Methionine and Lysine Supplementation in Low Quality Feed Ingredient based diets on the performance of broiler chicken[1]

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ABSTRACT

Two hundred Vencob broiler chicks were randomly assigned to four dietary treatments and replicated five times. Treatments composition were; 23 percent CP in starter and 20 percent CP in finisher (T1), 19 percent CP + lysine (0.04%) in starter and 16 percent CP + lysine (0.16%) in finisher (T2), 19 percent CP + methionine (0.09%) in starter and 16 percent CP + methionine (0.03%) in finisher (T3) and 19 percent CP + lysine (0.04%) + methionine (0.09%) in starter and 16 percent CP + lysine (0.16%) + methionine (0.03%) in finisher (T4). Starter diets were fed from 3rd days after hatching to 28th days of feeding period and finisher diets were fed from 29th days to 49th days of feeding period. Significant differences were found in feed consumption and body weight gains. However, similar feed efficiency was recorded among the treatments. The highest feed consumption and body weight gains were recorded from methionine and lysine supplemented groupsof the broiler chickens.

Key words: methionine, lysine, and broiler chicken

INTRODUCTION

Nepal comprises 5 million commercial layers and 4 million commercial broiler chickens. A total of 37800 tons of compounded poultry feed is produced in the country in a year to feed these commercial chickens (Paudyal and Osti, 2003). Nepalese feed industries are in take of stage, most of them have inadequate knowledge in nutritional balance of poultry feed. Animal protein sources found in Nepal are low in quality and expensive due to far from sea sources. Therefore poultry producer does not get enough return as they invested in the feed.

Protein is the most important component of feed ingredients. Twenty-two different amino acids are the building block of protein. Among them, 10 are indispensable for monogastric animal production. Those amino acids which are not synthesized by chicken are called indispensable (essential) where as those synthesize from other amino acids are called dispensable (nonessential) amino acids. Amino acids obtained from protein are used by chicken to fulfill a diversity of function; proteins are primary constituent of structural and protective tissues such as skin, feathers, bone matrix, ligaments, soft tissues, including organs and muscles. Methionine and lysine are first and second limiting

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amino acids (Gill, 2003) in most of plant protein sources. In exception to soybean which contain relatively higher amount of lysine all other plant protein sources contain low lysine. Similarly methionine contain in all plant sources are very low as required by chicken. Methinine is needed for protein synthesis, when there is no methionine protein synthesis does occur, because methinine is the initiator of protein synthesis. Lysine is also very important for growing birds, inadequacy of lysine suffer productive activities. Deficiency of lysine manifested depigmentation in birds (Vohra and Kralzer, 1959) and also causes reduced hemoglobin and hematocrit in chicken (Braham, et al. 1961).

National Research Council (NRC, 1994) recommended 23 percent crude protein in starter (0-3 weeks) and 20 percent for finisher (3-6 weeks) broiler chicken diets. At this level, it is hypothesized that, all most all of indispensable amino acids are balanced. Excess of amino acids from required level are deaminated and excreted from the faeces which lead to high cost of production and excreted amino acids and ammonia create environmental pollution.

Nowadays synthetic amino acids are available at chipper price, which could spare crude protein level by supplementing different amino acids. Feeding trial conducted at Animal Nutrition Division (NARC) revealed that 19 percent CP in starter and 16 percent CP in finisher broiler resulted same or even better performances of broiler chicken compared to recommended level with supplemental methionine and lysine (Osti, 2002). In this experiment Synthetic amino acids lysine and methionine are singly or in in combination are supplemented in starter and finisher diets of the broiler chicks to find out the better feed efficiency as well as cut down the cost of the protein in the diets.

