Research Article

GROWTH COMPARISON OF PIGLETS FED WITH DIFFERENT LEVEL OF BAKERY WASTE IN BASAL DIET

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ABSTRACT

An experiment was done on weaned piglets at Piggery Research Unit of Regional Agricultural Research Station, Tarahara, Sunsari, NARC, during 6 January 2019 to 5 May 2019 for 120 days after adjustment period of seven days. Twenty piglets, after weaning at 4-6 months of age were allocated into four treatments, each with 5 replications by using Completely Randomized Design. Four types of diets were used as treatments. Bakery waste was not incorporated in the control group diet (T1) whereas in the diet of T2, T3 and T4 maize as an ingredient was replaced by 25, 50 and 75% with bakery waste, respectively. Concentrate mixture was provided in adlib amount twice a day and refusal was measured in next morning while body weight gain was measured at 15 days interval. The findings revealed that highest total body weight gain was observed when maize was replaced by bakery waste (50%) (T3).But the total body weight gain was statistically similar ($p>0.05$) among the treatments group. The average daily gain was also highest when maize as an ingredient was replaced by bakery waste 50% (T3) with the gain of 325 g/day. Total feed intake during experimental period was highest for the same treatment. Feed Conversion Ratio (FCR) of entire (120 days) experimental period was also statically similar ($p>0.05$) for all treatments (1kg body weight: 2kg feed). The findings thus suggested that replacement of maize as an ingredient by bakery waste in piglet diet could be beneficial if it is replaced by 50% compared to 25% or 75% inclusion.Further in depth research is required to assess the effectiveness of replacing maize and other important ingredients with bakery waste before recommending this practice to the piglet growers.

Key words: Pig, feeding, feed intake, body weight gain, Nepal

INTRODUCTION

Pig farming in Nepal has socio-economic and cultural importance for some ethnic groups, while for others it is a social or religious taboo. The overall population of domestic pigs and pork production in Nepal has been increasing over the years. Now a day, indigenous pigs constitute 58% of the total pig population while the remaining 42% are exotic or improved breeds. The pig population of Nepal is estimated to be 1.32 million and producing 24535 t pork per annum (MoAD, 2017).

Pork is one of the cheaper protein sources that can contribute towards food security in Nepal. Pigs are omnivores, and as such are ideally suited to convert non-human edible feedstuffs into high quality food animal protein.

Pork consumption has grown tremendously over the years across the Nepal, but production has not responded sufficiently to meet demand. One of the main reasons for the rise in pork demand is removal of cultural barriers that prevented people from consuming the meat. Most of the people who are growing pigs are overseas migrant workers who have returned home for good. Consumption of pork is going up in the country, as protein intake is continuously increasing due to rise in income level. Today, people of almost every ethnic background consume pork, which is pushing up demand for this meat product.

Feed is the single largest item representing about 70-75 % of total cost of production in pig husbandry. Pig ration usually contain cereal grains such as maize, wheat, barley or oats as source of energy. The farmers are handicapped on feeding of cereals because of high cost of cereal grains. It is therefore, imperative to find low cost feeds for sustaining the productivity of animals (Tzudir et al, 2012).Therefore, researchers always search for alternate feed resources to replace the maize used for the animal production as maize is one of heavily used ingredient in feed formulation. Alternate feed resources may include various organic by product from the food processing industry. The feeding of food waste or garbage to swine and other livestock is a common practice throughout the world and is often concentrated around metropolitan centers where it is available at bulk.These wastes may be fed to other livestock species, but has most often been used as a source of feed for swine (Westendorf et al., 1999). Among the food industry by product, bakery waste from the bakery is an important one. Bakery waste includes bread, cookies,

crackers and other confectionaries which contain98.77 % dry matter, 11.34% crude protein, 4.89% crude fibre and ether extract (7.36%). Large numbers of bakery factories are operated in the urban and peri-urban areas in Nepal, and they producea sizable amount of bakery waste during processing andmarketing. Waste bakery has no other definite use; it can be economically used in the pig ration as pig can accept a wide range of feed items. Results from different feeding trials with different classes of animals, i.e., cattle (Passini et al., 2001), sheep (Obeidat et al., 2012), goats (Haddad & Ereifej, 2004), pigs (Takahshi et al., 2012), rabbit (Al-Shami & Mohammed, 2009), and chickens (Adeyemo et al., 2013) indicated that bakery wastewas a satisfactory feed ingredient for animals in terms of growth and performance. Dried bakery product may replace up to one-half of the maize in maize soybean meal growing-finishing and sow diets and up to 20% in starter diets as reported by Thaler & Palmer (2010).

