

# REPLACEMENT OF MAIZE BY WHEAT BRAN ON GROWTH AND FEED INTAKE PATTERN IN PIGS

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## ABSTRACT

*The experiment was conducted to assess the effect of replacement of maize by wheat bran on growth and feed conversion efficiency in Large White Yorkshire (LWY) pigs. Thirty weaned piglets were randomly divided into three groups and were allotted to the three dietary treatments, T1 (control ration as per NRC, 1998), T2 (50 per cent of maize of control ration replaced by wheat bran) and T3 (100 per cent of maize of control ration replaced by wheat bran) and maintained for 70 days. The daily feed intake, fortnightly body weight were recorded and average daily gain and feed conversion efficiency were calculated. The average daily gain and feed conversion efficiency were 813.00, 769.86, 678.43 g and 2.80, 2.88, 3.08, respectively for three dietary treatments. There was no significant difference in the performance between pigs belongs to T1 and T2 treatments but had higher average daily gain and feed conversion efficiency than that of T3 treatment. This study reveals that pigs fed diet with 50 per cent of maize replaced by wheat bran performed in a similar way to that of control fed group and was better than those fed diet with 100 per cent replacement of maize by wheat bran.*

**Key words:** Pigs, Maize, Wheat bran, Growth, Feed efficiency.

## INTRODUCTION

Maize forms the major source of energy in the swine feed. Even though, India produces more than 20 million MT of maize per year, it could meet only 60 per cent of the requirement in the country. The lower availability coupled with increasing price of maize, necessitates an alternative energy source for incorporation in the swine feed.

Bhar *et al.* (2000) reported that maize can be completely replaced by wheat bran without any

adverse effect on their feed intake, body weight and carcass characteristics. Brouns *et al.* (1995) also used wheat bran at 67 per cent without any bad effect. Kyriazakis and Emmans (1995) found decreased feed intake when fibrous feed materials like wheat bran added at higher levels. Due to varied results reported by several workers and also due to lack of studies on the effect of replacing maize by wheat bran on growth and feed efficiency in Large White Yorkshire pigs in India, this work was carried out.

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**MATERIALS AND METHODS**

The experiment was conducted to assess the effect of replacement of maize by different levels of wheat bran on growth and feed efficiency in growing piglets. Thirty weaned female Large White Yorkshire piglets were randomly divided into three groups with five replicates in each group. Each replicates were allotted with two piglets and housed in a single pen. All piglets were housed in the same shed and were maintained under identical management conditions throughout the experimental period of 70 days. Clean drinking water was provided *ad libitum* in all the pens throughout the experimental period.

**Experimental rations:**

The animals were fed with standard grower ration containing 18 per cent of CP and 3265 kcal of ME/kg of feed up to 50 kg body weight and finisher ration with 16 per cent CP and 3265 kcal of ME /kg of feed from 50 kg body weight as per NRC (1998). The three groups of piglets were randomly allotted to the three dietary treatments, T1 (control ration as per NRC, 1998), T2 (50 per cent of maize of control ration replaced by wheat bran) and T3 (100 per cent of maize of control ration replaced by wheat bran). Ingredient composition of pig grower and finisher ration were given in the Table 1. The ration used in this study had similar nutrients as per NRC (1998; 2012) recommendations.

**Table 1. Ingredient composition of pig grower and finisher rations, %**

Ingredients	Grower rations <sup>1</sup>			Finisher rations <sup>1</sup>		
	T1	T2	T3	T1	T2	T3
<b>Yellow maize</b>	<b>70</b>	<b>35</b>	<b>0</b>	<b>74</b>	<b>37</b>	<b>0</b>
<b>Wheat bran</b>	<b>1.5</b>	<b>31</b>	<b>59.8</b>	<b>3.6</b>	<b>34.7</b>	<b>64.9</b>
Soyabean meal	26.25	25.5	25.0	20.5	19.7	19.2
Animal fat	0	6.5	13	0	7	14
Salt	0.5	0.5	0.5	0.5	0.5	0.5
Dicalcium phosphate	0.9	0.4	0	0.65	0.10	0
Calcite	0.85	1.1	1.7	0.75	1.0	1.4
Total	100	100	100	100	100	100
Nicomix AB <sub>2</sub> D <sub>3</sub> K <sup>1</sup> , g	25	25	25	25	25	25
Nicomix BE <sup>2</sup> , g	25	25	25	25	25	25
Zinc Oxide <sup>3</sup> , g	45	13	0	30	0	0
Oxylock antioxidant <sup>4</sup> , g	10	10	10	10	10	10

<sup>1</sup>Nicomix A, B<sub>2</sub>, D<sub>3</sub>, K (Nicholas Piramal India Ltd, Mumbai) containing Vitamin A- 82,500 IU, Vitamin B<sub>2</sub>-50 mg, Vitamin D<sub>3</sub>-12,000 IU and Vitamin K-10 mg per gram.

