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Effect of brooding systes on growth performance in large white yorkshire piglets

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Abstract
Pig industry is the fastest growing industry in the food sector in spite of cultural and religious taboo. Pigs are most prolific in nature and excel in converting inedible feed into edible nutritious meat. The first 72 hrs is the most critical period for the piglets and requires artificial heat supplement during this period since thermoregulatory centre for the piglets is underdeveloped. Growth performance of the piglets in the pre-weaning period contributes to the post weaning weight gain and the economic status of the farm. Twenty four sows immediately after farrowing was taken for the study. Four groups of animals comprising of 10 piglets each from six different sows were allotted in T_1(control), T_2(100-watt incandescent bulb brooding) T_3(100-watt infrared bulb brooding)and T_4 (wood charcoal brooding) based on the completely randomised design. Brooding facilities including lighting was provided for 35 days and growth study was continued for 60 days. All groups were given a standard health management practices and fed with creep feed from 14th to 35th day and grower feed from 36th to 60 days of study period. There was a significant (p<0.01) difference in the weight of the piglets in all the treatment groups from the second week onwards till eighth week. Weaning weight was higher in T_3 followed by T_2 compared to T_1. Average daily gain (ADG) also showed significant (p<0.01) difference. T_3 followed by T_2 had better ADG compared to T_1.

Keywords: Piglets, brooding systems, litter size, body weight, ADG

Introduction
Pig farming farms a very important component of the Indian livestock sector. According to the 19thLivestock census of India the total pig population comprises 2.01% to the total livestock population (http://dahd.nic.in). Pig population in India is estimated to be 10.29 million and it ranks 5thin the world. Pig contributes 468.8 tons of meat which covers 6.5% of the total national meat production. Swine farming is a profitable farming for the resource poor farmers (Antwi & Seahlodi, 2011) [2]. Since it requires less initial investment and they have good feed conversion efficiency and have the better potential to convert inedible feed and feed resources into an edible nutritious meat. Pig industry is the fastest growing industry in the food sector though there is a cultural and religious taboo for pig meat (Papas, 2013).

The first and foremost target of an ideal farm is to reduce the morbidity and mortality rate. The most critical period for survival of piglets is up to 72 hours after birth, resulting from the following variables: birth weight, birth order, air temperature, behaviour of the sow, deaths by crushing, starvation, and exposure to cold (Baxter *et al.*, 2008) [3]. Temperatures of 16 °C to 25 °C are most beneficial for sows while temperatures as high as 32 °C are agreeable for piglets (Dong *et al.*, 2001) [4]. However, cold weather temperature and wind chills could be dangerous to pig production (Grandin, 2013) [5]. The new born piglets need warmth close to its thermo-comfort zone with optimal humidity for the better performance.

Growth performance of the piglets at pre-weaning stage contributes to the post weaning weight gain of the piglets along with the survivability rate of the farm for the better profitability. Hence, the present study was conducted to evaluate the effect of different brooding systems on the growth performance of Large White Yorkshire piglets in both pre and post weaning stages in winter season in high altitude area of Wayanad district of Kerala.

Materials and Methods
Experimental details and data
Twenty-four sows of different parity with litter size of 8-12 immediately after farrowing were randomly selected for the study and divided into four homogenized groups with 6 sows in each

treatment. The study was conducted in the Pig unit, Instructional Livestock Farm Complex, College of Veterinary and Animal Sciences, Pookode. Four groups of animals comprising of 10 piglets each from six different sows were allotted in T_1(control), T_2 (100-watt incandescent bulb brooding) T_3(100-watt infrared bulb brooding)and T_4 (wood charcoal brooding) based on the Completely Randomised Design. All groups were housed in a farrowing pen of uniform size with concrete flooring and brooding facilities including lighting was provided for 35 days and growth study was continued for 60 days. All groups were given a standard health management practices and fed with creep feed from 14th to 35th day and grower feed from 36th to 60 days of study period as per the NRC 1998 recommendation.

