



Nutritional Evaluation of Potato Meal on Growth Performance, Nutrient Utilisation, Blood Parameters and Economics in Growing Pigs

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ABSTRACT

The experiment was conducted for nutritional evaluation of potato meal as an energy source in growing pigs. For the study, 12 pigs were distributed into 3 treatment groups for 60 days, each treatment having 4 pigs. Three treatments comprised of T₁ - control diet, T₂ -potato meal replacing 25% of crude protein contributed by maize and T₃ - potato meal replacing 50% of crude protein contributed by maize. The pigs of all experimental groups were weighed individually at 15 days intervals. Digestion trial and blood collection was done at the end of the experiment. Control diets fed pigs had better (P<0.05) body weight gain, final body weight, average daily gain and FCR as compared those of groups T₂ and T₃. Blood parameter showed no significant difference among the groups, whereas blood parameters remained within the permissible limit. It was concluded that as the amount of potato meal increased, the gain in body weight and the digestibility of nutrients decreased.

Key words: Digestibility, Maize, Pigs, Potato meal

INTRODUCTION

Now a day's pig farming is one of the fastest growing agribusiness of the world. The success of pig farming is greatly dependent upon the continuous and assured supply of good quality feeds at competitive price. Rapid body weight gain with balanced and cheap ration in minimum time is the main aim of pig production. Researchers have been making efforts to optimize the cost of production by utilizing cheaper and readily available energy and protein sources to be incorporated into the pig ration. Potato (*solanum tuberosum*) is a root crop grown in several Asian nations that can be used as an alternative source. Raw potatoes are sufficiently available at a very low price during harvesting season in December-January in Northern India. Some studies had shown that corn can be replaced by potato (*solanum tuberosum* L.) in the diet to some extent (Felix D'mello *et al.* 1975). Chemical composition of potato on dry matter basis for swine is approximately 15% dry matter (DM), 9.2% crude protein (CP), 0.4% ether extract (EE), 2.9% crude fibre (CF) and 5.4% total ash. Digestible energy (DE) of maize *i.e.* 3700 (DE, kcal/kg) which is almost similar to potato *i.e.* 3630 (DE, kcal/kg), so it may be replaced

with potato meal as an energy source. So it will be advantageous to feed raw potato to animals which are excellent source of nutrients. Moreover, their utilization can also reduce the cost of feeding, giving higher profits to farmers. So this study was carried out for nutritional evaluation of potato meal as pigs feed.

MATERIALS AND METHODS

Potatoes were purchased from local market and washed with tap water to remove dirt. After rinsing with water, potatoes were mashed by using grinding machine. Mashed potatoes were put on roof top for sun drying. Later on, sun dried potatoes were grinded to make powder. The samples of different feed ingredients along with potatoes were analysed for proximate composition (AOAC, 2007). A total of 12, growing pigs of both sexes were procured from Piggery Farm of Department of Livestock Production Management, GADVASU, Ludhiana. Pigs were reared at GADVASU pig farm under standard conditions. Three experimental rations were formulated as per NRC (1998) specifications (Table 1).

Experimental trial was continued for 60 days. Total 12 pigs were weighed individually on first day of experiment and distributed into 3 groups having 4 pigs in

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Table 1. Ingredient composition of experimental diets (parts/100 parts)

Ingredients (kg/100 kg)	T ₁	T ₂	T ₃
Maize	45	37	29
Potato meal	0	8	16
Wheat bran	10.14	11	13.8
Rice polish	20	19	16
Soybean Meal	12	6	5
Groundnut extraction	10	15.51	15.8
Mineral mixture	2	2	2
Methionine (g)	0.16	0.09	0
Salt (g)	0.5	0.5	0.5
Additives* (g)	0.2	0.2	0.2
Total	100	100	100

Each 100 kg ration contained: *Additives include Vitam. AB₂D₃K 15g, vitam B complex 20 g, Vitam. B₁₂ preparation 25 g, toxin binder 50 g, probiotic 100 g

each treatment. Sex ratio was maintained. The pigs were divided under the treatments as: T₁-Control (without potato meal), T₂ - with potato meal, replacing 25% of crude protein contributed by maize, T₃ - with potato meal, replacing 50% of crude protein contributed by maize.

Digestion trials for seven days were conducted at the end of experiment to study the effect of potato meal supplementation on the apparent nutrient digestibility. Three pigs from each treatment with comparable body weight were selected for digestion trial. After a four-day adaption period, pigs were fed with known quantity of feed in the morning and evening for the next three days. On the fourth day, the residual feed was removed and weighed to record the actual feed consumption for each replicate. Three day total collection method of faeces was used to determine the digestibility of nutrients for various proximate parameters. The blood samples were collected at the end of experiment, *i.e.* on 60th day from external jugular vein, serum harvested and stored at -20°C till further analysis. Serum samples were analyzed for SGOT, SGPT, cholesterol, triglycerides and glucose using commercial kit (Transasia (ERBA) Biochemistry test kits) following manufacturer's instruction.

