THE EFFECTS OF DIFFERENT MATCHA GREEN TEA TYPES AND THE MEAN OF SUPPLEMENTATION ON COLORED FEATHER BROILERS PERFORMANCE

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ABSTRACT

In order to evaluate the effect of green tea types (matcha or coarse powder green tea by product) and the mean of green tea inclusion on broiler performance, 420 King 303 broilers were randomly assigned into 4 groups consisted of 105 each. To test for the efficiency of green tea type and mean of introduction on broiler performance, meat quality and productivity. In treatment 0.25%, matcha green tea was added; in treatment 2, 0.25% of match green tea base on daily feed intake and offered via drinking water. Amount of drinking water containing matcha green tea was offered in double as feed intake, extra water if demanded was offered as regular drinking water. In treatment 3, 0.25% browsed green tea powder leftover after processing was added; housing and caring were similar among all treatments. Results showed that, despite of reduction in feed intake (by 14 – 18.9%), browse green tea by product had significant effect on live bodyweight (increased by 2.4 – 3.3%), daily growth, FCR (reduced by 6.5 – 10%) but not on the carcass characteristics. Matcha green tea supplement via drinking water had significant effect on production index (PI). It is recommended that matcha green tea can be supplemented to broiler chickens either via drinking water or addition into diet by 0.25%.

ẢNH HƯỞNG CỦA CÁC DẠNG CHÈ XANH VÀ PHƯƠNG PHÁP BỔ SUNG ĐẾN KHẢ NĂNG SẢN XUẤT CỦA GÀ THỊT LÔNG MÀU

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TỪ KHÓA

Dạng chè xanh
Vụn chè búp
Phương thức bổ sung
Gà thịt
Khả năng sản xuất

TÓM TẮT

Với mục đích đánh giá ảnh hưởng của các dạng chè xanh và phương pháp bổ sung chè xanh vào khẩu phần ăn cho gà thịt đến khả năng sản xuất, chúng tôi đã triển khai thí nghiệm trên 420 gà thịt Kìng 303 từ 1- 13 tuần tuổi. Số gà thí nghiệm được chia đều vào 4 lô thí nghiệm với 3 lần lặp lại. Lô đối chứng không bổ sung chè xanh; Lô thí nghiệm 1 bổ sung 0,25% bột matcha chè xanh vào thức ăn. Lô thí nghiệm 2 bổ sung 0,25% bột matcha chè xanh, được pha vào nước uống cho gà. Lô thí nghiệm 3 bổ sung 0,25% bột búp chè xanh trộn vào thức ăn. Gà thí nghiệm đảm bảo các yếu tố đồng đều về khối lượng bắt đầu thí nghiệm, môi trường thí nghiệm, thức ăn... chỉ khác nhau về sản phẩm chế biến chè xanh và phương pháp bổ sung chè xanh. Kết quả cho thấy việc bổ sung chè xanh dạng matcha hay bột chè đã có ảnh hưởng tích cực đến khả năng sản xuất của gà thịt thí nghiệm. Lô được bổ sung chè xanh đã làm tăng khối lượng cơ thể từ 2,4-3,3% so với lô đối chứng; giảm lượng thức ăn ăn vào từ 14-18,9%; giảm tiêu tốn thức ăn từ 6,5 – 10% so với lô không bổ sung chè xanh. Bổ sung chè xanh đã có ảnh hưởng tích cực đến tỷ lệ cơ ngực nhưng chưa có ảnh hưởng đến tỷ lệ cơ đùi cũng như tỷ lệ mỡ bụng của gà thí nghiệm. Có thể sử dụng bột chè xanh hoặc bột matcha bổ sung vào khẩu phần ăn cho gà với tỷ lệ 0,25% vào thức ăn hoặc nước uống cho gà thịt.

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1. Introduction

The demands for the antibiotics residual free animal products have been increased extensively as it is known that antibiotics as feed additive are harmful for human's health, creating antibiotic resistant bacteria. Therefore, antibiotics as animal feed additives was banned in animal feed industry worldwide. Vietnam has been imposing a ban on all kinds of antibiotics in livestock farming after 2020, thus, it's an urge for livestock industry in Vietnam to seek for the alternatives. There are a number of promising findings regarding this matter including the using of probiotics, medical herbs, inclusion of organic acids…; amongst these made affords, matcha green tea is currently attracting intensive attention. Matcha green tea is essentially processed green tea leaves that have been stone-ground into a delicate powder which original dated back from 10^{th} century from China. Matcha green tea and its bioactive components are known to posse many health-promoting and disease-preventing benefits, especially anti-inflammatory, antioxidant, anticancer, and metabolic modulation effects with multi-target modes of action [1]. The powder green tea, otherwise known as matcha, contains high amount of substances with antioxidant and anti-inflammatory effects. It has potential health benefits thank to its high concentration of catechins. The daily appropriate proportion of matcha consumption may support and stimulate the body health and thus prevent the infection of diseases [2].

