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Short Communication

The Effects of Dietary Methionine during 5 - 14 Weeks of Age on Growth Performance and Carcass Traits of Chickens

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Abstract | The study was conducted on 120 local crossbred chickens to identify the effect of Methionine supplementation on growth performance and carcass characteristics of chickens from 5 – 14 weeks of age. The experiment was a completely randomized design with four treatments (0.10; 0.15; 0.20; and 0.25% of Methionine in the diet, the total Met in each diet was increased following the standard of NRC) and three replicates per treatment (10 chickens per replicate, 5 male and 5 female chickens). The chickens had *ad libitum* accessed to feed and water. The results showed that there was a linear improvement of daily weight gain, feed intake, and feed conversion. Methionine supplementation in the diets at the rate of 0.25% reduced feed intake (51.13 g/day), increased final live weight (1513 g/bird), daily weight gain (18.30 g/bird), and improved feed conversion rate (2.79) ($P<0.05$). Carcass weight, breast weight, and thigh weight showed a linear increase by the Methionine treatments ($P<0.05$). However, internal organs were not exhibited any significant change ($P>0.05$) although their weight was increased with increasing concentration of Methionine. It could be concluded that the 0.25% Methionine supplementation is beneficial to improve the performance of chickens.

Keywords | Local crossbred chickens, Methionine, Growth performance, Carcass characteristics

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INTRODUCTION

It is important to improve the quality and quantity of local crossbred chickens, called Noi Lai chickens in Vietnam recently due to meet the increasing demand for Vietnamese consumption. Therefore, the studies on local crossbred chickens between Noi chickens and Binh Dinh chickens become popular in Vietnam for recent researches. Linh et al. (2020) recorded that the chickens (Noi Lai chickens) have owned the same characteristics as Noi chickens but the growth performance is better. The application of feed additives has achieved many achievements. The use of amino acid (AA) is the most common in feed formulation. Parsons (2020) recommended that we should make formulation for poultry diets depending on the digestible AA basis. Moreover, Methionine (Met) is usually the first limiting amino acid in broiler diets. Besides, there are two common kinds of Methionine which are DL-methionine and Liquid Methionine, classified as organic acid (Jankowski et al., 2014).

In previous studies, there were many positive effects of Met on animal growth performance, especially on poultry. Wen et al. (2018) showed that the supplementation of Met in the diet increases body weight gain and breast muscle of broilers. Rehman et al. (2019) also recorded the positive effect of Met in the diet as the increase of weight gain, carcass weight, chest, and thigh weight was observed. Horn et al. (2009), Ullrich et al. (2019), Elnesr et al. (2019), and Elwan et al. (2019) showed the same results in the increase

Table 1: The composition of feed in the experiment

Items	Methionine in the diet (%)			
	0.10 (T1)	0.15 (T2)	0.20 (T3)	0.25 (T4)
Ingredients (%)				
Maize	14.9	14.8	14.8	14.6
Broken rice	16.0	16.0	16.0	16.0
Rice bran	52.0	52.0	52.0	52.0
Soybean meal	10.0	10.0	10.0	10.0
Fish meal	6.00	6.00	6.00	6.10
Lysine	0.23	0.23	0.23	0.23
Methionine	0.10	0.15	0.20	0.25
Dicalcium phosphate	0.50	0.50	0.50	0.50
Mineral premix – Vitamin*	0.30	0.30	0.30	0.30
Nutrient composition				
Crude Protein (CP) (%)	17.0	17.0	17.0	17.0
Metabolizable Energy (MJ/kg DM)	13.0	13.0	13.0	13.0
Ether Extract (EE) (%)	8.05	8.05	8.04	8.05
Crude Fiber (CF) (%)	4.43	4.43	4.42	4.42
Ash (%)	7.15	7.15	7.15	7.15
Calcium (%)	0.78	0.78	0.78	0.78
Phosphate (%)	1.04	1.04	1.04	1.04

Note: * - Vitamin A: 2,500,000 UI; Vitamin D3: 600,000 UI; Vitamin E: 4,000 mg; Vitamin K3: 400 mg; Folic acid: 80 mg; Choline: 100,000 mg; Mangan: 14 g; Zn: 40 g; Fe: 32 g; Cu: 48 g; Iodine: 0.5 g; Co: 0.28 g; Se: 0.04 g

of growth performance and carcass characteristics. Besides, Poosuwan et al. (2007) recorded that the application of Met in drinking water helps broilers improve their growth performance by reducing *E. coli* level in the gastrointestinal tract of broilers. The increase of Met levels in the diets, up to 118% of the recommended NRC value, helps poultry increase weight gain, feed efficiency, and breast meat yield (Hickling et al., 1990). There was a suggestion that commercial poultry production does not need more than 0.50% Met in the diet during the starter phase for optimizing feed efficiency and growth performance of broilers (Jankowski et al., 2014).

