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By M.R. Tiwari, P.B. Chapagain, M.K. Shah & Y.K. Shrestha

Regional Agricultural Research Station, Lumle, Kaski

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Keywords : *quality protein maize, pigs, feeding, Nepal.*

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Evaluation of Quality Protein Maize (QPM) and Normal Mazie for Growth Performance of Crossbred Piglets in Wester Hills of (Nepal)

M.R. Tiwari [α], P.B. Chapagain [σ], M.K. Shah [ρ] & Y.K. Shrestha [ω]

Abstract - The pig population of the country is estimated to be 1.1 million and producing 17923 MT meats per annum. The pig farming constitutes the livelihood of rural poor belonging to the lowest socio economic strata and they have no means to undertake scientific pig farming with improved stock, proper housing, feeding and management. Maize is a primary source of energy supplement and can contribute up to 30 percent protein, 60 percent energy and 90 percent starch in animal's diet. About 70- 80 percent of maize production is used as a feed ingredient in the world. QPM is high in energy, low in fiber, and contains approximately 9-12% crude protein with two essential amino acids lysine and tryptophan. Pigs and chicken raised on QPM attained body weight at roughly twice the rate of animal fed with normal maize. Therefore, a study was carried out on growing crossbred male piglets (Landrace x Yorkshire) piglets of 35 days old with body weight of 8 kg at Regional Agricultural Research Station, Lumle, Kaski for 150 days to compare the growth performance of piglets fed with QPM and normal maize. Piglets were allocated into two groups having six piglets in each group by using Complete Randomized Design (CRD). Two types of concentrate mixture were prepared for piglets; starter (18% CP) and grower (16% CP). Piglets of T1 were provided adlib amount of normal maize included concentrate mixture whereas piglets of T2 received QPM included concentrate mixture in adlib amount. Concentrate mixture was provided to the piglets of both groups twice a day for both periods (starter–60 days and grower–90) of experiments. Experiment of 150 days revealed that average feed intake of T2 was higher (1.65kg/day/piglet) than T1 (1.48kg/day/piglet), however, it was not significant (P>0.05), between diet groups. Furthermore, total dry matter intake was higher in T2 (235.12 kg) than T1 (210.9 kg) whereas, feed conversion ratio (FCR) per kg live weight gain was higher for T2 (3.26:1 kg) than T1 (2.6:1 kg) which was not significant (P>0.05) between diet groups. Similarly, total body weight gain of experimental piglets was recorded higher in T1 (80.92 kg) than T2 (72.2 kg) which was also non-significant (P>0.05) between diet groups. Average daily gain of piglets was 571 and 511.0g for T1 and T2, respectively.

Keywords : *quality protein maize, pigs, feeding, Nepal.*

Author α : Animal Nutritionist, National Animal Science Research Institute, Khumaltar, Lalitpur. E-mail : tiwari65@yahoo.com
Author σ : Technical Officer, Regional Agricultural Research Station, Lumle, Kaski.
Author ρ : Scientist, Regional Agricultural Research Station, Lumle, Kaski.
Author ω : Senior Scientist, Regional Agricultural Research Station, Lumle, Kaski.

I. Introduction

The pig population of the country is estimated to be 1.1 million and producing 17923 MT meats per annum, that accounts 4.75% of total livestock population and 6.45 % of total meat production of the country (MOAC, 2010/11). The pig farming constitutes the livelihood of rural poor belonging to the lowest socio economic strata and they have no means to undertake scientific pig farming with improved stock, proper housing, feeding and management. The importance of pig is highest feed conversion efficiency, can utilize wide range of feedstuffs, highly prolific with shorter generation interval, requires small investment on building and equipments and dressing percentage ranges 65-80% in comparison to other livestock species. Similarly, pork is most nutritious with high fat and low water content and has better energy value than that of other meats. It is rich in vitamins like thiamin, niacin and riboflavin. Moreover, pig farming provides quick return since the marketable weight of fatteners can be achieved within a period of 6-8 months and has good demand in domestic as well as export markets for pig products such as pork, bacon, ham, sausages, lard etc.

