BIBLIOGRAPHY

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ABSTRACT

The study was conducted to assess the potentials of using carrot meal as feed supplement to commercial ration of swine from November 2011-February 2012 at Banig, Tawang, La Trinidad, Benguet.

Nine crossbred pigs at 58 days of age were distributed into three treatments with three replicates following the completely randomized design (CRD). The different treatments used in the study were as follows: T_0- Commercial ration (control group), T_1- 100g carrot meal per kg of commercial feeds and T_2- 200g carrot meal per kg of commercial feeds.

Statistical analysis revealed no significant differences in the gain in weight and feed intake of pigs given pure commercial feeds and those given 100g or 200g carrot meal per kg of commercial feeds. The average daily gain of hogs obtained in the study was 0.722kg with an average daily feed intake of 1.69kg for a period of 77 days. However, significant differences were observed in the feed conversion ratio (FCR), where pigs given pure commercial feeds had a significantly lower FCR of 2.03 while pigs given 200g carrot meal per kg commercial feeds had an FCR of 2.30.

Return on investment (ROI) of 23.07% and 21.86% obtained in pigs given 100g and 200g carrot meal per kg of commercial feeds respectively were lower than the ROI of 37.49 obtained in pigs given pure commercial ration.

The lower return on investment with the inclusion of carrot meal in the diet is due to the high cost of carrot meal. It is however recommended that, in case of glut in the supply of carrot in the market, carrot can be a good substitute to usually expensive commercial feeds.

INTRODUCTION

The local swine industry contributes about 98% of the country's total pork supply. Pork represents more than 50% of the total animal meat consumed by Filipinos (PCARRD, 2005). In swine production, feed cost constitutes about 70% to 80% of the total cost of production. Apparently high cost of feeds is the main reason why many small scale raisers stop raising swine. To reduce feed cost, local swine raisers practice giving available local feeds as feed supplement to the commercial ration. Other farmers opt to substitute part of the commercial ration with local feedstuffs.

In Cordillera, being a vegetable growing area there are many plant products that can be used as alternative sources of nutrients for pigs. These plant products are used either as supplement to commercial feeds or as substitute of parts of the commercial ration. One of these plants by-products is carrot pulp, the residue left after the extraction of carrot juice.

Carrot is known to be a good source of nutrients especially vitamins. With carrot juice becoming a popular drink for human, there is a need to look for ways to use the carrot pulp. One of which is as feed supplement to hogs. The result of this study will add to the post of knowledge in swine nutrition. Information generated from this study can be used by researchers, swine producers and student alike.

This experiment generally aimed to assess the potential of using carrot pulp meal as feed supplement for swine. Specifically, it aimed to:

a. determine the response of pigs to different levels of carrot meal supplement in terms of gain in weight, feed intake and feed efficiency; and

b. determine the profitability of raising pigs given diets supplemented with carrot meal to commercial feeds.

This study was conducted from October 2011 to February 2012 at Banig, Tawang, La Trinidad, Benguet.

REVIEW OF LITERATURE

Bautista and Mabesa (1997) stated that poultry and livestock farmers practice giving feed supplements and additives to animal ration to maximize productivity. Another reason for doing so is to lessen cost of production, by improving feed efficiency.

According to Church and Kellems (2010) one of the important nutrients that a commercial ration should contain is the vitamin A which is present in plants as carotene. Vitamins serve many important roles in the growth and performance of swine. Corn is known to be the main source of vitamin A in commercial feeds. However, other sources of carotene may also be included to meet the vitamin A requirement of pigs. Some of the carotene in corn is not converted efficiently to vitamin A. Also, heat damage or the use of organic acids to preserve high moisture in corn destroys much of the carotene. From a practical point, Vitamin A should be added to pig feed because it is relatively unstable in feeds.

Thompson and Kelly (1984) stated that carrot is rich in carotene, high in sugar and contains appreciable quantities of thiamine and ribottacin. Cullison (1979) reported that dried carrots contains 100% dry matter, 10.3 protein, 9.7 crude fiber, 0.037% calcium, 0.32% phosphorous and 890.8mg/kg carotene. Crude fiber in carrot consists of cellulose, hemicellulose and lignin, with cellulose being the most abundant. The Food and Nutrition Research Institute (FNRI, 1968) claimed that carrot contains 82% edible portion, 520 k/cal/kg ME, 15% protein, 9% ash, 0.69% calcium and 0.38% phosphorous. Thus, carrot contains nutrients which can supplement nutrients already in commercial rations for swine.

In poultry, Segundo (2004) observed that there were no significant differences in the initial weight, feed conversion ratio and feed cost/ kg gain in weight of birds. However, significant differences were observed in terms of the final weight and total gain in weight.

