

## Bakery Waste is an Alternative of Maize to Reduce the Cost of Pork Production

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### ABSTRACT

An experiment was carried out on weaned piglets to investigate the effect of different levels of bakery waste feeding on feed intake, feed conversion ratio and growth performance of pigs at Piggery Research Unit of Regional Agricultural Research Station, Tarahara, Sunsari from 16 October 2017 to 12 Feb 2018 for 120 days after adjustment period of seven days. Twenty four piglets after weaning were allocated into four treatments with 6 replications by using completely Randomized Design. Four types of experimental diets were composed for piglets. T1: concentrate feed without bakery waste, T2; concentrate feed where 25 % maize was replaced by bakery waste, T3; concentrate feed where 50% maize was replaced by bakery waste and T4; concentrate feed where 75% maize was replaced by bakery waste. Adlib concentrate mixture was given on group basis and was provide twice a day (morning and evening) to the experimental animals. Total feed offered to the experimental piglets was recorded daily in group basis and refusal next morning. The body weight gain of individual piglets was measured in 15 days interval in the morning before feeding. Experiment revealed that at the beginning of experiment, average feed intake was similar for all experimental groups (225 g/day) but at the end of the experiment feed intake was observed highest in T3 (1718.98g/day) where maize was replaced with bakery waste at the rate of 50 percent. The FCR was noted highest for T4 (1:3.17 kg) followed by T3 and T2 (1:3.19 and 1:3.22 kg, respectively). Both average feed intake and FCR was not significant among diet groups. Similarly, in case of weight gain, the highest body weight gain of experimental piglets was observed for T4 (48.6 kg) whereas body weight gain of T2 and T3 was similar (46 kg). The total weight gain for T2, T3 and T4 was almost similar (37 kg). Both body weight gain and total weight gain was not statistically significant among diet groups. Experiment revealed that maize can be replaced by bakery waste up to 75% without any adverse effect on body weight gain.

**Keywords:** Bakery waste, feed intake, weight gain, pig, Nepal

### INTRODUCTION

Nepal is an agricultural country where more than 60% of people depend upon agriculture. Total contribution of agricultural sector in GDP of Nepal is 32.35%. Among them contribution of livestock sector in total GDP is 30% (MoAC, 2009). The pig population of Nepal is estimated to be 1.33 million and producing 24535 MT pork per annum. Out of 1.33 million, indigenous pigs constitute 58% of the total pig population while the remaining 42% are exotic or improved breeds (Krishi Diary, 2018).

Pig is one of the oldest domesticated animals. People of certain ethnic groups such as Rai, Limbu, Magar, Tamang etc. prefer to keep pigs for festivals and ceremonial purposes. Initially production and consumption of pig is confined with some ethnic groups. But now-a-days due to urbanization and commercialization, production and consumption

of pork is increasing. It is also getting popular due to its short crop cycle, high benefit and easy feeding habit and is based on agricultural by-products and kitchen wastes.

A pig enterprise contributes in many ways to improve the livelihood of poor and vulnerable small-scale farmers. Pork and other pig products provide high value animal protein; the meat is easy to dress and has superior curing and storage qualities. Additional income is earned from the sale of piglets and importantly from their products. The low startup costs and small investments required for building and equipment are recovered fairly quickly as slaughter can take place at about six to eight months from birth, pending on breed and feed availability. Pig production a form of livestock keeping that does not necessarily require access to agricultural land and has therefore gained importance in the growing sector of periurban and

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urban small-scale livestock keeping (Dietze, 2011).

Maize is a primary source of energy and about 70-80 percent of maize production is used as a feed ingredient in the world. Feeding constitutes the greatest cost (about 70%) in raising pigs and affects the pig's performance and sustainability of the sector. More than 60% deficiency in concentrate feed sources is a threat to the pig industry, which compete directly with human for grains (NRC, 2011). Feed manufacturers and livestock producers are facing problems as prices of grains and oil cakes are increasing day by day. Therefore, researchers always search for alternate feed resources to replace the conventional ingredients used for the animal production.

To bridge the gap between the requirement and availability of feeds, there is a need to use more and more of non-conventional feeds. The scarcity and prohibitive cost of conventional feed sources aggravated by stiff competition between men and livestock for these feeds as well as insufficient emphasis on production have resulted in the evaluation of alternative and cheap agro-industrial products as source of feed. Bakery waste is a kind of by product which can be used as a high energy feed for animal feeding. These wastes may be fed to other livestock species, but has most often been used as a source of feed for swine (Westrendr of *et al.*, 1999). Dried bakery product is a mixture of bread, cookies, cake, crackers, and dough. It is similar to corn in protein and amino acid content (10.8% crude protein, 0.27% lysine, and 0.10% tryptophan) but higher in fat (11%). Similarly, bakery meal is rich in starch because wheat flour is the main ingredient in all bakery products. Because this starch is already thermally processed (cooked), it is highly digestible, and thus, of high nutritive value. As such, bakery meal is ideal for the diets of young pigs and starter broilers. In general, bakery meal contains about 2981 kcal/kg net energy which compares very favorably with maize at 2672 Kcal/kg net energy (Mavromichalis, 2013).

