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Keywords : *QPM feeding, synthetic lysine and methionine, broiler chicken, Nepal.*

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Evaluation of Quality Protein Maize (QPM) and Normal Mazie for Growth Performance of Broiler Chicken in Nepal

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Abstract - An experiment was carried out on Cob 500 broiler chickens at Swine and Avian Research Program, Khumaltar, Lalitpur to evaluate the growth performance of broiler chicken fed with normal Vs QPM based diet and with supplementation of synthetic lysine and methionine in both maize for 54 days (16 days starter and 38 days for finisher). The experimental day old birds were procured from Valley Feed, Bajalu, Kathmandu and were allotted into four treatments with three replications having 15 birds in each replication by using Complete Randomized Design (CRD). All experimental birds were vaccinated with F1 vaccine @ one drop / bird against Ranikhet at the first week and vaccinated with IB+ND vaccine against Gumbaro at 2nd and 5th weeks of experiment. Birds of T_1 were provided normal maize based diet, T_2 normal maize based diet with supplementation of synthetic lysine and methionine, T_3 QPM based diet and T_4 QPM based diet with supplementation of synthetic lysine and methionine. Concentrate mixture feeding was done on group basis and was provided to the experimental birds of all groups once a day (morning) in adlib amount for both periods (starter – 16 days and finisher – 38 days) of the experiment. Quantity of concentrate mixture given daily to the birds in groups weighed daily and refusal was weighed in the next morning. Experiment revealed that cumulative feed intake was found to be higher in QPM based diet group (5597 g) followed by QPM based diet with supplementation of synthetic lysine and methionine group (5403 g) and normal maize based diet with supplementation with synthetic lysine and methionine group (5377 g). The least feed consumption was recorded for normal maize based diet group (4937 g) which was none significant among diet groups. Similarly, total weight gain was found to be higher for QPM based diet with supplementation of synthetic lysine and methionine group (2180 g) followed by normal maize based diet with supplementation with synthetic lysine and methionine group (2141 g) and QPM based diet group (1996 g). The least weight gain was note in normal maize based diet group (1854 g) which was also none significant among diet groups.

Keywords : QPM feeding, synthetic lysine and methionine, broiler chicken, Nepal.

I. Introduction

Broiler is raised specifically for meat production. Typical broilers have white feathers and yellowish skin. Most commercial broilers bred for meat reach slaughter weight at between 5 to 7 weeks of age, although slower growing strains reach slaughter weight at approximately 14 weeks of age. Broiler chickens are most efficient converters of feed into animal protein in comparison to other domestic birds. The broiler farming need less capital, less space and give quick and early returns because of shorter generation intervals. In Nepal, there is high demand of broiler meat in the markets due to low price and remunerative value in comparison to other type of meat poultry industry. There are 39.5 million chickens in the Nepal (MoAC 2010/11). More than 60% of the population belongs to indigenous and rest is exotic origin.

Maize has become the world's chief animal feed. It provides more feed than any other grain. It is outstanding being high in energy, low in fibre and easily digested by most livestock species. Maize has remained a critical feed ingredient in monogastric diets particularly poultry. About 70% of maize produced worldwide is utilized in livestock feed. The normal maize varieties are low in lysine and tryptophan contents (NRC 1988 and FAO 2004).

QPM is a nutritionally superior cereal grain that possesses a higher proportion of two key amino acids, lysine and tryptophan, than is found in normal maize. QPM has amply demonstrated its superior performance as feed for monogastric animals, especially pigs and chickens. Chickens and pigs convert QPM feed into weight gain more efficiently than regular maize feed (Jarkin *et al.* 1970; Maner 1975 and Asche *et al*. 1985). The percentage of lysine content in QPM varied between 0.33 and 0.54 with an average of 0.38. This was 46 percent higher than normal maize, and QPM contained 66 percent more tryptophan (0.08%) than normal maize. These two amino acids allow the body to manufacture complete proteins (Palit and Babu 2003). Therefore, utilization of QPM can correct this deficiency and may be advantageous in the diets of monogastric animals (Hai *et al.* 2010).

