Research Article

Economics of Feeding Kitchen Wastes and Poultry Offals in Landrace Crossbred Pigs

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Abstract | An attempt was made to calculate the feeding economics of Landrace crossbred pig on replacement of balanced ration with kitchen waste and poultry offals. Twenty-four gilts were selected at eight months of age and randomly allotted to 3 groups viz, sole concentrate (C), kitchen wastes (K) and poultry offals (P) substituted groups. Further, eight gilts of each group were divided into two subgroups of four each for feeding once or twice a day (C1 and C2 in Control, K1 and K2 in K group, P1 and P2 in P groups, respectively). All the three diets were offered in one or two frequencies i.e., single diet 10:00hr or twice daily at 10:00hr and 16:00hr. Crude Protein (CP) in the standard ration was replaced by using kitchen wastes or poultry offals by substituting 40% of the CP in the control diet and rations were formulated iso-nitrogenously (18.40%). The feed intake of sows during gestation and lactation was recorded. It was observed that feed cost per sow per day was significantly lower (P<0.01) both during gestation and lactation in sows in groups K and P. Altogether the total cost of feeds incurred on sows upto weaning were significantly (P<0.01) highest in C (Rs. 2913.76±111.11), followed by P (Rs. 2263.29±92.38) and lowest in K (1448.61± 88.15) group. This finding indicates that the cost of feeding pigs can be significantly minimized by substituting the costly concentrate feed with kitchen wastes and alternate unconventional source of poultry offals at 14% and kitchen wastes at 40% level of inclusion.

Keywords | Economics, Kitchen waste, Poultry offals, Pig, Replacement

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INTRODUCTION

Pig rearing is largely undertaken by the weaker sections of the society both as a source of income and a choice of meat for consumption. Thus, pork is a poor man's meat. Among meat producing animals, pigs are important source of animal protein food across the world. According to FAO (2018), per capita animal protein availability in India is 12 g/day as against ICMR recommendation 34g/d per person per day. A good part of this gap can be met through increased supplies of pig products, as these species are prolific breeders, have short generation intervals and are efficient feed converters. Pig production is carried out largely by scavenging system. They are one among the fastest growing animals with Feed Conversion ratio of 1:4. Thus, in rearing of pigs, feed accounts for 70-75% of total production costs (ICAR, 2002). Exorbitant feed costs strongly suggest that alternative sources such as residues of agro-animal-poultry-domestic industrial wastes should be explored partially or totally to replace costly protein sources of GNC/Fish meals etc., in pig diets thus enabling cheaper pork production.

Hence to make pig farming profitable, cheap as well as balanced feed is to be developed. Pigs are omnivorous in nature. Kitchen waste and poultry offal are widely available

non-conventional food to reduce the cost of pig rearing. Hypothetically there is a huge quantity (around 130 million kg) of poultry offals per year with each bird contributing about 10% of its body weight in the form of viscera (Karmaker, 1998). Thus, huge amount of animal proteins is generated and disposed off indiscriminately causing environmental pollution. Alternatively, kitchen waste is also commonly available unconventional food in the urban areas which can be used for partial replacement of balanced ration (Ravi and Saskia, 2017). About 20-33% of food used for human consumption is wasted as kitchen wastes (Schanes et al., 2018; Gustavsson et al., 2011; Tolan, 1983). With increase in the purchasing power of people and more urbanization there is huge scope of utilizing kitchen wastes in substituting ration of pigs with kitchen wastes. Keeping all these points in mind, an attempt was made to substitute the concentrate ration suitably with kitchen waste and poultry offals to reduce the cost of pork production.

MATERIALS AND METHODS

The experiment was conducted at swine production farm, (I.V.R.I., unit of A.I.C.R.P. on pigs), LPM section. Twenty-four crossbred gilts (Landrace x Desi) were selected at eight months of age, based on their uniform body weights, and eight gilts were randomly allotted to 3 groups viz, Control (C), Kitchen wastes (K) and Poultry offals (P) substituted groups, respectively. The Crude Protein content was set to 18.40% in all the groups. To feed the gilts of remaining treatment groups 40% of crude proteins in the standard ration was replaced by using kitchen wastes or poultry offals by substitution.

