

## Effect of Early Weaning on the Litter Traits of Pigs

Hemant Kumar<sup>1\*</sup>, Basant Kumar<sup>2</sup> and Ram Narayan Singh<sup>3</sup>

<sup>1</sup>Krishi Vigyan Kendra, Purnea (Bihar Agricultural University, Bhagalpur), Bihar-854327, India.

<sup>2</sup>RVO, Regional Director South Chotanagpur Range Kanke, Ranchi, Jharkhand- 834006, India.

<sup>3</sup>Department of Animal Nutrition, Ranchi Veterinary College, Birsa Agricultural University,  
Kanke, Ranchi, Jharkhand 834006, India.

### Authors' contributions

This work was carried out in collaboration among all authors. Authors HK and RNS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors HK, BK and RNS managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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### ABSTRACT

The present study was carried out with 444 crossbred piglets from 60 sows belonging to various genetic groups viz., ½ Landrace (LR) X ½ desi (D), ½ Tamworth (T) X ½ D, ½ LR X ¼ T X ¼ D and ½ T X ¼ LR X ¼ D maintained at Pig Breeding Farm of Ranchi Veterinary College, Birsa agricultural University, Ranchi. The 60 sows under examination were randomly allocated into 5 weaning groups; weaned at 3 weeks (W<sub>3</sub>), 4 weeks (W<sub>4</sub>), 5 weeks (W<sub>5</sub>), 6 weeks (W<sub>6</sub>) and 8 weeks (W<sub>8</sub>). Piglets of each weaning group offered 4 types of weaning diets T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> as creep feed from 2 to 8 weeks of age. Effect of diet and weaning time had non-significant influence on litter size at the 8<sup>th</sup> and 12<sup>th</sup> week of age. Weaning time significantly affected the litter weight at the 8<sup>th</sup> and the 12<sup>th</sup> week of age; litter weight was greater in piglets weaned at the 5<sup>th</sup>, 6<sup>th</sup> and 8<sup>th</sup> than at the 3<sup>rd</sup> and 4<sup>th</sup> week of age (P<0.05). Although weaner diet had non-significant effect on litter weight, numerically higher values for litter weight at the 12<sup>th</sup> week was observed in T<sub>1</sub> (63.25 ± 8.21 kg) than that of T<sub>3</sub> (56.63 ± 6.38 kg) followed by T<sub>2</sub> (53.74 ± 6.30 kg) and T<sub>4</sub> (52.98 ± 5.58 kg). The present study suggested weaning of piglets either at 5<sup>th</sup> or 6<sup>th</sup> week of age instead of 8<sup>th</sup> week that in the conventional weaning time in India.

\*Corresponding author: E-mail: hemantdec20@gmail.com;

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## 1. INTRODUCTION

Under the normal management practices of pig raising in India, the piglets are weaned at 8 weeks of age. The mortality rate of piglets seem to increase when weaning is imposed at 8 weeks, probably due to non-availability of sufficient milk for all the piglets owing to the fact that peak of milk production occurs in the 3<sup>rd</sup> week and it declines steadily afterwards [1]. Biologically, sow becomes ready for next pregnancy in around 24 days after farrowing [2]. But, sows generally do not come in heat during the suckling period, because the ovulatory system remains does not work properly during lactation and thus their farrowing interval is extended [3]. With the use of milk replacer, creep mixture, pre-starter and starter diets, it may be possible to wean the piglets earlier than the usual weaning age of 8 weeks. This will reduce mortality of piglets, will minimize weight losses in sows and will permit earlier re-fertilization of the sows. Early weaning will reduce the number of runts that grow appreciably slower than their litter-mates, prevent the spread of diseases from sows to the piglets, minimize feed cost for the sows, save labour and floor space [4]. However, early weaning of piglets requires special rations which must be carefully formulated. Hence, the present study was carried out to examine the effects of various diets and weaning time on pigs' litter size and weight at the 8<sup>th</sup> and 12<sup>th</sup> week of age in India.