Several research works conducted by different researchers around the world reported that broiler chicken fed with QPM was much better over normal maize fed broiler; however, feeding value of QPM has not been evaluated in poultry feed in Nepal. Therefore, an attempt was made to evaluate the feeding value of normal maize and QPM with or without supplementation of synthetic lysine and methionine on broiler chickens at

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II. Materials and Methods

a) Experimental Animals

The experiment was carried out on Cob 500 broiler chickens at Swine and Avian Research Program, Khumaltar, Lalitpur from 14 March to 6 May 2013 (069/12/1 to 070/1/23 BS) for 54 days (16 days starter and 38 days finisher). The experimental day old birds were procured from Valley Feed, Bajalu, Kathmandu and were allotted into four treatments with three replications having 15 birds in each replication by using Complete Randomized Design (CRD). All experimental birds were vaccinated with F1 vaccine @ one drop /bird against Ranikhet at the first week and vaccinated with IB+ND vaccine against Gumbaro at 2nd and 5th weeks of experiment.

b) Diet Composition

Feed ingredients such as normal maize, soybean cake, mustard cake, rice bran, mineral mixture, methionine, lysine, oil, DCP and salt were procured from "*Champadevi Feed Industries*", Chapagau, Lalitpur while QPM was bought from National Maize Research Program, Rampur, Chitawan and wheat grain from Agriculture Botany Division, Khumaltar, Lalitpur. Four types of concentrate mixture were composed for experimental birds; starter (22% CP) and finisher (18% CP) which are presented in Table 1, 2, 3 and 4.

Table 1 : Starter ration for 1-15 days for T_1 and T_3 group

Ingredient	Part	CP	ME Kcal	Methionine	Lysine	Ca	P
Normal Maize / QPM	46	3.68	1351.02	0.041	0.07	0.12	0.11
Soybean meal	15	6.01	307.05	0.087	0.36	0.04	0.09
Rice bran	10	1.08	293.70	0.020	0.45	0.01	0.12
Meat and bone meal	13	7.21	267.96	0.486	0.12	1.34	0.66
Oil	0.15	0.00	1155.00	0.000	0.00	0.00	0
Mineral	0.65	0.00	0.00	0.000	0.00	0.00	0
Salt	0.7	0.00	0.00	0.000	0.00	0.00	0
Mustard cake	13	4.05	277.68	0.089	0.02	0.00	0.09
Wheat grain	0	0.00	0.00	0.000	0.00	0.00	0
DCP	1.5	0.00	0.00	0.000	0.00	0.35	0.25
Total	**100**	**22.03**	**3652.41**	**0.72**	**1.02**	**1.86**	**0.66**

Table 2 : Starter ration for 1 - 15 days for T_2 and T_4 group

Ingredient	Part	CP	ME Kcal	Methionine	Lysine	Ca	P
Normal Maize/ QPM	46	3.68	1351.02	0.04	0.07	0.12	0.11
Soybean meal	15	6.01	307.05	0.09	0.36	0.04	0.09
Rice bran	10	1.08	293.70	0.02	0.45	0.01	0.12
Meat and bone meal	13	7.21	267.96	0.49	0.12	1.33	0.66
Oil	0.15	0.00	1155.00	0.00	0.00	0.00	0
Mineral	0.65	0.00	0.00	0.00	0.00	0.00	0
Salt	0.5	0.00	0.00	0.00	0.00	0.00	0
Mustard cake	13	4.05	277.68	0.09	0.02	0.00	0.09
Wheat grain	0	0.00	0.00	0.00	0.00	0.00	0
Lysine	0.1	0.00	0.00	0.00	0.10	0.00	0
Methionine	0.1	0.00	0.00	0.10	0.00	0.00	0
DCP	1.5	0.00	0.00	0.00	0.00	0.35	0.25
Total	**100**	**22.03**	**3652.41**	**0.82**	**1.12**	**1.85**	**0.66**