Collected data were analyzed using ANOVA in SAS (version 9.3). The treatment means were compared by Duncan's Multiple Ranged Test (Duncan,

1995) and significance was declared at 5% level of significance ($P \leq 0.05$).

RESULTS AND DISCUSSION

Perusal of the growth parameters data (1-30 days) presented in Table 2 revealed that initial body weight (IBW) of pigs in all the three treatments were similar. The gain in body weight (GIW) was highest ($P \leq 0.05$) in control where no potato meal was included in the diet. The lowest ($P \leq 0.05$) gain in body weight was observed at the highest level of potato meal inclusion. Similar trend of linear decrease in average daily gain (ADG) was observed as the potato meal increased in the pig ration. Higher body weight gain and non-significant difference in feed consumption affected the feed conversion ratio (FCR). Best ($P \leq 0.05$) FCR was observed in the control and poorest ($P \leq 0.05$) FCR was observed in group T₃ containing highest level of potato meal. Similar results were found in the study of Bocian *et al.* (2017) which reported that feeding potatoes without being steamed produced better weight gain and feed intake as compared to the pigs fed ration containing steamed potatoes. However, results of experiment conducted by Tusnio *et al.* (2011) did not show any significant changes in GIW, ADG and feed intake with different level of incorporation of potato protein concentrate.

Data pertaining to the growth performance of

Table 2. Effect of potato meal on growth performance in growing pigs

Period (Age)	Parameter	T ₁	T ₂	T ₃	S.E.M	P-value
(1-30 days of experiment)	Initial body weight.	16.25	16.5	16.25	0.288	0.999
	Final body weight.	22.00	21.10	20.58	0.410	0.394
	Gain in weight.	5.475 ^a	4.600 ^b	4.050 ^c	0.198	0.001
	Average daily gain.	0.1825 ^a	0.1533 ^b	0.1350 ^c	0.006	0.001
	Average feed intake	0.534	0.528	0.524	0.009	0.931
	Feed conversion ratio	2.928 ^c	3.444 ^b	3.885 ^a	0.120	0.000
(31-60 days of experiment)	Initial body weight.	22.00	21.10	20.57	0.410	0.394
	Final body weight	29.12 ^a	26.97 ^{ab}	25.65 ^b	0.643	0.067
	Gain in weight	7.12 ^a	5.87 ^b	5.07 ^c	0.278	0.000
	Average daily gain.	0.23 ^a	0.19 ^b	0.17 ^c	0.009	0.000
	Average feed intake.	0.76	0.72	0.69	0.152	0.152
	Feed conversion. ratio.	3.23 ^c	3.68 ^b	4.10 ^a	0.109	0.000
Overall (1-60 days of experiment)	Initial body weight	16.25	16.5	16.25	0.288	0.999
	Final body weight	29.12 ^a	26.97 ^{ab}	25.65 ^b	0.643	0.067
	Gain in weight	12.60 ^a	10.47 ^b	9.12 ^c	0.474	0.001
	Average daily gain	0.21 ^a	0.17 ^b	0.15 ^c	0.008	0.001
	Average feed intake	0.62	0.60	0.58	0.011	0.526
	Feed.conversion ratio	2.96 ^c	3.44 ^b	3.87 ^a	0.113	0.001

^{a,b,c}Mean values with different superscripts in a row differ significantly ($P \leq 0.05$)

pigs during the second month (31-60 days) of the experiment is presented in Table 2. The final body weight at the end of second month of experiment was found to be lowest ($P \leq 0.05$) in T₃ group where potato meal was supplemented replacing 50% crude protein of maize. The FBW was maximum ($P \leq 0.05$) in the control group where potato meal was not added. FBW in group T₂ was intermediate between control and T₃ group. The gain in body weight (GIW) was maximum in control

group and it reduced ($P \leq 0.05$) linearly as the level of incorporation of potato meal increased from 0 to 50%. At the highest amount of potato meal inclusion, lowest ($P \leq 0.05$) gain in body weight was observed. Similar trend was observed in average daily gain. Weight gain ultimately was reflected in the FCR. Accordingly, best ($P \leq 0.05$) FCR was observed where gain in body weight was better. The FCR deteriorated ($P \leq 0.05$) as the level of potato meal increased. The results are in accordance

Table 3. Apparent digestibility (%) of nutrients in growing pigs supplemented with different level of potato

Parameter	T ₁	T ₂	T ₃	S.E.M	P value
Dry matter	77.15 ^a	74.49 ^b	71.61 ^c	0.80	0.001
Organic matter	78.82 ^a	77.76 ^b	76.60 ^c	0.34	0.003
Crude protein	75.39 ^a	72.90 ^b	70.57 ^c	0.70	0.000
Crude fibre	35.11 ^a	34.42 ^{ab}	33.19 ^b	0.35	0.049
Ether extract	74.68	74.43	74.82	0.28	0.885
Calcium	42.88	42.55	42.44	0.14	0.497
Phosphorus	38.80	38.22	38.61	0.27	0.746