In the conditions of Vietnam nowadays, poultry industry is more and more important; poultry farming is increasingly developed and poultry meat is gradually replacing other meat sources in human consumption. As the importance of the supplement of Met in the diets, shown above, this study was aimed to determine the effect of Met supplementation on the growth performance and carcass characteristics of the chickens.

MATERIALS AND METHODS

Location

The experiment was implemented at the experimental farm of School of Agriculture and Aquaculture, Tra Vinh University from January 2020 to March 2020. The experiment took place, conforming to Vietnam regulations. All of procedures of Animal Wealfare were accepted by Department of Veterinary and Animal Husbandry in Tra Vinh University.

Experimental design

A completely randomized design was used for this study to determine the growth performance and carcass traits of local crossbred chickens, called Noi Lai chickens. The experimental animal in the study was local crossbred chickens (between Noi chickens and Binh Dinh chickens). A total of 120 chickens from 5 to 14 weeks of age was allotted in four treatments (10 chickens per replicate). The chickens had *ad libitum* accessed to feed and water. Four treatments in the experiment consisted of treatment 1 – T1 (0.10% Met supplementation), treatment 2 – T2 (0.15% Met supplementation), treatment 3 – T3 (0.20% Met supplementation) and treatment 4 – T4 (0.25% Met supplementation). The birds in each replicate were kept in pens with 5 m^2 of size. Bio-yeast and rice husk were used to cover the floor. The cage was equipped with drinking nipples to apply an automatic drinking system. Throughout the experiment, the birds were vaccinated to prevent common diseases such as Newcastle, Chronic Respiratory Disease, and Avian Influenza.

Table 2: The effect of Met in the diets on growth performance of chickens

Criteria	Treatments				SEM	P
	T1	T2	T3	T4		
Initial weight, g/bird	348	363	361	360	5.684	0.331
Final weight, g/bird	1393^{b}	1422^{ab}	1446^{ab}	1513^{a}	20.764	0.019
Daily weight gain, g/bird	16.60^{b}	16.81^{b}	17.22^{ab}	18.30^{a}	0.3224	0.024
Feed intake, g/day	52.85^{a}	52.26^{ab}	51.73^{ab}	51.13^{b}	0.3560	0.046
Feed conversion	3.18^{a}	3.11^{a}	3.01^{ab}	2.79^{b}	0.0567	0.006

SEM - Standard Error of the Mean, Means in a row with the same superscripts are not significantly different (P<0.05) and vice versa

Table 3: The effect of Met in the diets on carcass characteristics and internal organs of chickens

Criteria	Treatments				SEM	P
	T1	T2	T3	T4		
Carcass weight	1001^{b}	1011^{b}	1035^{b}	1087^{a}	9.50	0.001
Carcass percentage	70.91	70.55	71.27	71.65	0.43	0.388
Breast weight	231^{b}	245^{ab}	254^{ab}	264^{a}	5.88	0.019
Thigh weight	320^{b}	352^{ab}	354^{ab}	370^{a}	7.61	0.010
Liver weight	31.33	31.70	32.33	32.27	1.97	0.980
Heart weight	7.17	7.37	7.87	8.23	0.33	0.180
Gizzard weight	40.37	40.67	41.50	42.33	1.00	0.536

SEM - Standard Error of the Mean, Means in a row with the same superscripts are not significantly different (P<0.05) and vice versa

Data collection

The feed was analyzed following the method of AOAC (1990). Feed ingredients and nutrients composition of the diets in the experiment are shown in Table 1. The diets were formulated to meet the demand of chickens from 5 – 14 weeks of age. The chickens were weighed individually at the beginning of the experiment and after every 7 days throughout the experiment. The feed was weighed to calculate feed consumption every morning before feeding. Chickens were slaughtered at the end of the experiment to determine the weight of carcass, breast, thigh, and internal organs including heart, liver, and gizzard. Chickens were slaughtered according to the methods of Freitas et al. (2018), Reyes et al. (2018) to get carcass weight (without a head, feather, legs, internal organs, and blood) and carcass percentage. For internal organs including heart, liver, and gizzard, it was weighed separately.