Based on chemical analysis of samples, the values of crude protein in kitchen wastes and poultry offals was found to be 19% and 55%, respectively. On this basis it was calculated that to replace 40% of crude proteins (18.40%) using substituted rations, it was essential to replace 40% of dry matter with kitchen wastes and in case of poultry offals rations, it was essential to replace 14% of dry matter with poultry offals. Further it was observed that kitchen wastes contained on an average 20% dry matter and poultry offals contained 33% dry matter and on the basis of this, actual feeding amount as percentage of body weight was calculated.

Thus, 5kg of kitchen wastes was equal to 1kg on dry matter basis and 3kg poultry offals was equal to 1kg on dry matter basis. For 100kg weighing gilt, to offer feed at 2.5% of body weight 2.5kg concentrate was offered in control (C) group, 1.5kg concentrate and 5kg kitchen wastes (as fed basis) (=1kg on DMB) in K group, 2.15kg concentrate and 1.06 kg poultry offals (as fed basis) (=0.35kg on DMB) in P group.

All the three rations were formulated to substitute feed ingredients to make the ration iso-nitrogenous diets (18.40%). The above prepared diet was fed @2.5% of body weight before farrowing and @3 % of body weight after farrowing until weaning. Further, eight gilts of each group were divided into two subgroups of four each for feeding once or twice a day (C1 and C2 in Control, K1 and K2 in K group, P1 and P2 in P groups, respectively). All the three diets were offered in two frequencies i.e., single diet 10:00hr or twice daily at 10:00hr and 16:00hr.

Statistical Analysis

Randomized Block Design was used with 3x2 factorial design (3 diets and 2 frequencies). The data on feed intake by sows during gestation and lactation were utilized and the rates of feed ingredients (as supplied to IVRI during the experimental period) were considered while computing the cost of rations.

RESULTS AND DISCUSSION

The average quantity intake of fresh kitchen wastes, poultry offals and concentrates consumed (kg/day) in various groups and feeding cost (Rs. /gilt or sow) on as fed basis during experimental period of gestation and lactation has been presented in the Tables 1,2,3,4 & 5, respectively. The summarized economics of feeding cost incurred during both phases of gestation and lactation (Rs. /sow/day), litter size, cost per piglet weaned has been presented in Table 6. It was observed that feed cost Rs. /sow/day was significantly lower (P<0.01) both during gestation and lactation in sows of groups K and P. The overall costs of feeds were Rs. 17.34±0.66, 8.62±0.32 and 13.47±0.55 per sow per day in groups C, K and P, respectively. Costs per kg diets were Rs. 7.92, 3.68 and 5.51 per kg feed intake (DM basis) in groups C, K and P, respectively. These findings indicate that kitchen wastes or poultry offals substituted diets reduced the daily cost of feeding by 52.21% and 32.72%, respectively than that of control diet.

The trends were similar when the total costs of feed per sow for total period of rearing from gestation to weaning was observed. Altogether the total cost incurred for feeding of sows from their conception to weaning of piglets were significantly (P<0.01) highest in group C (Rs. 2913.76±111.11), and lower in group P (Rs. 2263.29±92.38) and lowest in sows of group K (Rs. 1448.61±88.15). Though the feeding cost was lowest in K group it needs to be correlated with the lowest litter size (3.67±0.95) at weaning.

The feed cost per piglets born was significantly lower (P<0.01) in groups K (Rs. 135.69 ± 33.29) and P (Rs. 179.59±15.44). This finding is due to the higher costs of feeding gilts during gestation and also lower litter size

Table 1: Average intake of fresh kitchen wastes (KW) and poultry offals (PO) in various groups and cost on fed basis during experimental period of gestation.

Group*	Average fresh KW /PO intake during gestation (kg/day)	Sum for 112 days Feeding/gilt (kg)	Cost per kg diet/gilt Rs. /112 days	Cost for 112 days Feeding (Rs.)/gilt
K1	5.28± 0.16	580.56 ± 0.34	0.50	290.28 ± 7.75
K2	4.93 ± 0.09	538.58 ± 7.49	0.50	269.29 ± 3.74
P1	1.42 ± 0.08	154.47 ± 9.90	1.00	154.47 ± 9.51
P2	1.45 ± 0.48	155.08 ± 9.51	1.00	155.08 ± 9.51

*C1: Sole concentrate offered once daily at 10:00hr; C2: Sole concentrate offered twice daily at 10:00hr and 16:00hr; K1: Kitchen wastes offered once daily at 10:00hr; K2: Kitchen wastes offered twice daily at 10:00hr and 16:00hr; P1: Poultry offals offered once daily at 10:00hr; P2: Poultry offals offered twice daily at 10:00hr and 16:00hr

Table 2: Average intake of fresh kitchen wastes (KW) and poultry offals (PO) (kg/day) in various groups and cost (Rs.) on fed basis during experimental period of lactation.