<sup>2</sup>Nicomix BE (Nicholas Piramal India Ltd, Mumbai) containing Vitamin B<sub>1</sub>-4 mg, Vitamin B<sub>6</sub>-8 mg, Vitamin B<sub>12</sub>-40 mg, Niacin-60 mg, Calcium pantothenate- 40 mg and Vitamin E-40 mg per gram.

<sup>3</sup>Zinc oxide (Nice Chemicals Pvt. Ltd., kochi) containing 81.38% of Zn.

<sup>4</sup>Oxylock antioxidant (Vetline Ltd., Indore) contains Ethoxyquin, Butylated Hydroxy Toluene (BHT), Chelators and Surfactant.

**Feed intake, Body weight and Feed efficiency:**

Weighed quantities of feed were offered twice a day at 9.00 am and 3.00 pm. After adding feed in the manger little water was sprinkled over to moistening. The feed intake was measured daily after collecting the left over feed if any and body weight of the individual animals were taken fortnightly in the morning hours before feeding. Then average daily gain and feed conversion efficiency was calculated. Data collected on various parameters were statistically analyzed by Completely Randomized Design (CRD) method and means were compared by Duncan Multiple Range Test (DMRT) using Statistical Package for Social Studies (SPSS. 17.0.1v, 2008) software.

**RESULTS AND DISCUSSION****Feed intake**

Data on weekly average feed intake of pigs given the three experimental rations T1, T2

and T3 are presented in Table 2. The total feed intake recorded were 159.28, 154.98 and 145.98 kg, respectively and statistically T1 and T2 had similar feed intake but higher than that of T3 treatment. There was no difference in the feed intake between treatments in first three weeks, whereas from fourth to tenth week except for week eighth, there was no difference in the feed intake of pigs among T1 and T2 but was higher ( $P<0.05$ ) than that of T3 treatment. In the eighth week, there was no difference between T2 and T3, but had lower ( $P<0.05$ ) feed intake than T1 treatment. From the results on weekly feed intake it could be seen that replacement of maize at 100 per cent level by wheat bran lowered the feed intake, but there was no significant difference between control and 50 per cent maize replacement group except in eighth week. This is in agreement with Bhar *et al.* (2000) who observed similar feed intake in crossbred pigs fed diet with 0 and 50 per cent replacement of maize by wheat bran.

**Table 2. Average feed intake of LWY pigs maintained on the three experimental rations, kg**

Week	Feed intake <sup>1</sup>			Cumulative feed intake <sup>1</sup>		
	T1	T2	T3	T1	T2	T3
1	9.83±0.51	9.59±0.24	9.25±0.07	9.83±0.51	9.59±0.24	9.25±0.07
2	10.92±0.77	10.30±0.30	10.06±0.06	20.75±1.28	19.89±0.54	19.31±0.11
3	12.58±0.68	12.60±0.39	12.22±0.17	33.33±1.93	32.49±0.92	31.53±0.26
4	13.98±0.84 <sup>b</sup>	13.29±0.53 <sup>b</sup>	11.36±0.31 <sup>a</sup>	47.31±2.7 <sup>b</sup>	45.78±1.40 <sup>b</sup>	42.89±0.57 <sup>a</sup>
5	17.14±0.81 <sup>b</sup>	16.70±0.66 <sup>b</sup>	15.58±0.42 <sup>a</sup>	64.45±3.50 <sup>b</sup>	62.48±2.01 <sup>b</sup>	58.47±0.98 <sup>a</sup>
6	17.52±0.75 <sup>b</sup>	17.38±0.66 <sup>b</sup>	15.65±0.71 <sup>a</sup>	81.97±4.19 <sup>b</sup>	79.86±2.64 <sup>b</sup>	74.12±1.58 <sup>a</sup>
7	18.22±0.69 <sup>b</sup>	17.74±0.39 <sup>b</sup>	16.81±0.67 <sup>a</sup>	100.19±4.81 <sup>b</sup>	97.60±3.01 <sup>b</sup>	90.93±2.22 <sup>a</sup>
8	19.18±0.75 <sup>b</sup>	16.72±0.36 <sup>b</sup>	17.43±0.51 <sup>a</sup>	119.37±5.51 <sup>b</sup>	114.32±3.32 <sup>b</sup>	108.36±2.72 <sup>a</sup>
9	18.86±0.57 <sup>b</sup>	19.05±0.66 <sup>b</sup>	17.73±0.28 <sup>a</sup>	138.23±6.04 <sup>b</sup>	133.37±3.94 <sup>b</sup>	126.09±2.99 <sup>a</sup>
10	21.05±0.53 <sup>b</sup>	21.61±0.49 <sup>b</sup>	19.89±0.32 <sup>a</sup>	159.28±6.54 <sup>b</sup>	154.98±4.42 <sup>b</sup>	145.98±3.30 <sup>a</sup>
Total	159.28±6.54 <sup>b</sup>	154.98±4.42 <sup>b</sup>	145.98±3.30 <sup>a</sup>	159.28±6.54 <sup>b</sup>	154.98±4.42 <sup>b</sup>	145.98±3.30 <sup>a</sup>

