

Original Research Article

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Effect of Supplementation of HQPM-1 Maize Grain on Production Performances in Cross Bred (*Hampshire* x *Ghungroo*) Grower Pigs

Keshab Barman^{1*}, Santanu Banik¹, S. R. Pegu¹, Sunil Kumar¹, D. Konwar², P. J. Das¹, J. I. Rahman¹, A. K. Das¹, Swaraj Rajkhowa¹, S. L. Jat³ and Sujay Rakshit³

¹ICAR-National Research Centre on Pig, Guwahati, Assam, India

²FVSc & AH, SKUAST-Jammu, RS Pura, Jammu, India

³ICAR-Indian Institute of Maize Research, Ludhiana, India

*Corresponding author

ABSTRACT

Keywords

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Eighteen crossbred (HS x Ghungroo) grower pigs (weighing from 40.4 ± 1.31 to 40.69 ± 3.73) were divided into three groups using randomized block design and they were supplemented with 0, 50 and 100 % HQPM-1(Quality Protein Maize Hybrid variety-1) maize grain by replacing the normal maize to the basal diet and designated as T₁, T₂ and T₃ respectively. The protein content of the experimental diet was 18.12 ± 0.21 , 18.38 ± 0.04 and 18.44 ± 0.11 respectively in T₁, T₂ and T₃ groups while protein content of HQPM-1 maize grain was 9.39 ± 0.20 . Dry matter intake was found similar across the treatment groups. There was no significant difference on nutrient digestibility across the treatment groups. Similarly there was no significant difference on average daily gain (g/day), feed intake per kg gain (FCR) and feed cost per kg gain. However, FCR and feed cost per kg gain was found better at 50 % and 100 % replacement of normal maize with HQPM-1 maize in the diet. Feed cost per kg gain was reduced by Rs.4.30 and Rs.1.40 at 50 % and 100 % replacement of normal maize with HQPM-1 in crossbred grower pigs.

Introduction

Maize (*Zea mays*) grain is used as the major source of energy in pig diet. Maize constituting 50-60 % of the total dietary composition and about 90-100% of total energy source in the pig diet. Therefore, maize grain plays an important role in pig feeding. There are different varieties of maize grain namely yellow maize, white maize, quality protein maize (QPM) etc. However, they are differing in nutrient composition

(Snow *et al.*, 2004, Panda *et al.*, 2010). QPM has a higher nutritional value for livestock (Kaul *et al.*, 2019) and also reduce the requirement of feed by 3.4 % in pig ((Lopez-Pereira, 1992). Feeding QPM variety maize in livestock resulted in better performances as reported by different researchers (Omage *et al.*, 2009, Panda *et al.*, 2010, Panda *et al.*, 2014; Barman *et al.*, 2020). Normal maize protein is deficient in lysine and tryptophan and has less value for monogastric animals (Jia *et al.*, 2013). However, QPM variety

maize contains double the amount of lysine than normal maize (Panda *et al.*, 2010). The International Maize and Wheat Improvement Centre (CIMMYT) have developed many varieties of QPM (Nuss and Tanumihardjo, 2011). Quality Protein Maize has a hard endosperm rich in lysine and tryptophan. In broiler chick, feeding of QPM maize enhance the growth and meat quality while in layers improved age at first egg laying, egg production, and egg quality parameters (Eshetie, 2017). In pigs, feeding of QPM improved the FCR, reduce the cost of production, increasing average daily gain as reported by different researchers (Mpofu *et al.*, 2012; De-Quan and Shi-Huang, 1994) while no significant difference by replacing normal maize with QPM in pig as reported by Tiwari *et al.*, (2013). HQPM-1 is single cross hybrid variety quality protein maize. Protein content varies from 10.7 to 10.95 % as reported by other researchers (Carillo *et al.*, 2004; Sangeeta and Grewal, 2018). Although lots of research was conducted to find out feeding value of QPM in livestock, there is scanty of literature on use of HQPM-1 feeding in pigs. Therefore, present study was conducted with the objective to see its effect on substitution of normal yellow maize by different level of HQPM-1 in crossbred (HS x GH) grower pigs.