In recent days, acceptance of pork consumption has been growing in the Nepalese society; therefore, rearing of pig and consumption of pork is not culture or religion dependent. Simultaneously, increased urbanization and individuals access to cross cultural environments has increased the acceptance of pork in almost all societies of the country (Dhauwadel and Ghimire, 2004). As the internal production is not sufficient to meet the demand of the nation, live pigs worth of NRs 470.26 million and frozen pork of worth NRs 327.02 million was imported during 2010/11 period (MOAC, 2010/11).

Maize is a primary source of energy supplement and can contribute up to 30 percent protein, 60 percent energy and 90 percent starch in animal's diet. About 70-80 percent of maize production is used as a feed ingredient in the world. Although, normal maize contains between eight and nine percent protein, the quantity of two essential amino acids (lysine and tryptophan) is below nutritional requirement for mono gastric animals. QPM possess balance of essential amino acids and can reduce the dietary inclusions of protein - rich

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ingredients such as fishmeal and synthetic lysine and thereby resulting savings on the cost of feed and making animal products more affordable (Okai *et al.*, 2005; Vasal, 2006). Researchers (Ortega *et al.*, 1986; Sproule *et al.*, 1988; Osei *et al.*, 1999) have compared the chemical composition of QPM with normal maize. The percentage lysine content of 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 percent) than normal maize. Therefore, utilization of QPM can correct this deficiency and may be advantageous in the diets of livestock and monogastric animals (Hai *et.al*, 2010). QPM contains nearly twice as much usable protein as other maize grown in the tropics and yields 10% more grain than traditional varieties of maize. These two amino acids allow the body to manufacture complete proteins (Palit and Babu, 2003).

Several research works conducted by different researchers around the world reported that performance of piglets fed with QPM was much better over normal maize fed piglets; however, feeding value of QPM has not been evaluated adequately in pigs and poultry in Nepal. Therefore, an attempt was made to evaluate the feeding value of normal maize and QPM on growing piglets at Regional Agricultural Research Station Lumle, Kaski of western hills.

II. Methodology

a) Experimental Animals

The experiment was carried out on growing crossbred male piglets (Landrace x Yorkshire) at Regional Agricultural Research Station, Lumle, Kaski from 13 December 2011 to 13 May 2012 (068/8/28 to 069/1/28). The experimental piglets were procured from Livestock Farm, Lampatan, Pokhara, Kaski of about 35 days old with average body weight of 8.0 kg were allotted into two groups having six piglets in each group by using Complete Randomized Design (CRD). All experimental animals were drenched with Fenbendazole @ 5 mg/kg body weight against internal parasites and vaccinated with swine fever vaccine @ 1ml/kg body weight before putting in the experiment.

b) Diet Composition

Feed ingredients such as soybean cake, rice bran, normal maize, minerals, methionine and salt were procured from "*Khowpa Feed Industries",* Bhaktapur while QPM was bought from National Maize Research Program, Rampur, Chitawan. Two types of concentrate mixture were composed for experimental animal; starter (18% CP) and grower (16% CP) which are given in Table 1. Methionine was added in both concentrate mixture @ 100 g/100 kg of concentrate mixture.

Table 1 : Composition of concentrate mixture (in %)

Ingredients	Starter Ration		Grower Ration	
	Part	CP %	Part	CP %
Normal maize / QPM	50	3.94	50	3.94
Rice bran	16	1.42	22	1.95
Soy bean cake	32	12.68	26	10.30
Mineral	1	0	1	0
Salt	1	0	1	0
Total	**100**	**18.04**	**100**	**16.19**

c) Experimental Diet

Following diets were formulated to the experi-mental piglets (Table 2)

