glucose, mg·dL ⁻¹	211.00 ^c	203.00 ^b	195.00 ^a	220.00 ^d	2.15	0.000
SGOT, mg·dL ⁻¹	186.00 ^a	234.00 ^d	225.00 ^c	193.00 ^b	4.69	0.000

DW = drinking water

Proximate components of meat from different level of treatments showed any statistical variation (Table 4). Leilem leaves juice supplementation gave positive impact on protein, fat meat production, and meat cholesterol. Highest protein meat and lowest fat meat were found in level 10 mL/L DW treatment, but lowest meat cholesterol was found in level 20 mL/L DW treatment. Moreover, there was no variation in physical and sensory evaluation of meat among the LLJ treated groups.

TABLE 4. Effect of Leilem Leaves in Drinking Water on Proximate Component of Meat

Variables	Treatments				SEM	pValue
	0 ml/L DW	10 ml/L DW	20 ml/L DW	30 ml/L DW		
Crude Protein, %	66.88 ^a	83.74 ^c	76.65 ^b	82.83 ^d	1.55	0.000
Crude Fat, %	10.47 ^d	7.17 ^a	10.18 ^c	9.73 ^b	0.30	0.000
Meat Cholesterol, mg/100 g	115.72 ^d	109.43 ^b	104.02 ^a	113.37 ^c	1.02	0.000

DW = drinking water

Present experiment revealed that supplementation of leilem leaves juice improved breast meat and meat tenderness of broilers. There were no differences found in the color, flavour, texture and taste of the breast meat samples (Table 5), and the prefer values were between 4.42-4.88.

TABLE 5. Effect of Leilem Leaves in Drinking Water on Physical and Sensory Evaluation of Meat

Variables	Treatments				SEM	pValue
	0 ml/L DW	10 ml/L DW	20 ml/L DW	30 ml/L DW		
Color	4.61	4.48	4.42	4.48	0.07	0.83
Flavor	4.64	4.58	4.61	4.58	0.08	0.99
Texture	4.70	4.88	4.70	4.79	0.08	0.82
Taste	4.61	4.82	4.58	4.76	0.09	0.77
Water Content, %	75.78	75.44	74.15	75.06	0.27	.180
WHC, %	62.98 ^a	64.78 ^a	57.28 ^b	56.63 ^b	1.14	.010
Cooking loss, %	30.85	31.00	29.25	31.23	1.06	.924
Tenderness, g/cm ²	190.25 ^b	180.20 ^a	180.20 ^a	190.10 ^b	1.46	.000

DW = drinking water

The enhanced weight of breast meat might be due to the presence of different bioactive components in leilem leaves juice. Feed additives in poultry feed are for improving nutritive value of ingredients and enhancing broiler

performance by increasing growth rate and improving feed conversion ratio. Alternative antibiotic growth promoters are used to help growing animals to utilize their feed efficiently, get maximum benefit from it and allow them to become healthy. Phyto-genic growth promoters are active throughout the gastrointestinal tract, therefore, which would exhibit broad-spectrum antimicrobial potential, through improved nutrient utilization, and improved overall growth performance of broilers through addition of gastrointestinal histomorphology thereby enhancing host immunity [29].

Yang et al [30] reported that broiler drinking water with the inclusion of plant extract combination can be used to enhance the oxidative stability, shelf life and quality characteristics of broiler leg meat without compromising the growth performance. Supplementation of drinking water with mixed herb extract (2 ml/L) or outdoor access improved drip loss and carcass percentage without giblet, and had no effect on WHC and color in the breast muscle [31].

The WHC is meaningful as prior to determine the final weight of the meat. In this study, supplementation of broilers with plant extracts decreased the WHC and no significant different of cooking loss, suggesting better quality of meat. Cooking loss is very important to the meat industry as the main point of the profit is water retention. Positive influences of plants extract on meat quality of chickens have been observed by many scientists using different supplements and similar to our findings. WHC having direct bearing on the color and tenderness of meat, is among the most important functional properties of raw meat. Increase in the water content of muscles, enhancing tenderness, juiciness, firmness, and appearance, improve the quality and economical value of meat [32].

