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Effect of diet containing sweet potato (*Ipomoea batatas*) meal on nutrient utilization and growth performance of indigenous growing pigs

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ABSTRACT

Twenty- four (24) indigenous growing pigs were selected and randomly divided into 4 treatment groups consisting of 6 animals in each group penned individually and provided with the facility of separate feeding and watering to each pig. Sweet potato (*Ipomoea batatas*) meal (roots and leaves at 1:1 ratio) was incorporated in the diet to replace standard pigs grower ration at 0% (G1), 25% (G2), 50%(G3) and 75% (G4). During the feeding trial of 90 days, it was observed that the average dry matter intake was higher in G2 followed by G3 and G1 being the lowest. The feed conversion efficiency and average daily gain decreased as the level of sweet potato meal increased. However there were no significant differences (P>0.05) among the different treatment groups in regards to feed conversion efficiency and average daily gain. From the digestibility trial, no significant differences (P>0.05) were observed in the digestibility co- efficient of dry matter, crude protein and crude fibre among the different treatment groups. It is concluded that sweet potato meal can replace standard pig grower ration up to 75% without any adverse effect on growth, feed conversion efficiency and nutrient utilization.

Key words: Feed conversion efficiency, Growth performance, Indigenous pigs, Nutrient digestibility, Sweet potato meal.

INTRODUCTION

Livestock is an inseparable part of Agricultural and Animal Husbandry economy of the people in Mizoram. Amongst the livestock, pig is the most preferred species and every family rears pig as backyard venture. Pig farming is one of the main sources of cash income for subsistence of the farmers in Mizoram and determines family's purchasing power because of unprofitable traditional "Jhum" cultivation practice. Feeding is one of the biggest constraints for the pig farmers in this region. This is mainly due to unavailability and/or inadequate availability of the conventional feed ingredients and dependence on other parts of the country for feed ingredients. In order to meet the nutrient requirements of the livestock, it becomes very crucial to look for alternative feed resources available in the region which can effectively be utilized for feeding livestock and also decrease the dependence on imports. One of the unconventional feed very commonly used by the pig farmers in Mizoram is sweet potato (*Ipomoea batatas*) leaves and the roots. Sweet potato appears to be the best alternative to conventional feed resources considering, the region has tremendous potential for cultivation of this crop.

Sweet potato assumes special significance among the tuber crops on account of its acceptability as a food, feed and fodder crop (Nedunchezhiyan and Reddy, 2002). Sweet potato was reported to be better than other tubers like Colocasia, for swine feeding (Yadav and Gupta, 1997) but raw sweet potato feeding leads to reduce nutrient utilization and results into poor performance of pigs (Anonymous 2005). In India, unmarketable tubers and vines after harvest are fed to pig and other livestock. However, scientific information regarding nutritive value and usefulness of sweet potato meal (roots and leaves) as pig feed is very limited. Therefore, an experiment was planned to study the effect of feeding different levels of sweet potato meal on growth and nutrient utilization in growing local pigs.

MATERIALS AND METHODS

The research work was carried out in the Instructional Livestock Farm of the College of Veterinary Sciences & Animal Husbandry, Selesih, Aizawl. Samples of *Ipomoea batatas* plant were collected from the nearby villages for analysis. The leaves were chopped in a manual straw chaffing machine. These chopped materials were stored indoors under normal environmental conditions. The parts of the plant evaluated in the laboratory include the leaves and the roots. Twenty-four indigenous breed (Ghungroo) of pigs of similar average body weights were divided randomly into 4 treatment groups (G1, G2, G3, G4) as such 6 pigs in each group and housed individually in well-ventilated animal shed of the farm. A provision for feeding the animals individually, twice a day was arranged. Fresh drinking water was provided at all times. The duration of the experiment was 90 days. A standard Grower-Finisher Ration was prepared as per NRC, 1998. This mixture was considered as a Standard

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Concentrate mixture (CMS). Three types of rations which are iso-caloric and iso-nitrogenous to the Standard Concentrate Mixture (CMS) were prepared by replacing sweet potato meal 25% (G2), 50%(G3) and 75%(G4) and G1 group was control with 100% concentrate feed.