MATERIALS AND METHODS

Two hundred Vencob broiler chicks were randomly assigned to four dietary treatments and replicated five times. Treatments composition; 23 percent CP in starter and 20 percent CP in finisher (T1), 19 percent CP + 0.04 percent lysine in starter and 16 percent CP + 0.16 percent lysine in finisher (T2), 19 percent CP + 0.09 percent methionine in starter and 16 percent CP + 0.03 percent methionine in finisher (T3) and 19 percent CP + 0.04 percent lysine + 0.09 percent methionine in starter and 16 percent CP + 0.16 percent lysine + 0.03 percent methionine in finisher (T4) were formulated (Tables 1 & 2). Starter diets were fed from 3rd days after hatching to 28th days of feeding period and finisher diets were fed from 28th days to 49th days of feeding period. Feed was given two times a day adlibitum and chicks were raised in deep litter system. Data on initial body weight, daily feed consumption and weekly body weight was recorded up to 7 weeks of feeding period. Body weight gains were calculated by subtracting initial weights from weekly body weight of chicks. The composition and calculated nutrient composition of broiler starter and finisher diets are given in tables 1 and 2 respectively.

Table 1. The composition and calculated nutrients composition of broiler starter (0-3w) diets with different level of crude protein supplemented with methionine and lysine.

Ingredients	Percent CP and limiting amino acids in treatments diets			
	T1=23 % CP	T2=19 % CP+ Lys	T3=19 % CP+ Met	T4=19 % CP + Met & Lys

Rice polish	17.00	18.00	18.00	18.00
Maize grits	35.00	46.00	46.00	46.00
Fish meal	10.00	3.00	3.00	3.00
Soybean meal	26.00	22.00	22.00	22.00
Mustard oil cake	5.00	5.00	5.00	5.00
Soybean oil	5.00	4.00	4.00	4.00
Salt	0.25	0.25	0.25	0.25
Bone meal	0.75	0.75	0.75	0.75
Lime stone	0.50	0.50	0.50	0.50
Vitamin + mineral mixture	0.50	0.50	0.50	0.50
Methionine	0.00	0.00	0.0.09	0.09
Lysine	0.00	0.04	0.00	0.04
Total	100.00	100	100	100
Calculated nutrients content				
Metablizable energy (ME Kcal/kg)	3167.00	3193.00	3193.00	3193.00
Crude protein %	22.77	19.02	19.02	19.02
Calcium	1.14	1.00	1.00	1.00
Phosphorous total	0.75	0.69	0.69	0.69
Methionine	0.52	0.41	0.50	0.50
Lysine	1.48	1.10	1.06	1.10

Table 2. The composition and calculated nutrients composition of broiler finisher (3-7w) diets with different level of crude protein supplemented with methionine and lysine.

Ingredients	Percent CP and limiting amino acids in treatments diets			
	T1=20 % CP	T2=16 % CP+ Lys	T3=16 % CP+ Met	T4=16 % CP + Met & Lys
Rice polish	20.00	25.00	25.00	25.00
Maize grits	40.00	48.00	48.00	48.00
Fish meal	5.00	2.00	2.00	2.00
Soybean meal	23.00	15.00	15.00	15.00
Mustard oil cake	5.00	4.00	4.00	4.00
Soybean oil	5.00	4.00	4.00	4.00
Salt	0.25	0.25	0.25	0.25
Bone meal	0.75	0.75	0.75	0.75
Lime stone	0.50	0.50	0.50	0.50
Vitamin + mineral mixture	0.50	0.50	0.50	0.50
Methionine	0.00	0.00	0.03	0.03
Lysine	0.00	0.16	0.00	0.16
Total	100.00	100	100	100
Calculated nutrients content				
Metablizable energy (ME Kcal/kg)	3164.00	3214.00	3214.00	3214.00
Crude protein %	20.06	16.17	16.17	16.17
Calcium	0.87	0.90	0.90	0.90
Phosphorous total	0.73	0.73	0.73	0.73

Methionine	0.44	0.35	0.38	0.35
Lysine	1.18	1.00	0.84	1.00

Data collected in experiment were analyzed by following completely randomized design (CRD) using linear model (Statistx, 1996) in a personal computer. Tukey's W-procedure (Steel and Torrie, 1960) was used to calculate treatments mean comparison.