Statistical analysis

Data on live weight, daily weight gain, and feed conversion of the chickens were analyzed to determine the growth performance. All parts of the slaughtered body were weighed to determine carcass characteristics. Data were analyzed as a completely randomized design using ANOVA procedures. The results analysis was shown as statistically significant when $p < 0.05$.

RESULTS

Effects of Met on growth performance of the chickens

Table 2 showed the effect of graded Met in the diets on the growth performance of experimental chickens. It was clear that chickens had a better performance at the diet of 0.25% Met (T4) ($p<0.05$). Final live weight in treatment T4 was higher than other treatments, especially, the treatment T1 ($p<0.05$). Daily weight gain showed the same results in four treatments. When the diets added Met, feed conversion of chickens was improved ($p<0.05$). Besides, feed intake was decreased when increased the amount of Met in the diet ($p<0.05$). And there was a linear improvement of feed conversion, an increase of daily weight gain, and reduce feed intake throughout the experiment. It mostly reflected the function of Met in the diet as an essential amino acid for experimental chickens.

Effects of Met on carcass traits

Table 3 showed the effect of different levels of Met in the diets on carcass traits of chickens at the end of the experiment. Carcass weight was higher in 0.25% Met supplemented group than other treatments in the experiment ($p<0.05$). Similarly, breast weight and thigh weight were also increased and reach the peal level in the treatment group of 0.25% Met ($p<0.05$). However, there was no difference in liver, heart, and gizzard weight between four treatments even though the Met level was increased.

DISCUSSION

The supplementation of Met in the diets has many beneficial effects on growth performance and carcass characteristics which were recorded in the studies of Horn et al. (2009), Wen et al. (2018), Rehman et al. (2019), Elnesr et al. (2019), Ullrich et al. (2019) and Elwan et al. (2019). In this study, the levels of Met is higher than the recommendation of NRC to find the most suitable level of Met after increasing it in the diet. Growth performance of chickens was better because the Met in the diets helps chickens increase the abilities to absorb and digest nutrients in the diets (Horn et al., 2009; Lee et al. 2020) by increasing the height and length of the villus. It was also recorded in the study of Rehman et al. (2019), the diets with Met have a positive effect on villus development. Thus, chickens did not consume a high amount of feed for their demand. Besides, Met is one of the important AA in poultry, the deficiency of Met could cause a decrease in growth performance, metabolic disorder, and impaired immune system as reported in the studies of Bunchasak (2009) and Alagawany et al. (2016). Elnesr et al. (2019) and Elwan et al. (2019) debated that Met helps poultry produce energy through protein synthesis, thus it helps chickens increase their growth performance as well. Additionally, Met improves antioxidant capacity in poultry (Lai et al., 2018; Rehman et al., 2019) which protects the chicken body against the detrimental effects of free radicals damage (Marques et al., 2014). Mostly, free radicals damage is in cells and tissues from internal and external sources such as inflammation, diseases, metabolism, or food and drugs (Rice-Evans et al., 1991). Moreover, Met is used by animals directly as a precursor for protein synthesis (Fang et al., 2010). That is the reason Met could improve the growth performance of chickens in this study.

The results of carcass characteristics in this study were in line with the study of Ahmed and Abbas (2011), Bouyeh (2012). As a first limited amino acid, Met plays an important role in the process of protein synthesis or as a precursor for protein synthesis (Fang et al., 2010). There is no question that breast and thigh are a major proportion of protein synthesis in the chicken body which are sensitive to essential amino acids in the diets (Bouyeh and Gevorgyan, 2011). Ullrich et al. (2019), and Rakangtong and Bunchasak (2011) found that supplemented Met affects the relative weight of edible organs. The results of this study showed that there were no significant effects of Met on the liver, heart, and gizzard although their weight was bigger. It was due to the significant effect of Met as an amino acid is on the muscle of chickens and edible organs where the activity of protein synthesis is taken place (Jariyahatthakij et al., 2019). Additionally, there were no significant differences because this study was conducted in different conditions, chicken breeds, and different amounts of Met in the diet.

CONCLUSION

The increase of Met in the diet led to the increase of the growth performance and carcass traits of local crossbred chickens. Besides, the slaughtered weights of chickens were increased according to the increase of Met and mostly reflected the growth performance of chickens. The greatest performance was exhibited by the treatment of 0.25% Met in the diet.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS CONTRIBUTION

All authors have contributed equally in this research.

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