Baldino (2011) on his study revealed that carrot pulp can be used as feed supplement to swine ration because it apparently increased the final weight and return on investment of hogs.

MATERIALS AND METHODS

The materials used in this study include: nine crossbreed (Duroc x Largewhite) female weaned pigs, carrot pulp meal, commercial feeds, weighing scale, oven drier, juicer, pigpen, self feeders, disinfectants, stick broom and recording materials.

A week before the start of the study, the pens including the feeding trough was cleaned and disinfected.

The nine weaned pigs were distributed at random into three treatments following the completely randomized design (CRD). Each treatment was replicated three times with one pig serving as a replicate. The individual weights of the experimental animals were taken before placing them into their respective pens. The following are the different treatment used in the study.

T_0= Commercial feeds (Control group)

T_1= 100 grams carrot meal per kg of commercial feeds

T_2= 200 grams carrot meal per kg of commercial feeds

Takiis variety of carrot was used in this study. Carrots about three months of age were collected and washed thoroughly. The carrots were passed through a juicer to separate the juice from the pulp. The carrot pulp was sundried for two to three days to reduce the water content up to 80-90%. Finally, the carrot meal was weighed based on the specific amount per treatment before it was given to the experimental animals.

All pigs were subjected to the same care and management except for the kind of ration that were offered to them. The feeding regime was done for 77 days. Carrot meal was offered to the pigs at 8:00 am in the morning starting when they were 58 days old up

to when they were 135 days of age. Commercial feeds and water were provided adlibitum. Self feeders and nipple drinkers were provided to ensure that commercial feeds and clean water respectively were always available. Cleaning of the pens was done every day.

The following data were gathered:

1. Initial weight. This was determined by weighing the hogs at 58 days of age.

2. Final weight. This was determined by weighing the hogs at 135 days of age.

3. Weight before shifting ration. This was determined by weighing the hogs before shifting to the grower ration.

4. Amount of feeds offered. This was obtained by weighing the feeds offered to the swine from the start of the experiment until the end of the experimental period.

5. Amount of feed leftover. This was determined by weighing the spilled/wet/refused feeds.

6. Cost of inputs. This was determined by recording all the expenses used in the study.

From the above data, the following parameters were computed:

1. Feed intake consumption

a. Total feed intake (TFI). This was obtained by using the formula:

TFI = amount of feed offered- amount of feed leftover

b. Daily feed intake (DFI). This was determined using the formula:

DFI = total feed intake- number of days of the experiment

2. Gain in Weight

a. Total gain weight (TGW). This was determined using the formula:

$$TGW = \text{Final Weight} - \text{Initial Weight}$$

b. Daily gain in weight (DGW). This was determined using the formula:

$$DGW = \frac{\text{Total Gain in Weight}}{\text{Number of days of the experiment}}$$

3. Feed conversion ratio (FCR). This was determined using the formula:

$$FCR = \frac{\text{Feed Intake}}{\text{Total gain in weight}}$$

4. Feed cost/kg gain. This was determined using the formula;

$$\text{Feed Cost/kg Gain} = FCR \times \text{Feed Cost per Kilogram of Feed}$$

5. Return on Investment. This was determined using the formula:

$$ROI = \frac{\text{Gross Sales-Total Expenses}}{\text{Total Expenses}}$$

Data Analysis

All above data were tabulated and analyzed using ANOVA for Completely Randomized Design (CRD). Results were compared using the Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Body Weight

The initial weight and final weight of the experimental animals were presented in Table 1. Statistical analysis revealed no significant differences in the initial weight of pigs given pure commercial feeds and those given 100g or 200g of carrot meal per kg of commercial feeds. This indicates homogeneity of experimental units ensuring no biases among treatments at the start of the study.

Likewise, statistical analysis showed no significant differences in the final weights of the hogs among treatments. This indicates that pigs given commercial feeds grew as well as those given 100g or 200g carrot meal per kg of commercial feeds from 58 to 135 days of age. Result of this study did not conform with the observation of Baldino (2011) that pigs fed 2 to 2.2 kg of commercial feeds supplemented with 1kg and 2kg carrot pulp daily from 81 days to 145 days of age were heavier than those fed with commercial feeds only.

Table 1. Initial and final weights of pigs

TREATMENT	MEAN (kg)	
	INITIAL WEIGHT AT 58 DAYS OF AGE	FINAL WEIGHT AT 135 DAYS OF AGE
Commercial feeds (Control group)	17.83[a]	79.33[a]
100g Carrot meal per kg commercial feeds	17.47[a]	73.67[a]
200g Carrot meal per Kg commercial feeds	17.59[a]	78.33[a]

Means with the same letter are not significantly different at 5% level DMRT.

