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Behaviour of sows in three different farrowing facilities

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Abstract
Sows are being reared in confinement of farrowing crates after parturition which provides an intermediary step to prevent piglet crushing, however it has a negative impact on the welfare of the sows. This study was conducted to assess the behaviour of sows in three different farrowing facilities. A total of twenty-five sows were placed in one of the three farrowing facilities viz. Conventional farrowing crate (10) -F1, Guard rail model (9) -F2 and Modified Farrowing crate (6)- F3 five days prior to farrowing up to the weaning of piglets at 42 days. Results indicated significant effects (p<0.01) of farrowing facility and days post farrowing on the body postures of sows like standing, sitting, sternal lie and lateral lie. The duration of lateral lie was higher in conventional farrowing crate than the sows that were reared in guard rail model and modified farrowing crate. Vices such as bar biting was seen higher in confined conventional farrowing crate. However modified farrowing crate showed comparatively less duration of vices like bar biting, sham chewing and feed trough biting compared to conventional farrowing crate. Facilitating farrowing system with modified farrowing crate would reduce the pre weaning mortality of piglets without compromising the welfare of the sow could.

Keywords: Modified farrowing crate, farrowing crate, guard rail model, sow behaviour

1. Introduction
Pigs are usually reared indoors in groups or by using gestation crates for sows. A gestation crate which is a metal enclosure, often used in intensive pig farming, in which a sow may be kept individually during pregnancy (Tonsor *et al*., 2009) [1]. By limiting the sow's movements and giving the piglets a secure place to stay, the farrowing crate was created to lower piglet mortality. But the main issues of farrowing crates relating to space are the physically and behaviourally restrictive systems in which sows are kept during gestation, farrowing and lactation which affects the welfare of the animal.

This research aims at studying the effects of three different farrowing systems viz. conventional farrowing crate, guard rail model and modified farrowing crate on sow welfare by assessing its behaviour. The potential advantages in terms of sows' flexibility to engage in natural behaviours and have the potential to improve wellbeing through an increase in sow mothering activities and result in a decrease in stereotypical behaviour (such bar biting), and an increase in social contacts between piglets and sows.

According to Jessen (2016) [2], sows that are reared outdoors provides various potentially favourable conditions for the sows, allowing them to exercise and undertake behaviours for which they are well-suited and driven to accomplish things like rooting and making nests, and providing a peaceful setting during parturition whereas in farrowing crates, the sow's wellbeing is at risk by restricting her movement, social contacts, and the expression of natural behaviours like nesting. Thus, more feasible solutions to improve sow welfare with new housing structure that is designed to better accommodate the sow's natural activity and safeguard the piglets from being crushed should be opted. (Baxter *et al.*, 2011) [3]. The hinged farrowing crate gave sows more opportunity to express a wider range of behaviours, as seen by increased time spent interacting with their environment and piglets and decreased time spent resting/sleeping once the crate was opened. (Herber *et al.*, 2019) [4].

2. Materials and Methods
The experiment was conducted at the Piggery unit of Livestock Farm Complex (LFC), Madhavaram Milk Colony, Chennai-51. A total of 25 sows of Large White Yorkshire breed of different parities were selected for this study. The sows were housed in conventional sties in groups of four after mating.

During the observation period, five days before the expected farrowing date, each sow were moved randomly from the conventional sty to the farrowing unit in one of the three farrowing facilities/crate models on the basis of farrowing stage. Thus, of the 25 sows, 10 sows each were placed in Conventional farrowing crate (F1), 9 sows in Guard rail model (F2) and 6 in Modified Farrowing crate (F3).

