

EFFECT OF DIFFERENT FLOORING SYSTEMS ON GROWTH PERFORMANCE, FEED UTILIZATION AND BIOMETRIC TRAITS OF LARGE WHITE YORKSHIRE PIGLETS DURING THE POST-WEANING PERIOD

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ABSTRACT

24 Large White Yorkshire piglets weaned at 56-day age were allotted randomly to 4 experimental groups with 6 piglets in each group i.e., T1 (control group) was reared on the concrete floor, T2 rubber mat, T3 elevated slatted floor, and T4 reared on soil floor. Experimental duration was of 126 days after weaning. The initial body weights (kg) of piglets were 8.12 ± 0.35 , 8.13 ± 0.57 , 8.13 ± 0.54 , and 8.12 ± 0.42 and which was increased to 50.45 ± 2.41 , 49.00 ± 4.39 , 56.45 ± 1.74 , and 47.92 ± 5.26 , respectively in T1, T2, T3, and T4 by ninth fortnight. The average daily gain (g) was 132.14 ± 10.23 , 148.21 ± 29.53 , 174.41 ± 9.69 , and 128.57 ± 22.59 in the first fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively and was increased to 518.98 ± 50.71 , 506.84 ± 57.19 , 537.55 ± 39.66 , and 510.83 ± 81.86 in the ninth fortnight on concrete, rubber mat, elevated slatted and soil floor, respectively. The average feed intake (kg/head/day) was 0.470 ± 0.02 , 0.490 ± 0.03 , 0.539 ± 0.02 , and 0.477 ± 0.02 in first fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively and was increased to 2.598 ± 0.07 , 2.482 ± 0.05 , 2.737 ± 0.08 , and 2.702 ± 0.07 in ninth fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively. The average feed conversion ratio was 3.55 ± 0.14 , 3.31 ± 0.17 , 3.09 ± 0.14 , and 3.71 ± 0.14 in the first fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively and was changed to 5.01 ± 0.13 , 4.90 ± 0.10 , 5.09 ± 0.14 , and 5.29 ± 0.14 in the ninth fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively. Statistical analysis revealed a non-significant ($P > 0.05$) difference among mean initial body length, height at withers, heart girth, and hip width and between all the fortnights throughout the experiment.

KEYWORDS: Large White Yorkshire piglets, postweaning period, Different floors, Growth performance, Biometry,

1. INTRODUCTION

The challenges faced by the country in securing food as well as nutritional security for the fast-growing population need an integrated approach in livestock farming. Pig farming has the potential to provide employment opportunities to seasonally employed rural farmers and supplementary income to improve their living standards. Pig has got one of the highest feed conversion efficiencies i.e., they produce more live weight gain from a given weight of feed than any other class of meat-producing animals except the broilers. Pigs can utilize a wide variety of feedstuffs viz. grains, forages, damaged feeds, and garbage and convert them into valuable nutritious meat. Pigs are one of the most prolific breeders with high fecundity and shorter generation interval. They have high growth potential of reaching market weight at an early age under better management conditions.

In recent years there has been a growing concern about animal welfare due to the undesirable consequences on general productivity performance (Miro *et al.*, 2016). Increased demand for quality animal products has led to the intensification of production that compromises animal welfare (Candiani *et al.*, 2008). Animal welfare, among other things, depends on the type of floor in their housing. The floor as the main part of the house influences animal welfare by its design and material, which is then manifested in species-specific behavior, the occurrence of lesions and diseases, and convenience (Kymalainen *et al.*, 2009).

Flooring type may affect growth performance if the flooring material causes stress to the animal. Therefore, the ideal bed needs to be hygienic, dry, resilient, and reasonably temperature resistant. Proper flooring management and design are critical for better health care, longevity, comfort, and increased productivity. A balance must exist between animal comfort and well-being, cleanliness, and feed digestibility and efficiency. So, there is a need to explore different materials as floors to ensure the balance between comfort and productivity.

Rubber mats have not yet been widely used in pig production. However, studies of their effect on breeding female welfare have shown favorable results, including improved lying comfort, and sows and gilts find them preferable at low environmental temperatures (Ostovic *et al.*, 2015). In commercial pig production, pigs are mostly kept on

a slatted, semi-slatted concrete or concrete floor. These floor types are advantageous in terms of durability, hygiene, and human resources, but offer poor comfort to the animals.

As in India much work on effect of flooring systems on performance in pigs is not done. In view of the above, the present study was planned to study the effect of different flooring systems viz. elevated slatted floor, soil floor, rubber mat floor and concrete floor on performance of piglets during postweaning period.

2. MATERIALS AND METHODS

The present study was undertaken to find out the effect of different flooring systems viz. elevated slatted floor, soil floor, rubber mat floor and concrete floor on growth performance of Large White Yorkshire piglets during postweaning period under an intensive system.

2.1 Location of the study

The experiment was conducted at Pig Unit, Livestock Farm Complex (LFC), College of Veterinary Science, Rajendranagar, Hyderabad.

2.2 Environmental conditions

Hyderabad is located in central Telangana and the city lies at 17.366° N latitude and 78.476° E longitude in the Deccan Plateau and rises to an average height of 536 m above the sea level. Hyderabad has a unique combination of a tropical wet and dry climate that borders on a hot semi-arid climate (Koppen climate classification). During the period of the study, the average maximum temperature recorded was 31.5 °C while the average minimum temperature was 21.7 °C.

2.3 Selection of experimental animals

24 Large White Yorkshire piglets weaned at 56-day age were allotted randomly to 4 experimental groups with 6 piglets in each group in Completely Randomized Design (CRD) under an intensive system. Weaning was done at the morning hours of the day. Piglets were reared on four types of flooring systems i.e., T1 (control group) was reared on the concrete floor, T2 rubber mat, T3 elevated slatted floor, and T4 reared on soil floor. Experimental duration was of 126 days after weaning.