The differences in observation maybe attributed to feeding regime employed. In the current study, commercial feed was provided *ad libitum* in all treatments, while in the case of Baldino, commercial feeds were restricted to 2 kg per day during the growing period and 2.2 kg during the finishing period. It would appear that pigs given carrot had additional nutrients for extra growth.

Feed Intake

Total and daily feed intakes of pigs in 77 days were presented in Table 2. Feed intake comprises the total weights of the commercial feeds and carrot meal which was offered to the animals from 58 days to 135 days of age. In terms of total feed intake, statistical analysis revealed no significant differences among treatment means. Pigs given pure commercial feeds had a total feed intake of 124.50 kg, pigs given 100g carrot meal per kg of commercial feeds and pigs given 200g carrot meal per kg of commercial feeds had a total feed intake of 126.82 kg and 140.17 kg, respectively.

Table 2. Total and daily feed intake of pigs for a feeding period of 77 days

TREATMENT	FEED INTAKE (kg)	
	TOTAL	DAILY
Commercial feeds (Control group)	124.50[a]	1.62[a]
100g Carrot meal per Kg commercial feeds	126.82[a]	1.65[a]
200g Carrot meal kg commercial feeds	140.17[a]	1.82[a]

Means with the same letter are not significantly different at 5% level DMRT.

In terms of daily feed intake, statistical analysis revealed no significant difference among treatment means of hogs. Hogs given pure commercial feeds had daily feed intake of 1.62 kg, hogs given 100g carrot meal per kg of commercial feeds and hogs given 200g carrot meal per kg of commercial feeds had daily feed intake of 1.65kg and 1.82kg respectively. The average daily feed intake of pigs fed from 58 to 135 days of age was 1.69kg. This indicates that animals given 100g or 200g carrot meal per kg of commercial feeds had consumed more or less the same amount of feeds with hogs fed pure commercial feeds. Thus, carrot meal had no adverse effect on the palatability of the feed nor did not improve the appetite of the animal.

Gain in Weight

Table 3 presents the total and average daily gain in weight of pigs. Statistical analysis revealed no significant differences in total gain in weight of pigs in 77 days. Pigs given pure commercial feeds had total gain in weight of 61.45 kg, pigs given 100g carrot meal per kg of commercial feeds and pigs given 200g carrot meal per kg of commercial feeds had a total gain in weight of 56.19 kg and 60.74 kg, respectively.

Table 3. Total and average daily gain in weight of pigs for a feeding period of 77 days

TREATMENT	GAIN IN WEIGHT (kg)	
	TOTAL	AVERAGE DAILY
Commercial feeds (Control group)	61.45[a]	0.798[a]
100g Carrot meal per kg commercial feeds	56.19[a]	0.730[a]
200g Carrot meal kg commercial feeds	60.74[a]	0.789[a]

Means with the same letter are not significantly different at 5% level DMRT

Results shows that animals given 100g or 200g carrot meal per kg of commercial feeds had similar growth rate with hogs fed pure commercial feeds resulting in the same final weight. The average daily gain (ADG) attained in this study is higher than the ADG of 558g for triple cross hogs raised for 149.05 days in backyard in the result released by the Philippine Council for Agriculture and Resource Research (PCCARD, 1996). In the current study average daily gain in weight of pigs in 135 days of age was 0.772kg.

Differences in the observation maybe due to the differences in the growing period considered. In this study, the ADG was obtained from 58 days to 135 days of age. It may be that the study conducted by PCCARD had started from 30 days to 149.05 days of age. Other differences could be attributed to the bred of animals used in the study.

Feed Conversion Ratio (FCR)
and Feed Cost/kg Gain

Table 4 shows the feed conversion ratio (FCR) and feed cost per kg gain of the experimental animals. Statistical analysis revealed that there is a significant difference between the animals given commercial feeds and the pigs given 200g carrot meal per kg commercial feeds in terms of feed conversion ratio. Feed conversion ratio of pigs given 100g carrot meal per kg of commercial feeds was not significantly different to those pigs given pure commercial feeds and those pigs given 200g carrot meal per kg of commercial feeds. Control group had a feed conversion ratio of 2.03 with a feed conversion efficiency (FCE) of 0.49, animals fed with 100g and 200g carrot meal per kg of commercial feeds had a feed conversion ratio of 2.25 and 2.30 with a FCE of 0.44 and 0.43 respectively. This means that hogs given 200g carrot meal per kg of commercial feeds had required more feeds to produce a kilogram increase in body weight.

Table 4. Feed conversion ratio and feed cost/kg gain in weight of pigs grown from 58 to 135 days of age

TREATMENT	FEED CONVERSION RATIO	FEED COST/KG GAIN IN WEIGHT (Php)
Commercial feeds (Control group)	2.03[a]	48.72
100g Carrot meal per kg commercial feeds	2.25[ab]	64.58
200g Carrot meal per kg commercial feeds	2.30[b]	65.16

Means with the same letter are not significantly different at 5% level DMRT.