RESULTS AND DISCUSSION

1. Feed consumption

1 –4th week of feeding period (starter)

Table 3 present the average weekly cumulative feed consumption (g/bird) of broiler fed with different levels of methionine and lysine from 1 – 4th week feeding period. The highest feed consumption was recorded at 4th week of feeding period from methionine and lysine supplemented group followed by methionine supplemented group. The lowest consumption was observed from control (23 % CP) group.

Table 3. Average weekly cumulative feed consumption (g/bird) of broiler fed with different level of methionine and lysine from 1 – 4th week feeding period.

	Weekly feed consumption (g/bird)			
Treatments (starter diets)	1st	2nd	3rd	4th
23%CP	103.32	410.66	792.88	1315.06
19%CP+lys	105.88	424.08	861.54	1521.39
19%CP+met	97.20	409.90	877.10	1604.10
19%CP+lys & met	106.51	431.41	975.18	1644.54
Mean	103.23	419.01	876.67	1521.27
CV%	8.73	6.90	11.49	11.38
Probability	0.46	0.66	**0.056**	**0.011**
Tukeys value (0.05) for comparison	18.62	60.10	172.16	255.45

5 –7th week of feeding period (finisher)

Average weekly cumulative feed consumptions (g/bird) of broiler fed with different levels of methionine and lysine from 4 – 7th week of feeding period iare presented in table 4. The highest feed consumption was recorded from methionine and lysine supplemented group followed by methionine supplemented group and the lowest from control group up to 6th week of feeding period. At 7th week no significant difference was observed.

Table 4. Average weekly cumulative feed consumption (g/bird) of broiler fed with different level of methionine and lysine from 5 – 7th week feeding period.

	Weekly feed consumption (g/bird)		
Treatments (finisher diets)	5th	6th	7th
20%CP	2012.14	2882.86	3814.52
16%CP+lys	2257.26	3192.74	4095.63
16%CP+met	2301.10	3225.90	4091.10

16%CP+lys & met	2411.79	3413.70	4384.53
Mean	2245.58	3178.80	4096.44
CV%	9.71	8.91	7.88
Probability	**0.03**	**0.027**	**0.062**
Tukeys value (0.05) for comparison	347.34	442.11	545.33

In both the cases (starter and finisher), the feed consumption trend was found similar to the feed consumptions reported in NRC (1994). The highest feed consumption from methionine and lysine supplemented group indicate that balance of essential amino acids in particular limiting ones is of greater importance then the content crude protein in the diets of the broiler chicks.

2. Body weight

1 – 4th week of feeding period (starter)

Table 5 present the average initial and weekly body weight (g/bird) of broiler fed with different level of methionine and lysine from 1 – 4th week feeding period. There was no significant differences were observed in initial weights of chicks assigned to 4 different dietary group. But the highest body weight was recorded from methionine and lysine supplemented group followed by lysine supplemented group. The lowest was observed from nonsupplemented group (control).

Table 5. Average initial and weekly body weight (g/bird) of broiler fed with different level of methionine and lysine from 1 – 4th week feeding period.

Treatments (starter diets)	Initial wt. (g/b)	Weekly body weight (g/bird)			
		1st	2nd	3rd	4th
23%CP	46.40	99.20	202.00	350.40	617.42
19%CP+lys	46.02	104.00	225.96	413.75	726.00
19%CP+met	46.10	100.00	209.20	386.40	711.60
19%CP+lys & met	46.22	105.00	225.16	441.35	774.13
Mean	46.19	102.05	215.58	397.97	707.29
CV%	1.30	5.41	6.56	9.37	9.33
Probability	0.68	0.26	**0.01**	**0.001**	**0.001**
Tukeys value (0.05) for comparison	0.97	10.40	19.16	31.17	69.69

5 – 7th week of feeding period (finisher)

Average body weight (g/bird) of bird fed with different level of methionine and lysine from 1 to 7th week of feeding period are presented in table 5 & 6. Significant differences on average body weight of chicks from 4 dietary treatment groups were observed in 2nd and 6th week of feeding period. But in 7th week of feeding period no significant differences were recorded. The highest body weight was observed from methionine and lysine supplemented group followed by lysine supplemented group. The lowest was observed from control group.