Table 2 : Experimental diets of the piglets

S/n	Treatment	Experimental Diets
1	1	Normal maize included concentrate mixture *adlib*
2	2	QPM included concentrate mixture *adlib*

d) Feeding Regime

Concentrate mixture feeding was done on group basis was provided to the piglets of both groups twice a day (morning and evening) in *adlib* amount for both periods (starter – 60 days and grower – 90 days) of the experiment. Quantity of concentrate mixture given daily to the piglets in groups weighed daily and refusal was weighed in the next morning. Drinking water was provided thrice a day 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

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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 quality protein maize were sent to Food Lab of Agriculture Botany Division of NARC 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 150 days (60 days starter and 90 days grower) after an adaptation period of 7 days. Total feed intake by the piglets in the group was recorded daily for both experimental periods. The body weight gain of individual piglet was measured at biweekly interval in the morning before feeding.

g) Data Analysis

Data of feed intake and body weight gain were analyzed by **"t"** 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 3.

Table 3 : Chemical composition of feed ingredients (% DM basis)

Ingredients	DM	OM	TA	CP	CF	EE
Normal maize	87.69	97.97	2.03	9	2.34	4.48
Quality protein maize (QPM)	89.36	97.62	2.38	9	6.26	5.12
Rice bran	87.85	89.5	10.5	10	4.83	5.1
Soybean cake	86.87	92.63	7.37	44	9.38	0.7

Comparison of nutritional composition of QPM and NM is given in Table 4 and figure 1.

Table 4 : 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	
	NM	QPM	NM	QPM	NM	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

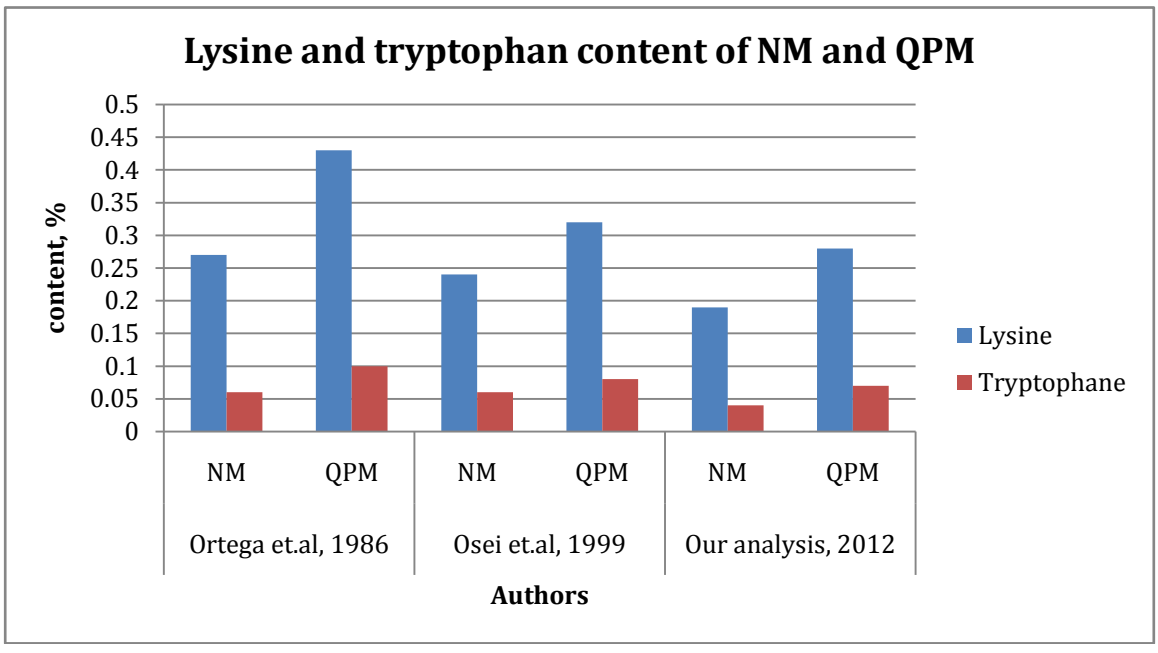

Figure 1 : Comparison of lysine and tryptophan content of QPM and normal maize

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b) Feed Intake

Average daily intake of concentrate mixture by piglets for both experimental periods is given in Table 5.