Dried bakery product may replace up to one-half of the corn in corn soybean meal growing-finishing and sow diets and up to 20% in starter diets (Thaler and Palmer, 2010). Large numbers of bakery factories are operated in the urban and peri-urban areas, and they produce a sizable amount of bakery waste during processing and marketing of the bakery. 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, sheep, goats, pigs, rabbit and chickens indicated that bakery waste is a satisfactory feed ingredient for animals (Paola et al, 2008).

There is a paucity of information regarding the use of bakery waste in the diet of pigs. Keeping in view of the above facts, the study was designed to investigate the effect of different levels of bakery waste feeding on feed intake, utilization and growth performance of pigs.

## MATERIAL AND METHODS

### Experimental site and Animal Selection

The experiment was conducted on weaned piglets at Piggery Research Unit of Regional Agricultural Research Station, Tarahara, Sunsari from 16 October 2017 to 12 Feb 2018 for 120 days after adjustment period of seven days. Twenty-four piglets after weaning were allocated into four treatments with 6 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 metabolisable energy at the level of 2700 Kcal/kg to meet the requirements. All diets were balanced for Lysine, Tryptophan, Calcium and Phosphorous as per the requirements.

**Table 1.** Diet composition for experimental piglets, kg

S/N	Ingredients	T1	T2	T3	T4
1	Maize	40	30	20	10
2	Bakery waste	0	10	20	30
3	Soybean meal	22.3	22.3	22.3	22.3
4	Rice bran	35	35	35	35
5	Oil	0.5	0.5	0.5	0.5
6	Mineral	0.5	0.5	0.5	0.5
7	Salt	0.5	0.5	0.5	0.5
8	Lysine	0.1	0.1	0.1	0.1
9	Methionine	0.1	0.1	0.1	0.1

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10	DCP	1	1	1	1
	Total	100	100	100	100
1	Crude protein	16	16	16	16
2	ME Kcal	2700	2700	2700	2700
3	Tryptophan	0.23	0.23	0.23	0.23
4	Lysine	2.21	2.21	2.21	2.21
5	Calcium	0.41	0.41	0.41	0.41
6	Phosphorous	0.79	0.79	0.79	0.79

### Experimental Diet of Experimental Piglets

Four experimental diets were composed for experimental animal which is presented in Table 2

**Table2.** *Experimental diets*

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 provide 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, Khumaltar, Lalitpur for proximate analysis. Representative samples from offered concentrate mixture were analyzed for Dry Matter (DM), Crude Protein (CP), Tryptophan, Lysine, Calcium, Phosphorous and energy. The DM was determined by oven drying at 100°C for 24 hrs. Crude protein of the samples was determined using the Kjeldahl method. Similarly, samples

**Table3.** *Nutrient of feed ingredients in dry matter basis*

S/n	Ingredients	DM	CP	ME Kcal	Tryptophan	Lysine	Ca	P
1	Maize	89	9	3300	0.1	0.18	0.289	0.28
2	Soybean meal	89	45	2300	0.65	2.7	0.29	0.65
3	Rice bran	90	12	3300	0.22	5	0.08	1.3
4	Oil	NA	NA	7700	NA	NA	NA	NA
5	Lysine	NA	NA	NA	NA	0.1	NA	NA
6	Tryptophan	NA	NA	NA	0.1	NA	NA	NA
7	DCP	99	NA	NA	NA	NA	0.23	0.18
8	Bakery waste	91.19	17.23	2842.4	NA	NA	NA	NA

### Feed Intake of Experimental Piglets

Mean daily feed intake of experimental animals was recorded 226.15 g in first 15<sup>th</sup> days which reached 1702.24 g at the end of the experimentation (120 days) which was statistically similar ( $p>0.05$ ) among diet groups. At the 15<sup>th</sup> days of experiment,

of maize, soybean meal and rice bran were sent to Food Research Division, Khumaltar, Lalitpur for Tryptophan and Lysine content analysis. Tryptophan and Lysine was analyzed at the laboratory of Food Research Division, NARC, Khumaltar, Lalitpur as suggested by Hornandez H and L.S. Bates (1969) for Tryptophan and as suggested by Doll H. and B. Koie (1975) for Lysine. Phosphorous and calcium were determined by spectro-photometer and titration methods, respectively.