The conventional farrowing crates were barred metal crates within a pen where pregnant sows were placed shortly before giving birth. Concrete flooring covered the whole interior of the pen. The farrowing crate facility had an area of 2.2 metre x 1.4 metres with a height of 0.95 metre whereas the sow in the crate had an area of 1.6 metre x 0.7 metre. The guard rail model of farrowing facility had guard rails provided on the four sides of the wall. Guard rails were made of galvanized iron with a height of 25 cm from the floor and 30 cm from the wall. Solid concrete flooring covered the entire pen. The pen had an area of 3 metre x 2.12 metre with a height of 1.4 metre. The modified farrowing crate was specially designed to improve sow welfare. The modifications included elevated slatted floor made of poly vinyl slatted floor which facilitates very little or no contact of piglets with urine/faeces, hinged sides wherein the sides of the crate were opened upwards providing lactating sows with the opportunity to move more freely and lie comfortably from the third day after farrowing, nest box was placed alongside the farrowing crate, on the right upper corner within the pen, that the piglets had easy access to. The area of the modified farrowing crate was 1.85 metre x 2.2 metre with a height of 0.9 metre.

The animals' behaviour was recorded using a video system. The behaviour of the sows was recorded continuously through Closed Circuit Television (CCTV) camera HiLook Vision installed at about 45° angle in each of the farrowing facilities. The camera was connected to a video recorder device. From these video tapes, every 30 minutes, videos were scanned (Huynh *et al.*, 2007) [5]. The duration (min/24 hour) of occurrence of various behavioural events were recorded. An overhead CCTV camera was used to continually record litter behaviour on days 1, 3, 6, 25 and 40 postpartum. Every instance of lying down that occurred during the 24-hour period prior to the crate being opened and the immediately after 24-hour period had its sow behaviours analysed. Observations on the following parameters were recorded (Jarvis *et al.* 2001) [6].

The behavioural components of sows recorded are defined:

Behaviour	Definition
Lateral lie	Sow is lying on its side, with one shoulder or hindquarter/ham resting on the ground. From side view, three or four legs can be observed.
Sternal lie	Sow is lying on her belly without her shoulder resting on the floor.
Rolling	Sows roll from sternal to lateral recumbency or the other way around without changing her posture.
Sitting	Both of the sow's front legs, as well as the sow's back, are on the ground.
Standing/walking	Sow stands on or moves on all four legs.
Rooting	Action with a nose or front paws for digging in the floor before lying down
Sham chewing:	Chewing air, chewing with no food in the mouth
Bar biting	Rhythmically biting a bar of the farrowing crate
Biting feed trough	trough Sniffing or biting the feeding trough

The collected data was subjected to statistical analysis using SPSS. ANOVA was used to evaluate data with a normal distribution.

3. Results and Discussion

From the table 1, it is evident that there is significant effects of farrowing facility and day post farrowing in all the body postures of the sows observed ($p<0.05$). The effects of interaction between farrowing facility and day post farrowing for the standing ($p<0.05$) and sternal lie ($p<0.01$) body posture of the sow was found to be effective. The sows reared in conventional farrowing crate had means (1337.45±0.56 min) for duration of lateral lie higher than the sows that were reared in guard rail model (1110.08±0.35 min) and modified farrowing crate (1073.78±0.42 min). When compared to sows in guard rail crates, sows in conventional farrowing crates spent a significantly higher percentage of time lying down, which will negatively affect the length of the milk let-down and, ultimately, weight gain (Pedersen *et al.*, 2011) [7]. It will also inhibit social behaviour between piglets and sow, including aspects of social learning (Chidgey *et al.*, 2016) [8].