Table 3 : Finisher ration for 16 - 54 days for T_1 and T_3 group

Ingredient	Part	CP	ME Kcal	Methionine	Lysine	Ca	P
Normal maize / QPM	40	3.20	1175	0.04	0.08	0.10	0.10
Soybean meal	10	4.01	205	0.06	0.24	0.03	0.06
Rice bran	10	1.08	294	0.02	0.45	0.01	0.12
Meat and bone meal	9	4.99	186	0.34	0.08	0.93	0.46
Oil	0.15	0.00	1155	0.00	0.00	0.00	0.00
Mineral	1.15	0.00	0	0.00	0.00	0.00	0.00
Salt	1.2	0.00	0	0.00	0.00	0.00	0.00

Mustard cake	11	3.43	235	0.08	0.21	0.00	0.08
Wheat grain	16	2.10	59	1.09	0.51	0.02	0.04
DCP	1.5	0	0	0	0.00	0.35	0.25
Total	**100**	**18.80**	**3307**	**1.62**	**1.56**	**1.44**	**1.10**

Table 4 : Finisher ration for 16 - 54 days for T_2 and T_4 group

Ingredient	Part	CP	ME Kcal	Methionine	Lysine	Ca	P
Normal maize / QPM	40	3.20	1175	0.04	0.08	0.10	0.10
Soybean meal	10	4.01	205	0.06	0.24	0.03	0.06
Rice bran	10	1.08	294	0.02	0.45	0.01	0.12
Meat and bone meal	9	4.99	186	0.34	0.08	0.93	0.46
Oil	0.15	0.00	1155	0.00	0.00	0.00	0
Mineral	1.15	0.00	0	0.00	0.00	0.00	0
Salt	1	0.00	0	0.00	0.00	0.00	0
Mustard cake	11	3.43	235	0.08	0.21	0.00	0.08
Wheat grain	16	2.10	59	1.09	0.51	0.02	0.04
Lysine	0.1	0.00	0	0.00	0.10	0.00	0
Tryptophan	0.1	0.00	0	0.10	0.00	0.00	0
DCP	1.5	0.00	0	0.00	0.00	0.35	0.25
Total	**100**	**18.80**	**3307**	**1.72**	**1.66**	**1.44**	**1.10**

c) Experimental Diet

Following diets were formulated to the experimental broiler chickens (Table 5)

Table 5 : Experimental diets of the broiler

Treatment	Experimental diets
1	Normal maize included concentrate mixture
2	Normal maize included concentrate mixture + synthetic lysine and methionine
3	QPM included concentrate mixture
4	QPM included concentrate mixture + synthetic lysine and methionine

d) Feeding Regime

Concentrate mixture feeding was done on group basis and was provided to the experimental birds of all groups once a day (morning) in *adlib* amount for both periods (starter – 16 days and finisher – 38 days) of the experiment. Quantity of concentrate mixture given daily to the birds in groups weighed daily and refusal was weighed in the next morning. Drinking water was provided in adequate amount.

e) Chemical Analysis

The samples of feed ingredients were sent to the Animal Nutrition Division, Khumaltar, Lalitpur for proximate analysis. Representative samples from offered concentrate mixture were analyzed for Dry Matter (DM), Crude Protein (CP), Crude Fibre (CF), Ether Extract (EE) and Ash contents (TA). The DM was determined by oven drying at 100°C for 24 hrs. Crude protein of the samples was determined using the Kjeldahl method. Ether extract was determined using Soxhlet apparatus. Ash content was determined by ashing at 550°C in a muffle furnace for 16 hrs (AOAC 1980). Crude Ether of the samples was determined using the Van Soest method (Goering, H.K. and Van Soest 1970). Similarly, samples of normal maize and QPM were sent to Food Research Division, Khumaltar, Lalitpur for tryptophan and lysine content analysis. Tryptophan was analyzed as suggested by Hornandez H. and Bates L.S. (1969) and Lysine as suggested by Doll H. and Koie B. (1975).

f) Data Measurement

The trial period consisted for 54 days (16 days starter and 38 days finisher). Total feed intake by the experimental birds in the group was recorded daily for both experimental periods. The body weight gain was measured in group basis (replication-wise) in seven days interval in the morning before feeding.

g) Data Analysis

Data of feed intake and body weight gain were analyzed by "***One way Annova***" test for every measurement using statistical package Minitab 2003, versions 13.20

III. Results and Discussion

a) Chemical Composition of feed ingredients

The result of chemical analysis and amino acids content are given in Table 6.

