

Evaluation of dried bread waste as feedstuff for growing crossbred pigs

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Abstract

Aim: The aim was 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.

Materials and Methods: The study was conducted for a period of 3 months (December, 2012-March, 2013). 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. The experimental animals were fed as per their body weight following Indian Council of Agricultural Research requirements. They were fed twice a day according to schedule at 9:00 am and 3:00 pm. The water was kept available to animals round the clock. The cost of the experimental diets was calculated based on the existing price of the ingredients during the experimental period. Samples of feed were collected for analysis of proximate principles as per Association of Official Analytical Chemist. Body weight of all animals was recorded fortnightly basis in the morning before feeding with the use of platform type electronic weighing balance. Feed conversion ratio (FCR) and protein conversion ration was calculated by using a standard formula. Data were analyzed, using one-way analysis of variance (ANOVA). Means showing significant differences in the ANOVA table were compared using the Duncan multiple range test.

Results: Crude protein content (%) of the diets was 16.01 ± 0.02 , 16.13 ± 0.02 , 16.14 ± 0.02 , 16.04 ± 0.02 , 16.08 ± 0.02 and 12.72 ± 0.03 , respectively for the G1, G2, G3 and G4, groups. Proximate compositions (%) of diets used in the experiment were not significantly different. Digestibility coefficients of all the nutrients were significantly varied among the experimental groups. Daily feed intake was significantly ($p < 0.05$) varied among the groups. Average daily gain (kg/pig/day) were significantly ($p < 0.01$) higher in group G2 (0.377). FCR was significantly ($p < 0.01$) higher in the G2 group (4.35).

Conclusion: Bread waste can economically supplement up to 50% to the diet of crossbred growing pigs.

Keywords: bread waste, crossbred pigs, economics, feed intake, growth performance.

Introduction

Feeding constitutes the greatest cost (about 70%) in raising pigs and affects the pig's performance and sustainability of the sector. Pigs are monogastric and omnivorous. More than 60% deficiency in concentrate feed sources is a threat to the pig industry, which compete directly with human for grains [1]. 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. Alternate feed resources include various organic by product from the food processing industry which do not have any definite use. 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 [2]. Among the food industry by product, bread waste from the bakery is an important one. Bakery waste includes bread, cookies, crackers and other confectionaries. Large numbers of bread factories are operated in the urban and peri-urban areas, and they produce a sizable amount of bread waste during processing and marketing of the bread. Waste bread 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 [3], sheep [4], goats [5], pigs [6], rabbit [7] and chickens [8] indicated that bakery waste was a satisfactory feed ingredient for animals.

There is a paucity of information regarding the use of bread waste in the diet of crossbred pigs. Keeping in view of the above facts, the study was designed 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.

Materials and Methods

Ethical approval

The experiment followed the guidelines of Institutional Animal Ethics Committee.

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Proposed work was conducted at pig farm of All India Coordinated Research Project on pigs, live-stock farm, Adhartal, College of Veterinary Science and A.H., Nanaji Deshmukh Veterinary Science University, Jabalpur (M.P.). The study was conducted for a period of 3 months (December, 2012-March, 2013). No mortality was recorded during the entire experimental period. Large White Yorkshire crosses (LWY X Desi) were included in the study. A total of 24 weaned crossbred growing pigs of both sexes were selected. The pigs were randomly assigned to four different groups, with six animals in each group (Table-1). The pre-experimental period of 15 days was allowed to get the experimental animals adjusted before the actual start of the experiment. The experimental animals were fed as per their body weight following Indian Council of Agricultural Research [9] requirements. They were fed twice daily according to schedule at 9:00 am and 3:00 pm. The water was kept available to animals round the clock. The cost of the experimental diets was calculated based on the existing price of the ingredients during the experimental period (Table-2).

Samples of feed were collected for analysis of proximate principles viz. dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), nitrogen-free extract (NFE), and total ash by the standard methods of Association of Official Analytical Chemist (AOAC) [10]. Body weight of all animals was recorded fortnightly basis in the morning before feeding with the use of platform type electronic weighing balance. Feed conversion ratio (FCR) and protein conversion ratio were calculated by using a standard formula. At the end of the experiment digestion trial for 3 days

Table-1: Gross composition (%) and rate of concentrate mixture used in the experiment.