The characteristic of flavor can be beneficial or non-beneficial depending on consumer preference. Proximate composition and nutritive value of meat will depend on the diet, age, genetics, sexual maturity, management, and environmental conditions of the source animal. Wuri et al [33] reported that color characteristics of chicken meat detected by the descriptive panelist were significantly affected by the both factors concentration of soursop leaf and soaking time, while aroma characteristics were insignificantly affected by the treatments soursop leaf in water. Supplementation of 0.2% *Cymbopogon citratus* leaf meal (CcLM) can repair liver damage and/or restore cell permeability, consequently reducing liver toxicity and preventing enzyme leakage into the blood circulation. CcLM in the ration has an effect in increasing the hepatoprotective, hypoglycemic and anti-necrotic effects in broilers without affecting the organoleptic properties of broiler meat [34].

CONCLUSION

Results showed that birds drank leilem leaves juice had similar growth performance among treatment and control group, however had significantly different on SGR, GE, serum biochemical, proximate component of meat, WHC and tenderness of meat, without adversely affecting the organoleptic properties of the broiler meat. The result showed non significance compared to control, so, honestly, we do not have to use this supplement, but you can imply that using this supplement improved some variable that may benefit for growth performance, carcass characteristics, serum biochemical, and physical evaluation of meat.

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REFERENCES

1. Y. Mehdi *et al.*, "Use of antibiotics in broiler production: Global impacts and alternatives," *Anim. Nutr.*, vol. 4, no. 2, pp. 170–178, 2018.
2. S. Diaz-Sanchez, D. D'Souza, D. Biswas, and I. Hanning, "Botanical alternatives to antibiotics for use in organic poultry production," *Poult. Sci.*, vol. 94, no. 6, pp. 1419–1430, 2015.
3. T. A. Rafiu, M. D. Shittu, B. A. Adebomi, I. A. Hameed, T. S. Ajao, and A. Adewale, "Utilization Potential of Catmint and Better Leaf Aqueous-Extracts on Performance and Physiological Characteristics of Broiler Birds," vol. 6, no. 6, pp. 230–238, 2019.