Table 6. Average initial and weekly body weight (g/bird) of broiler fed with different level of methionine and lysine from 1 – 4th week feeding period.

Treatments (finisher diets)	Initial wt. (g/b)	Weekly body weight (g/bird) 5th	6th	7th
20%CP	46.40	956.56	1324.22	1636.67
16%CP+lys	46.02	1025.60	1384.55	1621.27
16%CP+met	46.10	993.00	1384.00	1628.00
16%CP+lys & met	46.22	1081.41	1501.66	1774.51
Mean	46.19	1014.14	1398.61	1665.11
CV%	1.30	7.88	6.03	7.25
Probability	0.68	**0.05**	**0.004**	0.21
Tukeys value (0.05) for comparison	0.97	45.98	110.91	220.14

Weekly body weight of chicks (in both cases) from this study is comparable to results reported by Santosa (2002) and NRC (1994). The highest body weight recorded from methinine and lysine supplemented group may be due to the effect of balance of these two limiting amino acids in the diets.

3. Body weight gain

1 – 4th week of feeding period (starter)

Table 7 presents the average daily body weight gain (g/bird/d) of broiler chicken fed with different levels of methionine and lysine from 1- 4th week of feeding period. Significant differences were observed in daily body weight gain of chicks in 2nd 3rd and 4th week of feeding period. The highest body weight gain was recorded from methionine and lysine supplemented group followed by lysine supplemented group. The lowest was observed from nonsupplemented group (control).

Table 7. Average daily body weight gain (g/bird/d) of broiler fed with different level of methionine and lysine from 1 – 4th week feeding period.

Treatments (starter diets)	Daily body weight gain (g/bird/d) 1st	2nd	3rd	4th
23%CP	7.54	14.69	21.20	38.15
19%CP+lys	8.28	17.42	26.83	44.61
19%CP+met	7.70	15.60	25.31	46.46
19%CP+lys & met	8.40	17.17	30.88	47.54
Mean	7.98	16.22	26.06	44.19
CV%	9.86	9.20	15.117	11.97
Probability	0.27	**0.002**	**0.002**	**0.001**
Tukeys value (0.05) for comparison	0.97	1.75	1.74	3.17

5 – 7th week of feeding period (finisher)

The average daily body weight gain (g/bird/d) of broiler fed with different level of methionine and lysine from 5- 7th week of feeding period arwe presented in table 8. Significant differences were recorded in 5th week of feeding period. However, in rest of

the period (6^{th} and 7^{th}) there were no significant differences were observed among the treatments. In 5^{th} week of feeding period, the highest body weight gain was observed from methionine and lysine supplemented group followed by lysine supplemented group.

Table 8. Average daily body weight gain (g/bird/d) of broiler fed with different level of methionine and lysine from 5 – 7^{th} week feeding period.