Table 1: Mean (± SE) of duration (min/24 hour) of various body postures after farrowing (day 1,3,6,25 and 40) and its analysis of variance in three different farrowing facilities

Body Postures	Days post farrowing	Farrowing facility			SD	P-value		
		Conventional Farrowing Crate (F_1)	Guard Rail Model (F_2)	Modified Farrowing Crate (F_3)		Day	Farrowing facility	Day x Farrowing facility
Standing	Day 1	18.57±0.20	26.99±0.47	17.02±0.85	11.28	<0.05	<0.05	<0.05
	Day 3	30.21±0.32	31.45±0.51	25.46±0.32				
	Day 6	34.05±0.75	32.96±0.21	31.72±0.41				
	Day 25	37.99±0.41	40.37±0.41	35.14±0.12				
	Day 40	61.93±0.71	40.39±0.54	35.63±0.74				
	Mean	36.55±0.25	34.43±0.21	28.99±0.21				
Sitting	Day 1	2.82±0.21	6.68±0.42	7.89±0.54	5.11	<0.05	<0.05	0.09
	Day 3	6.45±0.41	9.21±0.81	8.56±0.24				
	Day 6	6.98±0.45	10.57±0.64	11.22±0.27				
	Day 25	7.32±0.74	11.97±0.34	9.20±0.54				
	Day 40	19.70±0.64	11.17±0.47	15.12±0.32				
	Mean	8.654±0.49	9.92±0.54	10.39±0.38				
	Day 1	7.35±0.41	131.71±0.51	20.39±0.64	12.04	<0.01	<0.01	<0.01

Sternal lie	Day 3	19.79±0.74	174.51±0.84	25.46±0.34				
	Day 6	29.05±0.24	179.13±0.62	32.33±0.24				
	Day 25	29.59±0.34	211.41±0.71	28.39±0.21				
	Day 40	42.95±0.11	202.03±0.56	33.06±0.33				
	Mean	25.75±0.37	179.76±0.65	27.93±0.35				
Lateral lie	Day 1	1382.35±0.41	1215.56±0.64	1372.05±0.64	11.20	<0.01	<0.01	0.07
	Day 3	1354.68±0.95	1151.63±0.24	1347.51±0.21				
	Day 6	1339.52±0.68	1014.35±0.21	1336.25±0.64				
	Day 25	1334.01±0.49	1079.68±0.41	1331.66±0.21				
	Day 40	1276.69±0.28	1089.18±0.24	1313.04±0.37				
	Mean	1337.45±0.56	1110.08±0.35	1073.78±0.42				

In guard rail model, walking and rolling behaviour was having significant effect ($p<0.05$) between the days post farrowing. However, rooting and sniffing behaviour had no significant effect ($p>0.05$) in the three farrowing facilities (Table 2). The rooting behaviour was comparatively less in conventional farrowing crate (2.77±0.26 min) than the other farrowing systems. This was similar to the findings of Burne *et al.*, (2000) [9] who found that confined pigs perform less pawing and rooting than sows placed in free moving pen with access to straw. The means of duration of eating/drinking was higher in guard rail model (34.74±0.36 min).

Table 2: Mean (± SE) of duration (min/24 hours) for other sow activities after farrowing and its analysis of variance in three different farrowing facilities

Sow activity	Days to farrowing	Farrowing facility			SD	F value
		Conventional Farrowing Crate (F_1)	Guard Rail Model (F_2)	Modified Farrowing Crate (F_3)		
Walking	Day 1		31.04±0.11		5.20	4.91**
	Day 3		31.81±0.21			
	Day 6		34.74±0.34			
	Day 25		37.86±0.72			
	Day 40		38.34±0.81			
	Mean		34.76±0.44			
Eating/drinking	Day 1	28.90±0.51	30.93±0.45	23.15±0.47	5.47	10.85**
	Day 3	28.57±0.34	31.81±0.11	29.69±0.64		
	Day 6	29.76±0.82	34.74±0.64	27.43±0.42		
	Day 25	30.08±0.74	37.86±0.41	32.89±0.34		
	Day 40	34.89±0.64	38.34±0.64	37.54±0.11		
	Mean	30.44±0.61	34.74±0.36	30.14±0.39		
Rooting	Day 1				2.77	1.67 NS
	Day 3	1.56±0.25	3.29±0.74	4.23±0.41		
	Day 6	3.23±0.31	4.83±0.64	3.72±0.34		
	Day 25	2.02±0.24	4.19±0.54	3.61±0.11		
	Day 40	4.26±0.22	7.51±0.34	3.32±0.74		
	Mean	2.77±0.26	4.96±0.57	3.23±0.4		
Rolling	Day 1				2.26	3.32**
	Day 3		4.93±0.21			
	Day 6		2.65±0.34			
	Day 25		5.84±0.54			
	Day 40		4.95±0.41			
	Mean		4.59±0.38			
Sniffing	Day 1	1.54±0.32	6.23±0.74	2.45±0.65	1.62	3.644NS
	Day 3	2.54±0.21	3.99±0.54	5.22±0.21		
	Day 6	2.75±0.37	4.78±0.21	2.67±0.41		
	Day 25	3.01±0.54	5.76±0.64	3.27±0.47		
	Day 40	3.98±0.75	7.31±0.98	4.09±0.34		
	Mean	2.76±0.44	5.62±0.62	3.54±0.42		