<sup>1</sup>Mean of 5 observations

a, b - Means of different superscripts within the same row differ significantly ( $P<0.05$ )

**Body weight gain**

The data on the body weight gain of pigs are presented in Table 3. The average initial and final body weight of piglets belonging to three groups were 23.94, 23.96 and 24.01 kg and 80.85,

77.85 and 71.50 kg, respectively. The statistical analysis of the data revealed no significant difference in the average body weight between T1 and T2 treatments but always had higher ( $P < 0.05$ ) average body weight than T3 group.

**Table 3. Average body weight gain of LWY pigs maintained on the three experimental rations, kg**

Fortnight	Weight gain <sup>1</sup>			Cumulative weight gain <sup>1</sup>		
	T1	T2	T3	T1	T2	T3
Initial body weight	23.94±1.30	23.96±1.55	24.01±1.19			
1	10.25±0.50 <sup>b</sup>	10.13±0.27 <sup>b</sup>	8.94±0.25 <sup>a</sup>	10.25±0.50 <sup>b</sup>	10.13±0.27 <sup>b</sup>	8.94±0.25 <sup>a</sup>
2	10.35±0.63 <sup>b</sup>	9.53±0.46 <sup>b</sup>	7.97±0.34 <sup>a</sup>	20.60±0.81 <sup>b</sup>	19.66±0.70 <sup>b</sup>	16.91±0.34 <sup>a</sup>
3	12.33±0.39 <sup>b</sup>	11.53±0.49 <sup>b</sup>	9.95±0.51 <sup>a</sup>	32.93±1.09 <sup>b</sup>	31.19±1.04 <sup>b</sup>	26.82±0.80 <sup>a</sup>
4	11.13±0.39 <sup>b</sup>	9.90±0.27 <sup>b</sup>	9.39±0.26 <sup>a</sup>	44.06±1.15 <sup>b</sup>	41.09±1.06 <sup>b</sup>	36.25±0.88 <sup>a</sup>
5	12.85±0.73 <sup>b</sup>	12.80±0.41 <sup>b</sup>	11.24±0.45 <sup>a</sup>	56.91±1.48 <sup>b</sup>	53.89±0.85 <sup>b</sup>	47.49±1.26 <sup>a</sup>
Final body weight	80.85±2.76 <sup>b</sup>	77.85±2.35 <sup>b</sup>	71.50±2.00 <sup>a</sup>			

<sup>1</sup>Mean of 5 observations

a, b - Means of different superscripts within the same row differ significantly ( $P < 0.05$ )

In this present study pigs maintained on T3 treatment recorded significantly lower growth rate compared to T1 and T2 groups. This may be due to the higher level of wheat bran (64.9 per cent) in T3 ration which resulted in high crude fibre (9.40 per cent) and acid insoluble ash (6.52 per cent) content in the ration. This is in agreement with Kyriajakis and Emmans (1995) who observed a significant decrease in growth rate in growing purebred pigs fed on a high level (60 per cent) of wheat bran containing diet. Sikka *et al.* (1989) found that replacement of maize and rice bran with paddy grain in growing and finishing pigs led to significant decrease in the growth rate. Sheikh *et al.* (2011) observed significant reduction in weight gain in crossbred pigs fed diet containing paddy grain instead of maize.