The natural antioxidants, such as polyphenols [3], a wide range of compounds accounts for as much as 30% of the dry weight of green tea [4], [5]. Polyphenols are believed to be exceptionally powerful antioxidants, with effects comparable to those of vitamins, such as vitamins C and E, carotene and tocopherol [6], [7].

Matcha green tea has been studied in animal experiments extensively as an alternation for antibiotic and growth promotor. Matcha green tea was reported to have an exhibition of bacterial activities [8], reduction of stress in animal experiments [9]. The inclusion of green tea powder also reported to have promotion on the growth of Lactobacillus and inhibit the proliferation of E. coli; increase the proportion of leg meat, the calcium content, and the lightness color of the breast meat, while increasing the IMF content and redness color of the breast meat of broilers [10]. As for the growth promotor, performance and meat quality of broiler chickens were improved such as body weight gain and feed conversion ratio [11].

Thai Nguyen province is known for its famous tea production, with annual yield of 170,000 tons, accounted for 70% of total domestic market. Green tea processing has leftover a number of by-products such as browse green tea powder, tea crumbled… This is a potential sources that can be utilized as animal feed in the effort of eliminate use of antibiotic as feed additive.

Although there were a number of discoveries that have been published in poultry research, it is still unknown regarding the efficiency of matcha green tea in different source and mean of introduction, therefore, in this study, matcha green tea sources and mean of given were taken into account.

2. Materials and methods

The experiment was conducted on 420 King 303 broilers randomly assigned into 4 groups consisted of 105 each. Birds in each group were similar in age, body weight, healthy condition and caring. Birds were fed with basal diet for colored feather broilers provided by Jafpa Comfeed Ltd – Vietnam. Feed was offered in 3 different stages in accordance with their stage of growth. The order of the groups as followed:

- Control: Without supplementation of matcha green tea.
- Group 1 (Treatment 1): Supplemented with 0.25% matcha green tea into diet.
- Group 2 (Treatment 2): Supplemented with 0.25% based on daily feed intake and offered via drinking water. Amount of drinking water containing matcha green tea was offered in double as feed intake, extra water if demanded was offered as regular drinking water.

- Group 3 (Treatment 3): Supplemented 0.25% browsed green tea powder leftover after processing.

The measuring parameters included livability, growth rate was daily monitored and recorded. For the meat productivity and quality, 3 birds from each group were slaughtered at 13 weeks of age, the parameters includes live weight, carcass, dressing percentage, breast, thigh, abdominal fat were measured in compliance with TCVN 13474-1:2022 standard.

Meat quality was evaluated followed by the method of Fletcher (1999) [12], Debut et. Al. (2003) [13] with following parameters: pH_{24} (by pH Testo230 - Germany), meat color 24h after slaughtered was measured by Minolta CR-410 device (Japan). The meat tendency was measured by Warner Bzatzler 2000D Device (USA) after steamed. Meat dehydration (weight loss) after 24h storage and processing loss was measured as the different before and after steamed at 75^0C for 60 mins.

Data was statistically analyzed by ANOVA using SPSS 26.

3. Results and Discussion

The accumulative survival rate of experimental birds

The accumulative survival rate of experimental birds was presented in Table 1. Data in Table 1 showed that the survival rate of experimental birds in all treatments was from 97.14 to 100%, particularly, there was no mortality in treatment 1, and there was no significant different amongst groups. That was, perhaps, the antioxidant contents of matcha green tea such as vitamin C which helped to robust and maintain chickens health by reinforce the immune system of the body [14], [15]. Our results were also supported by findings from Sarker et al., 2010 [16].

Table 1. *The accumulative livability rate of experimental birds to 91 days (%)*

Week of age	Control	Treatment 1	Treatment 2	Treatment 3	P
			Mean		
1.	100.00	100.00	100.00	100.00	
2.	100.00	100.00	100.00	100.00	
3.	99.05	100.00	100.00	100.00	0.441
4.	99.05	100.00	100.00	100.00	0.441
5.	99.05	100.00	100.00	100.00	0.441
6.	99.05	100.00	100.00	100.00	0.441
7.	99.05	100.00	100.00	100.00	0.441
8.	99.05	100.00	99.05	100.00	0.596
9.	99.05	100.00	99.05	98.10	0.728
10.	97.14	100.00	99.05	98.10	0.728
11.	97.14	100.00	99.05	98.10	0.728
12.	97.14	100.00	99.05	98.10	0.728
13.	100.00	100.00	99.05	98.10	0.728

Broiler performance

Live bodyweight to 91 days old.