However, there is a paucity of information regarding the use of bread waste in the diet of pigs. Keeping in view of the above facts, the study was designed to investigate the effect of bakery waste feeding on feed intake and growth performance of crossbred piglets and to evaluate the economics of bakery waste feeding.

MATERIAL AND METHODS

Experimental site andanimal selection

An experiment was conducted on weaned piglets at Piggery Research Unit of Regional Agricultural Research Station, Tarahara, Sunsari from 6 January 2019 to 5May 2019 for 120 days after adjustment period of seven days. Twenty piglets after weaning of 4-6 months age were allocated into four treatments each with 5 replications by using Completely Randomized Design. All experimental animals were drenched with Febendazole at the rate of 5 mg/kg body weight against internal parasites at the beginning of the experiment.

Diet composition

The feeds were formulated containing 16% crude protein and metabolizable energy at the level of 2700 kcal/kg to meet the requirements. All diets were balanced for calcium and phosphorous as per the requirements.

Table 1. Diet composition for piglet (kg)

Ingredients	T1	T2	T3	T4
Maize	40	30	20	10
Bakery waste	0	10	20	30
Soybean meal	22.5	22.5	22.5	22.5
Rice bran	36	36	36	36
Oil	0.5	0.5	0.5	0.5
Mineral	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100
Nutrient content				
Crude protein	16	16	16	16
ME Kcal	2700	2700	2700	2700
Calcium	0.41	0.41	0.41	0.41
Phosphorous	0.79	0.79	0.79	0.79

Experimental diet

Four experimental diets as of treatments were thus prepared to feed the experimental animal (Table 2).

Table 2. Experimental diet used for feeding animal

Treatment	Diet
1	Concentrate feed without bakery waste
2	Concentrate feed where 25 % maize was replaced by bakery waste
3	Concentrate feed where 50% maize was replaced by bakery waste
4	Concentrate feed where 75% maize was replaced by bakery waste

Feeding regime

Adlib concentrate mixture was given on group basis and was provided twice a day (morning and evening) to the experimental animals. The experiment animals had free access to clean drinking water.

Chemical analysis

The samples of feed ingredients were sent to the Animal Nutrition Division, NARC, Khumaltar, Lalitpur forproximate analysis. Representative samples from offered concentrate mixture were analyzed for DryMatter (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 by using the Kjeldahl method. Ether extract was determined by using Soxhlet apparatus. Total ash content was determined by ashing at 550^0C in muffle furnace for 16 hrs (AOAC, 1980). Ether extract of the samples was determined using the Van Soest methods (Goering HK and Van Soest, 1970). Phosphorous and calcium were determined by spectrophotometer and titration methods, respectively.ME value was calculated by using formula suggested by Weiss and Tebbe (2019).

ME Kcal/kg = 10[(3.5 x CP) + (8.5 x CF) + (3.5 x NFE)]

Observation recording

Total feed offered to the experimental piglets was recorded daily in group basis and refusal in the next morning. The body weight gain of individual piglet was measured at 15 days interval in the morning before feeding.

Data analysis

Data of feed intake and body weight gain were analyzed by "One way Annova" test for every measurement using statistical package SPSS, version 16

RESULTS

Chemical composition of feed ingredients

Chemical composition of feed ingredients is presented in Table (3).

Table 3. Nutrient of feed ingredients in dry matter basis

Ingredients	DM	CP	ME Kcal	Ca	P
Maize	89	9	3300	0.289	0.28
Soybean meal	89	45	2300	0.29	0.65
Rice bran	90	12	3300	0.08	1.3
Oil	NA	NA	7700	NA	NA
Bakery waste	91.19	17.23	2842.4	NA	NA

Body weight gain

The body weight gain trend of the experimental animals is presented in Table (4).

Table 4. Body weight gain (Mean ± SE) of experimental animal

Treatment	Initial body weight (kg)	Final body weight (kg)	Total weight gain (kg)	Average daily gain (g)
Without BW	11.66±2.68	49.70±4.68	38.04±2.1	317±2.2
25% maize replaced with BW (T2)	12.00±2.28	49.10±3.41	37.10±1.62	309±1.51
50% maize replaced with BW (T3)	11.03±1.72	50.06±2.69	39.03±1.55	325±1.58
75% maize replaced with BW (T4)	11.25±2.13	44.46±4.49	33.21±4.68	276±5.01
Mean	11.49±1.03	48.33±1.86	36.85±1.38	306.75±1.29
F - value	0.037	0.447	0.828	0.828
P - value	0.990	0.723	0.498	0.498
CV %	39.99	16.99	17.24	17.25
LSD value	3.15	4.98	5.51	5.6

Note: BW = Bakery waste

Table (4) showed that initial body weight of the experimental animals ranged from 11to12 kg. By the end of the experiment, highest total body weight gain was observed when maize ingredient was replaced with 50% of the bakery waste (T3) followed by control (39.03 and 38.04 kg, respectively) but the treatments were statistically similar in terms of total body weight gain at the end of experiment (Table 4). The average daily weight gain was also recorded highest for the same treatment (T3) followed by control (325 and 317 g /day, respectively) (Table 4).