**Feed conversion efficiency**

The data on the fortnightly feed conversion efficiency and their cumulative values of pigs under three treatment groups are presented in Table 4. The overall feed conversion efficiency recorded was 2.80, 2.88 and 3.08, respectively. There was no significant difference between T1 and T2 for feed conversion efficiency during any fortnight and cumulative period, but had better efficiency than that of T3 treatment. The result observed in T3 treatment may be due to the higher level of crude fibre (9.40 per cent) and acid insoluble ash (6.52 per cent) content in the ration.

**Table 4. Average feed conversion efficiency of LWY pigs maintained on the three experimental rations**

Fortnight	Feed conversion efficiency <sup>1</sup>			Cumulative feed conversion efficiency <sup>1</sup>		
	T1	T2	T3	T3	T2	T3
1	2.03±0.12 <sup>a</sup>	1.97±0.06 <sup>a</sup>	2.17±0.06 <sup>b</sup>	2.03±0.12 <sup>a</sup>	1.97±0.06 <sup>a</sup>	2.17±0.06 <sup>b</sup>
2	2.58±0.13 <sup>a</sup>	2.73±0.07 <sup>a</sup>	2.97±0.08 <sup>b</sup>	2.29±0.07 <sup>a</sup>	2.33±0.05 <sup>b</sup>	2.54±0.04 <sup>b</sup>
3	2.82±0.11 <sup>a</sup>	2.97±0.12 <sup>a</sup>	3.15±0.08 <sup>b</sup>	2.48±0.06 <sup>a</sup>	2.56±0.05 <sup>a</sup>	2.76±0.05 <sup>b</sup>
4	3.38±0.18 <sup>a</sup>	3.49±0.11 <sup>a</sup>	3.66±0.16 <sup>b</sup>	2.71±0.08 <sup>a</sup>	2.78±0.05 <sup>a</sup>	2.99±0.05 <sup>b</sup>
5	3.13±0.13 <sup>a</sup>	3.19±0.16 <sup>a</sup>	3.36±0.10 <sup>b</sup>	2.80±0.05 <sup>a</sup>	2.88±0.05 <sup>a</sup>	3.08±0.06 <sup>b</sup>

<sup>1</sup>Mean of 5 observations

a, b - Means of different superscripts within the same row differ significantly (P&lt;0.05)

**Daily gain and feed conversion efficiency of growing pigs**

To reach body weight of 50 kg, T1 and T2 treatment took 4 weeks whereas T3 treatment

took 5 weeks period. Average daily gain and feed conversion efficiency of growing pigs maintained on the three experimental grower rations T1, T2 and T3 are presented in Table 5. The average weight gain of these pigs during growing stage was 27.10, 25.49 and 26.86 kg,

**Table 5. Average daily gain and feed conversion efficiency of LWY pigs maintained on the three experimental rations**

Parameters	Growing stage <sup>1</sup>			Finishing stage <sup>1</sup>			Overall period <sup>1</sup>		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
Average initial body weight, kg	23.94 ±1.30	23.96 ±1.55	24.01 ±1.19	51.04 ±2.13	49.45 ±2.41	50.87 ±1.76	23.94 ±1.30	23.96 ±1.55	24.01 ±1.19
Average final body weight, kg	51.04 ±2.13	49.45 ±2.41	50.87 ±1.76	80.85 ±2.76 <sup>b</sup>	77.85 ±2.35 <sup>b</sup>	71.50 ±2.00 <sup>a</sup>	80.85 ±2.76 <sup>b</sup>	77.85 ±2.35 <sup>b</sup>	71.50 ±2.00 <sup>a</sup>
Total weight gain, kg	27.10 ±0.89	25.49 ±0.92	26.86 ±0.80	29.81 ±0.72 <sup>b</sup>	28.40 ±0.29 <sup>b</sup>	20.63 ±0.53 <sup>a</sup>	56.91 ±1.48 <sup>b</sup>	53.89 ±0.85 <sup>b</sup>	47.49 ±1.26 <sup>a</sup>
Average daily weight gain, g	774.29 ±25.57 <sup>b</sup>	728.29 ±26.28 <sup>b</sup>	639.52 ±19.08 <sup>a</sup>	851.71 ±20.48 <sup>b</sup>	811.43 ±8.37 <sup>b</sup>	736.78 ±18.79 <sup>a</sup>	813.00 ±21.20 <sup>b</sup>	769.86 ±12.16 <sup>b</sup>	678.43 ±18.06 <sup>a</sup>
Total feed intake, kg	64.45 ±3.50 <sup>a</sup>	62.48 ±2.01 <sup>a</sup>	73.82 ±1.70 <sup>b</sup>	94.83 ±3.27 <sup>b</sup>	92.50 ±2.50 <sup>b</sup>	72.16 ±1.64 <sup>a</sup>	159.28 ±6.54 <sup>b</sup>	154.98 ±4.42 <sup>b</sup>	145.98 ±3.30 <sup>a</sup>
Feed conversion efficiency	2.37 ±0.06 <sup>a</sup>	2.45 ±0.03 <sup>a</sup>	2.75 ±0.05 <sup>b</sup>	3.18 ±0.06 <sup>a</sup>	3.26 ±0.10 <sup>a</sup>	3.50 ±0.09 <sup>b</sup>	2.80 ±0.05 <sup>a</sup>	2.88 ±0.05 <sup>a</sup>	3.08 ±0.06 <sup>b</sup>