Group*	Average KW/PO intakes in fresh basis	Sum for 56 days Feeding/sow (kg)	Cost per kg diet	Cost for 56 days Feeding (Rs.)/sow
K1	6.96 ± 0.21	389.49 ± 11.73	0.50	194.74 ± 5.87
K2	7.24 ± 0.29	405.44 ± 16.04	0.50	202.72 ± 8.02
P1	1.40 ± 0.20	78.55 ± 11.02	1.00	78.55 ± 11.02
P2	1.27 ± 0.07	71.20 ± 3.81	1.00	71.20 ± 3.81

*C1: Sole concentrate offered once daily at 10:00hr; C2: Sole concentrate offered twice daily at 10:00hr and 16:00hr; K1: Kitchen wastes offered once daily at 10:00hr; K2: Kitchen wastes offered twice daily at 10:00hr and 16:00hr; P1: Poultry offals offered once daily at 10:00hr; P2: Poultry offals offered twice daily at 10:00hr and 16:00hr

Table 3: Average quantities of fresh concentrates consumed (kg/day) in various groups and cost (Rs.) on fed basis during experimental period of gestation.

Group*	Average fresh concentrates intake during gestation (kg/day)	Sum for 112 days Feeding/gilt (kg)	Cost per kg diet	Cost for 112 days Feeding (Rs.)/gilt	Total costs of concentrate and KW/PO in gestation
C1	2.22± 0.10	243.68± 11.72	7.32	1783.70± 85.80	1783.70± 85.80
C2	2.17± 0.09	241.79± 8.67	7.32	1769.89± 63.46	1769.89± 63.46
K1	1.17± 0.01	128.30± 8.16	4.53	581.21± 36.99	871.48± 42.16
K2	1.17± 0.18	131.91± 3.84	4.53	597.56±17.39	866.86±19.85
P1	1.85± 0.12	205.48± 18.48	5.61	1152.70± 103.7	1307.17± 107.04
P2	1.86 ± 0.10	210.30± 9.18	5.61	1179.75± 51.53	1334.83± 59.29

*C1: Sole concentrate offered once daily at 10:00hr; C2: Sole concentrate offered twice daily at 10:00hr and 16:00hr; K1: Kitchen wastes offered once daily at 10:00hr; K2: Kitchen wastes offered twice daily at 10:00hr and 16:00hr; P1: Poultry offals offered once daily at 10:00hr; P2: Poultry offals offered twice daily at 10:00hr and 16:00hr

(6.00±1.04) born in C group. However, the differences between K and P groups were non-significant.

The feeding costs per piglet weaned was highest in groups C (Rs.343.90±80.10), as compared to group K (Rs. 222.26±52.56) and P (Rs. 187.42±26.98). These values did not differ significantly due to higher standard error which was a result of reduction in litter size at weaning in all the groups and particularly more mortality observed in Kitchen wastes fed group.

Economizing the ration by substituting the feed ingredients and varying feeding levels have been worked by various authors (Ravindra and Patel 2016; Thirumurugan, 2003; Yeshwant, 2000; Thiam, 1992). But the feed costs vary from time to time. It is important to note that there was significant reduction in feed cost. But the litter size at weaning was non-significantly reduced in the kitchen wastes substituted group which is a matter of concern.

It was observed that feed cost (Rs.) per sow per day was significantly lower (P<0.01) both during gestation and lactation in sows in groups K and P. Altogether the total cost of feeds incurred on sows up to weaning were significantly (P<0.01) highest in C (Rs. 2913.76±111.11), followed by P (Rs. 2263.29±92.38) and lowest in K (1448.61± 88.15)

Table 4: Average quantities of fresh concentrates consumed (kg/day) in various groups and cost (Rs.) on fed basis during experimental period of lactation.