2.4 Housing and management of experimental animals

The floor space provided was 1.5 m² per piglet during the post-weaning period. All the piglets were dewormed at the start of the experiment. All the experimental animals were kept under hygienic conditions throughout the experimental period. Healthy surroundings and proper cleanliness was maintained in the experimental sheds. Proper feeding and watering arrangements were made hygienically.

2.5 Feeding and watering management

All piglets were fed with concentrate mixture twice a day, i.e., 9.00 AM and 5.00 PM, following the nutrient requirements as per the ICAR (2013). Leftover of feed, if any, was recorded next day morning at 24 hours intervals throughout the experiment to calculate the total feed consumed per day. Potable, clean and fresh drinking water was made available to each animal in separate water trough throughout the experimental period.

2.6 Body weight gain

Body weights of piglets were recorded at fortnightly intervals throughout experiment with a digital electronic platform weighing balance before offering feed and water in the morning. Total weight gain was calculated by subtracting final body weight from initial body weight.

3.8 Average daily gain (ADG)

The average daily gain was calculated by using the following formula

$$\text{ADG} = \frac{\text{Final weight (kg)} - \text{Initial weight (kg)}}{\text{Number of days}}$$

ADG was calculated fortnightly during experimental period.

2.9 Feed intake

Feed offered and feed refusal was monitored fortnightly for each experimental group throughout the experimental period and feed intake was calculated.

Table 1 Ingredient composition of concentrate mixture (kg)

Ingredient	Creep feed (Pre-Starter ration) (%)	Grower ration (%)	Finisher ration (%)
Body weight (kg)	Up to 10	10 to 25	25 to 60

Maize	32	34	34
De-oiled rice bran (DORB)	15	15	24
Red gram chuni (RGC)	11	19	19
Groundnut cake (GNC)	39	29	20
Mineral mixture	2	2	2
Salt	1	1	1
CP Supplied*(%)	20.02	18.1	16.12

*(ICAR, 2013)

2.10 BIOMETRIC MEASUREMENTS

Body measurements were recorded by using a standard measuring tape to the nearest 0.5 centimeters after the animals were allowed to stand squarely on an even ground. This was performed before offering feed and water in the morning.

The body measurements were recorded as per Gautam *et al.* (2018) as mentioned below.

- Body length (BL) :** : Body length was measured from the top of the head in between the ears to the base of the tail.
- Heart girth (HG) :** : Heart girth was measured around the body just behind the front legs and over the shoulder area.
- Height at wither :** : Height at wither was measured from the top of the withers to the bottom of the foreleg.
- Hip width (HP) :** : Distance from the tuberosity prominence of ilium bone of one side to the other, across the rump.

2.11 CRUDE PROTEIN (CP)

A known quantity of the ground samples (appropriate aliquots) were digested using Turbo therm (Gerhardt, Germany) with the suitable quantity of concentrated H₂SO₄ in the presence of catalytic digestion mixture (CuSO₄ and K₂SO₄ in 1:10 ratio). An acid blank was also run along with the samples for correction of any nitrogen contribution by the acid itself. The nitrogen content of the sample was estimated by distilling in auto-analyzer (Vapodest, Gerhardt, Germany). The nitrogen content multiplied by the factor 6.25 arrives the CP content of the sample, which was expressed as a percentage on DMB. (AOAC, 2005)

The data was subjected to analysis of variance (Snedecor and Cochran, 1994) and a comparison of means of different treatment groups was made by Duncan's multiple range test (Duncan, 1955).

3. RESULTS

3.1 GROWTH PERFORMANCE

3.1.1 Body Weights

The initial body weights (kg) of piglets at weaning were 8.12 ± 0.35 , 8.13 ± 0.57 , 8.13 ± 0.54 , and 8.12 ± 0.42 and which was increased to 50.45 ± 2.41 , 49.00 ± 4.39 , 56.45 ± 1.74 , and 47.92 ± 5.26 , respectively in T1, T2, T3, and T4 by ninth fortnight. The body weight of piglets increased as they advanced in age. The overall mean for body weight (kg) of LWY piglets were 26.89 ± 1.17 , 26.66 ± 2.30 , 31.07 ± 0.89 , and 25.87 ± 2.39 on concrete, rubber mat, elevated slatted, and soil floors, respectively. Statistical analysis of the data showed an insignificant ($P > 0.05$) difference among the four treatment groups. (Table 2)

3.1.2 Average Daily Gain

As per Table 3, the average daily gain (g) which was 132.14 ± 10.23 , 148.21 ± 29.53 , 174.41 ± 9.69 , and 128.57 ± 22.59 during first fortnight on different flooring systems viz; concrete, rubber mat, elevated slatted and soil floors, increased to 518.98 ± 50.71 , 506.84 ± 57.19 , 537.55 ± 39.66 , and 510.83 ± 81.86 by ninth fortnight in the respective flooring systems.

There was no significant difference ($P > 0.05$) among the treatments during different fortnights. The overall mean for average daily gain (g) of LWY piglets were 335.97 ± 19.41 , 324.44 ± 31.27 , 383.47 ± 14.14 , and 315.88 ± 41.96 on concrete, rubber mat, elevated slatted, and soil floor, respectively. The overall mean for average daily gain was highest in T3 but the difference was non-significant among the four treatment groups.