Materials and Methods

The experiment was conducted after approval from the institute animal ethics committee. Eighteen crossbred (HS x Ghungroo) grower pigs (weighing from 40.4±1.31 to 40.69 ± 3.73) were divided into three groups using randomized block design. Three different diets were used for feeding of the animals namely - T₁: standard grower ration without High Quality Protein Maize-1 (HQPM-1) grain, control diet, T₂: standard grower ration supplemented with 50% HQPM-1 grain, T₃: standard grower ration supplemented with

100% HQPM-1 grain mixed with required salt and mineral mixtures similar to standard diet. The nutrient requirement of pigs was made as per BIS (1986). The pigs were fed on the experimental grower rations twice daily in the morning and evening. The experiment was conducted for a period of 45 days. Digestibility trial was conducted at the end of the experiment. The lysine and methionine are balanced in all the rations as per requirement. The ingredient composition of the ration is given in Table 1. The calculated (ARC, 1977) energy (ME, Kcal/kg) of experimental diet was 3284.8, 3371.5 and 3003.5 respectively in T₁, T₂ and T₃ group. Proximate composition was done as per AOAC (1990).

Statistical analysis

Feed intake, nutrient digestibility, feed conversion ratio (feed gain ratio), feed cost per kg gain, average daily weight gain was subjected to a one-way ANOVA with experimental diet (T₁, T₂ and T₃) as fixed effect as per Snedecor and Cochran (1989). Differences were considered significant when P<0.05.

Results and Discussion

The protein content (% DM) of the ration was 18.12 ± 0.21, 18.38±0.04 and 18.44 ± 0.11 in T₁, T₂ and T₃ respectively and that of HQPM-1 and normal maize was 9.39 ± 0.05 and 8.53 ± 0.22 respectively. Nitrogen free extract content (% DM) of the ration was 63.35 ± 0.01, 64.35 ± 0.61 and 63.90 ± 0.09 to in T₁, T₂ and T₃ respectively and that of HQPM-1 and normal maize was 83.13 ± 0.14 and 84.33 ± 0.24 respectively (Table 2). Similar nutritional composition of QPM maize grain was also reported other researchers (Panda *et al.*, 2010; Sangeeta and Grewal, 2018). Similarly, Kaul *et al.*, (2019) also reported that protein composition of hybrid variety of QPM ranged from 8.86 to 10.80 %. The crude

protein, ether extracts and crude fiber content of HQPM-1 was found higher than normal maize. Similar result was also reported by Zhai *et al.*, (2002).

The digestibility coefficient of DM ranged from 78.72 ± 6.95 to 89.07 ± 5.22 in T₃ to T₁ respectively and other was within this range of variation. Similarly, CP digestibility ranged from 75.76 ± 4.93 to 87.22 ± 8.47 in T₃ to T₂ respectively and other was within this range of variation. The digestibility of OM, EE, CF and NFE was also followed the same patterns (Table 3). Nutrients digestibility was reduced (P>0.05) at 100% supplementation of HQPM-

1maize grain by replacing normal maize in comparison to control and 50 % substitution of normal maize grain with HQPM-1 maize. Nutrients digestibility was found higher (P>0.05) at 50% substitution of normal grain by HQPM-1 maize in comparison to control and 100 % substitution.

The reduction in digestibility of nutrients at 100 % replacement of normal maize grain with HQPM-1 grain might be due to other dietary factors. The reduction of DM digestibility by feeding QPM maize grain in pigs in comparison to normal maize was also reported by Landin *et al.*, (2014).

Table.1 Ingredient composition (wt/wt) of experimental ration

Ingredients	T ₁	T ₂	T ₃
Normal Maize (Yellow variety)	60.0	30.0	0.0
HQPM-1 Maize	0.0	30.0	60.0
Wheat bran	12.0	12.0	12.0
Ground nut cake	12.5	12.5	12.5
Soya bean meal	14.0	14.0	14.0
Mineral mixture	1.0	1.0	1.0
Salt	0.5	0.5	0.5
Total	100.0	100.0	100.0
Phytase, g	40.0	40.0	40.0
Lysine, g	100.0	100.0	100.0

T₁=0 % replacement of normal maize with HQPM-1, T₂=50 % replacement of normal maize with HQPM-1, T₃=100 % replacement of normal maize with HQPM-1