### Data Measurement

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

### Data Analysis

Data of feed intake and body weight gain were analyzed by “One-wayAnnova” test for every measurement using statistical package SPSS, version 16

## RESULTS AND DISCUSSION

### Chemical Composition of Feed Ingredients

Chemical composition of feed ingredients is presented in Table 3.

feed intake of T1, T2 and T3 was noted almost similar (225 g) but in T4 it was found slightly more (227.61 g). In 30, 45 and 75 days, highest feed intake was observed in T1 (331.1, 690.37 and 1157.46 g, respectively) and lowest was found in T2 (322.64, 688.55 and 1150.8 g, respectively). However, in 60 days, the highest feed intake was

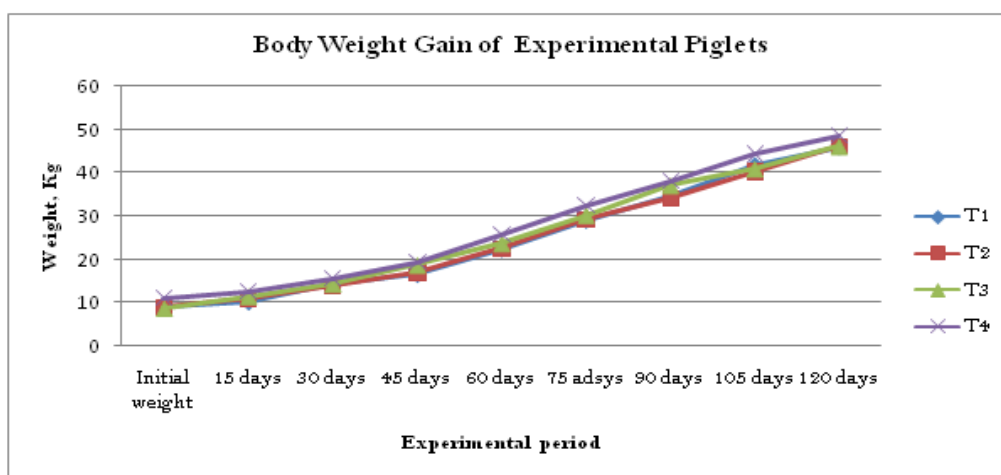
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seen in T4 (984.83 g) and lowest in T1 (968.52 g). Unlike to others, in 90, 105 and 120 days, the highest feed intake was recorded in T3 (1359.33, 1530.07 and 1718.98 g, respectively) and the lowest in T4 (1328.54, 1516 and 1682.47 g, respectively). The FCR was recorded higher for T4 (1:3.17kg) followed by T3 and T2 (1:3.19 kg and 3.22 kg, respectively)

### Growth Performance of Experimental Piglets

Average initial body weight of the experimental animals was 9.4 kg and reached 46.53 kg at the end of experiment. The data revealed that fortnight body weight gain of experimental animals in all experimental period was found non-significant

( $p>0.05$ ). During 15 days of experiment, highest body weight gain was found in T4 (12.6 kg) followed by T3 (11.5 kg), T2 (11.1 kg). Similarly, weight gain was found highest in T4 (15.7, 19.5, 25.8, 32.5, 38.25, 44.4 and 48.6 kg) in all experimental periods (30, 45, 60, 75, 90, 105 and 120 days, respectively) and lowest body weight gain was found in T1 (22.4, 29 and 45.9 kg) in 60, 75 and 120 days, respectively. However, least body weight gain was found in T2 in 30 days (14.1 kg), 90 days (34.2 kg) and 105 days (40.4 kg). This experiment suggested that expensive maize could be replaced with bakery waste from 50 – 70 % without adverse effect on body weight gain and feed intake of piglets.



**Table 4:** Feed intake of experimental animals, g (Mean±SD)

TRT	15 days	30 days	45 days	60 days	75 days	90 days	105 days	120 days	FCR
1	225.81±1.36	331.1±3.26	690.37±4.5	968.52±5.33	1157.46±7.12	1330.41±8.12	1516.01±8.34	1708.83±9.76	3.24
2	225.75±4.26	322.64±3.8	688.55±4.85	984.08±5.02	1150.8±6.89	1349.22±8.34	1525.74±7.04	1698.71±9.41	3.22
3	225.44±3.72	327.62±2.48	690.2±5.62	977.7±4.39	1157.42±7.55	1359.33±6.23	1530.07±8.61	1718.98±9.82	3.19
4	227.61±2.86	326.13±2.01	690.11±5.56	984.83±6.47	1150.83±5.12	1328.54±7.75	1516±7.3	1682.47±8.99	3.17
Mean	226.15±2.28	326.88±3.94	689.8±5.34	978.8±5.19	1154.15±6.34	1341.95±7.67	1521.96±7.25	1702.24±9.56	3.20
P value	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05