3.1.3 Feed Intake

The average feed intake (kg/head/day) was 0.470 ± 0.02 , 0.490 ± 0.03 , 0.539 ± 0.02 , and 0.477 ± 0.02 in first fortnight on concrete, rubber mat, elevated slatted and soil floor, respectively and was increased to 2.598 ± 0.07 , 2.482 ± 0.05 , 2.737 ± 0.08 , and 2.702 ± 0.07 in ninth fortnight on concrete, rubber mat, elevated slatted and soil floor, respectively. (Table 4). There was a significant difference ($P < 0.01$) among the treatments in all fortnights except the first fortnight. The overall means for feed intake (kg/head/day) of LWY piglets were 1.427 ± 0.02 ,

1.395 ± 0.02, 1.590 ± 0.02, and 1.415 ± 0.02 on concrete, rubber mat, elevated slatted, and soil floor, respectively. The overall mean feed intake was highest in T3 and significantly (P<0.05) more compared to other treatment groups.

3.1.4 Feed conversion ratio:

The data presented in Table 5 revealed that the average feed conversion ratio ranged from 3.55 ± 0.14, 3.31 ± 0.17, 3.09 ± 0.14, and 3.71 ± 0.14 during the first fortnight on concrete, rubber mat, elevated slatted and soil floor, respectively and was changed to 5.01 ± 0.13, 4.90 ± 0.10, 5.09 ± 0.14, and 5.29 ± 0.14 during the ninth fortnight. There was a significant (P<0.01) difference in the mean feed conversion ratio among the treatments during all fortnights. The overall mean for feed conversion ratio of LWY piglets were 4.25 ± 0.07, 4.30 ± 0.07, 4.13 ± 0.06, and 4.48 ± 0.08 on concrete, rubber mat, elevated slatted and soil floor, respectively. The overall mean for feed conversion ratio was highest in soil floor and was significantly different (P<0.01) from concrete, rubber mat, and elevated slatted floor, whereas the overall mean for feed conversion ratio was lowest in the elevated slatted floor but the difference was non-significant with concrete and rubber mat floor.

Table 2 Mean ± SE value of body weight (kg) of LWY piglets during the postweaning period

Floor type	Initial body weight (kg)	Body weight (kg)									Overall mean body weight (kg)	Total gain weight (kg)
		F1	F2	F3	F4	F5	F6	F7	F8	F9		
T1	8.12 ± 0.35	9.97 ± 0.46	12.95 ± 0.61	15.67 ± 0.83	18.75 ± 1.09	24.02 ± 1.39	30.81 ± 1.68	36.18 ± 1.57	43.18 ± 1.90	50.45 ± 2.41	26.89 ± 1.17	42.33 ± 2.45
T2	8.13 ± 0.57	10.20 ± 0.97	13.70 ± 1.47	16.27 ± 1.42	19.38 ± 1.67	25.12 ± 2.16	29.66 ± 2.48	34.75 ± 2.80	41.91 ± 3.65	49.00 ± 4.39	26.66 ± 2.30	40.88 ± 3.94
T3	8.13 ± 0.54	10.58 ± 0.53	15.66 ± 0.69	18.48 ± 0.74	22.83 ± 0.68	30.08 ± 1.01	35.45 ± 1.24	41.23 ± 0.96	48.93 ± 1.27	56.45 ± 1.74	31.07 ± 0.89	48.32 ± 1.78
T4	8.12 ± 0.42	9.92 ± 0.65	13.93 ± 1.05	15.68 ± 1.22	18.33 ± 1.71	23.71 ± 2.30	29.24 ± 2.91	33.31 ± 3.26	40.77 ± 4.28	47.92 ± 5.26	25.87 ± 2.39	39.80 ± 5.29
N	6	6	6	6	6	6	6	6	6	6	6	6
SEM	0.224	0.322	0.515	0.562	0.734	0.994	1.138	1.254	1.559	1.872	0.945	1.825
P value	1.000	0.899	0.308	0.247	0.110	0.071	0.196	0.122	0.265	0.397	0.206	0.373

T1: Concrete Floor

T2: Rubber Mat Floor

T3: Elevated Slatted Floor

T4: Soil floor

N: No. of animals in each treatment Value

SEM: Standard Error Mean

P Value: Probability

Table 3 Mean ± SE value of average daily gain (kg) of LWY piglets during the postweaning period

Floor type	Average daily gain (kg)									Overall mean ADG (kg)
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
T1	0.132 ± 0.01	0.213 ± 0.02	0.194 ± 0.02	0.220 ± 0.04	0.376 ± 0.05	0.485 ± 0.03	0.383 ± 0.02	0.501 ± 0.05	0.519 ± 0.05	0.336 ± 0.02
T2	0.148 ± 0.03	0.250 ± 0.05	0.184 ± 0.02	0.223 ± 0.02	0.410 ± 0.04	0.324 ± 0.03	0.364 ± 0.03	0.511 ± 0.07	0.507 ± 0.06	0.324 ± 0.03
T3	0.174 ± 0.01	0.363 ± 0.04	0.201 ± 0.02	0.311 ± 0.03	0.518 ± 0.04	0.383 ± 0.05	0.413 ± 0.03	0.550 ± 0.05	0.537 ± 0.04	0.384 ± 0.01

T4	0.129 ±0.02	0.286 ±0.04	0.126 ±0.02	0.189 ±0.04	0.385 ±0.07	0.395 ±0.06	0.291 ±0.04	0.533 ±0.09	0.511 ±0.08	0.316 ±0.04
N	6	6	6	6	6	6	6	6	6	6
SEM	0.010	0.022	0.012	0.018	0.027	0.024	0.017	0.032	0.028	0.014
P value	0.372	0.080	0.087	0.077	0.223	0.109	0.072	0.956	0.984	0.368