The duration of feeding trial was 90 days, during which daily dry matter intake was calculated by recording the daily feed offered and residual feed. A digestion trial of 5 days was conducted on 3 animals from each group. Representative samples of each of the concentrate feed ingredients, locally available feedstuffs used in the experiment, residual feeds and fecal matter were analyzed in the laboratory for proximate principles as per the method described by AOAC (2000), Fibre fractions as per the method described by Goering and Van Soest (1970) and Calcium and Phosphorus as per the method described by Talapatra *et al*. (1940). Cyanogenic glycosides in the feed stuffs were also estimated (AOAC, 2000) .The data observed were subjected to standard statistical analysis (Snedecor and Cochran, 1994) for discussion and interpretation of results.

RESULTS AND DISCUSSION

The chemical composition, fibre fractions and toxic principles of different parts of sweet potato and meal have been presented in Table 1. It was observed that the chemical composition(%) of sweet potato root (6.15 CP, 6.35 ash, 1.41 EE, 4.35 ADF) in the present study was similar with observations of Noblet *et al*. (1990), who reported that the roots of *Ipomoea batatas* contain 4.4 , 3.1 , 0.6 and 4.2 % CP, ash, EE and ADF respectively. The chemical composition of sweet potato leaves was 9.54, 1.48 and 27.69% for ash, crude fat and crude protein, respectively in the present study. Antia *et al*. (2006) also found similar values for ash, CF and CP of sweet potato leaves, 11.10, 4.90, 28.85% (on DM basis) respectively. Cyanogenic glycosides content of sweet potato root, leaf and meal was 4.32, 34.88 and 7.56 mg/100 gm respectively. The chemical compositions of experimental diets have been presented in Table 2. It was observed that the CP % was similar for all the groups (20.92, 20.84, 20.55 and 20.49 % for G1, G2, G3 and G4 respectively) which indicated that all the rations were iso-nitrogenous.

Table 1: Chemical composition of different parts of sweet potato (% DM basis) and toxic principles of different parts of sweet potato

Attributes	Sweet Potato Root	Sweet Potato Leaf	Sweet Potato Meal
Dry Matter	30.06	12.49	20.01
Total Ash	6.35	24.75	5.92
Crude Protein	6.15	27.69	18.71
Crude Fibre	1.41	15.37	6.07
Ether Extract	1.41	1.48	1.71
Acid Insoluble Ash	2.00	9.54	0.76
Nitrogen Free Extract	84.68	30.70	67.59
Neutral Detergent Fibre	29.29	44.01	45.79
Acid Detergent Fibre	4.35	29.68	10.36
Cyanogenic Glycosides (mg/100g)	4.32	34.88	7.56

Average dry matter intake (g/day) consisting of the dry matter intake through concentrate mixture and boiled sweet potato meal for the whole experimental period has been presented in the Table 3. It was observed that dry matter intake by experimental pigs in different groups showed significant difference (P<0.01) during 1st, 2nd, 3rd, 7th, 8th, 12th and 13th weeks of feeding trial. In the present study, the higher feed intake by the control group (G1) as compared to the treatment groups (G2, G3 and G4) in the first 3 weeks could be due to the fact that in the beginning of the experiment, pigs have not well adapted with the experimental feed i.e. sweet potato meal. However the higher dry matter intake in the treatment group (G2, G3 and G4) as compared to control group (G1) was observed in the last 10 weeks of the experimental period. Total dry matter intake during the period of feeding trial was highest in G2 (1946.83±144.45) where replacement of concentrate mixture with SPM was 25%, while

Table 2: Chemical composition and fibre fractions (% DM basis)and the digestibility coefficients(%) of rations in different groups of pigs