Table 6 : Chemical composition of feed ingredients (% DM basis)

Ingredients	DM	OM	TA	CP	CF	EE
Normal maize	87.69	97.97	2.03	9.0	2.34	4.48
QPM	89.36	97.62	2.38	9.0	6.26	5.12
Rice bran	87.85	89.5	10.5	10.0	4.83	5.1
Mustard cake	87.27	90.5	9.5	35.0	11.23	NA
Soybean cake	86.87	92.63	7.37	46.29	9.38	0.7
Wheat grain	93.0	91.3	8.7	14.0	8.45	NA
Meat cum bone meal	93.22	67.2	32.8	49.93	3.43	NA

Comparison of nutrient content of QPM and normal maize is given in Table 7

Table 7 : Comparison of the nutritional composition of QPM and Normal maize (on dry basis)

Nutrient	Ortega, *et al*.1986		Osei *et al*. 1999		Our analysis 2012	
	Normal maize	QPM	Normal maize	QPM	Normal maize	QPM
Crude Protein, %	9.8	9.8	8.92	9.11	9	9
Ether Extract, %	NA	NA	4.48	5.12	4.48	5.12
Crude Fibre, %	NA	NA	1.93	2.14	2.34	6.26
Organic matter	NA	NA	98.10	98.40	97.97	97.62
Ash, %	NA	NA	1.90	1.60	2.03	2.38
Lysine, %	0.27	0.43	0.24	0.32	0.19	0.28
Tryptophan, %	0.06	0.10	0.06	0.08	0.04	0.07

b) Feed Intake

The average feed intake of experimental birds has been presented in Table 8.

Average feed intakes of experimental birds were observed 17.05 g in 7 days which reached 5328 g by the end of experiment (54 days) which was none significant among diet groups. Feed intake of QPM based diet group (T_3) was higher than that of normal maize based diet group (T_1) from beginning to the end of experiment which was highly significant ($P<0.001$) in 22 days and 29 days ($P<0.001$) of experiment while rest of period was none significant. Supplementation of synthetic lysine and methionine in QPM based diet group (T_4) performed higher feed intake in 36 days (124.4 g) and 43 days (151.96 g) of experiment only whereas in other periods normal maize based diet with supplementation of synthetic lysine and methionine groups (T_2) had more feed intake. The cumulative feed intake was found to be higher in T_3 (5597 g) followed by T_4 (5403 g) and T_2 (5377 g). The least feed consumption was recorded for T_1 group (4937 g) which was none significant among diet groups.

Table 8 : Feed intake of experimental birds, g (Mean ± SD)

TRT	Days								Cumulative feed intake
	7	15	22	29	36	43	50	54	
1	16.23±0.17	36.03±1.64	64.69±0.57	90.88±2.02	107.21±10.23	132.73±9.02	148.30±17.91	153.18±5.81	4937±0.3
2	17.38±1.19	39.50±0.74	77.72±1.22	110.95±4.1	118.66±6.46	121.6±24.65	163.55±29.9	166.53±14.92	5377±0.52
3	17.28±0.83	37.45±0.60	70.40±0.67	107.07±3.43	121.05±11.43	144.73±2.22	177.87±4.34	173.29±4.19	5597±0.11
4	17.32±0.55	37.71±1.81	70.90±2.09	103.75±2.38	126.4±6.88	151.96±6.24	158.25±21.20	148.46±14.32	5403±0.28
Mean	17.05±0.83	37.67±1.07	70.93±4.94	103.16±8.3	118.33±10.61	137.76±16.72	161.99±20.74	160.37±13.99	5328±0.38
P- value	P>0.05	P>0.05	P<0.001	P<0.001	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05