T1: Concrete Floor

T2: Rubber Mat Floor

T3: Elevated Slatted Floor

T4: Soil floor

N: No. of animals in each treatment

SEM: Standard Error Mean

P Value: Probability Value

Table 4 Mean ± SE value of feed intake (kg/day/head) of LWY piglets during the postweaning period

	Feed intake (kg/day/head)									Overall feed intake (kg/day/head)
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
	0.470 ±0.02	0.662 ±0.01 ^d	0.858 ±0.02 ^b	1.100 ±0.02 ^b	1.357 ±0.02 ^b	1.673 ±0.03 ^b	1.955 ±0.02 ^b	2.167 ±0.02 ^c	2.598 ±0.07 ^{ab}	1.427 ±0.02 ^b
	0.490 ±0.03	0.726 ±0.02 ^c	0.897 ±0.02 ^b	1.089 ±0.01 ^b	1.296 ±0.02 ^b	1.606 ±0.03 ^c	1.886 ±0.02 ^c	2.080 ±0.02 ^d	2.482 ±0.05 ^{bc}	1.395 ±0.02 ^b
	0.539 ±0.02	0.992 ±0.02 ^a	0.942 ±0.01 ^a	1.199 ±0.02 ^a	1.493 ±0.04 ^a	1.894 ±0.02 ^a	2.141 ±0.02 ^a	2.338 ±0.01 ^a	2.737 ±0.08 ^a	1.590 ±0.02 ^b
	0.477 ±0.02	0.788 ±0.02 ^b	0.669 ±0.02 ^c	1.068 ±0.02 ^b	1.350 ±0.03 ^b	1.698 ±0.02 ^b	1.759 ±0.02 ^d	2.226 ±0.02 ^b	2.702 ±0.07 ^b	1.415 ±0.02 ^b
	14	14	14	14	14	14	14	14	14	14
	0.011	0.018	0.016	0.012	0.017	0.018	0.021	0.015	0.036	0.016
	0.129	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.000

Means with different superscripts row-wise differ significantly: P<0.01.

T1: Concrete Floor

T2: Rubber Mat Floor

T3: Elevated Slatted Floor

T4: Soil floor

N: No. of observations

SEM: Standard Error Mean

P Value: Probability Value

Table 5 Mean ± SE value of feed conversion ratio of LWY piglets during the postweaning period

	Feed conversion ratio									Overall feed conversion ratio
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
	3.55 ±0.14 ^a	3.10 ±0.06 ^a	4.42 ±0.11 ^c	4.99 ±0.10 ^b	3.61 ±0.06 ^a	3.45 ±0.05 ^c	5.10 ±0.06 ^b	4.33 ±0.03 ^a	5.01 ±0.13	4.25 ±0.07 ^b
	3.31 ±0.17 ^{ab}	2.90 ±0.06 ^b	4.89 ±0.11 ^b	4.89 ±0.07 ^b	3.16 ±0.04 ^b	4.95 ±0.08 ^a	5.18 ±0.06 ^b	4.07 ±0.04 ^c	4.90 ±0.10	4.30 ±0.07 ^{ab}
	3.09 ±0.14 ^b	2.73 ±0.05 ^b	4.68 ±0.05 ^{bc}	3.85 ±0.07 ^c	2.88 ±0.07 ^c	4.94 ±0.04 ^a	5.19 ±0.04 ^b	4.25 ±0.02 ^{ab}	5.09 ±0.14	4.13 ±0.06 ^b

3.71 ±0.14 ^a	2.75 ±0.06 ^b	5.32 ±0.14 ^a	5.67 ±0.09 ^a	3.51 ±0.07 ^a	4.29 ±0.06 ^b	6.05 ±0.07 ^a	4.18 ±0.04 ^b	5.29 ±0.14	4.48 ±0.08 ^a
14	14	14	14	14	14	14	14	14	14
0.080	0.035	0.068	0.096	0.050	0.088	0.059	0.021	0.066	0.039
0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.193	0.010

Means with different superscripts column wise differ significantly: P<0.05; P<0.01

T1: Concrete Floor

T2: Rubber Mat Floor

T3: Elevated Slatted Floor

T4: Soil floor

N: No. of observations

SEM: Standard Error Mean

P Value: Probability Value

3.2 BIOMETRY OF PIGLETS DURING POSTWEANING PERIOD

Piglets have a balanced relationship between body weights and biometry. The body measurements included in the study were body length, heart girth, height at withers, and hip-width, during different fortnights.

3.2.1 Body length: The perusal of Table 6 revealed that the mean initial body length (cm) was 46.07 ± 0.86 , 44.45 ± 0.92 , 45.50 ± 0.87 , and 46.18 ± 0.88 in T1, T2, T3, and T4 treatment groups respectively and the same was increased to 86.08 ± 2.96 , 84.95 ± 4.92 , 90.13 ± 2.23 , and 84.47 ± 5.82 by the ninth fortnight. Statistical analysis revealed a non-significant ($P>0.05$) difference among mean initial body length and between all the fortnights throughout the experiment. The overall mean body length (cm) was 63.73 ± 1.11 , 63.34 ± 2.09 , 66.96 ± 0.89 , and 62.66 ± 2.20 in T1, T2, T3, and T4 treatment groups respectively during the postweaning period.