The brooder pen of 90 cm length x 50 cm width x 50 cm height was uniform in all groups with concrete flooring. The brooding facilities including light were given for the piglets till 35 days and growth study were continued up to 60 days during winter season. Brooder box with 100 watt incandescent bulb and a brooder box with 100 watt infrared bulb was used for electrical brooding and a drum of size 85.09 cm in height and 57.15cm in diameter was used with 2-3.5kg charcoal/ day for wood charcoal brooding.

Parameters studied in the present study were litter size at birth and at weaning, litter weight at birth and at weaning, average weekly weight and average daily gain of the Large White Yorkshire piglets.

Litter size at birth and at weaning

Number of the piglets born and the number of piglets survived till weaning was observed.

Weight at birth and weaning

Weights of each piglet were recorded at birth and at weaning to get growth performance of the piglets in different treatment groups.

Weekly body weight from birth to weaning and up to 60 days

The body weights of all the piglets were recorded using a digital weighing machine in every week till weaning. Thereafter, body weights of the piglets were recorded at the time of weaning and from the next week up to the end of the experiment.

Average weekly gain:

The weekly weight gain of each piglet was calculated by using the formula by Pandey, *et al.* (1996).

Average weekly gain=W_2-W_1/T_2-T_1

Where W_1 and W_2 are the initial and final body weights of the piglets for a particular period and T_1 and T_2 are the corresponding time units.

Statistical Analysis

The data obtained during the course of the study were analyzed statistically as per the methods described by Snedecor and Cochran (1994) using the SPSS version21.0 ® software.

Results and Discussion

The effects of different brooding system on the growth performance of the piglets were studied.

Litter weight at birth and at weaning

The mean ± SE litter weight of the LWY piglets at birth in the present study was higher than earlier reported by Kotresh *et al.* (2016) [9] (1.48 ± 0.04). The overall birth weight of the piglets was 1.88 ± 0.17 and weaning weight (kg) was 6.31 ± 0.36. The mean ± SE litter weight (kg) of the piglets at birth and at weaning was observed and values are given in the Table.2. The present study supports with the findings of Adam *et al.* (1980) [1] who found that during first 3 days of postpartum, supplemental heat was very advantage, whereas the control group animals used more energy for homeothermy and possibly the average weight gain was significantly (P<0.01) reduced. This findings also supported by Beshada *et al.* (2006). This might be due heat lamp (175 W, infra-red lamps) with heat sensors to maintain the temperature of piglets thereby improved average daily gain

Litter size at birth and at weaning

The mean ± SE litter size of the piglets at birth and at weaning was observed and the values are depicted in the Table. The mean litter size of the Large White Yorkshire piglets at birth in T_1, T_2, T_3, and T_4 were 10.00 ± 0.41, 10.00 ± 0.41, piglets each in all the four treatments. The litter size at weaning in T_1, T_2, T_3, and T_4 were 8.17 ± 0.31, 9.33 ± 0.21, 9.67 ± 0.42, 8.83 ± 0. 31 respectively. The overall litter size at birth and weaning was 10 ± 1.18 and 9 ± 0.93 respectively. These finding are in agreement with Matabane *et al.* (2018) [10] who reported that average litter size for LWY was 11.8, the number of piglets born alive was 10.2 and number of piglets weaned (9.5) was influenced by season but not by sex of the piglets. The present findings more or less were in support of Kotresh *et al.* (2016) [9],

Table 1: Litter size at birth and at weaning

Treatment	At birth	At weaning
T1	10.00 ± 0.41	8.17 ± 0.75^{b}
T2	10.00 ± 0.41	9.33 ± 0.52^{a}
T3	10.00 ± 0.63	9.67 ± 1.03^{a}
T4	10.00 ± 0.41	8.83 ± 0.75^{ab}
F-value	0.00^{ns}	4.14**
p-value	0.96	0.01

Weekly body weight

The mean ± SE body weight of the Large White Yorkshire Piglets were recorded in different brooding systems and the values are presented in Table 2 and Figure 1.The overall weight (kg) of the piglets in T_1, T_2, T_3, and T_4 at 1st week was 1.96 ± 0.02kg, in 2nd week was 2.76 ± 0.02, in 3rd week was 3.62 ± 0.03, in 4th week was 4.79 ± 0.03, in 5th week was 6.31 ± 0.04, in 6th week was 7.87 ± 0.04, in 7th week 9.50 ± 0.04, and in 8th week was 11.19 ± 0. There was a significant (p<0.01) difference in the weight of the piglets from the second week onwards in all the treatments.T_3 showed an increased body weight from the second week onwards followed by T_2.This results are in agreement with the findings by Lalremruata *et al.* (2015) [6].

