The Broiler biological value(BV) of <CUC> DL－Methionine

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1. Test objective

By adding different doses of <CUC> DL-methionine and <DEGGUSA>DL-methionine in broiler feed to observe the effect of methionine on production performance of broilers, research the BV of <CUC> DL-methionine and <DEGGUSA>DL-methionine.

2. Materials and methods

2.1 Test materials

<CUC> DL－Methionine is provided by Ningxia Unisplendour Tianhua Methionine Co.,Ltd. , <DEGGUSA> DL-Methionine is bought from the market.

2.2 Test animals and grouping

Based on a single factor completely random design, 567 1 day old healthy AA broilers (42+4) are reexamined for 3 days, and then randomly divided into 9 treatment groups with 9 replicates per group, each replicate has 7 broilers. 9 treatment groups are: 1 basic ration group with no methionine, 4 groups in whose diet added different levels of <CUC> DL-methionine and 4 groups in whose diet added different levels of <DEGGUSA>DL-methionine. At 4-21 days of age, the added methionine levels for 4 groups are 0.05%, 0.06%, 0.13%, 0.20%, 0.28%, while at 22-24 days of age, the added methionine levels are 0.05%, 0.10%, 0.15%, 0.20%. The test period is 42 days.

2.3 Test ration

The basic ration of Corn-soybean meal is made according to the standard recommended by ARBOR ACRES company’s AA Broiler Management Manual and the standard of China Broiler Feeding (2004).The composition and nutrition of basic ration refer to table 1.

Table 1 the composition and nutrition of basic ration %

Raw material	Content		Nutrient	Nutrient level	
	1-21 days	22-42 days		1-21days	22-42days
Corn	58.30	63.80	ME/(MJ/kg)	12.55	12.94
Soybean meal，43%	31.78	25.60	Crude protein	12.55	12.94
Corn gluten meal(63%CP)	2.40	3.00	Lysine	12.55	12.94
Soybean oil	3.50	4.00	Methionine	12.55	12.94
Calcium hydrogen	1.20	0.98	Methionine+Cystine	12.55	12.94
Mountain flour	1.80	1.62	Ca	12.55	12.94
Salt	0.30	0.30	Nonphytate phosphorus	12.55	12.94

DL-methionine		
Vitamine	0.30	0.30
Micronutrients	0.20	0.20
Lysine	0.22	0.20
Total	100	100

*per kg diet :vitamin A(all-trans-retinol acetete),12,000U; vitamin D3,3,000IU;vitamin Ks(menadione sodium bisulfate), 3mg;nitamin B1(thiamin mononitrate),2.4mg; riboflavin, 9.0 mg; vitamin B6,4.0mg; nitamin B12,0.014mg, calcium pantothenate,30mg; Niacin,40mg; Folic acid,1.0mg;Biotin,0.12mg; Choline(choline chloride),700mg; Cu(cuSO4.5H2O),8mg;Zn(ZnSO4.7H2O),40mg ;Fe(FeSO4.7H2O),80mg ;I(KI),0.35mg,Se(Na2SeO3),0.15mg ;Mn(Mn SO4.H2O,120mg.

2.4 Breeding and management

According to the requirements of “AA broiler Feeding Management Handbook" to feed and manage the experimental groups and contrast groups, all groups are equally distributed in the henhouse. Light 24 hours a day, light intensity is 5-10Lx, good ventilation, free eating and drinking.

2.5 Test time and place

The experiment is totally 42 days from October 28, 2010 to December 9th, placed in broilers henhouse of Key Laboratory of animal nutrition in Beijing Animal husbandry and Veterinary Research Institute of Chinese Academy of Agricultural Sciences.