Data of live bodyweight of all birds in different treatments was presented in Table 2. It can be seen from the Table that there was significant different of bodyweight in broilers from different treatment starting from the 2nd week of age ($p<0.001$) to the end of the experimental period. In which it can be seen that the heavier live bodyweight observed in birds fed with 0.25% of browse green tea by product in the diet. This tendency followed by birds fed with 0.25% matcha based on feed intake introduced to birds via drinking water and birds fed with diet contained 0.25% matcha green tea. Birds in control group (without matcha green tea inclusion into diet) showed the least in bodyweight. However, in some weeks throughout experiment, there was a similarity in bodyweight in birds of different treatments except for that of the control compared to treatment 3. In overall, birds given diets containing 0.25% browse green tea by product showed the best performance in this trait. The inclusion of matcha green tea into broiler diet has stimulated the

animal growth, this can be explained that, matcha green tea has acted similar to that of feed additives as growth promotor. So that, the inclusion of matcha green tea has improved protein digestibility in birds [17].

Table 2. *Live weight of experimental birds at 91 days (gam/bird) (n=3)*

Week of age	Control	Treatment 1	Treatment 2	Treatment 3	P
			Mean		
hatch	38.40	38.31	38.34	38.43	0.711
1.	101.39	102.17	101.37	102.54	0.552
2.	197.22^{b}	197.33^{b}	198.15^{b}	200.98^{a}	0.003
3.	332.86	336.66	335.24	334.62	0.141
4.	476.79^{d}	492.31^{b}	484.62^{c}	495.71^{a}	< 0.0001
5.	665.95^{d}	669.99^{c}	681.55^{b}	711.63^{a}	< 0.0001
6.	867.36^{c}	867.29^{c}	894.43^{b}	930.33^{a}	< 0.0001
7.	1099.27^{d}	1119.19^{b}	1129.62^{c}	1181.90^{a}	< 0.0001
8.	1319.25^{d}	1363.14^{b}	1347.99^{c}	1404.43^{a}	< 0.0001
9.	1535.00^{d}	1586.56^{b}	1557.61^{c}	1610.33^{a}	< 0.0001
10.	1733.28^{d}	1779.43^{b}	1753.64^{c}	1792.39^{a}	< 0.0001
11.	1904.41^{c}	1945.24^{a}	1931.93^{b}	1948.35^{a}	< 0.0001
12.	2042.65^{b}	2084.10^{a}	2085.73^{a}	2084.98^{a}	< 0.0001
13.	2155.59^{c}	2208.67^{b}	2203.69^{b}	2229.50^{a}	< 0.0001

Table 3. *Absolute daily gain of experimental birds to 91 days (gam/bird/day) (n=3)*

Period (days)	Control	Treatment 1	Treatment 2	Treatment 3	P
			Mean		
1 - 7	9.00	9.12	9.00	9.16	0.571
8 - 14	13.69	13.59	13.83	14.06	0.142
15 - 21	19.38	19.90	19.58	19.09	0.057
22 - 28	20.10^{d}	22.46^{ba}	21.55^{ca}	23.01^{a}	0.003
29 - 35	27.02^{c}	25.63^{d}	28.13^{b}	30.84^{a}	< 0.0001
36 - 42	28.77^{c}	28.19^{c}	30.41^{b}	31.24^{a}	< 0.0001
43 - 49	33.13^{c}	35.99^{a}	33.60^{b}	35.94^{a}	< 0.0001
50 - 56	31.43^{b}	34.85^{a}	31.20^{b}	31.79^{b}	< 0.0001
57 - 63	30.82^{c}	31.92^{b}	29.95^{a}	29.41^{a}	< 0.0001
64 - 70	28.33^{a}	27.55^{a}	28.00^{a}	26.01^{b}	0.001
71 - 77	19.59^{b}	23.69^{ba}	25.47^{a}	22.28^{a}	0.022
78 - 84	19.75^{b}	19.84^{b}	21.97^{a}	19.52^{b}	0.010
85 - 91	16.13^{c}	17.80^{b}	16.85^{c}	20.65^{a}	< 0.0001
1 - 91	23.41^{b}	23.85^{b}	23.79^{b}	24.07^{a}	0.003