Group*	Mean intake of Concentrates during lactation	Sum for 56 days Feeding/sow (kg)	Cost per kg diet	Cost for 56 days Feeding (Rs.)/sow	Total costs of concentrate and KW/PO in total	Final costs of Gestation and lactation (Rs.)
C1	3.20± 0.2	179.18± 11.10	7.32	1311.92±81.24	1311.92±81.24	3095.62^{A} ± 164.37
C2	2.48± 0.22	138.68± 17.79	7.32	1015.40± 130.28	1015.40± 130.28	2732.08 ^{AB}± 130.74
K1	1.05± 0.20	58.68± 11.24	4.53	265.58± 50.87	460.33± 55.28	1341.59 ^{D}± 112.89
K2	1.62± 0.36	90.84± 20.30	4.53	411.15± 91.98	613.88± 97.04	1480.73 ^{D}± 113.75
P1	2.85± 0.27	159.45± 21.67	5.61	895.02± 121.61	973.57± 129.65	2324.25 ^{BC}± 253.14
P2	3.20± 0.12	141.87± 6.50	5.61	796.30± 36.47	867.50± 38.34	2202.34 ^{C}± 72.82

*C1: Sole concentrate offered once daily at 10:00hr; C2: Sole concentrate offered twice daily at 10:00hr and 16:00hr; K1: Kitchen wastes offered once daily at 10:00hr; K2: Kitchen wastes offered twice daily at 10:00hr and 16:00hr; P1: Poultry offals offered once daily at 10:00hr; P2: Poultry offals offered twice daily at 10:00hr and 16:00hr

A,B,C - means with different superscripts in a column differ significantly (P<0.01)

Table 5: Cost of feeding gilts in the three systems of rearing (one sow from conception to weaning of piglets)

Effects	Gestation cost/day(Rs.)	Lactation cost/day(Rs.)	Total cost/day(Rs.)
Overall means	12.18± 0.71	16.32± 1.13	13.56 ± 0.82
Treatment			
C	15.63 ^{A}± 0.40	20.78 ^{A}± 1.43	17.34 ^{A}± 0.66
K	7.83 ^{C}± 0.25	10.20 ^{C}± 1.26	8.62 ^{C}± 0.52
P	11.99 ^{B}± 0.47	16.44 ^{B}± 0.90	13.47 ^{B}± 0.55
Frequency			
1X	12.80± 1.08	18.06± 1.99	14.55± 1.37
2X	11.66± 0.96	14.86± 1.17	12.73± 0.97
Treatment X Frequency Interaction			
C1	15.93± 0.77	23.43± 1.45	18.43± 0.98
C2	15.33± 0.31	18.13± 1.65	16.26± 0.55
K1	8.03± 0.85	8.67± 1.52	8.24± 1.08
K2	7.74± 0.18	10.96± 1.73	8.81± 0.68
P1	12.06± 0.87	17.39± 1.64	13.83± 1.07
P2	11.92± 0.53	15.49± 0.68	13.11± 0.43

C: Sole concentrate; K: Kitchen waste; P: Poultry offals: C1: Sole concentrate offered once daily at 10:00hr; C2: Sole concentrate offered twice daily at 10:00hr and 16:00hr; K1: Kitchen wastes offered once daily at 10:00hr; K2: Kitchen wastes offered twice daily at 10:00hr and 16:00hr; P1: Poultry offals offered once daily at 10:00hr; P2: Poultry offals offered twice daily at 10:00hr and 16:00hr

A,B,C - means with different superscripts in a column differ significantly (P<0.01)

group. This finding indicates that the cost of feeding can be significantly minimized by substituting the costly concentrate feed with kitchen wastes and alternate unconventional source of poultry offals.

The findings were similar to that of Ravindra and Patel, (2016) who reported significant (P<0.01) reduction in feeding costs (Rs. 631.50±13.39) in finisher pigs when feed was offered at levels of 25% green berseem + 50% kitchen waste + 25% concentrate in Group IV when compared with feeds incorporating higher levels of concentrates at 30, 35 and 40%. Saskia and Bharu, (2010) also reported that the feed cost per kg live weight gain was also lower (P<0.01) when the piglets were fed on kitchen wastes-based diet. There were no significant differences in the values of costs incurred among the sows fed once or twice as well as between the interacting groups. However, it may be observed that the feed cost per piglet weaned was numerically lowest (Rs. 347.75±32.52) in group P2 as compared to highest cost in C2 (Rs.1079.12±478.67). This finding is due to the fact that the litter size at weaning were highest in P2 group (6.50 ±0.65) as compared to lowest in K1 group (3.52±2.50). When the costs were expressed per piglet weaned (Rs./piglet), the cost of rearing each piglet were Rs. 912.88±241.16, Rs. 625.37±84.39 and Rs. 460.87±66.438 in sows of groups C, K and P, respectively. Though the val

Table 6: Economics of rearing sows from conception to weaning of piglets on feeding costs incurred per piglet born and weaned.