Table.2 Proximate composition of experimental diets

Ration	OM %	CP %	CF%	EE %	Ash %	NFE %
T ₁	93.38±0.03	18.12±0.21	9.39±0.19	2.48±0.01	6.62±0.03	63.35±0.01
T ₂	94.44±0.40	18.38±0.04	9.37±0.20	2.35±0.05	5.56±0.40	64.35±0.61
T ₃	93.67±0.01	18.44±0.11	9.41±0.18	1.92±0.21	6.33±0.01	63.90±0.09
HQPM-1 Maize	98.04±0.05	9.39±0.20	2.22±0.16	3.31±0.17	1.96±0.05	83.13±0.14
Normal maize yellow variety	97.82±0.06	8.53±0.22	2.04±0.04	2.92±0.12	2.18±0.06	84.33±0.24

T₁=0 % replacement of normal maize with HQPM-1, T₂=50 % replacement of normal maize with HQPM-1, T₃=100 % replacement of normal maize with HQPM-1

Table.3 Effect of supplementation of QPM on nutrient digestibility in growing crossbred pigs

Group	DM	OM	CP	EE	CF	NFE
T ₁	89.07±5.22	89.00±5.56	86.52±5.94	83.46±8.10	82.92±6.16	92.16±4.43
T ₂	88.87±5.84	89.61±5.49	87.22±8.47	89.56±6.32	82.48±8.44	92.46±3.45
T ₃	78.72±6.95	78.64±5.64	75.76±4.93	79.93±6.58	68.67±8.92	84.04±6.17
P Value	0.477	0.407	0.481	0.66	0.452	0.47

T₁=0 % replacement of normal maize with HQPM-1, T₂=50 % replacement of normal maize with HQPM-1, T₃=100 % replacement of normal maize with HQPM-1

Table.4 Effect of supplementation of QPM on nutrient utilization in growing crossbred pigs

Parameters	T ₁	T ₂	T ₃	P value
DM intake	1180.0±37.4	1180.0±20.0	1190.0±10.0	0.949
Initial weight	40.4±1.31	40.76±2.71	40.69±3.73	0.992
Final weight	54.78±1.19	55.24±2.65	54.66±3.71	0.992
growth	319.8±33.5	321.8±9.7	310.4±7.1	0.917
FCR	3.81±0.28	3.69±0.16	3.84±0.1	0.917
Feed cost/kg gain	102.3±7.5	98.0±4.2	100.9±1.9	0.832

T₁=0 % replacement of normal maize with HQPM-1, T₂=50 % replacement of normal maize with HQPM-1, T₃=100 % replacement of normal maize with HQPM-1

The dry matter intake (g/d) ranged from 1180.0 ± 37.4 in T₁ to 1190.0 ± 10.1 in T₃ group. The DM intake was found similar (P>0.05) across all treatment groups. In contrast to the present findings, Mpfu *et al.*, (2012) found reduced feed intake in weaner pigs by inclusion of QPM maize grain. The average gain in weight (g/d) was ranged from 310.4±7.1 in T₃ to 321.8±9.7 in T₂ group. The gain in weight was found higher (P>0.05) at 50 % inclusion of HQPM-1 in the diet in comparison to other two groups. Improvement in growth in pigs when supplemented with QPM by replacing normal maize was also reported by other researchers (Mbuya *et al.*, 2011; Yongfeng and Jay-Lin, 2016). The FCR was ranged from 3.69 ± 0.16 in T₂ to 3.81 ± 0.28 in T₁ group (Table 4). Dry matter intake and growth was found similar across all groups. However, FCR was improved (P>0.05) in T₂ group supplemented with 50 % HQPM-1 maize grain in comparison to 0% and 100 % HQPM-1 maize

grain supplemented groups. Improvement in FCR and growth upon supplementation of QPM in pig was also reported other researchers (Gao, 2002; Mpfu *et al.*, 2012).

The feed cost per kg gain (Rs/kg gain) ranged from 98.0 ± 4.2 in T₂ to 102.3 ± 7.5 in T₁ groups and other was within this ranged. Feed cost per kg gain was reduced (P<0.05) by Rs. 4.3 and 1.4 in T₂ and T₃ groups in comparison to T₁ group. Supplementation of QPM maize grains in pigs has reduced the cost of production as also reported by Mpfu *et al.*, (2012). Similarly, Omage *et al.*, (2009) also reported that feeding QPM to rabbits reduced cost of production.

From this study, it is concluded that supplementation of HQPM-1 maize grain at 50 % level in crossbred grower pigs result in better performances in comparison to 0 and 100 % replacement of normal maize with HQPM-1 maize grain.

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