Ingredients	Concentrate mixture			
	1	2	3	4
Maize	45.00	45.00	33.00	15.00
Wheat bran	24.00	21.00	30.00	29.00
Rice polish	12.00	11.00	8.00	7.00
GNC	11.00	15.00	20.00	32.00
Fish meal	6.00	6.00	7.00	15.00
Mineral mixture	1.00	1.00	1.00	1.00
Salt	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00
Rate (Rs.)/Quintal	1525.86	1576.34	1636.51	1886.29

Rate of waste bread @ Rs.790/kg, GNC=General nutrition corporation

Table-2: Grouping of animals, their diet and cost of diet.

Groups	Diets	Cost(Rs.)/Quintal
G1	Concentrate mixture-1	1525.86
G2	Concentrate mixture-2 (75%)+ Bread waste (25%)	1379.76
G3	Concentrate mixture-3 (50%)+ Bread waste (50%)	1213.26
G4	Concentrate mixture-4 (25%)+ Bread waste (75%)	1064.07

was conducted. Feed and fecal samples were analyzed by the standard methods of AOAC [10].

Statistical analysis

Data were analyzed, using one-way analysis of variance (ANOVA) described by Snedecor and Cochran [11]. To study the effect of bread waste feeding on various parameters, the following model was used.

$$Y_{ij} = \mu + B_j + e_{ij}$$

Y_{ij} = Observation under the i^{th} group

μ = Overall mean

B_j = Fixed effect of i^{th} group ($i=1, 2, 3$ and 4)

e_{ij} = Random error, which is assumed to be normally and independently distributed with zero mean and constant variance σ^2e .

Means showing significant differences in the ANOVA table were compared using the Duncan multiple range test [12].

Results and Discussion

Proximate composition of experimental diets is depicted in Table-3. Proximate compositions like DM, CP, EE, CF, NFE and ash were 93.25%, 12.52%, 8.45%, 2.87%, 71.51% and 4.65%, respectively for the dried bread waste. Proximate compositions (%) of diets used in the experiment were not significantly different except CP. Digestibility coefficients of individual nutrients have been depicted in Table-4. Digestibility coefficients of all the nutrients were significantly ($p < 0.05$) varied among the experimental groups.

Daily feed intake is presented in Table-5. Overall daily feed intake was significantly ($p < 0.05$) varied among the groups. Highest daily feed intake (kg/pig) was observed in the G3 group (1.647 ± 0.060). It was also observed in the present study that as the inclusion of bread waste in the diet increases above 50% level, the feed intake starts declining. Similar observation also found in the case of daily DM intake. Average feed intake on the basis of per cent body weight was not significantly varied among the groups. Average daily protein intake (kg/pig) of crossbred growing pigs were also significantly ($p < 0.05$) varied among the experimental groups. Present study clearly indicated that as the bread waste inclusion above 50% in the diet, all types of intakes are reduced.

Average daily gain (ADG) of crossbred growing pigs was presented in Table-5. Overall ADG (kg/pig) over the entire experimental period was 0.371, 0.377, 0.375 and 0.273, respectively for the G1, G2, G3 and G4 groups. Statistical analysis of the parameter revealed that they were significantly ($p < 0.01$) different. Highest ADG (kg/pig) was observed in group G2 (0.377).

Feed conversion efficiency of the experimental groups over the entire experimental period is depicted in Table-5. The average feed efficiency in entire experimental period in different groups was

Table-3: Proximate composition (%) of diets used in different groups.

Groups	DM	CP	CF	EE	NFE	Ash
G1	93.79±0.11	16.01±0.02	3.44±0.04	3.59±0.06	69.19±0.12	7.77±0.06
G2	94.34±0.20	16.13±0.02	3.14±0.01	4.16±0.04	69.23±0.15	7.35±0.12
G3	95.37±0.25	16.14±0.02	3.23±0.07	5.54±0.04	67.35±0.03	7.75±0.04
G4	95.04±0.14	16.04±0.02	3.07±0.01	5.60±0.12	66.01±0.15	7.61±0.05

DM=Dry matter, CP=Crude protein, EE=Ether extract, CF=Crude fiber, NFE=Nitrogen-free extract

Table-4: Digestibility coefficient (%) of diets used in different groups.