Weekly body weight gain

The mean ± SE weight gain of the piglets with the different brooding system in T_1, T_2, T_3, and T_4 are depicted in the Table.3. and Figure.2.The overall average weight gain (kg) of the piglets in group T_1, T_2, T_3, and T4 in 1st week was 0.75 ± 0.01, in 2nd week was 0.81 ± 0.01, in 3rd week was 0.86 ± 0.01, in 4th week was 1.17 ± 0.02, in 5th week was 1.52 ± 0.01, in 6th week was 1.57 ± 0.01, in 7th week was 1.63 ± 0.01, and in 8th week was 1.69 ± 0.01. There was a significant (p<0.01)

difference in the weekly weight gain of the piglets in all the treatments. The above findings were in consonance with the findings of Martelli *et al.* (2015) [11]. Increased weight gain noticed in the T_3 followed T_2 than T_1.

Table 2: Average body weight of the piglets with different brooding system

Treatment	Mean birth weight	Pre weaning (1st – 35th day)					Post weaning (36th -60th day)		
		1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week
T_1	1.25±0.02	1.93±0.03	2.64±0.04^{c}	3.43±0.05^{c}	4.41± 0.04^{c}	5.93±0.05^{b}	7.42±0.05^{b}	9.09±0.06^{c}	10.83±0.06^{c}
T_2	1.21±0.03	1.94±0.04	2.70±0.03^{b}	3.51±0.04^{ab}	4.82±0.07^{ab}	6.37±0.08^{ab}	8.08±0.07^{a}	9.65±0.08^{a}	11.29±0.08^{b}
T_3	1.22 ± 0.02	2.02±0.03	3.00±0.04^{a}	4.02±0.05^{a}	5.12±0.06^{a}	6.60±0.07^{a}	8.08±0.07^{a}	9.74±0.08^{a}	11.44±0.09^{a}
T_4	1.21 ± 0.02	1.93±0.03	2.69±0.03^{b}	3.48±0.04^{ab}	4.79±0.05^{b}	6.32±0.06^{ab}	7.92±0.09^{b}	9.54±0.10^{b}	11.21±0.11^{bc}
F value	2.71^{ns}	1.94^{ns}	19.10**	38.37**	25.66**	19.24**	18.91**	13.30**	9.03**
p-value	0.52	0.125	0.01	0.01	0.01	0.01	0.01	0.01	0.01

^{a,b,c} Mean ± SE with different superscripts are significantly differ within column.
**significance at 1% level; ns-non significant

There was a significant (p<0.01) difference in the body weight of the piglets in all the treatments. T_3 showed an increased body weight from the second week onwards followed by T_2 and T_4 than T_1.

Table 3: Average daily gain (kg) of LWY piglets with different brooding system

Treatment	Pre weaning (1st – 35th day)					Post weaning (36th -60th day)		
	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week
T_1	0.66±0.01	0.70±0.01^{c}	0.79±0.01^{b}	0.91±0.01^{c}	1.49±0.01^{b}	1.48±0.01^{c}	1.57±0.01^{c}	1.64±0.01^{c}
T_2	0.80 ±0.01	0.77±0.01^{b}	0.86±0.01^{ab}	1.34±0.04^{a}	1.53±0.03^{ab}	1.55±0.01^{b}	1.66±0.02^{a}	1.70±0.02^{b}
T_3	0.87±0.01	0.98±0.02^{a}	1.03±0.02^{a}	1.36±0.01^{a}	1.54±0.01^{a}	1.66±0.05^{a}	1.67±0.01^{a}	1.74±0.01^{a}
T_4	0.79 ±0.01	0.75±0.01^{b}	0.79±0.01^{b}	1.09±0.01^{b}	1.52±0.01^{ab}	1.49±0.01^{bc}	1.62±0.01^{b}	1.68±0.01^{bc}
F value	99.77^{ns}	100.63**	117.40**	88.15**	2.16^{ns}	30.06**	12.69**	9.57**
p-value	0.12	0.01	0.01	0.01	0.94	0.01	0.01	0.01

