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Effects of dietary *Moringa oleifera* leaf powder supplementation on growth performance and carcass traits of broiler chickens

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Abstract Dietary supplementation of moringa leaf powder (MLP) was evaluated for its effects on the growth performance and carcass traits of broiler chickens. A total of 120 broilers were assigned to three dietary treatments consisting of a control diet, a diet supplemented with 1% MLP, and a diet supplemented with 2% MLP. Feed intake, body weight gain (BWG), feed conversion ratio (FCR), and carcass characteristics were measured during the 42-day feeding trial. The results showed that the supplementation with MLP at both inclusion levels did not significantly affect feed intake, body weight gain (BWG), or FCR compared with the control group ($p > 0.05$). Carcass traits and internal organ weights were also not significantly different among treatments. The result indicated that a diet supplemented with 2% MLP was not negatively impacted on growth performance or carcass traits.

Keywords: Moringa leaf powder, Broiler, Carcass quality

Introduction

The broiler chicken industry is a rapidly growing sector globally, driven by low production costs and high production efficiency (Mottet and Tempio, 2017). In poultry production, various chemical substances—such as growth promoters and antibiotics—are frequently employed (Landers *et al*., 2012). This practice carries the risk of antimicrobial resistance (AMR) and the presence of chemical residues. Consequently, many producers are now increasingly focusing on the use of natural additives.

Moringa (*Moringa oleifera*) is a medicinal plant currently being studied for its potential as a natural dietary supplement for animals. It is a tropical tree, and its leaves contain essential amino acids, a wide range of vitamins—such as vitamin A, B-complex vitamins, vitamin C, and vitamin E—as well as vital minerals including calcium, potassium, and iron. The leaves have a high crude

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protein content, reaching 25–30%. Furthermore, they contain bioactive compounds such as flavonoids, saponins, tannins, and phenolic compounds (Anwar *et al*., 2007; Leone *et al*., 2015), which possess antioxidant properties and can help stimulate the immune system in animals.

Olugbemi *et al*. (2010) studied the supplementation of moringa leaves in broiler diets and found that broilers receiving this supplementation exhibited superior performance compared to those that did not. Furthermore, Melesse *et al*. (2011) observed that moringa leaves positively influence the immune system of broilers and enhance carcass quality characteristics. Overall, it can be concluded that incorporating moringa leaves into poultry diets is beneficial to the poultry industry and helps reduce the reliance on other feed additives.

The use of antibiotics in poultry production has raised concerns regarding antimicrobial resistance and drug residues in meat products. The World Health Organization (WHO, 2020) identified antimicrobial resistance as a major global public health concern. In addition, increasing consumer demand for antibiotic-free poultry products and stricter food safety regulations have encouraged the search for natural feed additives (FAO, 2019). Under these conditions, moringa leaf powder has received attention as a potential alternative feed supplement in broiler production.

Previous studies have shown that moringa leaves contain nutrients and bio-active compounds that may support animal growth and health. At the same time, reducing antibiotic use in livestock production has become an important issue because of concerns regarding antimicrobial resistance and food safety. In addition to its nutritional value, moringa is widely available in many tropical regions and may serve as a low-cost feed resource (Nouman *et al.*, 2014). The use of moringa leaf products in animal diets may also help support more sustainable feed management practices.

The use of natural feed additives has become increasingly important due to concerns about antibiotic use in livestock production and consumer demand for safer poultry products. Although moringa leaves contain nutrients and bioactive compounds that may benefit broiler production, results from previous studies remain inconsistent. Therefore, this study evaluated the effects of dietary *Moringa oleifera* leaf powder supplementation on the growth performance and carcass traits of broiler chickens.

Materials and methods

Preparing of leaf powder

Fresh Moringa leaves for this experiment were collected locally in Chanthaburi, chopped into small pieces, and oven-dried at 60°C until a constant

weight was achieved, following Ali *et al*. (2017), then ground into a powder and stored in an airtight container.

Laboratory animals and housing

One hundred and twenty-one-day-old broiler chicks were obtained from a local hatchery. During the first week, the chicks were reared together to allow for environmental acclimatization and received vaccinations in accordance with standard poultry health protocols. Initial weights were recorded, and the chicks were randomly assigned to the experimental groups.

The broiler chick pens used in the experiment measured 4 × 5 meters; the floors were covered with rice husks, and each pen was equipped with water and feed troughs. Feed and water were provided ad libitum throughout the experiment. Temperature was maintained using brooders during the early stage of rearing and gradually adjusted according to bird age.

Feeding and management practices

During the first seven days, chicks were brooded together under controlled temperature conditions. The brooding area was gradually expanded according to chick growth. After allocation to treatments, birds continued to receive routine vaccinations, including Newcastle disease at day 7 and infectious bronchitis at day 14. Birds were fed ad libitum throughout the experimental period. The poultry house was cleaned and disinfected before the trial, and standard biosecurity practices were followed throughout the trial.