Groups	DM	CP	CF	EE	NFE
G1	83.54±1.25 ^a	95.21±2.21 ^a	87.15±1.84 ^a	85.22±2.74 ^a	78.65±1.94 ^a
G2	84.31±1.62 ^a	96.11±1.82 ^a	86.14±1.45 ^a	84.11±2.21 ^a	76.12±1.91 ^a
G3	82.21±1.11 ^a	94.25±2.01 ^a	85.32±1.47 ^a	82.11±2.14 ^a	75.35±1.98 ^a
G4	79.31±1.24 ^b	92.85±1.87 ^b	81.44±1.75 ^b	79.21±2.32 ^b	70.11±1.87 ^b

Means bearing different superscripts within same column differ significantly (^{ab}, p<0.05). DM=Dry matter, CP=Crude protein, EE=Ether extract, CF=Crude fiber, NFE=Nitrogen-free extract

Table-5: Effect of bread waste feeding on feed intake, feed conversion efficiency, ADG of growing crossbred pigs.

Groups	G1	G2	G3	G4
Daily feed intake (kg/pig)	1.613±0.062	1.636±0.068	1.647±0.060	1.392±0.049
Daily dry matter intake (kg/pig)	1.513±0.058	1.547±0.065	1.562±0.056	1.327±0.047
Average feed intake (% of body weight)	4.11±0.23	4.17±0.19	4.29±0.22	3.92±0.21
Average daily protein intake (kg/pig)	0.258 ^a ±0.010	0.264 ^a ±0.011	0.265 ^a ±0.009	0.223 ^b ±0.007
FCR	4.36 ^A ±0.03	4.35 ^A ±0.01	4.41 ^A ±0.02	5.12 ^B ±0.01
ADG (kg/pig)	0.371 ^A ±0.015	0.377 ^A ±0.016	0.375 ^A ±0.014	0.273 ^B ±0.010

Means bearing different superscripts within same row differ significantly (^{ab}, p<0.05, ^{AB}, p<0.01), FCR=Feed conversion ratio, ADG=Average daily gain

4.36, 4.35, 4.41 and 5.12, respectively for the G1, G2, G3 and G4 groups. Overall FCR was significantly (p<0.01) varied among the experimental groups. Highest FCR was found in the G2 group (4.35). The result of the present study again indicated that the FCR values were not significantly different among the G1, G2 and G3 groups, whereas significantly higher value was found in G4 group. FCR value indicated that how efficiently the feedstuffs are utilized for the production purpose.

In the present study, higher body weight gain was observed in the G2 group where 25% bread waste was added to the diet. In accordance with the present study, Sirtori *et al.* [13] reported higher ADG in the bread waste supplemented groups. In contrast, Kwak and Kang [14] reported that neither the body weight gain nor the ADG was affected in pigs maintained on food waste mixture and that the feed efficiency decreased when larger amounts of the food-waste mixture were incorporated into the diet. Thus, the growth rate was severely affected. This might be reflected in the feed efficiency which was significantly lower. Paola *et al.* [15] reported that the voluntary feed intake of sows supplemented with bakery waste was 10% lower than that of the control group, although, productive performances of the treated sows were not different from those of the control group. In the present study, mild form of constipation was found in the G4 group, where more than 50% bread waste was included in the diet. As bread waste contains less

fiber [16] which may cause constipation, and the animals are maintained in confinement, where pigs did not have any access to other sources of fiber. Besides this, the feeding preference of pigs is varied depending on the type of food material. This may be the reason of low feed intake in the G4 group, where 75% bread waste was included in the diet. Chae *et al.* [17] reported that the feed consumption, weight gain, and ADG decreased in pigs maintained on a diet of 40% dried food waste. Similarly, Iwamoto [18] reported significantly lower ADG in the breadcrumbs supplemented group than in the control group.

Conclusion

On the basis of the findings of the present study, it could be 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. Price of the waste bread is approximately 52% of the price of the maize. Therefore, if bread can be purchased for 52% or less of the price of maize, then it may be economical.

Authors' Contributions

BR and GPL designed the experiment, AK conducted sample collection and performed the experiment under supervision of BR. Manuscript preparation was supervised, reviewed and edited by BR and AJ. All authors read and approved the final manuscript.

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Competing Interests

The authors declare that they have no competing interests.

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