Table 5 : Average feed intake of experimental piglet/day

Concentrate Mixture	(Mean ± SE)	
	T1	T2
Starter (60 days)		
Feed intake, kg	0.82±0.11	0.83±0.13
Average daily gain, g	291±24.0	274.8±30.0
Total Dry Matter Intake (DMI) per animal, kg	46.74	47.31
Feed Conversion Ratio (Feed: Gain), kg	2.45:1	2.86:1
Grower (90 days)		
Feed intake, kg	2.29±0.35	1.74±0.26
Average daily gain, g	688.0±103	616±127.0
Total Dry Matter Intake (DMI) per animal, kg	195.8	148.77
Feed Conversion Ratio (Feed: Gain), kg	3.16:1	2.68:1
Entire trial period (150 days)		
Feed intake, Kg	1.48±0.34	1.65±0.27
Average daily gain, g	571±0.02	511±0.01
Total Dry Matter Intake (DMI) per animal (150 days), kg	210.9	235.12
Feed Conversion Ratio (Feed: Gain), kg	2.6:1	3.26:1

Table 5 revealed that in starter period, piglets of T2 had higher feed intake (0.83 kg), total dry matter intake (47.31 kg) and FCR (2.86:1 kg) than that of T1 which were for feed intake (0.82 kg), total dry matter intake (46.74 kg) and FCR (2.45:1 kg) whereas average daily gain was higher in T1 (291 g) than that of T2 (274.8 g). Feed intake and average daily gain were not significant ($P>0.05$) between diet groups. Similarly, in grower period of experiment, there was noted higher feed intake (2.29 kg), average daily gain (688 g) and total dry matter intake (195.8 kg) and FCR (3.16.1) in T1 than that of T2 which were for feed intake (1.74 kg), average daily gain(616 g), total dry matter intake (148 kg) and FCR (2.68:1 kg). In this period, average daily gain was not significant ($P>0.05$) and feed intake was significant ($P<0.01$) between diet groups. Likewise, in 150 days of experiment, T2 was recorded higher in feed intake (1.65 kg), total dry matter intake (235.12 kg) and FCR (3.26:1 kg) than that of T1 that were for feed intake (1.48 kg), total dry matter intake (210.9 kg) and FCR (2.6:1 kg) whereas average daily gain was noted higher in T1 (571 g) than that of T2 (511 g).

c) Growth Performance

The growth performance of experimental piglets is given in Table 5 and Figure 2.

Table 5 : Growth performance of piglets (Mean±SE)

Parameter	T1	T2
Initial Body weight, kg	8.08±0.47	8.15±0.37
Initial metabolic weight, kg	4.79	4.82
Final Body weight, kg	89.0±3.67	80.17±2.75
Final metabolic weight, kg	28.97	26.79
Total weight, gain, kg	80.92	72.02
Average daily gain, g	571±0.02	511±0.01

The initial body weight of experimental piglet of T1 and 2 was almost similar (8.08 and 8.15 kg) and reached 89.0 and 80.17 kg by the end of experiment (150 days) for T1 and 2, respectively. Both initial and final body weight was found to be not significant ($P>0.05$) between diet group. The highest body weight gain was recorded for T1 (80.92 kg) than that of T2 (72.02 kg). Similarly, highest average daily gain was observed for T1 (571 g) than that of T2 (511g), however, it varied from 248 to 773 g for T1 and from 195 to 722 g in T2.