**Table 5.** Body weight gain of experimental piglets, kg (Mean±SD)

TRT	Initial weight	15 days	30 days	45 days	60 days	75 days	90 days	105 days	120 days	Total weight gain	Average daily gain (ADG)
1	9.2±1.69	10.3±1.94	14.3±2.3	16.6±3.44	22.4±4.03	29±4.91	34.8±5.39	41.7±7.08	45.9±7.58	36.7	305.83
2	9.2±1.16	11.1±1.61	14.1±1.95	17.2±2.75	22.6±4.12	29.3±4.41	34.2±5.39	40.4±6.7	46.2±7.12	37	308.33
3	8.7±1.14	11.5±0.75	14.3±0.88	18.7±1.54	23.7±1.37	30.2±1.29	37.1±2.66	40.9±2.83	46.1±3.25	37.4	311.66
4	11.2±2.18	12.6±2.56	15.7±2.7	19.5±3.28	25.8±3.91	32.5±3.75	38.25±4.78	44.4±6.43	48.6±6.51	37.4	311.66
Mean	9.4±3.36	11.26±3.7	14.52±4.24	17.94±6.04	23.48±7.43	30.07±8.26	35.95±10.8	41.67±12.62	46.53±13.39	37.13	309.41
P value	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05

## DISCUSSION

In Nepal, evaluation of bakery waste on feed intake, FCR and growth performance of pig is not

studied so far. Therefore, this experiment was carried out to explore the possible levels of replacement of maize with bakery waste in pig diets. Experiment revealed that at the beginning of

experiment, average feed intake was similar for all experimental groups (225 g/day) but at the end of the experiment feed intake was observed highest in T3 (1718.98g/day) where maize was replaced with bakery waste at the rate of 50 percent. The FCR was noted highest for T<sub>4</sub> (1:3.17 kg) followed by T3 and T2 (1:3.19 and 1:3.22 kg, respectively). Both average feed intake and FCR was not significant among diet groups.

Similarly, in case of weight gain, the highest body weight gain of experimental piglets was observed for T4 (48.6 kg) whereas body weight gain of T2 and T3 was similar (46 kg). The total weight gain for T2, T3 and T4 was almost similar (37 kg). Both body weight gain and total weight gain was not statistically significant among diet groups. Experiment revealed that maize can be replaced by bakery waste up to 75% without any adverse effect on body weight gain.

Both pig and poultry are non-ruminant animals. Therefore, results of different levels of maize replaced by bakery waste on feed intake, FCR and growth performance of pig and poultry are cited in the discussion parts. Barman et al. (2016) conducted an experiment on crossbred piglets by replacing maize with bakery waste at the rate of 0%, 25% and 50% in the diet and 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 piglets.

Manu (2013) conducted an experiment to evaluate discarded biscuits (DB) as an alternative to maize in pig diets. A total of twenty large white starter pigs aged 9-10 weeks with an average initial weight of 16.6kg were allotted to five groups with four replicates in a Complete Randomized Block Design. They were fed ad-libitum with isonitrogenous diets containing 0%, 10%, 20% and 30% levels of DB replacing similar amounts of maize and representing treatments T1, T2, T3 and T4, respectively. In his experiment, he noted that there were no significant differences in average daily feed intake, average total feed intake, average daily weight gain, average total weight gain and feed conversion efficiency (FCE) values for the four dietary treatments. There was a linear decrease in feed cost as the level of DB increased in the diet, and the cost of gain followed a similar trend. He was concluded that DB could constitute as much as 30% of the diet and replace about 60% of the maize in the diet of growing pig without any adverse effect on growth performance and carcass characteristics

thereby reducing the competition for maize between humans and livestock.

Kumar *et al.* (2014) carried out a trial in order to investigate the effect of bread waste feeding on feed intake, utilization and growth performance of crossbred pigs and to evaluate the economics of bread waste feeding. The study was conducted for a period of 3 months using large white Yorkshire crosses (LWY X Desi) were included in the study. A total of 24 weaned crossbred growing pigs were randomly assigned to four different groups, with six animals in each group. Results indicated that waste can economically supplement up to 50% to the diet of crossbred growing pigs.

Olafadehan *et al.* (2010) conducted an experiment on laying hens by replacing maize with dried bakery waste at the rate of 0%, 10%, 20% and 30% in the diet and they concluded that could be included at 30% in layers diet which is equivalent to 75% replacement of maize without compromising performance but rather improving it and benefits accruable to farmers. Moreover, they suggested that study on 100% replacement of maize with dried bakery waste; nutrient retention and even amino acid profile of dried bakery waste which could have possibly enhanced performance of the birds should be investigated.