## 2. MATERIALS AND METHODS

### 2.1 Experimental Animal

A total of sixty crossbred sows with 444 piglets belonging to 4 genetic groups viz. ½ Landrace + ½ Desi(B<sub>1</sub>; 115), ½ Tamworth + ½ Desi(B<sub>2</sub>; 129), ½ Landrace + ¼ Tamworth + ¼ Desi (B<sub>3</sub>; 101) and ½ Tamworth + ¼ Landrace + ¼ Desi(B<sub>4</sub>; 99) maintained at Pig Breeding Farm of Ranchi Veterinary College, Birsa Agricultural University, Ranchi(Jharkhand).

### 2.2 Design of Experiment

Sows were randomly allocated into 5 weaning groups (12 per group). They were weaned at 3 weeks (W<sub>3</sub>), 4 weeks (W<sub>4</sub>), 5 weeks (W<sub>5</sub>), 6 weeks (W<sub>6</sub>) and 8 weeks (W<sub>8</sub>). Piglets of each weaning group were then provided with 4 types of creep feed (Table 1) between the 2<sup>nd</sup> and 8<sup>th</sup> week of age. The numbers of piglets in the weaning groups were 87 (W<sub>3</sub>), 92 (W<sub>4</sub>), 88 (W<sub>5</sub>), 81 (W<sub>6</sub>) and 96 (W<sub>8</sub>). For the evaluation of each weaner diet, piglets from 15 sows were selected. The number of piglets in T<sub>1</sub> (109) belonging to 4 genetic groups mentioned above were 30 (B<sub>1</sub>), 34 (B<sub>2</sub>), 24 (B<sub>3</sub>) and 21 (B<sub>4</sub>). The corresponding numbers for T<sub>2</sub> (112) were 32, 30, 25 and 25, for T<sub>3</sub> (109) 25, 31, 26 and 27 and for T<sub>4</sub> (114) 28, 34, 26 and 26. After 8 weeks, piglets of all groups were provided with a common grower diet and fed *ad lib*. The grower diet consisted of

**Table 1. Composition and analysis of the offered creep diet**

Ingredients (%)	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
Maize	38.0	31.0	53.0	51.0
Barley	15.5	14.0	10.0	8.0
Pearl millet	3.0	14.0	--	6.5
Groundnut cake	13.5	13.0	7.0	6.5
Fish meal	9.0	9.0	9.0	9.0
Skim milk powder	8.0	8.0	8.0	8.0
Jaggery	5.0	5.0	5.0	5.0
Lard	5.0	3.0	5.0	3.0
Dicalcium phosphate	1.0	1.0	1.0	1.0
Calcium carbonate	0.5	0.5	0.5	0.5
Sodium chloride	0.4	0.4	0.4	0.4
Mineral and Vit. Pre-mix	1.1	1.1	1.1	1.1
Antibiotics*				
<b>Chemical composition(calculated)</b>				
CP(%)	20.05	20.03	18.06	18.06
DE(kcal/kg)	3502	3311	3480	3385
CF(%)	3.12	3.09	2.62	2.59
Lysine(%)	1.00	1.02	1.00	0.92
Meth. + Cyst. (%)	0.67	0.66	0.60	0.60

\* Sulfadimidine -100 mg/kg diet; Binit (Furazolidone) – 50 mg/kg diet

maize (60 kg), groundnut cake (13 kg), wheat bran (18 kg), fish meal (7 Kg), Mineral Mixture (1.5 Kg), common salt (0.5 kg) and vitamins (A B<sub>2</sub>D<sub>3</sub>) premix (20 gm). Weaning was performed by removing the dam from the farrowing pen and further rearing the piglets in the same pen to protect them from removal stress.

### 2.3 Litter Size and Litter Weight

The experiment was continued till the 12<sup>th</sup> week of age. The litter size and litter weight at birth, 8<sup>th</sup> and 12<sup>th</sup> week of age were recorded.