The absolute bodyweight gain

The bodyweight gain of experimental birds was shown in Table 3. The Data showed that the weekly gain and overall bodyweight gain of experimental birds were in accordance with bodyweight, in which, starting from the 3rd weeks of experiment, birds fed with diet containing 0.25% browse green tea by product showed to have better gain compared to that of other treatments and that of the control. However, at some stages, treatment 1 and treatment 2 (week 8, 10, and 12) had a better bodyweight gain. In overall, there was no significant difference between average daily gain in birds of the control and treatment 1 and 2. But not for that of treatment 3 which differed significantly ($p<0.003$). As for the quality of leftover browses green tea process, the higher contents of antioxidant and antimicrobial substances in matcha that played as a growth promotor agent in the diet, thus improved nutrient digestibility which boosted daily gain in birds from treatments 3. This findings were similar to that of research done by Farahat et al. [18]; Afsharmanesh et al. [17]; and Shomali et al. [19].

Feed intake of experimental birds fed with matcha green tea inclusion into diet.

Feed intake is one of the indicators to evaluate diet palatability and animal performance. In our trials, feed intake of trial birds was significant different amongst treatments. As the trial birds were acclimatized with given diet, the feed intake at different stages was not in similar trend. As during the first few weeks of experimental period, birds tended to consume similar amount of feed compared to each other treatments; however, start from 9th week, feed intake was observed significantly highest in control group till the end of the experimental period followed by birds from treatment with 0.25% matcha inclusion in diet. Feed intake of broiler chickens has been suggested as one of the most important factors determining the growth rate of chicken. As the amount and quality of different sources of green tea inclusion in this experiment were different in some extends, which made the feed intake of birds in treatment with 0.25% by product from browse green tea processing seen to be lowest. By product from browsed green tea processing has more tannin content, which reduced feed palatability, thus reduced feed intake in animal [20]-[22].

Table 4. *Feed intake of experimental birds to 91 days (g/bird/day) (n=3)*

Week of age	Control	Treatment 1	Treatment 2	Treatment 3	P
			Mean		
1.	10.75	10.75	10.48	10.75	0.070
2.	21.77^{a}	21.77^{a}	20.95^{b}	21.56^{a}	0.01
3.	34.29^{c}	36.87^{a}	36.73^{a}	35.78^{b}	<.0001
4.	42.03^{b}	43.69^{a}	42.04^{b}	43.81^{a}	0.018
5.	57.29^{b}	55.78^{c}	55.37^{c}	59.32^{a}	0.0017
6.	61.82^{a}	61.77^{a}	59.86^{b}	61.43^{a}	0.018
7.	72.12^{a}	71.84^{b}	66.80^{c}	72.38^{a}	<.0001
8.	73.49^{c}	77.01^{a}	67.99^{d}	76.51^{b}	<.0001
9.	79.82^{a}	77.82^{c}	73.76^{d}	78.98^{b}	<.0001
10.	84.91^{a}	82.18^{b}	77.74^{d}	80.50^{c}	0.0002
11.	88.94^{a}	85.71^{b}	81.87^{d}	84.75^{c}	<.0001
12.	97.76^{a}	88.84^{b}	86.27^{c}	83.38^{d}	<.0001
13.	106.72^{a}	91.02^{b}	89.01^{c}	86.54^{d}	<.0001

Table 5. *The accumulative FCR of experimental birds to 91 days (n=3)*

Week of age	Control	Treatment 1	Treatment 2	Treatment 3	P
			Mean		
1.	1.18	1.18	1.18	1.17	0.687
2.	1.43^{a}	1.43^{a}	1.38^{b}	1.39^{b}	0.005
3.	1.59^{c}	1.63^{a}	1.61^{b}	1.61^{b}	0.045
4.	1.75	1.74	1.72	1.71	0.207
5.	1.86^{a}	1.86^{a}	1.80^{b}	1.78^{c}	0.001
6.	1.93^{a}	1.94^{a}	1.84^{b}	1.83^{b}	<.0001
7.	1.98^{a}	1.95^{b}	1.87^{c}	1.87^{c}	<.0001
8.	2.04^{a}	2.00^{b}	1.94^{d}	1.97^{c}	0.000
9.	2.12^{a}	2.06^{b}	2.01^{c}	2.06^{b}	0.003
10.	2.23^{a}	2.17^{b}	2.10^{c}	2.17^{b}	0.000
11.	2.39^{a}	2.29^{b}	2.20^{c}	2.30^{b}	<.0001
12.	2.57^{a}	2.44^{b}	2.33^{c}	2.44^{b}	<.0001
13.	2.77^{a}	2.59^{b}	2.49^{d}	2.55^{c}	<.0001

Accumulative feed conversion efficiency (FCE).