Olafadehan *et al.* (2010) conducted another trial to investigate the response of laying hens fed graded levels of dried bakery waste (DBW) as partial replacement of maize in an 8-week experiment using completely randomized design. Sixty-four, 35 weeks old Isa brown layers were divided into four treatment groups of two replicates each consisting of 8 birds per replicate and assigned to four diets were formulated to containing 0% (control), 10, 20 and 30% levels of DBW. Feed intake, body weight gain, protein intake and egg weight did not differ significantly among the dietary treatments. Hen day production was higher ( $p < 0.05$ ) in 20 and 30% DBW diets than in 10% DBW and control. Efficiency of conversion feed to eggs was superior ( $p < 0.05$ ) in DBW diets as compared with control; even among the DBW diets, it was better in 20 and 30% DBW than 10% DBW. Cost of feed consumed/day and feed cost/dozen egg were lower ( $p < 0.05$ ) in DBW diets than the control and least in 30% DBW diet, though 20% DBW diet has an intermediate position between 10 and 30% DBW diets. Savings on feed cost and feed cost/dozen egg were significantly higher with 30% DBW followed by 20 and 10% DBW diets, respectively. Birds

fed 30% DBW diets exhibited best performance and the diet was most cost effective.

Shafey *et al.* (2011) studied the effects of replacing corn with extruded Bakery Waste (BW) in the diet of laying hens on the performance (feed intake, egg production, egg weight, egg mass and feed efficiency) and egg components (albumin, yolk, and eggshell) and characteristics of egg shell (thickness and strength) and albumin (height and Haugh unit) and yolk (height and color) and feed costs of egg production. Six isocaloric and isonitrogenous diets were formulated using 0%, 20%, 40%, 60%, 80% and 100% of BW. The replacement of corn for up to 100% with BW reduced feed costs with no impairment on the performance, egg components, characteristics of eggshell and albumin and yolk height. The feed conversion ratio did not differ significantly among different treatment groups. The replacing with BW reduced yolk color (YC). It is concluded that BW can completely replace corn in laying hen diets without affecting the performances, egg components, egg characteristics of albumen and eggshell and yolk height. Yolk pigment should be added to the diet to improve YC when  $\geq 40\%$  of corn replaced with BW.

Torki and Kimiaee (2011) compared the effects of dietary replacement of maize with bakery by-product (BB) with or without enzyme supplementation on the performance of laying hens and egg quality characteristics. One hundred eighty Hyaline Leghorns were distributed between 30 cages with almost same egg production (EP) level among the cages fed six isocaloric and isonitrogenous diets (ME=2900 kcal/kg and crude protein=15.20 g/100 d diet) with five replicates with six bird each. The experiment was conducted as a 3x2 factorial arrangement of treatments including three replacement levels 0, 50, and 100% of corn with dried bakery by-product replacement and enzyme supplementation (0 and 0.06 g/100 g diet of Hemicellulase®, a commercial  $\beta$ -mannanase –based enzyme product). Replacing dietary corn with BB had no significant effect on egg production (%), except in week 2. Egg production in group of 100% corn replacement in week 2 was lower than the other dietary groups. However, the overall EP for weeks 1-4 was not significantly affected by replacing dietary corn with BB. In addition, FCR was not significantly affected by dietary treatment. Egg weight was affected by dietary corn replacement in weeks 1 and 2; however, no significant difference was found in weeks 3 and 4. Egg quality characteristics were not affected by dietary treatment. Enzyme supplementation had no significant effect on performance of hens and egg quality traits.

Saleh *et al.* (1996) conducted a study to evaluate the use of high levels of dried bakery products in diets of broiler chickens and incorporated at levels up to 25% of diets fed to broiler chicken. There were no significant differences in body weight, feed utilization, mortality, feed consumption, or calorie: gain ratio among chicks fed the different dietary treatments.

Al-Tulaihanet *et al.* (2004) conducted experiment on 250 broiler chicks to evaluate the use of dried bakery waste in the diets of broilers. Diets were formulated to contain 0, 5, 10, 20 and 30 % dried bakery waste were fed to the broiler chicks. These diets were isocaloric isonitrogenous containing 3200 kcal/kg ME with 22% crude protein in the starter diet and 20% protein and 3200 kcal/kg ME in the finisher diet. There was no significant difference in weekly feed consumption among treatment groups. However, cumulative feed consumption showed significant decrease in dried bakery waste fed group. The results provided evidence that inclusion of up to 30% dried bakery waste in the broiler diets had no harm effect on the performance of the birds.