### 2.4 Statistical Analysis

The recorded data were subjected to two way analysis of variance (Randomized Block Design) as described by Snedecor and Cochran [5] using following statistical model:

$$Y_{ijk} = \mu + W_i + D_j + e_{ijk}$$

Where,

$Y_{ijk}$  = K<sup>th</sup> observation under j<sup>th</sup> diet and i<sup>th</sup> weaning group,  
 $\mu$  = Population mean  
 $W_i$  = effect of i<sup>th</sup> weaning group  
 $D_j$  = Effect of j<sup>th</sup> diet group  
 $e_{ijk}$  = Random error

The statistical significance was studied by 'F' test. Whenever, the effect was significant, the pair wise comparison of mean was performed with the help of critical difference test. Standard Error (S.E.) of each mean was calculated with following formula:

$$S.E. = \sqrt{\frac{\sum X^2 - (\sum X)^2/n}{n(n-1)}}$$

Where,

X = each value in the data set  
 n = number of value in the data set

## 3. RESULTS AND DISCUSSION

### 3.1 Litter Size at Birth

Although litter size among the different dietary groups was similar at birth, 8<sup>th</sup> and 12<sup>th</sup> week of age (Table 2), a reduction in litter size was observed as the age advanced. The reduction in litter size between birth and 8<sup>th</sup> week in T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> dietary groups were 1.13, 2.00, 1.46 and

1.47, respectively, and the corresponding values of reduction between 8<sup>th</sup> and the 12<sup>th</sup> week were 0.07, 0.13, 0.27 and 0.26, respectively. The lack of significant differences might be attributed to the heterogeneity of litter size within different groups.

Similarly the litter size of piglets among different weaner groups at birth, 8<sup>th</sup> and 12<sup>th</sup> week of age was also statistically similar but there was a reduction by 1.58, 2.50, 1.08, 0.58 and 1.50 from birth to 8<sup>th</sup> week of age in W<sub>3</sub>, W<sub>4</sub>, W<sub>5</sub>, W<sub>6</sub> and W<sub>8</sub> weaning groups, respectively. The corresponding values from 8<sup>th</sup> to 12<sup>th</sup> week were 0.00, 0.09, 0.42, 0.17 and 0.25, respectively. The maximum reduction observed in piglets weaned at 4<sup>th</sup> week (W<sub>4</sub>) followed by W<sub>3</sub>, W<sub>8</sub>, W<sub>5</sub> and W<sub>6</sub> piglets. However, between the 8<sup>th</sup> to 12<sup>th</sup> weeks, the greatest reduction was observed in W<sub>5</sub> group by W<sub>8</sub>, W<sub>6</sub>, W<sub>4</sub> and W<sub>3</sub> group. The lowest reduction in litter size between the 8<sup>th</sup> and the 12<sup>th</sup> week in W<sub>3</sub> piglets could be possible attributed to the earlier provision of solid feed. The greater rates of mortality till weaning were observed after birth and till the 8<sup>th</sup> week of age. However, the total reduction in litter size from birth to 12<sup>th</sup> week was lowest in W<sub>6</sub> group (0.75) followed by W<sub>5</sub> (1.50), W<sub>3</sub> (1.58), W<sub>4</sub> (1.59) and W<sub>8</sub> (1.75) group indicating that weaning at the 6<sup>th</sup> week of age is the most advantageous since the losses are the lowest. Litter sizes recorded in the present experiment at birth and at 8<sup>th</sup> week of age are in agreement with the results of Singh et al. [6,7] in Large White Yorkshire pigs who found better litter size at 56 day weaned group than 28 and 35 day weaned groups. Mukhopadhyay et al. [8] also recorded similar result in crossbred pigs under Indian conditions.

### 3.2 Litter Weight

Litter weight among dietary groups at birth, 8<sup>th</sup> and 12<sup>th</sup> week of age was similar (Table 3). Numerically higher litter weight in T<sub>1</sub> at 8<sup>th</sup> and 12<sup>th</sup> weeks of age (50.95 and 63.25 kg, respectively) might be due to numerically higher litter size although the differences were non-significant. The lowest litter weight was observed in W<sub>4</sub> group which did not differ significantly from that of W<sub>3</sub> group. The lower litter weight in those two weaning groups could be possibly attributed to the weaning shock and occurrence of severe diarrhea at this early age that negatively affect. The litter weight of W<sub>6</sub> group were recorded to be maximum at 8<sup>th</sup> and 12<sup>th</sup> week of age which were significantly (P<0.05) higher than those of W<sub>3</sub> and W<sub>4</sub> but did not differ significantly from those