The experiment was conducted at the Department of Agricultural Technology, Faculty of Agro-Industrial Technology, Rajamangala University of Technology Tawan-ok, Chanthaburi Campus, Thailand. The dietary trial lasts for a total of six weeks (days 1–42).

Experimental design

The study employed a Completely Randomized Design (CRD). The experimental chickens were divided into three treatment groups, with 40 birds per group; each treatment group was further subdivided into four replicates, with 10 birds per replicate. The first treatment group served as a control, receiving a commercial feed without any additives, while the second treatment group received a diet supplemented with 2% moringa leaf powder.

The experiment was divided into an initial phase (0–21 days) and a growth-to-finishing phase (21–42 days). All dietary formulations were prepared to

provide a complete nutrient profile in accordance with the standard requirements for broiler chickens established by the NRC (1994).

Data collection

The study divided the experiment into an initial phase (0–21 days) and a growth-to-finishing phase (21–42 days). All dietary formulations were prepared to provide a complete nutrient profile in accordance with the NRC (1994) standard requirements for broiler chickens.

Carcass characteristics: Upon completion of the experiment, chickens were randomly selected for the study of carcass characteristics; they were fasted for 12 hours before slaughter. Birds were weighed prior to slaughter, and carcass weights after defeathering, evisceration, and dressing were recorded. Internal organs including liver, heart, gizzard, spleen, and abdominal fat were weighed individually. Dressing percentage and relative proportions of carcass parts (breast, thighs, drumsticks, wings, head, and neck) were then calculated.

Statistical analysis

Data were analyzed using analysis of variance (ANOVA) under a completely randomized design. Treatment means were compared using the general linear model (GLM) procedure of SAS (1985). Duncan's new multiple range test was applied when significant differences were detected at $p < 0.05$.

Results

Feed intake

The average daily feed intake (g/bird/day) of broiler chickens fed different dietary treatments is presented in Table 1. During the starter phase (1-21 days), feed intake ranged from 136.68 ± 1.45 to 1097.23 ± 93.07 g/day across treatments. Feed intake continued to increase during the grower-finisher phase (21-42 days), ranging from 1793.95 ± 64.97 to 3617.35 ± 55.95 g/day. No significant differences ($p > 0.05$) in feed intake were observed among the treatment groups throughout the experimental period. Dietary supplementation with 1% or 2% moringa leaf powder did not affect feed intake compared with the control group.

Body weight gain

The average body weight gain (BWG) of broiler chickens fed different dietary treatments is presented in Table 1. During the starter phase (1-21 days), BWG values were similar among treatment groups. Body weight gain continued to increase with age during grower-finisher phase (21-42 days). Birds supplemented with 1% or 2% moringa leaf powder showed BWG values comparable to those of the control group throughout the experiment. Statistical analysis showed no significant differences ($p > 0.05$) among treatments at any stage of the trial.

Table 1. Mean and standard deviation of feed intake, body weight gain and feed conversion ratio of broiler chickens fed diets with or without moringa leaf powder supplementation

	Control (T1)	**1% moringa leaf (T2)**	**2% moringa leaf (T3)**	**p-value**
Feed intake (g/day)				
1 – 7 days	138.93 ± 4.82	140.63 ± 5.43	136.68 ± 1.45	0.457
7 – 14 days	453.28 ± 15.11	450.33 ±13.52	455.43 ±13.19	0.876
14 – 21 days	1097.23 ± 93.07	1075.23 ± 117.11	1095.95 ± 106.25	0.947
21 – 28 days	1793.95 ± 64.97	1807.13 ± 14.36	1839.15 ± 62.09	0.486
28 – 35 days	2840.38 ± 63.04	2802.43 ± 64.59	2899.55 ± 76.86	0.185
35 – 42 days	3607.40 ± 55.81	3531.93 ± 159.25	3617.35 ± 55.95	0.467
BWG (g/bird)				
1 – 7 days	120.43 ± 1.47	119.83 ± 2.08	121.93 ± 1.94	0.302
7 – 14 days	358.65 ± 5.61	359.53 ± 8.23	356.50 ± 3.63	0.778
14 – 21 days	757.45 ± 8.47	761.53 ± 5.85	756.70 ± 9.08	0.664
21 – 28 days	1268.10 ± 30.95	1273.03 ± 28.87	1263.28 ± 32.67	0.906
28 – 35 days	1705.25 ± 19.29	1686.15 ± 22.19	1691.13 ± 33.08	0.569
35 – 42 days	2308.63 ± 50.73	2291.80 ± 46.38	2321.18 ± 43.86	0.687
FCR				
1 – 7 days	1.15 ± 0.05	1.17 ± 0.04	1.12 ± 0.01	0.194
7 – 14 days	1.26 ± 0.05	1.25 ± 0.02	1.28 ± 0.04	0.698
14 – 21 days	1.45 ± 0.13	1.41 ± 0.16	1.45 ± 0.13	0.915
21 – 28 days	1.41 ± 0.03	1.42 ± 0.04	1.46 ± 0.06	0.399
28 – 35 days	1.67 ± 0.03	1.66 ± 0.06	1.72 ± 0.06	0.314
35 – 42 days	1.56 ± 0.04	1.54 ± 0.07	1.56 ± 0.04	0.832

Feed conversion ratio

The feed conversion ratio (FCR) of broiler chickens fed different dietary treatments is shown in Table 1. FCR values increased gradually with age in all treatment groups. However, dietary supplementation with moringa leaf powder at 1% or 2% did not significantly affect FCR compared with the control diet ($p > 0.05$).