Effects	Gestation cost (Rs.)	Litter size at birth	Cost per piglet born	Lactation cost	Litter size at weaning	Cost per piglet weaned	Total cost incurred on sows upto weaning	Final cost per live piglet incurred from conception to weaning
Overall means	1364.00± 79.36	7.14± 0.55	227.64 ± 27.45	913.65 ± 63.31	4.73 ± 0.48	253.82 ± 35.71	2277.64 ± 137.74	670.10 ± 111.23
Treatment								
C	1750.10 ^{A} ± 44.37	6.00 ± 1.04	344.66 ^{A} ± 46.81	1163.66 ^{A} ± 79.83	4.75 ± 0.92	343.90 ± 80.10	2913.76 ^{A} ± 111.11	912.88 ± 254.16
K	877.51 ^{C} ± 28.53	7.67 ± 1.02	135.69 ^{B} ± 33.29	571.10 ^{C} ± 70.59	3.67 ± 0.95	222.26 ± 52.56	1448.61 ^{C} ± 88.15	625.37 ± 184.39
P	1342.76 ^{B} ± 53.02	7.88 ± 0.74	179.59 ^{B} ± 15.44	920.54 ^{B} ± 50.18	5.50 ± 0.63	187.42 ± 26.98	2263.29 ^{B} ± 92.38	460.87 ± 66.17
Frequency								
1X	1433.52 ± 120.70	7.30 ± 0.68	222.15 ± 34.90	1011.31 ± 111.28	4.60 ± 0.70	268.91 ± 44.31	2444.82 ± 230.35	674.69 ± 119.67
2X	1306.07 ± 106.96	7.00 ± 0.85	232.22 ± 42.45	832.26 ± 65.27	4.83 ± 0.69	241.25 ± 55.62	2138.33 ± 162.30	666.28 ± 183.13
Treatment X Frequency								
C1	1783.70 ± 85.80	6.25 ± 1.31	317.89 ± 52.70	1311.92 ± 81.24	5.25 ± 1.25	311.86 ± 91.18	3095.62 ± 164.36	746.64 ± 232.17
C2	1716.51 ± 34.59	5.75 ± 1.80	371.42 ± 83.49	1015.40 ± 92.12	4.25 ± 1.49	375.95 ± 144.73	2731.91 ± 92.44	1079.12 ± 478.67
K1	898.82 ± 95.74	9.50 ± 0.50	95.41 ± 15.10	485.56 ± 85.19	3.50 ± 2.50	247.75 ± 152.62	1384.38 ± 180.93	732.17 ± 471.28
K2	866.86 ± 19.85	6.75 ± 1.31	155.83 ± 48.24	613.88 ± 97.04	3.75 ± 1.11	209.52 ± 53.48	1480.73 ± 113.75	571.97 ± 212.43
P1	1350.68 ± 97.79	7.25 ± 0.75	189.77 ± 15.46	973.57 ± 91.68	4.50 ± 0.87	236.54 ± 38.57	2324.25 ± 179.00	574.00 ± 104.12
P2	1334.83 ± 59.29	8.50 ± 1.32	169.41 ± 28.35	867.50 ± 38.34	6.50 ± 0.65	138.29 ± 17.34	2202.34 ± 72.82	347.75 ± 32.52

C: Sole concentrate; K: Kitchen waste; P: Poultry offals: C1: Sole concentrate offered once daily at 10:00hr; C2: Sole concentrate offered twice daily at 10:00hr and 16:00hr; K1: Kitchen wastes offered once daily at 10:00hr; K2: Kitchen wastes offered twice daily at 10:00hr and 16:00hr; P1: Poultry offals offered once daily at 10:00hr; P2: Poultry offals offered twice daily at 10:00hr and 16:00hr
A,B,C - means with different superscripts in a column differ significantly (P<0.01)

ues are non-significant it is observed that the cost of rearing piglets can be reduced by incorporating poultry offals at 14% and kitchen wastes at 40% level of inclusion.

CONCLUSION

The study findings indicate that the cost of feeding in pigs can be significantly minimized by substituting the costly concentrate feed with kitchen wastes and alternate unconventional source of poultry offals at 14% and kitchen wastes at 40% level of inclusion.

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CONFLICT OF INTEREST

There is no conflict of interest

AUTHORS CONTRIBUTION

The first two authors have perfomed the research work. All other authors have contributed equally in analysis and completion of manuscript

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