4. Basir M.K. *et al.*, "Effect of Carica papaya leaves extract on blood hematology, serum biochemistry and immune response of broilers," *Adv. Life Sci.*, vol. 7, no. 4, pp. 147–157, 2020.
5. M. Krauze, M. Cendrowska-Pinkosz, P. Matusevičius, A. Stepińska, P. Jurczak, and K. Ognik, "The effect of administration of a phytobiotic containing cinnamon oil and citric acid on the metabolism, immunity, and growth performance of broiler chickens," *Animals*, vol. 11, no. 2, pp. 1–19, 2021.
6. B. Dey, S. Chowdhury, S. Bulbul, and B. Chowdhury, "Efficacy of neem leaf meal as a hypocholesterolemic dietary additive in laying pullets," *Bangladesh J. Anim. Sci.*, vol. 40, no. 1–2, pp. 13–17, 2012.
7. C. Leeratiwong, P. Chantaranonthai, and A. J. Paton, "A Synopsis of the Genus Clerodendrum L. (Lamiaceae) in Thailand," *Trop. Nat. Hist.*, vol. 11, no. October, pp. 177–211, 2011.
8. Y. P. Utami, A. H. Umar, R. Syahrini, and I. Kadullah, "Standardisasi Simplisia dan Ekstrak Etanol Daun Leilem (*Clerodendrum minahassae* Teijsm. & Binn.)," *J. Pharm. Med. Sci.*, vol. 2, no. 1, pp. 32–39, 2017.
9. C. F. Kairupan, F. R. Mantiri, and R. R. H. Rumende, "Phytochemical Screening and Antioxidant Activity of Ethanol Extract of Leilem (*Clerodendrum minahassae* Teijsm. & Binn) as an Antihyperlipidemic and Antiatherosclerotic Agent," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 217, no. 1, 2019.
10. H. R. R. Situmorang, O. Waworuntu, and C. Mintjelungan, "Uji Konsentrasi Hambat Minimum (Khm) Ekstrak Daun Leilem (*Clerodendrum Minahassae* L.) Terhadap Bakteri *Streptococcus Mutans*," *Pharmakon*, vol. 5, no. 4, pp. 69–76, 2016.
11. B. I. Rumagit, A. C. Wullur, and L. C. Tandawuya, "ANALGESIC EFFECTS OF ETHANOL EXTRACTS STEM LEILEM *Clerodendrum minahassae* Teijsm , and Binn , AtTHE WHITE RAT (*Rattusnorvegicus*)," vol. 1, no. 1, pp. 447–452, 2017.
12. S. Bontjura, O. A. Waworuntu, and K. V. Siagian, "Uji Efek Antibakteri Ekstrak Daun Leilem (*Clerodendrum Minahassae* L.) Terhadap Bakteri *Streptococcus Mutans*," *Pharmakon*, vol. 4, no. 4, 2015.
13. R. Rumondor, M. R. Komalig, and K. Kamaluddin, "Efek Pemberian Ekstrak Etanol Daun Leilem (*Clerodendrum minahasae*) terhadap Kadar Kreatinin, Asam Urat dan Ureum pada Tikus Putih (*Rattus novergicus*)," *Bio-Edu J. Pendidik. Biol.*, vol. 4, no. 3, pp. 108–117, 2019.
14. R. Malawat, F. Leiwakabessy, and T. Watuguly, "Efek Jus Daun Matel (*Clerodendrum Minahassae* L.) Dan Daun Bayam Duri (*Amaranthus Spinusus* L.) Dalam Meningkatkan Kadar Hemoglobin Dan Jumlah Eritrosit Pada Mencit (*Mus Musculus*)," *Sci. Map J.*, vol. 1, no. 2, pp. 105–114, 2019.
15. F. Alom, M. Mostofa, M. N. Alam, M. G. Sorwar, J. Uddin, and M. M. Rahman, "EFFECT OF INDIGENOUS MEDICINAL PLANT TULSI (*Ocimum sanctum*) LEAVES EXTRACT AS A GROWTH PROMOTER IN BROILER," vol. 2, no. 1, pp. 97–102, 2015.
16. A. M. Orheruata, S. O. Nwokoro, G. O. Alufohai, and B. I. Omagbon, "Growth indices and economy of feed intake of broiler chickens fed changing commercial feed brands at starter and finisher phases," *Int. J. Poult. Sci.*, vol. 5, no. 12, pp. 1123–1127, 2006.
17. A. Oj, M. Ad, and O. Bk, "Effect of Aqueous Moringa Oleifera (Lam) Leaf Extracts on Growth Performance and Carcass," *Brazilian J. Poult. Sci.*, vol. 19, no. 2, pp. 273–280, 2017.
18. A. Sudarman, Sumiati, and R. Kaniadewi, "Performance of broiler chickens offered drinking water contained water extracted beluntas (*Pluchea indica* L.) leaf and sugar cane," *Media Peternak.*, vol. 35, no. 2, pp. 117–122, 2012.
19. A. Triwibowo, N. E. Wati, and M. Suhadi, "Pengaruh Penambahan Air Perasan Daun Pepaya (*Carrica Papaya* L) Dalam Air Minum Terhadap Performans Ayam Broiler The Effect of the Addition of Papaya Leaf Juice (*Carica Papaya* L) in Drinking Water on the Performance of Broiler Chickens Ternak Ruminansi," vol. 5, no. 2018, pp. 32–40, 2021.
20. S. Khothijah, E. Erwan, and E. Irawati, "Performa Ayam Broiler yang Diberi Ekstrak Daun Jambu Mete (*Anacardium occidentale* Linn) dalam Air Minum," *J. Ilmu Nutr. dan Teknol. Pakan*, vol. 19, no. 1, pp. 19–23, 2021.
21. O. E. Oke *et al.*, "Physiological responses and performance of broiler chickens offered olive leaf extract under a hot humid tropical climate," *J. Appl. Poult. Res.*, vol. 26, no. 3, pp. 376–382, 2017.
22. M. N. Hasan, M. Mostofa, M. G. Sorwar, M. T. Hasan, K. Das, and D. M. N. Hossain, "Effects of Tulsi Leaf Extract on Body Weight Gain in Broiler Production," *Bangladesh J. Vet. Med.*, vol. 14, no. 1, pp. 21–25, 2016.
23. J. O. Alagbe, "Effect of Feeding Different Levels of *Luffa aegyptiaca* Extracts on the Growth Performance of Broiler Chicken Fed Corn-Soya Meal Diet," *Int. J. Adv. Biol. Biomed. Res.*, vol. 7, no. 4, pp. 299–309, 2019.
24. M. Camy, M. Redoy, A. Shuvo, B. Ray, M. Rahman, and M. Al-Mamun, "Effect of aqueous herbal extracts on growth, plasma metabolites and meat characteristics of broiler," *Bangladesh J. Anim. Sci.*, vol. 48, no. 2, pp. 108–115, 2020.