<sup>1</sup>Mean of 5 observations

a, b- Means with different superscripts within the same row differ significantly (P&lt;0.05)

respectively. On statistical analysis there was no difference in the average weight gain among the three treatments. The average daily gain in the three groups was 774.29, 728.29 and 639.52 g, respectively. There was no difference in the average daily gain between T1 and T2 treatments. However, pigs on these treatments had higher ( $P<0.05$ ) daily gain than that of T3 treatment. Pigs under T3 group took longer period (42 days) to reach 50 kg body weight than other groups (35 days). The total feed intake of grower ration was 64.45, 62.48 and 73.82 kg and the feed conversion efficiency was 2.37, 2.45 and 2.75, respectively for three treatments. The treatment T1 and T2 recorded similar values but had significantly lesser feed intake and better feed conversion efficiency than that of T3 treatment.

The result in this study indicates that the average daily gain in growing pure breed of Large White Yorkshire pigs were not affected by 50 per cent of maize replacement by wheat bran. The lower performance values recorded in T3 groups may be because of higher level of wheat bran.

#### **Daily gain and feed conversion efficiency of finisher pigs**

The pigs were maintained till the T3 group reaches 70 kg body weight. Average daily gain and feed conversion efficiency of finisher pigs maintained on the three experimental finisher rations are presented in Table 5. The average weight gain of these pigs during finisher stage was 29.81, 28.40 and 20.63 kg and average daily gain was 851.71, 811.43 and 736.78 g, respectively for three treatments.

Statistical analysis revealed no difference in weight gain and average daily gain between T1 and T2, however these treatments had higher ( $P<0.05$ ) values than T3 treatment. The feed intake and feed conversion efficiency in the three groups was 94.83, 92.50, 72.16 and 3.18, 3.26 and 3.50, respectively. The treatment T1 and T2 recorded

similar values but had significantly better feed conversion efficiency than that of T3 treatment.

#### **Overall daily gain and feed conversion efficiency of experimental pigs**

The overall average daily gain and feed conversion efficiency of pigs maintained on the three experimental rations are presented in Table 5. The average final weight and weight gain of these pigs for overall period were 80.85, 77.85 and 71.50 kg and 56.91, 53.89 and 47.49 kg, respectively. The overall average daily gain was 813.00, 769.86 and 678.43g, respectively for three treatments. There was no difference in final body weight, weight gain and average daily gain between T1 and T2, but had higher values than that of T3 treatment. The total feed intake and overall feed conversion efficiency for three treatment groups was 159.28, 154.98, 145.98 and 2.80, 2.88, 3.08, respectively. There was no significant difference for these parameters between T1 and T2, but had better feed conversion efficiency than that of T3 treatment.

In the present study T3 treatment recorded significantly lower average daily gain and feed efficiency compared to other groups. This may be due to high crude fibre (9.40 per cent) and acid insoluble ash (6.52 per cent) content in the ration which might have affected the digestion and utilization of other nutrients. This is in agreement with Kyriazakis and Emmans (1995) who reported decreased weight gain and feed conversion efficiency in growing purebred pigs fed on a high level (more than 60 per cent) of wheat bran in their diet. Growth rate and feed efficiency of pigs were depressed as fiber level in the diet increased (Cline and Richert, 2000; Grieshop *et al.* 2000).

#### **CONCLUSION**

This study reveals that pigs fed diet with 50 per cent of maize replaced by wheat bran performed in a similar way to that of control fed group and was better than those fed diet with 100 per cent replacement of maize by wheat bran.

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