Pigs given 100g carrot meal per kg commercial feeds and pigs fed with 200g carrot meal per kg commercial feed had higher feed cost per kg gain in weight of Php 64.58 and Php 65.16, respectively. Control group had lower feed cost per kg gain in weight of Php 48.72. Lower feed cost per kg gain was a direct effect of the lower feed conversion ratio of pigs. Likewise, high cost of the carrot meal had affected the feed cost per kilogram gain in weight of the animal.

Return on Investment

Table 5 presents the return on investment of pigs. Control group registered the highest return on investment (ROI) of 37.49%, pigs given 100g carrot meal per kg of commercial feeds and pigs given 200g carrot meal per kg of commercial feeds had a ROI of 23.07% and 21.86% respectively. The lower ROI from pigs given 100g and 20g carrot meal per kg commercial feeds was a direct effect of the low net income due to the high cost of expenses incurred in the carrot meal.

Table 5. Return on investment of pigs grown from 58 to 135 days of age

TREATMENT	GROSS SALES (Php)	TOTAL COST OF PRODUCTION (Php)	NET INCOME (Php)	ROI (%)
Commercial feeds (Control group)	28,560.00	20,769.58	7,786.05	37.49
100g Carrot meal per kg of commercial feeds	26,520.00	21,548.68	4,971.32	23.07
200g Carrot meal per kg of commercial feeds	28,200.00	23,140.63	5,059.37	21.86

*Cost of feeds is based on Uno brand feeds. Starter- Php 1,300.00/bag, Grower- 1,300.00/ bag. 1 bag is 50 kg. Carrot meal is Php 5.00/100g. Cost per kilogram of hogs was based on Php 120.00 liveweight.

Total cost of production includes; cost of feeds, stocks, building depreciation, water and electricity, labor, medication, repairs and maintenance, and miscellaneous. Cost of feeds is based on the prize of Uno brand of feeds. Starter pellet costs Php 1,300.00/bag while grower pellet costs Php 1,200.00/bag (1 bag=50kg). Carrot meal costs Php 5.00 per 100g. The cost per kilogram of hogs was based on Php 120.00 live weight.

Result of this study did not conform with the observation of Baldino (2011) where he reported an ROI of 33.81% and 29.94% for pigs fed with commercial feeds + 2 kg carrot pulp and pigs given commercial feeds + 1 kg carrot pulp respectively. In the current study ROI obtain from hogs given 100g and 200g carrot meal per kg commercial feeds were 23.07% and 21.86 % respectively.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study was conducted to determine the response of pigs to different levels of carrot meal supplement in terms of gain in weight, feed intake and feed efficiency and to determine the profitability of raising pigs given diets supplemented with carrot meal to commercial feeds. The treatment used in the study were; pure commercial feeds (control group), 100g carrot meal per kg of commercial feeds and 200g carrot meal per kg of commercial feeds.

Initial weights of animals at the start of the study had no significant difference as revealed by the statistical analysis. This had indicated homogeneity of the pigs used in the experiment.Giving100g and 200g carrot meal per kg of commercial feeds had increased the feed conversion ratio; meanwhile, it had not reduced nor improved the feed intake, total gain in weight and daily gain in weight.

Feed conversion ratio (FCR) attained from pigs given 100g and 200g carrot meal per kilogram of feeds were 2.25 and 2.30 respectively, pigs given pure commercial feeds had lower FCR of 2.03. As regards to the total and daily feed intake, hogs had an average of 130.50kg and 1.69kg respectively. The average total and daily gain in weight of hogs for 77 days were 59.46kg and 0.772kg respectively.

Feed cost per kilogram gain in weight obtained from pigs given 100g and 200g carrot meal were Php 64.58 and Php 65.16 respectively were higher from Php 48.72 obtained from pigs fed with pure commercial feeds.

Furthermore, return on investment (ROI) of 23.07% and 21.86% obtained in pigs given 100g and 200g carrot meal per kg commercial feeds respectively were lower than the ROI of 37.49% obtained in pigs given pure commercial feeds.

Conclusion

From the result of this study carrot meal maybe used as a feed supplement to swine. However, it has to be noted that it is an additional cost which may lower return on investment.

Recommendation

Based on the result, in case of glut in the supply of carrot in the market, carrot can be a good substitute to usually expensive commercial feeds. Furthermore, it might be worth studying if carrot meal is included in the commercial ration of swine. Another study should be conducted to determine the carcass quality and meat composition of meat derived from pigs fed with carrot meal as feed supplement.

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