Table 2. Carcass traits mean values of broiler chickens fed diets with or without moringa leaf powder supplementation

Carcass traits	Control (T1)	1% moringa leaf (T2)	2% moringa leaf (T3)	p-value
Live weight (kg)	2.11 ± 0.23	2.01 ± 0.25	2.04 ± 0.27	0.712
Post-slaughter (kg)	2.01 ± 0.23	1.90 ± 0.32	1.96 ± 0.23	0.693
Defeathered (kg)	1.96 ± 0.19	1.83 ± 0.21	1.93 ± 0.24	0.431
Eviscerated (kg)	1.73 ± 0.18	1.70 ± 0.21	1.70 ± 0.21	0.958
Liver (g)	41.75 ± 6.88	40.25 ± 8.78	44.38 ± 14.34	0.732
Heart (g)	9.00 ± 2.27	9.00 ± 2.07	9.63 ± 1.19	0.752
Gizzard (g)	31.38 ± 6.37	32.50 ± 7.84	33.63 ± 5.53	0.797
Abdominal fat (g)	15.88 ± 11.05	18.13 ± 5.22	16.63 ± 6.97	0.854
Head and neck (g)	138.25 ± 22.28	133.63 ± 13.20	139.13 ± 24.19	0.847
Shank and feet (g)	77.25 ± 12.34	75.63 ± 15.64	73.88 ± 13.78	0.891
Drumstick (g)	204.13 ± 24.36	201.13 ± 25.89	203.50 ± 30.80	0.973
Wings (g)	159.50 ± 12.69	155.63 ± 17.94	153.25 ± 13.63	0.704
Pectoralis major (g)	380.63 ± 70.65	374.38 ± 54.22	374.50 ± 87.47	0.981
Pectoralis minor (g)	76.75 ± 9.15	77.63 ± 13.39	78.13 ± 13.40	0.974
Thigh (g)	234.50 ± 37.36	210.00 ± 36.21	225.88 ± 47.59	0.487
Carcass frame (g)	372.88 ± 42.39	373.63 ± 49.53	359.50 ± 43.84	0.784

Carcass traits

The carcass traits of male and female broiler chickens fed different dietary treatments are presented in Table 2. Live body weight, post-slaughter weight, defeathered weight, and eviscerated weight were not significantly affected by dietary treatment ($p > 0.05$).

Likewise, no treatment effects were observed for internal organs including the liver, heart, gizzard, and abdominal fat. The weights of carcass

parts, such as the head and neck, shank and feet, drumstick, wings, breast, thigh, and carcass frame were also similar among treatment groups.

Discussion

In the present study, supplementation with 1% and 2% moringa leaf powder did not significantly affect feed intake, body weight gain (BWG), feed conversion ratio (FCR), or carcass traits of broiler chickens. Similar findings were reported by Tesfaye *et al.* (2021) and Aderinola *et al.* (2013), who observed no significant differences in growth performance or carcass yield at low to moderate levels of moringa supplementation.

However, some studies have reported different results. Zanu *et al.* (2012) and Olugbemi *et al.* (2010) observed improvements in growth rate, feed intake, and FCR in broilers fed diets containing higher levels of moringa. Ayssiwede *et al.* (2011) also reported improved carcass yield and organ development. A report by Akinmoladun *et al*. (2024) indicates that the carcass quality characteristics and performance of broiler chickens supplemented with Moringa leaves are superior to those of broilers that did not receive such supplementation.

Broiler growth performance improves when Moringa leaf powder is supplemented at levels of 3–5%; conversely, performance declines when inclusion levels exceed 5%, potentially due to the presence of anti-nutritional factors in the Moringa leaves (Zhang *et al.*, 2019). Furthermore, studies by Kakengi *et al*. (2007) and Melesse *et al*. (2013) have shown that the content of these anti-nutritional factors in Moringa leaf products can be reduced through various processing methods, such as fermentation or aqueous extraction.

No significant differences were observed in the carcass quality characteristics of the experimental chickens, a finding consistent with reports by Tesfaye *et al*. (2021) and Melesse *et al*. (2011), who noted that dietary supplementation with moringa leaf powder—at levels that are not sufficiently high—does not affect carcass quality. However, the use of processed moringa leaves can have a greater impact on carcass quality performance.

In this study, the inclusion of moringa leaves at a low level (1–2%) did not have a significant effect on feed intake, body weight gain, feed conversion ratio (FCR), or carcass quality. Therefore, future research could explore the processing of moringa-based products, as well as the use of higher inclusion levels.

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Conflicts of interest

The authors declare no conflict of interest.

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