2.6 Production performance test

To observe respectively the situation of feeding, drinking, activities etc., according to each stages records of ADI, death number, weight for 4-21 days and 22-42 days of age broilers, to calculate the average weight, the average ADI, daily weight gain, feed conversion rate and mortality rate of each phase.

$$\text{ADG (g/d)} = \frac{\text{average weight in the end of test(g)} - \text{average weight in the beginning(g)}}{\text{Test days}}$$

$$\text{Average Feed Daily Intake (AFI) (g/d)} = \frac{\text{Total feed consumption (g)}}{\text{Total breeding days}}$$

$$\text{Feed conversion ratio (F/G)} = \frac{\text{Total feed consumption (g)}}{\text{Total weight gain (g)}}$$

$$\text{mortality rate} = \frac{\text{Death number}}{\text{Total number}} \times 100\%$$

2.7 Test data processing

The test data means average± standard deviation . Analysis of variance is use to treat the data by General linear model (GLM) procedure in SAS software. If there is significant difference, use Duncan's multiple range test to compare the significance of difference between each average number. Significant levels of P ＜ 0.05. At the same time, refer to the Littell (1997) statistical method, according to the following nonlinear models, to separately calculate the BV of <CUC> DL-methionine VS <DEGGUSA>DL-methionine in 4-21 days, 22-42 days and 4-42 days of age.

$$Y=a+b*(1-e^{-(b1*x1+b2*x2)})$$

In this formula, Y is the evaluation index of growth effect (daily weight gain, feed conversion efficiency,etc.). x1 is the addition level of <CUC> DL-methionine, X2 is the the addition level of <DEGGUSA>DL-methionine. A is the animal growth effect with feed basic ration, B is the gradual effect value of animal growth, a+b is the maximum growth effect when feeding with different methionine diets , B1 is the slope of x1, B2 is the slope of x2, b1/b2 is the BV of <CUC> DL-methionine relative to<DEGGUSA>DL-methionine.

3. Result and analysis

3.1 The influence on production performance of 4-21 days old broilers fed with different dosage and brand of DL-Methionine.

Table2

The influence on production performance of 4-21 days old broilers fed with different dosage and brand of DL-Methionine.

	ADG(g)	ADFI(g)	F/G	Death Rate(%)
Contrast Group	37.09 ± 1.78^{d}	54.20 ± 3.01^{b}	1.46±0.08	3.17±6.30
0.06% CUC	37.44 ± 2.09^{cd}	55.64 ± 2.75^{ab}	1.49±0.10	1.59±4.76
0.13% CUC	39.71 ± 2.39^{abc}	57.04 ± 3.25^{a}	1.44±0.08	0
0.20% CUC	41.51 ± 2.60^{ab}	58.03 ± 2.13^{a}	1.40±0.11	1.59±4.76
0.28%CUC	41.75 ± 1.77^{a}	58.14 ± 2.07^{a}	1.39±0.04	0
0.06%Degussa	37.48 ± 2.83^{cd}	55.72 ± 2.37^{ab}	1.49±0.13	0
0.13% Degussa	39.25 ± 2.17^{bcd}	56.97 ± 1.61^{a}	1.45±0.07	0
0.20% Degussa	41.72 ± 2.40^{a}	57.84 ± 2.55^{a}	1.39±0.10	0
0.28% Degussa	42.02 ± 2.47^{a}	58.26 ± 2.61^{a}	1.39±0.08	1.59±4.76
P Value	＜0.0001	0.0094	0.0729	0.4437

a-c Means with different superscripts within the same row differ significantly (P＜0.05)

As can be seen from the table 2, amino acids influences the ADG of broilers of 4-21 days age (P<0.0001) significantly. As the addition of amino acids developed, the ADG of broilers gradually improves. The ADG of groups with amino acid more than 0.13% is significantly higher than contrast groups' (P<0.05), and there is no significant difference between these two kinds of amino acids (P>0.05). To add amino acids markedly influences the ADFI of broilers of 4-21 days age (P=0.0095). As the addition of amino acids developed, the ADFI of broilers gradually improves, there into, the ADFI of groups with amino acid of 0.13% is significantly higher than contrast groups (P<0.05), and there is no marked difference between these two kinds of amino acids(P>0.05). To add amino acids has a tendency to reduce

F/G (P=0.0729), and there is no marked difference between these two kinds of amino acids (P>0.05). To add amino acids does not markedly influence the death rate of broilers of 4-21 days age (P=0.4437).