3.2.2 Height at wither: As per Table 7, the mean initial height at withers (cm) was 30.62 ± 0.36 , 30.35 ± 0.63 , 30.83 ± 0.57 , and 30.07 ± 0.38 in T1, T2, T3, and T4 treatment groups respectively and increased to 52.25 ± 1.42 , 51.22 ± 2.55 , 55.57 ± 0.80 , and 45.55 ± 6.87 at ninth fortnight in T1, T2, T3, and T4 treatment groups respectively. Statistical analysis revealed a non-significant ($P>0.05$) difference among mean initial height at withers and between all the fortnights throughout the experiment. The overall mean height at withers (cm) was 39.62 ± 0.58 , 39.38 ± 1.07 , 41.72 ± 0.41 , and 38.36 ± 1.51 in T1, T2, T3, and T4 treatment groups respectively during the postweaning period.

4.2.2.3 Heart girth: The mean initial heart girth (cm) was found to be 45.33 ± 0.82 , 44.87 ± 1.04 , 44.43 ± 0.77 , and 44.18 ± 0.63 in T1, T2, T3, and T4 treatment groups respectively and increased to 74.18 ± 1.62 , 73.77 ± 2.67 , 77.78 ± 1.17 , and 74.08 ± 2.97 at ninth fortnight in T1, T2, T3, and T4 treatment groups respectively. Statistical analysis revealed a non-significant ($P>0.05$) difference among mean initial heart girth and between all the fortnights throughout the experiment. The overall mean heart girth (cm) was 58.66 ± 0.83 , 58.24 ± 1.68 , 61.16 ± 0.54 , and 58.00 ± 1.57 in T1, T2, T3, and T4 treatment groups respectively during the postweaning period. (Table 8)

4.2.2.4 Hip width: From the results presented in Table 9, it was observed that the mean initial hip width (cm) of 10.90 ± 0.27 , 11.03 ± 0.52 , 11.07 ± 0.48 , and 10.58 ± 0.21 in T1, T2, T3, and T4 treatment groups respectively, increased to 21.22 ± 0.98 , 20.80 ± 1.21 , 22.57 ± 0.93 , and 21.00 ± 1.41 at ninth fortnight in the respective groups. Statistical analysis revealed a non-significant ($P>0.05$) difference among mean initial hip-width and between all the fortnights throughout the experiment. The overall mean hip width (cm) was 15.59 ± 0.30 , 15.70 ± 0.58 , 16.54 ± 0.42 , and 15.37 ± 0.56 in T1, T2, T3, and T4 treatment groups respectively during the postweaning period.

Table 6 Mean $\pm$ SE value of body length (cm) of LWY piglets during the postweaning period

Initial body length (cm)	Body length (cm)								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
07 86	48.95 $\pm$ 0.30	52.20 $\pm$ 0.61	53.92 $\pm$ 0.60	56.48 $\pm$ 0.88	60.47 $\pm$ 1.09	66.15 $\pm$ 1.80	71.05 $\pm$ 1.46	78.27 $\pm$ 1.91	86.08 $\pm$ 2.96
45 92	49.33 $\pm$ 0.76	52.15 $\pm$ 1.23	54.63 $\pm$ 1.04	56.55 $\pm$ 1.32	61.37 $\pm$ 1.68	65.13 $\pm$ 2.12	69.17 $\pm$ 2.48	76.72 $\pm$ 3.52	84.95 $\pm$ 4.92
50 87	49.20 $\pm$ 0.57	53.32 $\pm$ 0.48	55.70 $\pm$ 0.67	59.55 $\pm$ 0.53	64.90 $\pm$ 0.87	69.28 $\pm$ 1.40	75.78 $\pm$ 0.88	84.77 $\pm$ 1.39	90.13 $\pm$ 2.23
18 88	48.20 $\pm$ 0.78	51.80 $\pm$ 0.75	53.55 $\pm$ 0.95	55.73 $\pm$ 1.40	60.43 $\pm$ 1.57	65.38 $\pm$ 2.56	69.03 $\pm$ 2.95	75.32 $\pm$ 4.41	84.47 $\pm$ 5.82
	6	6	6	6	6	6	6	6	6
36	0.308	0.399	0.426	0.594	0.735	1.002	1.135	1.612	2.029
07	0.596	0.593	0.309	0.100	0.091	0.458	0.115	0.167	0.776

T1: Concrete Floor

T2: Rubber Mat Floor

T3: Elevated Slatted Floor

T4: Soil floor

N: No. of animals in each treatment
Value

SEM: Standard Error Mean

P Value: Probability

Table 7 Mean $\pm$ SE value of height at withers (cm) of LWY piglets during the postweaning period

Initial height at withers (cm)	Height at withers (cm)								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
62 36	31.90 $\pm$ 0.37	33.20 $\pm$ 0.22	34.18 $\pm$ 0.26	35.22 $\pm$ 0.32	37.18 $\pm$ 0.61	41.08 $\pm$ 0.94	43.87 $\pm$ 0.89	47.68 $\pm$ 1.23	52.25 $\pm$ 1.42
35 63	32.02 $\pm$ 0.47	33.67 $\pm$ 0.42	34.47 $\pm$ 0.34	35.58 $\pm$ 0.68	37.77 $\pm$ 1.11	40.35 $\pm$ 1.28	42.47 $\pm$ 1.25	46.83 $\pm$ 2.02	51.22 $\pm$ 2.55
83 57	32.85 $\pm$ 0.17	34.17 $\pm$ 0.28	35.03 $\pm$ 0.32	36.33 $\pm$ 0.44	40.32 $\pm$ 0.63	43.52 $\pm$ 0.64	46.52 $\pm$ 0.57	51.23 $\pm$ 0.42	55.57 $\pm$ 0.80
07 38	31.63 $\pm$ 0.47	33.15 $\pm$ 0.59	34.05 $\pm$ 0.54	34.92 $\pm$ 0.63	37.20 $\pm$ 0.98	40.17 $\pm$ 1.54	42.25 $\pm$ 1.76	46.32 $\pm$ 2.26	45.55 $\pm$ 6.87
	6	6	6	6	6	6	6	6	6
40	0.205	0.207	0.194	0.274	0.483	0.603	0.664	0.866	1.906
26	0.175	0.277	0.295	0.304	0.054	0.178	0.076	0.177	0.324