Al-Ruqaie *et al.* (2011) carried out an experiment to evaluate the effects of replacing corn with extruded bakery waste (BW) in corn-soybean diet during the starter and finisher periods (day to 21 and 22-35 days of age, respectively) on the performance (weight gain, feed intake and feed conversion ratio), nutrient utilization (apparent nitrogen retention and nitrogen corrected apparent Metabolizable Energy (ME), carcass characteristics and cost of feed of broiler chickens. Six isocaloric and isonitrogenous diets were formulated using 0%, 20%, 40%, 60%, 80% and 100 %, respectively. The level of corn in the basal (0 % BW) starter and finisher diets were 53.7 and 62.78 %, respectively. The replacement of dietary corn for up to 100% with BW reduced costs of total feed and feed for the production of a kg live weight with no impairment on the performance, nutrient utilization and carcass characteristics of broiler chickens.

Adeyemo *et al.* (2013) conducted a trial for 8 weeks to investigate the effect of dietary biscuit waste (BW) replacing maize (M) on performance and carcass characteristic of broilers. A total of 175 day old marshal broiler chickswere randomly divided into five treatments comprising five replicates of seven birds per replicate. Five experimental diets were formulated as follows; T1: (100% M: 0% BW), T2: (75% M: 25% BW), T3: (50% M: 50% BW), T4: (25% M: 75% BW), T5: (0% M: 100% BW) at both starter and

finisher phases. The feed intake (FI) was affected with increasing level of biscuit waste. There were significant differences across the treatments with treatment T1 having the highest value of 2.92kg for FI and T5 having the least value of 2.51kg while T2, T3 and T4 followed the same trend having the following values of 2.73kg, 2.70kg and 2.61kg, respectively. Average weight gain showed that there were no significant differences across the treatments, the values obtained were 1.13kg, 1.09kg, 1.10kg, 1.12kg and 1.10kg for treatments T1, T2, T3, T4 and T5, respectively. Feed conversion ratio showed significant differences ( $p < 0.05$ ) as birds in treatments T3, T4 and T5 recorded lower values of 2.47%, 2.37% and 2.33%, respectively while birds on treatment T1 had highest value of 2.60%. The carcass weights expressed as percentages of live weights (LW) did not show any significant differences. The result for breast weights showed significant differences ( $p < 0.05$ ) as birds on treatments four (25% M: 75% (BW) and five (0%M: 100% BW) had lower values of 10.05% (LW) and 11.20% (LW), respectively. Surprisingly, birds on T2 (75% M: 25% BW) had the highest breast meat value of 16.75%. The percentage organ weights showed no significant differences between liver, heart and spleen but the gizzard weights were significantly different among the treatments with the control having the highest value of 2.88% (LW). Results indicated that biscuit waste could be used as feed for broilers up to 50% replacement levels for maize at the starter and finisher phases without compromising performance and carcass value of broilers.

Oke and Samson (2013) conducted experiment to determine the effects of partial replacement of maize with bread waste meal on broiler chickens. One hundred and twenty day old Marshall broiler chicks were used in 56 day feeding trial consisting starter phase (0-4 weeks) and finisher phase (5-8 weeks) using completely randomized design to assess the effect of 0%, 10%, 20% and 30% inclusion levels of bread waste meal on the performance characteristics, carcass characteristics, sensory evaluation, cost benefit analysis and carcass characteristics of broilers chickens. Final live weight gain (g/bird) was 1980.6, 1890.4, 1835.2 and 1730.2 in 0%, 10%, 20% and 30% bread waste meal group, respectively. There was significant effect on body weight gain in the treatment group compared to control. The total feed consumed ranged from 5405.12 g/bird to 5801.60 g/bird, feed conversion ratio ranged from 2.9 to 3.20 and protein efficiency ratio ranged from 1.57 to 1.74. There was significant difference in total

feed consumption. The results of cost benefit analysis showed that the feed cost, feed cost/live weight gain were significantly different ( $p < 0.05$ ) as well. There were no significant differences observed in dressing percentage, liver, gizzard and heart weight between the different treatment groups. The sensory evaluation results showed that color, juiciness, flavor, texture and overall acceptability were not significantly different. Results indicated that bread waste meal at 0% inclusion supported improved performance while 30% inclusion level reduced cost of production