Feed intake

The feed intake of the experimental animals has been presented in Table (5).

Table 5. Feed intake of experimental piglet / day (Mean ± SD)

Treatment	30 days	60 days	90 days	120 days
Without BW	653.33±19.38	740.0±3.71^{d}	840.0±7.43	1126.67±17.9
25% maize replaced with BW (T2)	613.33±21.62	740.0±3.71^{d}	852.67±10.7	1126.67±17.9
50% maize replaced with BW(T3)	646.0±18.7	740.0±3.71^{d}	850.0±10.8	1126.67±17.9
75% maize replaced with BW (T4)	610.67±14.72	700.0±3.71^{abc}	850.0±10.8	1126.67±17.9
Mean	630.83±9.43	730.0±2.43	848.17±4.97	1126.67±8.83
F - value	1.371	29	0.310	0.000
P - value	0.255	0.000	0.818	1.00
CV %	16.37	3.64	6.42	8.59
LSD value	26.54	5.25	14.19	25.31

Note: BW = Bakery waste

Table (5) revealed that in 30 days of experiment,highest feed intake was recorded for control (T1) followed by 50% BW maize ingredient replaced with BW (T3) (653.3 and 646g / day, respectively) but treatments were statistically similar in terms of feed intake(g/day) (Table 5). Feed conversion ratio (FCR) of control (T1) and the treatment, 50% maize replaced by BW (T3) and 25% maize replaced with BW (T2) all were statistically similar ($p>0.05$) (Table 5).

Similarly, in the 60 days of experimentation period feed intake of control (T1), 25% maize replaced with BW (T2) and 50% maize replaced with BW (T3) was statistically similar (740 g /day) while for 75% maize replaced with BW (T4) the intake was significantly lowest ($p<0.05$) among the treatments (700 g/day).In 60 days period as well, FCR for all treatment groups was statistically similar (1: 2 kg).

Likewise, in 90 days of experiment, feed intake of all treatments except control (T1) was similar (848-852 g / day) whereas in case of control(T1)feed intake was lowest (840 g/day), however these values remained statistically similar ($p>0.05$) among the treatments (Table 5). FCR at the 90 days of experiment was similar to

that at 60 days of experiment whereas higher FCR was noted for the treatment 50% maize replaced with BW (T3) (1:1.85 kg).

At 120 days of experiment, feed intake of all treatments was statistically similar (1126 g / day) so as the FCR (1: 2 kg), but these values remained statistically non-significant among the treatments ($p>0.05$)(Table 5). Likewise, total feed intake during experimental period was also highest for the treatment-50% maize replaced with BW (T3) followed by control (T1) (100.8and 100.4kg, respectively). FCR of entire (120 days) experimental period was also statistically similar (1:2 kg) (Table 5).

Cost benefit analysis

Cost benefit analysis is a systematic approach to estimating the strength and weaknesses of alternatives used to determine option which provide the best approach to achieving benefits while preserving saving (David et al, 2013). Benefits and costs in cost benefit analysis are expressed in monetary terms and are adjusted for the time value of money; all flows of benefits and costs over time are expressed on a common basis in terms of their net present value (David et al, 2013).

In this study, cost benefit analysis was done by considering feed ingredient costs, labour cost and income from sales of experimental animals. The detail of cost benefit is presented in Table (6).

Table 6. Cost benefit analysis (NRs)

Parameters	Treatments			
	Without BW	25% maize replaced with BW (T2)	50 % maize replaced with BW (T3)	75% maize replaced with BW (T4)
Feed intake				
Maize cost	1440.0	1080.0	720.0	360.0
Soybean cake cost	1687.5	1687.5	1687.5	1687.5
Oil cost	112.5	112.5	112.5	112.5
Rice bran cost	1260.0	1260.0	1260.0	1260.0
Mineral mixture cost	165.0	165.0	165.0	165.0
Bakery Waste cost	0	250.0	500.0	750.0
Toxin binder cost	20.0	20.0	20.0	20.0
Labour cost	3283.0	3283.0	3283.0	3283.0.0
Total expenditure	**7968.0**	**7858.0**	**7748.0**	**7638.0**
Income from sales of animal	10795.40	10802.0	11132.0	9781.20
Net income	**2827.4**	**2944.0**	**3384.0**	**2143.0**