T1: Concrete Floor

T2: Rubber Mat Floor

T3: Elevated Slatted Floor

T4: Soil floor

N: No. of animals in each treatment

SEM: Standard Error Mean

P Value: Probability

Value

Table 8 Mean $\pm$ SE value of heart girth (cm) of LWY piglets during the postweaning period

Initial heart girth (cm)	Heart girth (cm)									Overall heart girth (cm)
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
45.33 $\pm$ 0.82	47.32 $\pm$ 0.60	48.37 $\pm$ 0.37	49.63 $\pm$ 0.39	51.88 $\pm$ 0.83	55.82 $\pm$ 1.30	62.97 $\pm$ 1.64	67.55 $\pm$ 0.98	70.15 $\pm$ 1.33	74.18 $\pm$ 1.62	58.6 $\pm$ 0.3
44.87 $\pm$ 1.04	46.75 $\pm$ 0.88	48.30 $\pm$ 0.83	49.63 $\pm$ 1.13	51.62 $\pm$ 1.62	57.95 $\pm$ 2.69	61.02 $\pm$ 2.01	65.43 $\pm$ 1.87	69.67 $\pm$ 1.83	73.77 $\pm$ 2.67	58.2 $\pm$ 1.0
44.43 $\pm$ 0.77	46.72 $\pm$ 0.40	49.12 $\pm$ 0.40	50.92 $\pm$ 0.72	54.90 $\pm$ 0.79	61.77 $\pm$ 0.82	66.67 $\pm$ 1.00	69.20 $\pm$ 0.51	73.40 $\pm$ 0.53	77.78 $\pm$ 1.17	61.1 $\pm$ 0.3
44.18 $\pm$ 0.63	46.93 $\pm$ 0.79	48.77 $\pm$ 0.52	49.78 $\pm$ 0.62	51.42 $\pm$ 0.94	55.93 $\pm$ 1.90	61.58 $\pm$ 2.70	64.53 $\pm$ 2.71	68.97 $\pm$ 2.37	74.08 $\pm$ 2.97	58.0 $\pm$ 1.3
6	6	6	6	6	6	6	6	6	6	6
0.396	0.327	0.272	0.374	0.591	0.985	1.014	0.895	0.851	1.095	0.64
0.773	0.924	0.718	0.587	0.115	0.105	0.195	0.254	0.271	0.551	0.28

T1: Concrete Floor**T2:** Rubber Mat Floor**T3:** Elevated Slatted Floor**T4:** Soil floor**N:** No. of animals in each treatment**SEM:** Standard Error Mean**P Value:** Probability

Value

Table 9 Mean $\pm$ SE value of hip width (cm) of LWY piglets during the postweaning period

Initial hip width (cm)	Hip width (cm)									Overall hip width (cm)
	F1	F2	F3	F4	F5	F6	F7	F8	F9	
10.90 $\pm$ 0.27	11.93 $\pm$ 0.14	12.57 $\pm$ 0.18	13.20 $\pm$ 0.15	13.75 $\pm$ 0.18	14.58 $\pm$ 0.29	16.38 $\pm$ 0.47	17.45 $\pm$ 0.54	19.25 $\pm$ 0.63	21.22 $\pm$ 0.98	13.2 $\pm$ 0.3
11.03 $\pm$ 0.52	12.22 $\pm$ 0.37	12.92 $\pm$ 0.40	13.33 $\pm$ 0.39	14.02 $\pm$ 0.42	14.98 $\pm$ 0.54	16.33 $\pm$ 0.51	17.65 $\pm$ 0.68	19.02 $\pm$ 0.85	20.80 $\pm$ 1.21	13.2 $\pm$ 0.3
11.07 $\pm$ 0.48	12.43 $\pm$ 0.20	13.18 $\pm$ 0.12	13.77 $\pm$ 0.27	14.45 $\pm$ 0.28	15.40 $\pm$ 0.45	17.20 $\pm$ 0.64	18.88 $\pm$ 0.52	20.98 $\pm$ 0.80	22.57 $\pm$ 0.93	10.2 $\pm$ 0.3
10.58 $\pm$ 0.21	11.32 $\pm$ 0.20	12.47 $\pm$ 0.39	13.18 $\pm$ 0.38	13.62 $\pm$ 0.29	14.72 $\pm$ 0.43	15.93 $\pm$ 0.59	17.07 $\pm$ 0.81	18.97 $\pm$ 1.05	21.00 $\pm$ 1.41	13.2 $\pm$ 0.3
6	6	6	6	6	6	6	6	6	6	6
0.187	0.143	0.152	0.154	0.157	0.213	0.277	0.334	0.431	0.554	0.18
0.811	0.124	0.333	0.529	0.256	0.573	0.455	0.254	0.304	0.696	0.18

T1: Concrete Floor**T2:** Rubber Mat Floor**T3:** Elevated Slatted Floor**T4:** Soil floor**N:** No. of animals in each treatment**SEM:** Standard Error Mean**P Value:** Probability

Value

4. DISCUSSION

4.1 GROWTH PERFORMANCE

4.1.1 Body weight: The initial body weights (kg) of piglets were 8.12 ± 0.35 , 8.13 ± 0.57 , 8.13 ± 0.54 , and 8.12 ± 0.42 and which was increased to 50.45 ± 2.41 , 49.00 ± 4.39 , 56.45 ± 1.74 , and 47.92 ± 5.26 , respectively in T1, T2, T3, and T4 by a ninth fortnight. The body weight of piglets increased as they advanced in age. The overall mean for body weight (kg) of LWY piglets were 26.89 ± 1.17 , 26.66 ± 2.30 , 31.07 ± 0.89 , and 25.87 ± 2.39 on concrete, rubber mat, elevated slatted, and soil floors, respectively. Statistical analysis of the data showed an insignificant ($P > 0.05$) difference among the four treatment groups. Numerically higher body weight of piglets at the end of experiment was found on slatted floor.