**Table 2. Average litter size of piglet weaned on different diets at different ages**

Weaning groups	Dietary groups				Overall Avg.(NS) (Weaning group)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	
<b>At Birth</b>					
W <sub>3</sub>	7.33 ± 1.20	7.00 ± 1.00	7.67 ± 2.03	7.00 ± 1.53	7.25 ± 0.64
W <sub>4</sub>	7.33 ± 0.88	8.00 ± 2.08	7.67 ± 0.67	7.67 ± 0.33	7.67 ± 0.51
W <sub>5</sub>	8.00 ± 2.08	7.67 ± 1.67	7.00 ± 0.58	7.33 ± 0.67	7.50 ± 0.61
W <sub>6</sub>	6.00 ± 1.00	6.33 ± 0.88	6.33 ± 1.33	8.33 ± 3.38	6.75 ± 0.87
W <sub>8</sub>	8.00 ± 2.52	8.67 ± 0.67	7.67 ± 1.45	7.67 ± 0.67	8.00 ± 0.66
Overall average(NS) (Diet Group)	7.33 ± 0.66	7.53 ± 0.56	7.53 ± 0.52	7.60 ± 0.66	
<b>At 8<sup>th</sup> Week</b>					
W <sub>3</sub>	6.33 ± 1.20	6.33 ± 1.20	4.67 ± 1.67	5.33 ± 0.88	5.67 ± 0.88
W <sub>4</sub>	4.67 ± 0.33	4.67 ± 0.33	6.00 ± 0.58	5.33 ± 0.33	5.17 ± 0.24
W <sub>5</sub>	7.00 ± 1.53	4.67 ± 0.33	7.33 ± 0.33	6.67 ± 0.67	6.42 ± 0.48
W <sub>6</sub>	5.67 ± 0.88	6.33 ± 0.88	5.33 ± 1.33	7.33 ± 2.40	6.17 ± 0.68
W <sub>8</sub>	7.33 ± 1.86	5.67 ± 0.33	7.00 ± 1.15	6.00 ± 0.00	6.50 ± 0.51
Overall average(NS) (Diet Group)	6.20 ± 0.55	5.53 ± 0.34	6.07 ± 0.50	6.13 ± 0.50	
<b>At 12<sup>th</sup> week</b>					
W <sub>3</sub>	6.33 ± 1.20	6.33 ± 1.20	4.67 ± 1.67	5.33 ± 0.88	5.67 ± 0.58
W <sub>4</sub>	4.67 ± 0.33	4.67 ± 0.33	6.00 ± 0.58	5.00 ± 0.58	5.08 ± 0.26
W <sub>5</sub>	6.67 ± 1.45	4.33 ± 0.33	6.67 ± 0.88	6.33 ± 0.88	6.00 ± 0.51
W <sub>6</sub>	5.67 ± 0.88	6.33 ± 0.88	5.00 ± 1.00	7.00 ± 2.65	6.00 ± 0.70
W <sub>8</sub>	7.33 ± 1.86	5.33 ± 0.33	6.67 ± 1.45	5.67 ± 0.33	6.25 ± 0.57
Overall average(NS) (Diet Group)	6.13 ± 0.53	5.40 ± 0.35	5.80 ± 0.50	5.87 ± 0.54	

Each value in average of 3, 12 and 15 litters for subgroup, weaning and dietary group, respectively.  
NS = Non-Significant