^{a,b,c} Mean ± SE with different superscripts are significantly differ within column.
**significance at 1% level;ns-non significant

There was a significant (p<0.01) difference in the weight gain of the piglets in all the treatments. There was an increase in the weight gain of the piglets in T_3 from the second week onwards followed T_2 and T_4 compared to T_1.

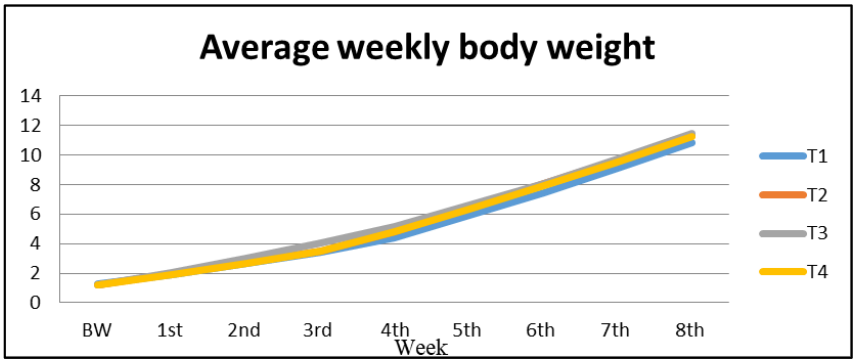

Fig 1: Trends in average weekly body weight of LWY piglets with different brooding system

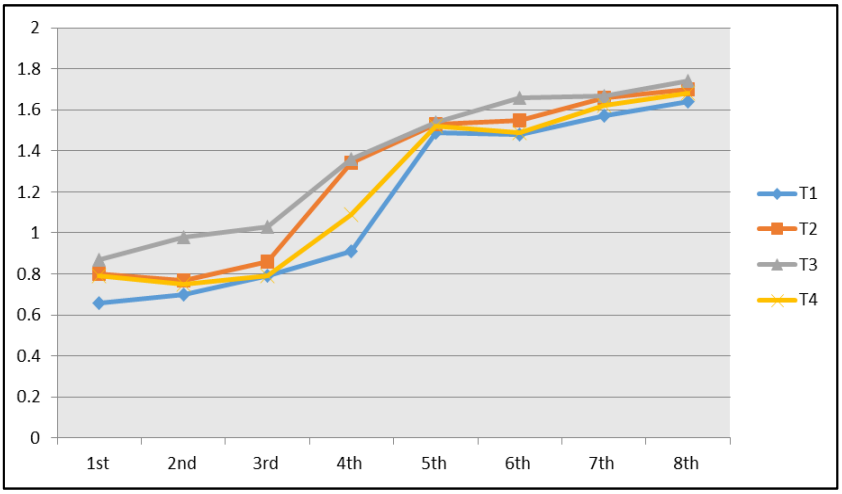

Fig 2: Trends in average daily gain of LWY piglets with different brooding system

Conclusion

Based upon the results of this study, this leads to the following conclusions that piglets reared under 100 W incandescent lamp brooding group (T_2) had comfort THI (87.42 ± 0.22 to 89.86 ± 0.15), relative humidity (RH) (46.71 ± 0.06 to 55.31 ± 0.85) and temperature (Ta) (31.92 ± 0.55 to 33.18 ± 0.09 ºC) which shown better average body weight gain of 1.70 ± 0.02 kg and obtained 10.91 per cent more net profit per kg of live weight than control group animals. Though, the wood charcoal brooding (T_4) groups shown slightly lesser weight gain and net profit ratio compared to electric brooding system, wood charcoal brooding could also be recommended where interrupted electricity supply occurred in rainy and winter season in high altitude rural areas.

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