The present findings are in concurrence with the results of Knecht *et al.* (2018) who have reported higher body weights in pigs raised on slatted floor. The floor type directly determines the physical activity of animals and the feed requirements that affect the growth rate (Lebret 2008). It should be noted that rest represents the largest proportion of the total daily activity by the pigs and affects weight gain (Averós *et al.* 2010). The present findings are not in agreement with the findings of Morrison *et al.* (2007), Correa *et al.* (2009), Hotzel *et al.* (2009), Earley *et al.* (2015) and Murphy *et al.* (2018) who have reported no effect of different floor types on body weight in piglets. Lyons *et al.* (1995), Zhou *et al.* (2015) reported higher body weight in pigs reared on straw/deep litter.

4.1.2 Average daily gain: The average daily gain (g) was 132.14 ± 10.23 , 148.21 ± 29.53 , 174.41 ± 9.69 , and 128.57 ± 22.59 in the first fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively and was increased to 518.98 ± 50.71 , 506.84 ± 57.19 , 537.55 ± 39.66 , and 510.83 ± 81.86 in the ninth fortnight on concrete, rubber mat, elevated slatted and soil floor, respectively. There was no significant difference ($P > 0.05$) among the treatments in different fortnights. The overall mean for average daily gain (g) of LWY piglets were 335.97 ± 19.41 , 324.44 ± 31.27 , 383.47 ± 14.14 , and 315.88 ± 41.96 on concrete, rubber mat, elevated slatted, and soil floors, respectively. The overall mean for average daily gain was highest in T3 but the difference was non-significant among the four treatment groups.

The present findings are similar with the findings of Knecht *et al.* (2018) who reported higher average daily body weight gain in piglets reared on slatted floor. In contrary Lebret *et al.* (2006), and Lowe *et al.* (2019) reported lower average daily gain in piglets reared on slatted floor.

Earley *et al.* (2015), Murphy *et al.* (2018), and Wei *et al.* (2019) reported no effect of different floor types on average daily weight gain.

4.1.3 Feed intake: The average feed intake (kg/head/day) was 0.470 ± 0.02 , 0.490 ± 0.03 , 0.539 ± 0.02 , and 0.477 ± 0.02 in first fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively and was increased to 2.598 ± 0.07 , 2.482 ± 0.05 , 2.737 ± 0.08 , and 2.702 ± 0.07 in ninth fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively.

There was a significant difference ($P < 0.01$) among the treatments in all fortnights except the first fortnight. The overall mean for feed intake (kg/head/day) of LWY piglets were 1.427 ± 0.02 , 1.395 ± 0.02 , 1.590 ± 0.02 , and 1.415 ± 0.02 on concrete, rubber mat, elevated slatted, and soil floors, respectively. The overall mean for feed intake was highest in T 3 but the difference was non-significant among the four treatment groups.

Similar findings were reported by Divate (2014), Chikwanda and Muchenje (2017) and Ramachandran *et al.* (2017) who reported higher feed intake in goats reared on slatted floor. In contrary Johnston and Morrison (2004), Lebret *et al.* (2006) and Morrison *et al.* (2007), reported lower feed intake in piglets reared on slatted floor, whereas, Yanar *et al.* (2010) reported lower feed intake in goats reared on slatted floor.

4.1.4 Feed conversion ratio: The average feed conversion ratio was 3.55 ± 0.14 , 3.31 ± 0.17 , 3.09 ± 0.14 , and 3.71 ± 0.14 in the first fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively and was changed to 5.01 ± 0.13 , 4.90 ± 0.10 , 5.09 ± 0.14 , and 5.29 ± 0.14 in the ninth fortnight on concrete, rubber mat, elevated slatted and soil floors, respectively.

There was a significant ($P < 0.01$) difference in the mean feed conversion ratio among the treatments during all fortnights. The overall mean for feed conversion ratio of LWY piglets were 4.25 ± 0.07 , 4.30 ± 0.07 , 4.13 ± 0.06 , and 4.48 ± 0.08 on concrete, rubber mat, elevated slatted and soil floors, respectively. The overall mean for feed conversion ratio was highest in soil and was significantly different ($P < 0.01$) from concrete, rubber mat, and elevated slatted floor, whereas the overall mean for feed conversion ratio was lowest in the elevated slatted floor but the difference was non-significant with concrete and rubber mat floor.

Similar better feed conversion ratio was reported by Knecht *et al.* (2018) in piglets reared on slatted floor. The present findings are not supported by the result of Keane *et al.* (2017) who reported better feed conversion ratio in piglets reared on deep litter floor. Lyons *et al.* (1995) and Wei *et al.* (2019) reported no effect of different floor types on feed conversion ratio in piglets. Similar feed conversion ratio in piglets reared on concrete floor in present study was reported by Ramesh and Sivakumar (2009) whereas lower feed conversion ratio was reported by Zebua *et al.* (2017), Durga *et al.* (2018), and Sandhu *et al.* (2018)

4.2 Biometry of Piglets During Different Fortnights Postweaning

Piglets have a balanced relationship between body weights and biometry. The body measurements included in the study were body length, chest girth, height at withers, and hip-width.