**Table 3. Average litter weight (kg) of piglet weaned on different diets at different ages**

Weaning groups	Dietary groups				Overall Avg. (NS) (Weaning group)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	
<b>At Birth</b>					
W <sub>3</sub>	6.21 ± 0.58	7.73 ± 1.56	6.75 ± 2.04	7.43 ± 1.56	7.03 ± 0.68
W <sub>4</sub>	6.45 ± 1.29	7.67 ± 2.17	7.93 ± 0.74	7.70 ± 0.70	7.44 ± 0.61
W <sub>5</sub>	7.20 ± 1.52	7.65 ± 1.54	8.10 ± 0.56	7.06 ± 0.22	7.50 ± 0.49
W <sub>6</sub>	6.11 ± 1.46	5.80 ± 1.19	5.28 ± 1.14	7.28 ± 3.64	6.12 ± 0.93
W <sub>8</sub>	7.68 ± 1.53	8.38 ± 0.78	8.30 ± 1.78	7.54 ± 0.52	7.98 ± 0.55
Overall average (NS) (Diet Group)	6.73 ± 0.53	7.45 ± 0.62	7.27 ± 0.60	7.40 ± 0.69	
<b>At 8<sup>th</sup> Week</b>					
W <sub>3</sub>	42.23 ± 9.48	41.07 ± 15.81	29.40 ± 11.80	29.82 ± 4.46	35.63 <sup>b</sup> ± 5.10
W <sub>4</sub>	23.93 ± 3.24	33.05 ± 6.27	38.13 ± 5.09	37.05 ± 2.36	33.04 <sup>b</sup> ± 2.56
W <sub>5</sub>	55.18 ± 6.80	40.72 ± 7.34	58.77 ± 13.68	46.32 ± 7.29	50.25 <sup>a</sup> ± 4.48
W <sub>6</sub>	61.17 ± 19.60	56.80 ± 13.78	43.08 ± 9.56	46.12 ± 14.86	51.79 <sup>a</sup> ± 6.73
W <sub>8</sub>	72.25 ± 15.13	34.23 ± 0.72	47.43 ± 4.53	48.47 ± 6.19	50.60 <sup>a</sup> ± 5.49
Overall average(NS) (Diet Group)	50.95 ± 6.44	41.17 ± 4.51	43.36 ± 4.48	41.55 ± 3.64	
<b>At 12<sup>th</sup> week</b>					
W <sub>3</sub>	55.70 ± 7.64	56.23 ± 22.43	40.45 ± 15.75	38.13 ± 6.39	47.63 <sup>b</sup> ± 6.90
W <sub>4</sub>	32.97 ± 4.69	41.75 ± 9.96	48.73 ± 7.05	47.05 ± 6.24	42.63 <sup>b</sup> ± 3.60
W <sub>5</sub>	67.90 ± 6.82	48.37 ± 8.88	81.83 ± 20.15	64.57 ± 13.65	65.67 <sup>a</sup> ± 6.75
W <sub>6</sub>	75.47 ± 25.02	78.13 ± 16.42	53.77 ± 11.23	63.07 ± 22.04	67.61 <sup>a</sup> ± 8.79
W <sub>8</sub>	96.90 ± 22.05	44.23 ± 2.24	58.37 ± 10.41	52.07 ± 9.61	62.89 <sup>a</sup> ± 8.29
Overall average(NS) (Diet Group)	63.25 ± 8.21	53.74 ± 6.30	56.63 ± 6.38	52.98 ± 5.58	

Each value in average of 3, 12 and 15 litters for subgroup, weaning and dietary group, respectively.  
a, b = Values in a column not sharing common superscripts differ significantly. (P < 0.05)

of W<sub>5</sub> and W<sub>8</sub> groups. Almost similar results i.e. better performance of pigs weaned at between 5<sup>th</sup> to 8<sup>th</sup> weeks of age was also recorded [9,10]. Our finding are supported by Devi et al. [11] who also noticed that higher body weight at 12<sup>th</sup> week of age in piglets weaned at 56 days of age than those weaned at 35 days but difference was non-significant statistically. Growth rate was higher for the 56 day weaning group as compared to early weaned groups [12].

#### 4. CONCLUSIONS

On the basis of the results, it is concluded that in India piglets may be weaned at 5 to 6 weeks of age and reared on weaner diets having 18 to 20% protein and 3300-3500 Kcal DE/Kg of diet fortified with adequate amount of minerals and vitamins supplements.

#### ETHICAL APPROVAL

Animal Ethic committee approval has been collected and preserved by the author(s).

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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