	Daily body weight gain (g/bird/d)		
Treatments (finisher diets)	5^{th}	6^{th}	7^{th}
20%CP	48.45	52.52	44.63
16%CP+lys	42.80	51.28	33.82
16%CP+met	40.20	55.86	34.86
16%CP+lys & met	43.90	60.03	38.98
Mean	43.84	54.92	38.07
CV%	17.98	16.45	29.27
Probability	**0.023**	0.46	0.43
Tukeys value (0.05) for comparison	8.25	15.13	16.64

Peng, et.al (2003) reported 31.20 – 32.88 g/d in 1- 3 week and 57.97 – 59.10 g/d average daily body weight gain of broiler fed with xylanase and phytase supplementation in wheat based diets. Similarly, Lee et.al (2003) reported that when chromium picolinate was supplemented on broiler diet the average daily body weight gain was 33.97 – 34.15 g/d in 1- 3 week and 76.27 – 79.07 in 3 – 6 week of feeding period. Results found in this study are in agreements with Peng, et.al (2003) and Lee, et.al (2003). The highest body weight gain recorded in methionine and lysine supplemented group may be due to effect of balanced diet (met & lys) compared to 23 percent CP diet. The second highest weight gain fed with lysine supplementation recorded in this study is in agreements with results of Kerr, et.al (1999) who reported that male broiler performances (body weight gain feed conversion) and breast meat yield are improved by feeding lysine level well above what is considered adequate by the NRC(1994). In an another study, Kerr, et.al (1999) also reported that feeding broilers diets containing 120 percent of NRC recommendations improves body weight gain, feed conversion, carcass yield, breast meat weight and breast meat yield.

4. Feed efficiency

Table 9 and 10 present the average weekly cumulative feed efficiency of broiler fed with different levels of methionine and lysine. In both cases no significant differences were recorded in cumulative feed efficiency.

Peng, et.al (2003) reported that when xylanase and phytase was supplemented in wheat based broiler diets, they found 1.35 – 1.40 in 1 – 3 week and 2.14 – 2.46 in 3 – 6 week feed to gain ratio. Same feed efficiency among the treatments found in this study, even reduced CP level, may be the effect of methionine and lysine supplementation. Reducing CP level from 23 to 19 percent in starter and 20 to 16 percent in finisher does not seem to effect the feed efficiency. This may be mainly due to the effect of the balance of the two limiting essential amino acids lysine and methionine in the diets of the broiler chicks.

Table 9. Average weekly cumulative feed efficiency of broiler fed with different level of methionine and lysine from 1 – 4th week feeding period.

	Weekly cumulative feed efficiency			
Treatments (starter diets)	1st	2nd	3rd	4th
23%CP	1.04	2.03	2.27	2.13
19%CP+lys	1.02	1.88	2.08	2.10
19%CP+met	0.97	1.97	2.27	2.25
19%CP+lys & met	1.01	1.92	2.21	2.12
Mean	1.01	1.95	2.21	2.15
CV%	8.21	7.03	9.61	6.42
Probability	0.72	0.377	0.57	0.44
Tukeys value (0.05) for comparison	0.17	0.26	0.43	0.28

Table 10. Average weekly cumulative feed efficiency of broiler fed with different level of methionine and lysine from 5 – 7th week feeding period.

	Weekly cumulative feed efficiency		
Treatments (finisher diets)	5th	6th	7th
20%CP	2.11	2.17	2.33
16%CP+lys	2.21	2.31	2.53
16%CP+met	2.31	2.33	2.52
16%CP+lys & met	2.23	2.27	2.47
Mean	2.22	2.27	2.46
CV%	6.56	5.28	5.25
Probability	0.18	0.25	0.06
Tukeys value (0.05) for comparison	0.25	0.23	0.21

CONCLUSION

The results of the study indicate that supplementation of the synthetic amino acids such as lysine and methionine has been good in improving feed consumption and also in increasing the body weights of the broiler chicks. It can therefore, be concluded that country like Nepal should not try to emphasize more on the balance of nutrients such as protein, carbohydrate, minerals and vitamins, but should also try to balance the composition of the individual nutrient like amino acids of protein. This will certainly helps reduce the cost of the expensive protein feed ingredients in the diets of the broiler chicks. Side by side low level of crude protein in the diets will also help reduce the nitrogen excretion from the gut and ultimately help in the reduction of the environmental pollution.

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