c) Growth Performance

The growth trend of experimental birds is presented in Table 9 and figure 1

Table 9 showed that initial body weight of experimental birds was 46 g, 45 g, 46 g and 45 g for T_1, T_2, T_3 and T_4, respectively which reached 1854 g, 2141 g,1996 g and 2180 g at the end of experiment (54 days). Both intial and final body weighs were none significant among the diet groups. Body weight gain of QPM fed group (T_3) was found to be higher from beginning to the end of experiment than that of normal maize fed group (T_1), however, significant effect of QPM feeding

was observed from 22 to 50 days of experiment while 7, 15 and 54 days of feeding was none significant. Supplementation of synthetic lysine and methionine in normal maize based diet group (T_2) performed higher body weigh gain from 7 to 36 days of experiment than that of QPM based diet with supplementation of synthetic lysine and methionine (T_4). Thatfater, from 43 to 54 days of experiment QPM based diet with supplementation of synthetic lysine and methionine (T_4) performed better in body weight gain. Effect of synthetic lysine and methionine supplementation in normal maize and QPM based diet on body weight gain of experimental birds was significant from 22 to 50 days of experiment while 7, 15 and 54 days of feeding was none significant. The total weight gain was found to be higher for T_4 (2180 g) followed by T_2 (2141 g) and T_3 (1996 g). The least weight gain was note in T_1 (1854 g) which was also none significant among diet groups.

Table 9 : Body weight gain of experimental birds, g (Mean± SD)

TRT	Days									
	0	7	15	22	29	36	43	50	54	Total weight gain
1	46±0	114±0	250±0.01	479±0.01	755±0.02	957±0.06	1228±0.07	1305±0.12	1928±0.04	1854±0.06
2	45±0	120±0	271±0	560±0.01	915±0.03	1199±0.01	1465±0.09	1944±0.12	2204±0.08	2141±0.08
3	46±0	115±0	252±0.01	499±0	811±0.01	982±0.03	1347±0.07	1883±0.28	2061±0.07	1996±0.08
4	45±0	112±0	249±0.01	528±0.03	866±0.01	1184±0.08	1547±0.11	2021±0.23	2233±0.32	2180±0.32
Mean	46±0	115±0	255±0.01	517±0.03	837±0.06	1080±0.12	1396±0.14	1788±0.34	2107±0.19	2042.75±0.14
P -Value	P>0.05	P>0.05	P>0.05	P<0.01	P<0.001	P<0.01	P<0.05	P<0.05	P>0.05	P>0.05