Ayarinde *et al.* (2014) conducted experiment to determine the effect of bread waste on performance and carcass characteristics of broilers at starter and finisher phases. A total of 240 broiler chicks were purchased and allotted randomly into four dietary treatments: T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> at an inclusion level of bread waste were 0%, 33%, 67% and 100%, respectively with three replicates of twenty birds per replicate. A total of 120 broilers were slaughtered at the end of the 8th week of the experiment and analyzed for carcass parameters. The results obtained at the starter phase of the experiment shows that T<sub>2</sub> having (67%) level of inclusion did not show any significant difference on weight gain. However, at the finisher phase, significant difference ( $p < 0.05$ ) were obtained on the FCR across dietary treatment with T<sub>2</sub> having the lowest mean value (2.08) compared to T<sub>1</sub> that recorded highest mean value (2.56). Feed conversion ratio was significant ( $p < 0.05$ ) throughout the finisher phase with T<sub>1</sub> having highest FCR compared to T<sub>3</sub> that recorded the least value (2.33). The FCR was found to be better in T<sub>2</sub> group at starter phase and in T<sub>3</sub> at finisher phase. There was significant difference observed in various treatment groups with 67% bread waste showed least feed intake at the starter phase but no significant differences were observed in finisher phase. The bread waste could be used as a replacement for maize in the diets of broilers either partially or completely in order to reduce feed cost and subsequently the cost of production.

Yadav *et al.* (2014) conducted a study to compare the efficacy of different level of bakery waste in the broiler ration. The experiment was carried out for 42 days (6 weeks) on 180 broiler chicks. Up to 3 weeks of age there was no significant difference in body weight gain of different treatment groups. However, from 4<sup>th</sup> to 6<sup>th</sup> week the gain in body weight in the group maintained on diet, in which 60% maize was replaced by bakery waste was significantly lower as compared to basal diet

20% replacement and 40% replacement. The gain in these three groups was comparable. The results for weekly and cumulative weekly feed consumption showed highly significant differences between treatment groups. The significantly higher consumptions were observed in T<sub>4</sub> and T<sub>3</sub> treatments groups. During 1<sup>st</sup>, 3<sup>rd</sup> and 4<sup>th</sup> week the FCR in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> was significantly better than T<sub>4</sub> group. From 4<sup>th</sup> to 6<sup>th</sup> week of age, FCR of basal diet was significantly better than the other groups. The FCR for birds feed with 20% and 40% replaced diet was significantly better than the birds feed on 60% replaced diet. The replacement of maize with bakery waste has resulted to lower margin of profit markedly in T<sub>4</sub> group. However, in T<sub>2</sub> and T<sub>3</sub> these was no significant difference therefore it can be concluded that 20% to 40% maize can be replaced without any adverse effect on economy however the percentage of replacement may be decided looking to the cost of maize and its availability.

### CONCLUSION

Bakery waste has no other definite use and it is cheaper than maize (maize NRS 40/kg and bakery waste NRs 17/kg). Our experiment revealed that maize can be replaced by bakery waste up to 75% without any adverse effect on feed intake, FCR and body weight gain. Similarly, inclusion of bakery waste in pig diet where it is abundantly available reduces the cost of pork production and contributes in enhancing the livelihood of pig raisers. However, further research should be conducted for cost benefit analysis of pig raising replacing maize with different levels of bakery waste in pig diets.

### ACKNOWLEDGEMENTS

Authors are grateful to Nepal Agricultural Research Council for allocating fund and encouragement for this experiment. Similarly, authors are thankful to Regional Director of Regional Agriculture Research Station (RARS), Tarahara, Sunsari for providing experimental animals and space for this experiment. Likewise, Mrs Sakuntala Rai, Technical Officer of Piggery Research Unit of (RARS), Tarahara also deserve the acknowledgement for data recoding during entire period of experiment. Authors are also thankful to all animal attendants of piggery Research Unit of RARS, Tarahara for their hard works in concentrate mixture preparation, shed cleaning and feeding of experimental piglets. Finally, thanks also go to scientific, technical, admin and finance staffs of Animal Nutrition Division, Khumaltar, Lalitpur for their moral and physical support during experimental period.