By means of nonlinear regression analysis, there is a model formula about influence of these two kinds of amino acids on the ADG of broilers of 4-21 days age, that is Y=36.49+12.79×(1-e-(-2.10×1-2.13×2)), the regressive relation of this model is significant(P<0.0001). As for the ADG of broilers of 4-21 days age, compared with Evonik Met, the biological value of CUC Met is 98.6%. There is a model formula about these two kinds of amino acids influence the ADFI of broilers of 4-21 days age, that is Y=54.12+4.90×(1-e-(-6.93×1-6.83×2)), the regressive relation of this model is significant(P=0.0001). As for the ADFI of broilers of 4-21 days age, compared with Evonik Met, the biological value of CUC Met is 101.5%. The regressive relation of nonlinear model, which is about F/G and death rate of broilers of 4-21 days age influenced by these two kinds of amino acids, is unremarkable.

3.2 The influence of different dosage and brands of DL-Methionine on production performance of broilers of 22-42 days age.

Table 3

The influence of different dosage and brands of DL-Methionine on production performance of broilers of 22-42 days age

	ADG(g)	ADFI(g)	F/G	Death Rate (%)
Contrast Group	69.79±3.03c	153.83±4.18	2.21±0.09	5.03±7.57
0.05% CUC	70.35±3.04c	155.29±6.43	2.21±0.09	3.17±6.30
0.10% CUC	71.81±2.65bc	156.94±3.35	2.19±0.11	3.17±6.30
0.15% CUC	74.98±3.22a	159.14±4.45	2.13±0.13	0
0.20% CUC	75.08±3.39a	159.34±2.15	2.13±0.11	0
0.05% Degussa	70.69±3.11c	155.97±4.82	2.21±0.12	0
0.10% Degussa	71.97±2.43bc	157.24±2.28	2.19±0.09	1.59±4.76
0.15% Degussa	74.53±3.18ab	158.42±3.35	2.13±0.11	3.17±6.30
0.20% Degussa	75.14±2.89a	159.49±4.78	2.12±0.05	1.85±5.56
P Value	<0.0001	0.0534	0.1947	0.3587

a-c Means with different superscripts within the same row differ significantly (P<0.05)

As can be seen from the table 3, to add amino acids markedly influences the ADG of broilers of 22-42 days age (P<0.0001). As the addition of amino acids developed, the ADG of broilers gradually improves, there into, the ADG of the groups with amino acid more than 0.15% is significantly higher than contrast groups' (P<0.05), and there is no significant difference between these two kinds of amino acids(P>0.05). To add amino acids markedly influences the ADFI of broilers of 22-42 days age (P=0.0534). As the addition of amino acids developed, the ADFI of broilers gradually improves, there into, the ADFI of the groups with amino acid more than 0.15% is significantly higher than contrast groups' (P<0.05), and there is no marked difference between these two kinds of amino acids(P>0.05). To add amino acids does not markedly influence the F/G of broilers of 22-42 days age (P=0.1947), and there is no marked difference between these two kinds of amino acids (P>0.05). To add amino acids does not markedly influence the death rate of broilers of 22-42 days age (P=0.3587).

By means of nonlinear regression analysis, there is a model formula about influence of these two kinds of amino acids on the ADG of broilers of 22-42 days age, that is Y=69.33+25.22×(1-e-(-1.00×1-0.99×2)), the regressive relation of this model is significant(P<0.0001). As for the ADG of broilers of 22-42 days age, compared with Evonik Met, the biological value of CUC Met is 101.0%. There is a model formula about influence of these two kinds of amino acids on the ADG of broilers of 22-42 days age, that is Y=153.8+8.33×(1-e-(-4.18×1-4.20×2)), the regressive relation of this model is significant(P=0.0015). As for the ADFI of broilers of 22-42 days age, compared with Evonik Met, the biological value of CUC Met is 99.5%. The regressive relation of nonlinear model, which is about F/G and death rate of broilers of 22-42 days age influenced by these two kinds of amino acids, is unremarkable.