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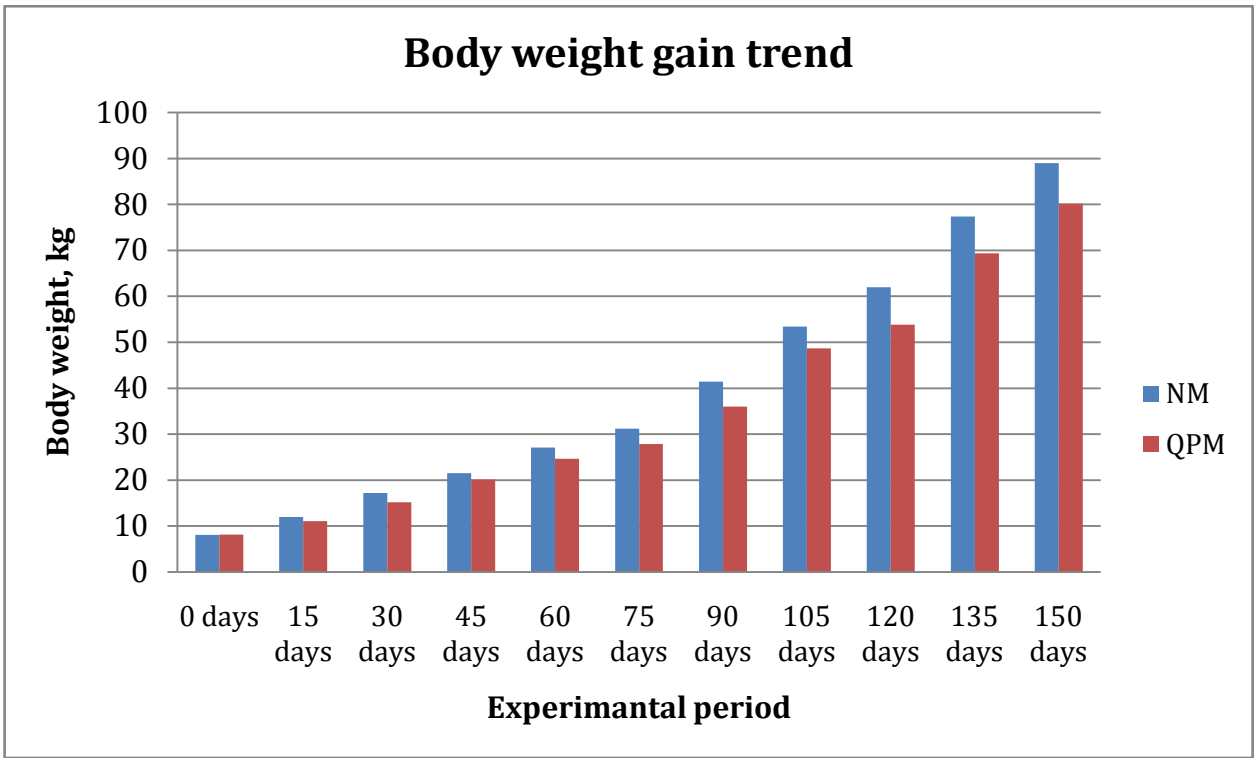

Figure 2 : Body weight gain of piglets fed with QPM and normal maize

IV. Discussion

This study was carried out with objective to compare the growth performance of crossbred piglets fed with normal maize and QPM incorporated concentrate mixture. Results of growth trial suggested that there was no significant ($P>0.05$) effect of QPM over normal maize on growth performance of piglets. It might be due to crossing of QPM with local varieties, subsequently it reduced the lysine and tryptophan content of QPM as mentioned in literatures, however, Cromwell *et.al*, (1967), Sihombing *et.al.* (1969), Marroquin *et.al.*, (1973), Maner (1975), Asche *et.al* (1985), Sullivan *et.al.* (1989) and Gao (2002) reported that QPM significantly ($P<0.05$) improved average daily gain and feed conversion ratio (FCR)) in all phase (starter, grower and finisher) of piglet fattening.

Anon (2012), reported that mean body weight of Giriraja chicken was higher in normal maize fed group (18.64±1.01 kg) than that of QPM fed group (17.21±1.28 kg), however, it was not significant between diet groups.

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 growth performance of growing piglets.

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