### REFERENCES

- [1] Al-Tulaihan, AA, H Najib and SM. Al-Eid (2004). The nutritional evaluation of locally produced dried bakery waste (DBW) in the broiler diets. *Pakistan Journal of Nutrition*. **3 (5)**: 294-299
- [2] Al-Ruqaie, IM, SA Swillam, HA Al-Batshan and TM Shafey (2011) Performance, nutrient utilization and carcass characteristics and economic impact of broiler chickens fed extruded bakery waste. *Journal of Animal Science and Veterinary Advances*. **10(16)**: 2061-2066
- [3] AOAC (2000) Association of Official Analytical Chemists, Official Method of Analysis, 15th Ed. Collegiate Press, Washington DC, USA **4**: 957
- [4] Adeyemo, GO, OR Oni and OG Longe (2013) Effect of dietary biscuit waste on performance and carcass characteristics of broilers. *Food Science and Quality Management*, **12**: 2224-6088
- [5] Ayarinde, OJ, AO Owosibo and AA Adeyemo (2014) Performance characteristics of broilers fed bread waste-based diets. *International Journal of Modern Plant and Animal Science*. **2(1)**: 1-11
- [6] Barman K, MK Tamuli, D Sarma, S Banik, NH Mohan, R Thomas, PP Gokuldas and SR Pegu (2016). Effect of replacing maize with bakery waste on the performance of growing crossbred pigs. *Journal of Animal Nutrition and Feed Technology*, **16 (1)**:165-168
- [7] Doll, H and B Koie (1975). Evaluation of high lysinemaizemutants. In: *Pollmer, WG, Phipps RH, eds. Inbreeding for seed protein improvement. 2<sup>nd</sup> ed. Nighoff, the Hague*, Pp 55-59
- [8] Dietze, K (2011). Pigs for prosperity. Rural Infrastructure and Agro Industries Division, Food and Agriculture Organization of the United Nations, Rome, Pp 2-4
- [9] Hornadez, H and LS Bates (1969). A modified method for rapid tryptophan analysis of maize. *Res. Bull No. 13*, CIMMYT
- [10] Krishi Diary (2018). Agriculture Information and Communication Centre. Ministry of Agriculture, Land Management and Cooperative, Harihar Bhawan, Lalitpur, Nepal
- [11] Kumar, A, B Roy, GP Lakhani and A Jain (2014) Evaluation of dried bread waste as feedstuff for growing crossbred pigs. *Veterinary World*, EISSN: 2231-091
- [12] MoAC (2009). Agribusiness and Statistical Division. Ministry of Agriculture and Cooperatives. Singh Durbar, Kathmandu, Nepal
- [13] NRC on Pig (2011). Annual Progress Report. National Research Centre on Pigs, ICAR, Rani, Guwahati, Assam, India, Pp 1-4
- [14] Mavromichalis, I (2013). Formulating poultry and pig diets with bakery meal. *News and Analysis on the Global Poultry and Animal Feed Industries*. WATTAgNet.com



## Bakery Waste is an Alternative of Maize to Reduce the Cost of Pork Production

- [15] Manu, F (2013) Nutrient composition, pest and microbial status and effect of discarded biscuits on the growth performance, carcass characteristics and economic profiles of growing-finishing pigs. *Thesis submitted to the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*
- [16] Olafadehan, OO, OA Olafadehan and JB Fapohunda (2010). Performance and economics of laying hens fed dried bakery waste. *Journal of Animal Nutrition and Feed Technology*, **10**:169 - 175
- [17] Oke, OA and O Samson (2013) Utilization of bread waste meal as replacement for maize in diets for broiler chickens. *Journal of Poverty, Investment and Development - An Open Access International Journal*. **1**
- [18] Paola, S, B Elisabetta, B Valentino, G Lina and S Alberto (2008) Bakery waste in sows' lactation diet. *Animal Fac. Medicine Veterinary Pharmacology*. **28**: 201-210
- [19] Saleh, EA, SE Watkins and PW Waldroup (1996) High level –usage of dried bakery by-product in broiler diets. *Journal of Applied Poultry*. **5**:33-38
- [20] Shafey, TM, MA Alodan, HA Al-Batshan, MA Abouheif, MS Alamri and IM Ruqaie (2011) Performance, egg characteristics and economic impact of laying hens fed extruded bakery waste. *Journal of Veterinary and Animal Advances*. **10(17)**: 2248-2252
- [21] Thaler, B and H Palmer (2010). Byproduct feed ingredients for use in swine diet. *Fact Sheet Pork Information Gateway, USA*, Pp 1-12
- [22] Torki, M and V Kimiaee (2011) Effects of dietary replacing corn with bakery by-product with or without enzyme supplementation on performance of laying hens. *International Conference on Environmental Science and Technology*. **6** IACSIT Press, Singapore
- [23] Westendr of, ML, T Schuler and EW Zirke (1999). Nutritional quality of recycled food plate waste in diets fed to swine. *Prof. Animal Science*, **15(2)**: 106-111
- [24] Yadav, DS, S Manish, JP Singh and AK Mishra (2014) Effect of replacement of maize with bakery waste in broiler ration. *International Journal of Agricultural Science and Veterinary Medicine*. **2**:1

**Citation:** Megh Raj Tiwari, Hem Raj Dhaka, "Bakery Waste is an Alternative of Maize to Reduce the Cost of Pork Production", *International Journal of Research in Agriculture and Forestry*, 7(5), 2020, pp. 1-9.

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