3.3 The influence on production performance of 4-42 days old broilers fed with different dosage and brand of DL-Methionine.

Table 4 the influence on production performance of 4-42 days old broilers fed with different dosage and brand of DL-Methionine.

	ADG(g)	ADFI(g)	F/G	Death Rate(%)
Contrast Group	55.16±2.30d	107.05±3.45c	1.94±0.08ab	7.94±10.38
0.05-0.06% CUC	55.63±1.74cd	108.80±3.88bc	1.96±0.07a	4.76±7.14
0.10-0.13% CUC	57.45±1.55b	110.56±3.62ab	1.93±0.09ab	3.17±6.30
0.15-0.20% CUC	60.01±2.13a	112.22±3.70a	1.87±0.11b	1.59±4.76
0.20-0.28%CUC	60.17±1.58a	112.81±1.51a	1.88±0.06b	0
0.05-0.06%Degussa	55.83 ± 2.22bcd	109.70 ± 3.03abc	1.97±0.09a	0
0.10-0.13% Degussa	57.33±1.13bc	110.89±1.81ab	1.93±0.05ab	1.59±4.76
0.15-0.20% Degussa	59.85±1.07a	111.85±2.73ab	1.87±0.05b	3.17±6.30
0.20-0.28% Degussa	60.32±1.84a	112.39±3.01a	1.86±0.04b	3.17±9.52
P Value	＜0.0001	0.0022	0.0080	0.2412

a-c Means with different superscripts within the same row differ significantly (P＜0.05)

From Table 4, it shows that to add amino acids has a significant influence on the ADG of 4-42 days old broilers(P<0.0001). The ADG of broilers increases gradually with the increase addition of amino acids. Among them, The ADG of groups with amino acid more than 0.10-0.13% are significantly higher than contrast group (P<0.05). There is no significant difference between two kinds of amino acids(P>0.05). To add amino acids has a significant influence on the ADFI of 4-42 days old broilers(P<0.0022). The ADFI of broilers increases gradually with the increase addition of amino acids. Among them, The ADFI of groups with amino acid more than 0.10-0.13% are significantly higher than contrast groups (P<0.05). There is no significant difference between two kinds of amino acids(P>0.05). To add amino acids has a significant influence on the F/G of 4-42 days old broilers(P=0.0080). The F/G of broilers decreases gradually with the increase addition of amino acids. Among them, The F/G of groups with amino acid more than 0.15-0.20% are significantly higher than the group with 0.10-0.13% (P<0.05). There is no significant difference between two kinds of amino acids(P>0.05). To add amino acids has no significant influence on the death rate of 4-42 days old broilers(P=0.2412).

By nonlinear regression analysis, the model formula for two kinds of amino acids that influence on the ADG of 4-42 days old broilers is Y=54.64+17.37*(1-e-(-1.49*1-1.50*2)). The regressive relation of this model is significant (P<0.0001). For the ADG of 4-42 days old broilers, the biological value of CUC Methionine is 99.3% of Evonik Methionine. The model formula for two kinds of amino acids that influence on the ADFI of 4-42 days old broilers is Y=107.1+6.65*(1-e-(-6.46*1-6.37*2)). The regressive relation of this model is significant (P<0.0001). For the ADFI of 4-42 days old broilers, the biological value of CUC Methionine is 101.4% of Evonik Methionine. The nonlinear regression relation of two kinds of amino acids that influence on the F/G and death rate of 4-42 days old broilers is not significant.

4. Conclusion

The experiment result shows that to add DL-Methionine in daily diet can improve the production performance of broilers significantly. The proper addition of amino acids is 0.13-0.20% (0-21 days old) and 0.10-0.15 %(22-42 days old).

The experiment result shows that, regarding to the ADG of broilers, the biological value of CUC Methionine is 98.6%-101.0% of Evonik Methionine; regarding to the ADFI of broilers, the biological value of CUC Methionine is 99.5-101.5% of Evonik Methionine. There is no significant difference of production performance on broilers with two kinds of DL-Methionine.

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