Attributes	Group 1	Group 2	Group 3	Group 4
Dry Matter	88.43	85.93	86.42	85.83
Crude Protein	20.92	20.84	20.55	20.49
Crude Fibre	4.65	4.99	5.36	7.08
Ether Extract	2.28	2.51	2.18	3.59
Total Ash	9.30	8.88	8.85	10.10
Acid Insoluble Ash	2.08	1.27	1.22	1.65
Nitrogen Free Extract	62.85	64.73	64.32	57.52
Neutral Detergent Fibre	27.93	29.41	13.81	19.61
Acid Detergent Fibre	9.16	9.52	9.30	9.16
	Digestibility coefficient of nutrients			
DM	78.19±1.58	78.21±0.49	78.79±0.23	80.75±1.15
CP	84.42±1.26	83.37±0.30	81.99±0.19	81.52±1.10
CF	64.21±1.90	58.77±1.74	59.01±0.29	55.99±2.23
EE*	78.99±0.92 ^{a}	77.32±0.99 ^{ab}	74.84±0.67^{bc}	72.213±1.78^{c}

^{abc}Values with different superscript in the same row differ significantly(P<0.05).

Table 3: Weekly Dry Matter Intake (g/day) by the pigs fed rations with different levels of sweet potato meal

Week	G1	G 2	G 3	G 4
1st*	1355.70±151.459[a]	1134.10±163.95[ab]	895.98±100.08[bc]	710.65±95.76[c]
2nd**	1635.38±127.27[a]	1302.65±151.08[ab]	1049.91±101.35[bc]	773.52±60.57[c]
3rd*	1610.70±125.70[a]	1442.60±121.33[a]	1358.36±159.67[a]	956.69±60.57[b]
4th	1621.35±123.10	1556.73±100.00	1524.44±95.18	1344.43±23.16
5th	1643.13±131.27	1678.94±129.69	1707.97±80.44	1893.38±4.49
6th	1565.8±165.42	1622.99±76.89	1735.03±68.87	1895.03±32.45
7th *	1747.74±161.23[c]	2002.42±53.27[b]	2003.08±21.33[b]	2294.86±27.07[a]
8th **	1749.77±175.53[c]	2106.94±60.76[b]	2215.63±20.24[a]	2448.78±33.06[a]
9th	2108.66±120.862	2334.40±99.077	2418.78±42.939	2393.53±107.20
10th	2241.31±75.43	2361.62±98.59	2531.54±39.65	2385.74±207.00
11th	2277.69±149.95	2577.15±88.96	2574.00±42.29	2605.60±111.55
12th *	2108.78±199.86[b]	2622.21±100.20[a]	2590.47±44.15[a]	2597.30±62.82[a]
13th *	2148.99±192.36[b]	2569.08±81.04[a]	2626.02±32.71[a]	2641.05±39.75[a]
Avg ± SE	1831.92±83.94	1946.83±144.45	1940.86±168.78	1918.50±201.71

[abc]Values with different superscripts in the same row differ significantly (P<0.05* and P<0.01**).

it was lower in G3 (1940.86±168.78) and lowest in G4(1918.50 ±201.72), might be due to gut fill condition owing to bulkiness of sweet potato meal which had around 80% moisture. The present results are supported by Gupta *et al*. (2007) who observed that feeding of boiled sweet potato to grower pigs increased feed intake significantly (P<0.01) up to 40% level of inclusion and then decreased at 60% level. Yadav *et al*. (1995) observed a significant decrease in feed (DM) intake (4.52±0.26 to 2.73±0.09) due to incorporation of sweet potato tuber at 50 &100 % level by replacing concentrate mixture in the diets of pigs.

Weekly body weight (kg) of pigs fed different levels of sweet potato meal is presented in Table 4. The average weekly body weights (kg) including initial and final body weight (kg) of pigs during the experimental period are presented in Table 5. There was no significant difference (P>0.05) in the initial and final body weight among the four groups. Loan and Vathana (2004) concluded that sweet potato chips can be effectively used by replacing maize in the diet of growing fattening pigs.