** significant at five per cent level ($p<0.05$)
NS – Not significant ($p>0.05$)

In addition, sows reared in modified farrowing facility exhibited less sham chewing compared with the sows from the other two farrowing facilities ($p<0.05$), whereas no effect of farrowing facility was found in the biting feed trough behaviour ($p>0.05$) (Table 3). Sham chewing was more noticed on 25 days post farrowing than other days. Bar biting behaviour was seen more in sows reared in conventional farrowing crate facility (4.22±0.36 min) than guard rail model (1.84±0.46 min) and modified farrowing crate facility (2.37±0.38 min). This was similar to the findings of Andersen *et al.* (2014) [10]; Yun and Valros (2015) [11] and Singh *et al.* (2017) [12] who reported a higher incidence of stereotypic behaviours in confined sows.

Table 3: Mean (± SE) of duration (min) of sow vices after farrowing and its analysis of variance in three different farrowing facilities

Sow vices	Days post farrowing	Farrowing facility			SD	F value
		Conventional Farrowing Crate (F_1)	Guard Rail Model (F_2)	Modified Farrowing Crate (F_3)		
Sham chewing	Day 1				3.98	1.59**
	Day 3	3.49±0.52	2.17±0.11	2.68±0.21		
	Day 6	5.18±0.32	5.32±0.52	2.82±0.72		
	Day 25	7.20±0.12	8.78±0.74	5.89±0.66		
	Day 40	7.65±0.74	11.93±0.92	7.20±0.41		
	Mean	5.88±0.43	7.05±0.57	4.78±0.5		
Bar biting	Day 1	4.38±0.24	1.23±0.41	1.58±0.25	1.42	18.62*
	Day 3	3.76±0.54	1.17±0.11	2.68±0.32		
	Day 6	4.15±0.35	1.55±0.74	2.21±0.41		
	Day 25	3.68±0.45	1.74±0.52	2.52±0.25		
	Day 40	5.12±0.24	3.52±0.52	2.85±0.65		
	Mean	4.22s±0.36	1.84±0.46	2.37±0.38		
Biting feed trough	Day 1				1.2	0.48^{NS}
	Day 3					
	Day 6	2.65±0.52		2.01±0.42		
	Day 25	2.85±0.64		2.06±0.58		
	Day 40	2.21±0.41		1.85±0.66		
	Mean	2.57±0.52		1.97±0.55		

** Significant at five per cent level ($p<0.05$)
* Significant at one percent level ($p<0.01$)
NS – Not significant ($P>0.05$)

Conclusion

The results of this study indicate that guard rail model farrowing facility enhanced the welfare of sows, however the modified farrowing crate has also shown to be a better option when compared to conventional farrowing crate in terms of sow welfare. As production animals, it is important that management changes are made to improve welfare aspect but at the same time consider economic impacts on the producer. Modified farrowing crate reported to be able to balance between the welfare of the sows and at the same time will function to prevent crushing of piglets and reduce pre weaning mortality.

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