^{a,b,c}Mean values with different superscripts in a row differ significantly ($P \leq 0.05$)

Table 4. Blood parameters in growing pigs supplemented with different level of potato during two months

Parameter	T ₁	T ₂	T ₃	S.E.M	P value
Glucose (mg/dl)	104.00	104.00	110.33	2.82	0.637
SGPT (u/l)	44.66	44.00	42.33	1.09	0.727
SGOT (u/l)	51.67	53.00	53.33	1.95	0.950
Cholesterol (mg/dl)	86.00	86.33	87.33	1.56	0.952
Triglyceride (mg/dl)	60.67	55.33	68.33	3.81	0.431

with Bocian *et al.* (2017) who reported lower weight gain and feed intake in group fed steamed potato. However contradictory results were found in the study of Xue *et al.* (2011) in which sows fed with 5% fermented potato pulp had better weight gain compared to control.

The findings of overall growth parameters during 0-60 days are shown in Table 2 which reveals that the gain in body weight (GIW) was highest ($P \leq 0.05$) in control group where no potato meal was included in the diet. With every addition of potato meal, GIW reduced ($P \leq 0.05$). With the addition of potato meal to the pig ration, a similar trend of linear decline in average daily gain (ADG) was seen. Higher body weight gain and non-significant difference in feed consumption affected the feed conversion ratio (FCR). Best ($P \leq 0.05$) FCR was observed in control group and poorest ($P \leq 0.05$) FCR was observed in group T₃, at the highest level of potato meal inclusion. Rahnema and Borton *et al.* (2000) found that group fed with varying levels of potato chip scraps had lower FCR than the control group. However, Tusnio *et al.* (2011) reported that groups fed potato protein concentrate had a higher FCR than the

control group.

The data presented in Table 3 suggested that apparent digestibility of dry matter (DM), organic matter (OM), crude protein (CP) and crude fibre was significantly ($P < 0.05$) higher in control group as compared to T₂ and T₃ groups. Similar results were found in study of Tusnio *et al.* (2011) in which the pigs fed with diet without potato protein concentrate (PPC) have shown significantly higher CP digestibility as compared to those fed PPC, but fat digestibility was higher with potato feeding. The digestibility of ether extract (EE), calcium and phosphorus were similar among the groups. Similarly, Heo *et al.* (2014) did not show any significant changes in dry matter (DM), crude protein (CP), calcium (Ca) and phosphorus (P) digestibility.

Data on blood parameters *i.e.*, glucose, SGPT, SGOT, cholesterol, triglyceride are presented in Table 4. No significant difference was observed between the control (T₁) group and the group fed with potatoes, *i.e.* T₂ and T₃. Similar result were found in the study of Singh *et al.* (2005) in which rats were fed on control, and addition of 5% or 10% potato peel powder in other 2 treatments for four weeks. The results showed that

Table 5. Effect of supplementing different levels of potato meal on economics of pig feeding

Variables	Cost Economics		
	T ₁	T ₂	T ₃
Feed cost / Kg	24.30	23.66	23.66
Total feed consumed (60days)	37.2	36	34.8
Total Feed Cost (₹)	903.96	851.76	823
Total weight gain (Kg)	12.60	10.47	9.12
Price/Kg of live weight (₹)	120	120	120
Total income (₹)	1512	1256.4	1094.4
Net profit (₹)	608.04	404	271

triglyceride, total cholesterol and blood glucose were similar among the groups. Xue *et al.* (2011) also observed non-significant differences on plasma glucose with addition of 5% fermented potato pulp in the diet of lactating sows. However, Tusnio *et al.* (2011) reported increase in level of triglyceride with potato protein diet as compared to control diet.

As presented in Table 5, the total cost of feed including all the ingredients and additives in T₁ was ₹ 2430 per quintal of feed whereas feed cost of T₂ and T₃ was ₹ 2366 per q. The same cost in both the treatments was due to higher quantity of oil in T₃ to balance the energy requirement. The amount of feed consumed during 60 days period was highest in T₁ followed by T₂ than T₃. Since feed intake was less in the groups in which potato meal was added leading to lower total cost of feed to rear pigs for 60 days in treatment groups and was more in T₁ group. Total weight gain was significantly ($P \leq 0.05$) higher in T₁ than T₂ and T₃ and was lowest ($P \leq 0.05$) in T₃. The selling price per kg body weight was Rs 120. Highest body weight in T₁ (control diet) where potato meal was not supplemented in the diet fetched highest income. The T₃ treatment, in which 50 percent of the crude protein of maize was replaced with potato meal, yielded the lowest income.

CONCLUSION

It was observed that as the amount of potato meal supplementation increased, the gain in body weight and the digestibility of nutrients decreased. Further research aiming at incorporation of potato meal at lower level is warranted.

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