Feed conversion efficiency (FCE) is a major trait that influences the usage of energy resources and the ecological footprint of livestock production. The most widely used measurement of individual feed conversion efficiency is the feed conversion ratio (FCR = intake/weight gain), due to its standardized on farm recording with appropriate feeder systems and the simple calculation. Feed conversion ratio accounts for the feed intake necessary to gain in body weight over a defined time period and results in an animal-specific value indicating better (low FCR) or worse

(high FCR) efficiency [23]. In our experiment, the FCE observed to have significant different amongst treatments ($p<0.001$). It can be seen that, broiler chickens fed with diets containing either 0.25% matcha green tea based on feed intake via drinking water or based on given feed or by product from browse green tea processing, had a lower FCE compared to those fed with diet without matcha green tea. In animal experiment, one of the factors, apart from feed, breed, nutrition… which contributed to well performance is their welfare where animals are free from stress, diseases, hunger… The contents of matcha green tea such as Theanine, a major amino acid in green tea, exhibits a stress-reducing effect [9] that had helped to improve FCE in our experiment.

Table 6. *The production index of experimental birds to 91 days (n=3)*

Week of age	Control	Trea. 1	Trea. 2	Trea. 3	P
			Mean		
1.	76.22	77.45	76.31	78.05	0.314
2.	79.45^{c}	79.36^{c}	82.52^{b}	83.44^{a}	0.001
3.	88.46	87.26	87.78	87.64	0.557
4.	88.81^{d}	94.27^{b}	92.42^{c}	95.34^{a}	0.004
5.	95.56^{d}	97.96^{c}	102.15^{b}	108.04^{a}	0.000
6.	101.36^{c}	101.78^{c}	110.7^{b}	116.30^{a}	<.0001
7.	108.14^{d}	112.97^{c}	118.91^{b}	124.97^{a}	<.0001
8.	110.82^{c}	118.30^{b}	119.41^{b}	121.41^{a}	0.023
9.	110.85^{b}	119.11^{a}	118.70^{a}	118.56^{a}	0.046
10.	107.79^{c}	114.89^{a}	111.36^{b}	113.19^{ab}	0.495
11.	98.32^{d}	108.08^{b}	110.48^{a}	105.57^{c}	0.001
12.	90.17^{c}	99.82^{b}	103.43^{a}	98.10^{b}	0.000
13.	82.10^{d}	91.96^{c}	94.48^{a}	92.55^{b}	0.002

The production index

The production index is the livability × average daily gain/feed conversion ratio × 10 and reflects the productivity of broiler chickens. Our data of production index was presented in Table 6, it can be seen that the PI was significantly different amongst treatments. In general, birds fed with diet containing 0.25% by product from browse green tea processing showed higher PI significantly compared to other treatments and that of the control, however, at the end of the experimental period, birds in treatment 2 (with 0.25% match green tea based on feed intake given via drinking water) showed to have better PI significantly.

Table 7. *Carcass characteristics of experimental birds at 91 days (n=3 male)*

Week of age	Control	Treatment 1	Treatment 2	Treatment 3	
			Mean		P
Carcass (%)	80.13	80.17	80.92	81.04	0.983
Breast meat prop. (%)	14.83^{c}	14.79^{c}	16.71^{a}	15.49^{b}	0.004
Thigh meat prop. (%)	19.22	19.94	20.26	19.60	0.719
Breast+ thigh prop. (%)	34.05	34.74	36.97	35.09	0.173
Abdominal fat prop. (%)	1.15	1.15	1.15	1.15	0.722

Carcass characteristics

There was no significant different of dressing percentage amongst treatments, however, there was significant difference of breast meat percentage in which, birds in treatment 2 had the highest breast meat proportion followed by birds in treatment 3. There was no difference between that of the control and treatment 1. The addition of matcha green tea or browse green tea by product had no effect on thigh meat, breast and thigh ratio; abdominal fat content. Our results were in contrary with findings from Biswas et al., 2001 [24] where they found the decrease of thigh and abdominal fat proportions when matcha green tea was fed.

4. Conclusion

From the obtained data, it can be concluded that matcha green tea sources and the mean of introduction for colored feather broiler did not affect broiler livability but had significant effect on chickens performance such as live weight and productivity, despite of reduction in feed intake. Matcha green tea sources had improved daily gain and the mean of matcha introduction via drinking water had improved FCR and PI. It is recommended that matcha green tea can be supplemented to broiler chickens either via drinking water or addition into diet.

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