It has been observed that there were no significant differences in the feed conversion efficiency and average daily

Table 4: Weekly Body Weight (kg) of pigs fed rations with different levels of sweet potato meal

Week	G1	G2	G 3	G4
Initial body weight	23.13±3.42	23.02±3.50	23.17±3.49	25.90±2.16
1st	27.17±3.67	27.43±3.64	27.75±3.49	30.50±2.16
2nd	31.83±3.79	32.25±3.97	32.25±3.38	34.50±2.16
3rd	36.50±3.87	36.00±4.00	36.42±3.35	37.60±2.01
4th	40.47±3.89	39.25±4.25	39.08±3.49	40.46±1.74
5th	44.00±3.72	43.33±4.06	42.25±3.43	43.80±1.63
6th	46.92±3.49	46.17±4.10	44.75±3.41	47.00±1.38
7th	50.08±3.57	49.58±4.14	48.33±3.52	50.60±1.58
8th	53.33±3.76	52.83±4.35	51.50±3.59	53.90±1.95
9th	56.25±4.07	55.83±4.29	54.67±3.65	57.30±2.09
10th	59.00±4.00	58.83±4.39	57.17±3.72	60.10±2.06
11th	62.33±4.19	61.67±4.52	61.00±3.51	63.10±2.35
12th	65.50±4.05	64.50±4.64	63.58±3.76	65.60±2.23
13th	68.25±4.18	67.33±4.43	66.25±3.68	68.10±2.17

Tabel 5: Growth performance of pigs fed rations with different levels of sweet potato meal

Week	G1	G2	G 3	G4
Initial body weight(kg)	23.13±3.42	23.02±3.50	23.17±3.49	25.90±2.16
Final body weight(kg)	68.25±4.18	67.33±4.43	66.25±3.68	68.10±2.17
Overall Body Weight Gain(kg)	45.12±1.03	44.32±2.29	43.08±1.97	42.20±0.98
ADG(kg)	0.50±0.01	0.49±0.03	0.48±0.02	0.47±0.01
Average feed intake (g/day)	1831.92±83.94	1946.83±144.45	1940.86±168.78	1918.50±201.71
FCR(kg/Kg wt. gain)	3.69±0.18	3.99±0.21	4.09±0.22	4.14± 0.11

gain when the pigs were fed with SPM at different levels. Similar findings was also reported by Montanez (1982) on feeding cooked sweet potato at a level as high as 50-60%.Naskar *et al*. (2008) also observed no significant differences in terms of feed conversion ratio (FCR) between control and 40% and also between 40% and 60% replacement of concentrate mixture with boiled Sweet Potato tuber.

The average values of the digestibility of DM, CP, CF and EE is represented in Table 2. Statistical analysis indicated that there were no significant differences (P>0.05) among the group in respect to digestibility of dry matter. The digestibility coefficient of dry matter ranged from 78.19±1.58 (G1, 0% SPM) to 80.75±1.15 (G4, 75% SPM) which increased as the level of SPM increased. However, statistically, no significant (P>0.05) difference was observed among the groups. The dry matter digestibility in the present study was also supported by Yadav *et al*. (1995) and Yadav and Gupta (1997). Statistical analysis indicated that there were no significant differences (P>0.05) among the group in respect to digestibility of CP. The CP digestibility decreased gradually with increasing level of SPM in the diet. Dominguez (1991) observed that the digestibility of nitrogen decreased from 89.6 to 73.3 per cent with the increased level of sweet potato roots in the pig's diet and opined that it is somewhat low because of the poor digestibility of sweet potato protein even cooked. Yadav *et al*. (1995) also reported that a decrease with the increase in the level of sweet potato tuber in the diet. The study revealed that CF digestibility was highest in G1 (64.21±1.90) and lowest in G4 (55.99±2.23). On statistical analysis, there was no significant differences (P>0.05) among the different treatment groups in respect to digestibility of CF.

Digestibility of EE also differ significantly (p<.05) among the different groups. The values increased with the increase in the SPM level. The lower digestibility of EE in the present study might be due to the higher level of crude fibre with the increased incorporation of SPM in the diets which was in good agreement with Dominguez (1991) who observed that the inclusion of sweet potato foliage lowered the digestibility of all nutrients due to the increases in the fibre content of the diet.

CONCLUSION

75% of the concentrate mixture can be replaced by sweet potato meal in the ration of indigenous growing pigs without any adverse effect on the growth performance and nutrient utilization.

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