25. M. M. Islam, M. M. Rahman, S. Sultana, M. Z. Hassan, A. G. Miah, and M. A. Hamid, "Effects of aloe vera extract in drinking water on broiler performance," *Asian J. Med. Biol. Res.*, vol. 3, no. 1, pp. 120–126, 2017.
26. S. Sigolo *et al.*, "Effects of different plant extracts at various dietary levels on growth performance, carcass traits, blood serum parameters, immune response and ileal microflora of Ross broiler chickens," *Ital. J. Anim. Sci.*, vol. 20, no. 1, pp. 359–371, 2021.
27. I. Skomorucha and E. Sosnowka-Czajka, "Effect of water supplementation with herbal extracts on broiler chicken welfare," *Ann. Anim. Sci.*, vol. 13, no. 4, pp. 849–857, 2013.
28. H. A. A. Omer, G. M. H. El-Mallah, S. S. Abdel-Magid, N. I. Bassuony, S. M. Ahmed, and A. K. A. El-Ghamry, "Impact of adding natural bioactive mixture composed of lemon, onion, and garlic juice at different levels on productive performance, egg quality, and some blood parameters of commercial laying hens," *Bull. Natl. Res. Cent.*, vol. 43, no. 1, 2019.
29. S. Ganguly and A. Prasad, "Role of plant extracts and cow urine distillate as immunomodulators: A RE," *J. Med. Plants Res.*, vol. 5, no. 4, pp. 649–651, 2011.
30. E. J. Yang, Y. S. Seo, M. A. Dilawar, H. S. Mun, H. S. Park, and C. J. Yang, "Physico-chemical attributes, sensory evaluation and oxidative stability of leg meat from broilers supplemented with plant extracts," *J. Anim. Sci. Technol.*, vol. 62, no. 5, pp. 730–740, 2020.
31. I. Skomorucha, E. Sosnowka-Czajka, and R. Muchacka, "Effects of Supplementing Drinking Water with Mixed Herb Extract or Outdoor Access on Meat Quality Characteristics in Broiler Chickens," *Ann. Anim. Sci.*, vol. 20, no. 2, pp. 647–660, 2020.
32. G. Offer *et al.*, "The structural basis of the water-holding, appearance and toughness of meat and meat products," *Food Microstruct.*, vol. 8, no. 1, pp. 151–170, 1989.
33. D. A. Wuri, J. F. Bale-Therik, and G. Bouk, "Effect of Concentration of Soursop (*Annona muricata*) Leaf and Soaking Time on Protein and Fat Contents and Sensory Quality of Raw Chicken Meat," *J. Appl. Chem. Sci.*, vol. 5, no. 1, pp. 388–393, 2018.
34. C. O. Gibson *et al.*, "305-309 Serum Biochemistry and Sensory Evaluation of Broiler Chicken Fed *Cymbopogon citratus* Leaf Meal," *World J. Agric. Res.*, vol. 5, no. 6, pp. 305–309, 2017.

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Publication

42 Gamal M. Suliman, Abdullah N. Alowaimer, Saud I. Al-Mufarrej, Elsayed O.S. Hussein et al. "The effects of clove seeds (Syzygium aromaticum) dietary administration on carcass characteristics, meat quality and

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