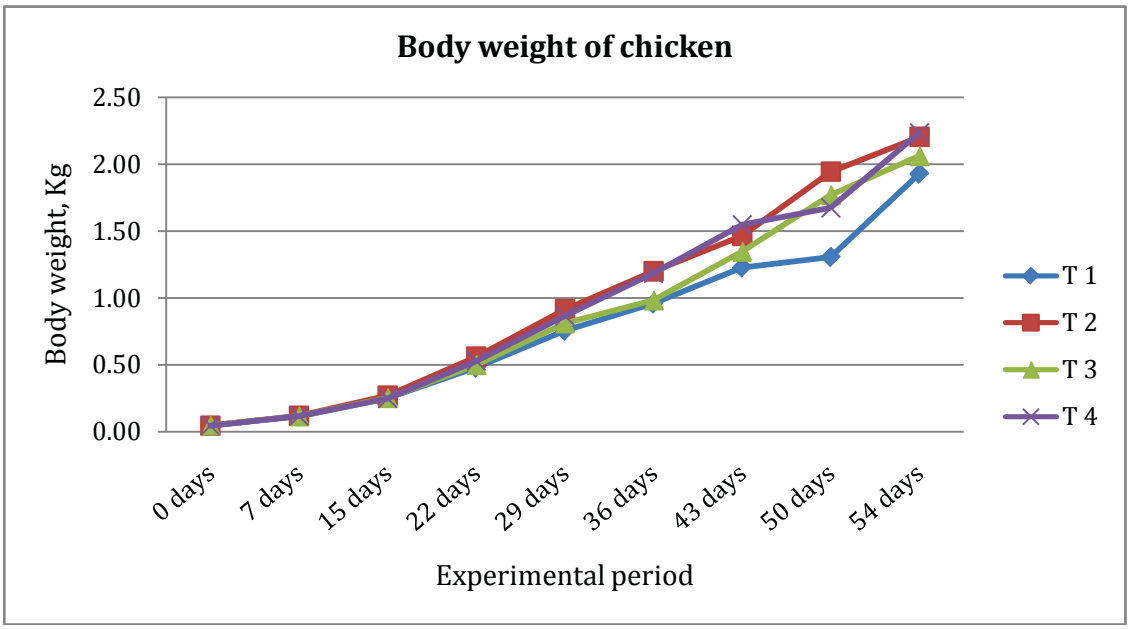

Figure 1 : Body weight gain trend of experimental birds

IV. Discussion

The objective of this study was to evaluate the growth performance and feed intake of broiler chickens fed with normal maize and QPM with or without supplementation of synthetic lysine and methionine in diets. Experiment revealed that there was no significant effect on total body weight gain and cumulative feed intake among normal maize and QPM diet group with or without supplementation of synthetic amino acids. It might be due to the variation in nutrient composition among the QPM cultivars.

Tyagi *et al.* (2008) did not find any significant difference with respect to body weight gain, feed

conversion and nutrient utilization efficiencies by feeding QPM diet to broiler chickens compared to those fed the normal maize diet. These variations noticed on the performance could be attributed to variation in nutrient composition among the QPM cultivars used in different studies. Bai (2002) reported that there was no significant difference between normal maize and QPM feeding to carcass percentage, abdominal fat percentage, percentage of eviscerated yield and percentage of eviscerated yield with giblets. At a given digestible lysine content, using QPM tended to increase weight gain but there was no statistical evidence to support this ($P>0.10$). Groote (2000) conducted an experiment by feeding normal maize and QPM to broiler chicken and noted that feed intake of both groups increased from 18.7 grams/bird/day in the first week, to 179.0 g/bird/day in the sixth week and tests showed no significant differences between the two diets (at the 5% level). Total feed intake over the six weeks was 3.38 kg/bird for the broilers on either diet, again with no significant difference between the two diets ($F = 0.265$, $p = 0.994$). Weight gain over the six weeks averaged 36.17 grams/ bird/day for broilers fed regular maize and 36.19 g/bird/ day for those fed on QPM diets and no statistical differences were found. Feed conversion efficiency, calculated as the weight gain over the feed intake, was 0.33 for both diets. In another experiment, he observed that dietary substitution of normal maize with QPM did not have any effect on body weight gain and feed consumption. However, feed conversion ratio was significantly ($P<0.01$) improved by substituting normal maize by QPM or supplementing lysine to normal maize based diet.

Nevertheless, Onimisi *et al*. (2009) reported that QPM in poultry diet improved growth performance of broilers and resulted into higher weight gains than normal maize. QPM did not result into significant changes on carcass and organ development of broilers. Amonelo and Roxas (2008) reported that broilers fed with either normal maize or QPM based diet had higher ($P<0.05$) live weight gain compared to those fed diets supplemented with synthetic lysine. Broilers fed either the QPM based diet or those supplemented with synthetic lysine had lower ($P<0.05$) feed consumption compared to broilers fed with normal maize diet. Broilers fed with QPM based diet had the best performance ($P<0.05$) in terms of feed efficiency. Ose *et al*. (2002) Birds receiving QPM as the sole source of amino acids performed significantly better *(*$P<0.05$*)* than their counterparts fed on normal maize. QPM fed birds weighed an average 708.0 g each at the end of the trials compared with 532.0 g for those on normal maize. The corresponding feed efficiencies were 4.28 and 6.55, respectively. Compared with birds on the balanced diet, however, QPM was inadequate in supporting broiler growth.

V. Conclusion

This experiment revealed that quality protein maize varieties that are available in Nepal are to be crossed with local varieties due to which content of essential amino acids such as lysine and tryptophan is reduced than as mentioned in literatures. Therefore, QPM could not exhibit better performance over normal maize on total weight gain and cumulative feed intake of broiler chickens.

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