Note: BW**,** Bakery waste

The feed ingredients which were used to prepare feed / ration as the diets for experimental animals were maize, soybean cake, oil, rice bran, mineral mixture, common salt, bakery waste and toxin binder. All ingredients except bakery waste were procured in the market of Lalitpur while bakery waste was procured from the biscuit factory of Khanar, Sunsari. The cost of the maize, soybean cake, oil, rice bran, and mineral mixture, common salt, and bakery waste and toxin binder was NRs 36, 75, 225, 35, 330, 22, 25 and 200 per kg. The labour cost was taken considering the rule and regulation of NARC for the fiscal year 2075/76. One labour was hired for the 97 days for feeding to experimental animals (20), cleaning of shed, to measure the feed refusal daily, to measure the body weight gain at 15 days interval, to provide the fresh drinking water and to help the veterinarian to treat the sick animal if that occurred. The wages of labour per day was NRs 517.0. The total labour cost was calculated NRs 517 / day × 127 days (NRs 65659.0) and divided by 20 experimental animals (65659/20 =3283.0). After completion of experiment, experimental animals were sold out to the butchers at the rate of NRs 220 /kg live weight. Had the experimental animals been sold to breeder farmers the selling rate might be higher than NRs 220.0. Cost benefit analysis showed that replacement of maize with bakery waste at the rate of 50% was comparatively beneficial than that of 25 and 75% replacement (Table 6).

DISCUSSION

The aim of this study was to evaluate the feed intake and growth performance of growing piglets by replacing maize with bakery waste at the rate of 0, 25, 50 and 75 percent in their diet.

Experiment revealed that there was no significant effect of replacement of maize with bakery waste in different proportion during entire experimental period except 60 days of experimental period where replacement of maize with bakery waste at the rate 75% had highly significant ($p<0.001$) effect on feed intake. FCR of control group and 50% maize replaced with bakery waste group T3 was almost similar (1:2.38 and 1:2.36 kg, respectively). Similar result was obtained by Narayanan et al. (2009) where they noted that biscuit waste could also be fed to suckling piglets without much nutritionally from 75 to 100 percent with corn.

Kumar et al. (2014) conducted at pig farm of All India Coordinated Research Project on pigs, livestock farm, Adhartal, College of Veterinary Science and Animal Husbandry, Nanaji Deshmukh Veterinary Science University, Jabalpur, India and concluded that bread waste can be added up to 50% to the growing crossbred pig ration without affecting growth performance. Feed cost per kg body weight gain could be reduced up to 20.45% in comparison to the conventional concentrate based diet.

Kumar et al. (2016) conducted an experiment on pig at Livestock farm, Adhartal, College of Veterinary Science and Animal Husbandry, Jabalpur for a period of 3 months. A total of 36 Large White Yorkshire crosses were randomly assigned to 4 different groups, with 9 animals in each group. Composition of the diets are as follows; T1(Control); concentrate mixture, T2; concentrate mixture (75%) + bread waste (25%), T3; concentrate mixture3 (50%) + bread waste (50%), T4; concentrate mixture (25%) + bread waste (75%). After that experiment they concluded that bread waste could be fed to the growing crossbred pigs without affecting growth performance.

In case of growth performance our study showed that there was no significant effect of different level of maize replacement with bakery waste from beginning to end of the experiment, however, highest body weight gain and average daily gain was obtained in T3 group (39.03 kg and 325 g/day) than that of other treatment groups. This finding was supported by findings of Barman *et al*, (2016) where they mentioned that average daily gain was 227.6, 230.6 and 218.4 g/d, respectively in 0, 25 and 50 percent replacement of maize with bakery waste was performed. By the end of experiment they concluded that maize can be replaced up to 50% with bakery waste for formulation of economic ration without affecting the growth, FCR and feed cost per kg gain in crossbred pigs.

CONCLUSION

Bakery waste has no other definite use and it is cheaper than maize. Findings from this experiment revealed that maize can be replaced by bakery waste in the diet of growing piglets up to 50% considering comparative benefit as reflected in terms of feed intake, FCR and body weight gain. Cost benefit analysis also showed that replacement of maize with bakery waste at the rate of 50% could be comparatively beneficial. However, further verification research should be conducted in the farmers' condition considering detail of substitution options, also to the other ingredients, before recommending this findingsfor widely dissemination.

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