4.2.1 Body length: The mean initial body length (cm) was 46.07 ± 0.86 , 44.45 ± 0.92 , 45.50 ± 0.87 , and 46.18 ± 0.88 in T1, T2, T3, and T4 treatment groups respectively and increased to 86.08 ± 2.96 , 84.95 ± 4.92 , $90.13 \pm$

2.23, and 84.47 ± 5.82 at ninth fortnight in T1, T2, T3, and T4 treatment groups respectively. Statistical analysis revealed a non-significant ($P>0.05$) difference among mean initial body length and between all the fortnights throughout the experiment.

The overall mean body length (cm) was 63.73 ± 1.11 , 63.34 ± 2.09 , 66.96 ± 0.89 , and 62.66 ± 2.20 in T1, T2, T3, and T4 treatment groups respectively during the postweaning period. The overall mean body length in T3 group was non-significantly higher than T1, T2, and T4. This might be due to higher body weights of piglets reared on slatted floor.

Body length measurement recorded in the present study was within the normal range reported by Khargharia *et al.* (2014), Alenyorege *et al.* (2013), Adeola *et al.* (2013), Ramesh and Sivakumar (2009), and Gautam *et al.* (2018).

The present findings are supported by the results of Yanar *et al.* (2010), Kartal and Yanar (2011), and Divate (2014) who have reported numerically higher mean body length in goats reared on slatted floor. Sundaram *et al.* (2002) reported significantly higher body length in goats reared on slatted floor.

4.2.2 Height at withers: The mean initial height at withers (cm) was 30.62 ± 0.36 , 30.35 ± 0.63 , 30.83 ± 0.57 , and 30.07 ± 0.38 in T1, T2, T3, and T4 treatment groups respectively and increased to 52.25 ± 1.42 , 51.22 ± 2.55 , 55.57 ± 0.80 , and 45.55 ± 6.87 at ninth fortnight in T1, T2, T3, and T4 treatment groups respectively. Statistical analysis revealed a non-significant ($P>0.05$) difference among mean initial height at withers and between all the fortnights throughout the experiment.

The overall mean height at withers (cm) was 39.62 ± 0.58 , 39.38 ± 1.07 , 41.72 ± 0.41 , and 38.36 ± 1.51 in T1, T2, T3, and T4 treatment groups respectively during the postweaning period.

Yanar *et al.* (2010), Kartal and Yanar (2011), and Divate (2014) reported numerically higher mean height at withers in goats reared on slatted floor hence in agreement with the present findings. Sundaram *et al.* (2002) reported significantly higher height at withers in goats reared on slatted floor.

In contrary to the present findings, Deshmukh (2017) recorded relatively higher height at withers in goats reared on soil floor and Archana (2018) reported relatively higher height at withers in goats reared on rubber mat floor. Height at wither recorded in the present study for the piglets in relation to body weight and age was within the normal range reported by Khargharia *et al.* (2014), Alenyorege *et al.* (2013), Adeola *et al.* (2013), Ramesh and Sivakumar (2009), and Gautam *et al.* (2018).

4.2.3 Heart girth: The mean initial heart girth (cm) was 45.33 ± 0.82 , 44.87 ± 1.04 , 44.43 ± 0.77 , and 44.18 ± 0.63 in T1, T2, T3, and T4 treatment groups respectively and increased to 74.18 ± 1.62 , 73.77 ± 2.67 , 77.78 ± 1.17 , and 74.08 ± 2.97 at ninth fortnight in T1, T2, T3, and T4 treatment groups respectively. Statistical analysis revealed a non-significant ($P>0.05$) difference among mean initial heart girth and between all the fortnights throughout the experiment.

The overall mean heart girth (cm) was 58.66 ± 0.83 , 58.24 ± 1.68 , 61.16 ± 0.54 , and 58.00 ± 1.57 in T1, T2, T3, and T4 treatment groups respectively during the postweaning period.

Heart girth measurement recorded in the present study was within the normal range reported by Khargharia *et al.* (2014), Alenyorege *et al.* (2013), Adeola *et al.* (2013), Ramesh and Sivakumar (2009), and Gautam *et al.* (2018). The present findings are similar to the findings of Yanar *et al.* (2010), Kartal and Yanar (2011), and Divate (2014) who have recorded numerically higher mean heart girth in goats reared on slatted floor. Sundaram *et al.* (2002) reported significantly higher heart girth in goats reared on slatted floor.

4.2.4 Hip width: The mean initial hip width (cm) was 10.90 ± 0.27 , 11.03 ± 0.52 , 11.07 ± 0.48 , and 10.58 ± 0.21 in T1, T2, T3, and T4 treatment groups respectively and increased to 21.22 ± 0.98 , 20.80 ± 1.21 , 22.57 ± 0.93 , and 21.00 ± 1.41 at ninth fortnight in T1, T2, T3, and T4 treatment groups respectively. Statistical analysis revealed a non-significant ($P>0.05$) difference among mean initial hip-width and between all the fortnights throughout the experiment.

The overall mean hip width (cm) was 15.59 ± 0.30 , 15.70 ± 0.58 , 16.54 ± 0.42 , and 15.37 ± 0.56 in T1, T2, T3, and T4 treatment groups respectively during the postweaning period.

The results obtained in the present study were non-comparable as the literature on hip width of LWY piglets on different floor types was scanty.

5. CONCLUSION

Results of the experiment indicated that the rearing of Large White Yorkshire piglets on elevated slatted floor proved to be numerically better in terms of the growth, feed intake, and feed conversion ratio but the significant differences are not observed in comparison with the piglets reared on concrete floor, rubber mat floor and soil floor.

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