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Influence of parity on reproductive performance of sows: Insights from pig farms in Kerala#

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Abstract

The study investigated how parity was related to various reproductive performances in crossbred sows across five different agro climatic zones of Kerala. The present study examined the reproductive performance of sows maintained up to the sixth parity by pig farmers. The shortest weaning-to-estrus interval (3.04 ± 0.21 days) was found in second-parity sows, while the longest interval (4.60 ± 0.89 days) occurred in sixth-parity sows. Optimal reproductive performance, including shorter weaning-to-service intervals was noted in sows in second and third parities. These sows also exhibited the lowest pre-weaning mortality and shortest inter-farrowing intervals, with the least weaning-to-service interval recorded at 4.27±0.55 days and the shortest inter-farrowing interval at 7.61 ± 0.43 months. Older sows in their fifth and sixth parities experienced longer weaning-to-service intervals and higher reproductive failure rates. Litter sizes at birth and weaning were higher in second-parity sows, with 11.82 ± 1.37 piglets and 8.91 ± 0.75 piglets, respectively, followed by third-parity sows. Second-parity sows also showed superior performance in other metrics such as birth weight in piglets (1.41 ± 0.14 kg), total litter weight at birth (13.17 ± 2.43 kg), weaning weight in piglets (12.12 ± 2.00 kg), litter weight at weaning (86.38 ± 14.12 kg), and weight gain per piglet (2.11 ± 0.54 kg). Better reproductive traits in sows and litter traits in piglets were observed in sows with parity two and three compared to sows with parity more than five and this study indicated that sows can be used effectively in breeding herds upto fifth parity.

Keywords: *Parity, reproductive performance, sows*

Development of livestock sector has boosted per capita availability of milk, eggs, and meat and swine husbandry offers significant potential due to its high fertility, prolificacy, quick generation interval, and early weight gain and efficient feed conversion. Parity is known to significantly influence a sow's physical condition and reproductive success (Koketsu *et al*., 1999). Higher parity sows often face challenges like increased body fat depletion and reduced reproductive efficiency which impact overall herd performance, while younger sows may experience issues such as lower milk production and higher piglet mortality. Reproductive indicators, especially prolificacy, are primarily influenced

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by the sow's breed, body condition, and age or parity (Karpiesiuk *et al*., 2018). Ensuring sows remain in optimal body condition necessitates adjusting their feed intake during gestation. However, the parity of the sow has been shown to influence body condition in different ways. Understanding the influence of parity on body condition traits and reproductive indices is important for optimizing swine production and improving animal welfare.

Current research indicates a significant gap in understanding how different parity stages affect reproductive performance and litter outcomes in sows. Despite the recognition that parity influences factors such as litter size and sow longevity, there is limited data on how to specifically tailor reproductive and management strategies to optimize both sow and litter performance across varying parities. Research on parity-related differences would provide inputs to swine producers on ways to optimize feeding, breeding, and health management practices tailored to the needs of sows at different stages of their reproductive life. Hence the present study was conducted to evaluate the impact of parity on the overall productivity and welfare of sows.

Materials and methods

Location and agro-climatic conditions of the study area

Ninety pig farms were specifically chosen for survey and observational studies across five distinct agro-climatic zones in Kerala (SLUB, 1997). North zone (Kozhikode, Malappuram, Kannur, Kasargod), south zone (Trivandrum, Kollam, Pathanamthitta), central zone (Thrissur, Ernakulam, Palakkad), high-altitude zone (Wayanad and Idukki districts), and special zone of problematic areas (Alleppey and Kottayam) were selected for the study.

Data collection on reproductive parameters of sows

Data on reproductive performances, parity and piglet mortality were collected through observation, discussion, interview and a structured questionnaire. Six farms were selected from each agro-climatic zone, with classification based on number of breedable sows small farms (≤6 breedable sows), medium farms (7-15 breedable sows), and large farms (>15 breedable sows) (Bengtsson and Whitakker, 1988). Different reproductive attributes defined by Kundu *et al*. (2020) were considered and mentioned in Table 1. Data collected was analysed to understand the impact of parity on body weight, body condition score, back fat thickness and reproductive efficiency of sow by analysis of variance (ANOVA) using software for statistical analysis, version SPSS 24.0 and results were interpreted.

Results and discussion

Second-parity sows demonstrated enhanced performance across several metrics, including piglet birth weight (1.41 ± 0.14 kg), total litter weight at birth (13.17 ± 2.43 kg), piglet weaning weight (12.12 ± 2.00 kg), litter weight at weaning (86.38 ± 14.12 kg), and weight gain per piglet (2.11 ± 0.54 kg). Takai and Koketsu (2008) also found that litter size showed an increase from the first to

Table 1. Reproductive attributes of crossbred pigs

Litter size at birth (no.)	Total number of piglets born for each individual female in a farrowing
Litter weight at birth (kg)	The sum total weight of piglets in a litter at farrowing by weighing the total born piglets by placing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams
Birth weight/piglet (kg)	Birth weight per piglet refers to the average weight of a piglet at the time of its birth
Litter size at weaning (number)	Number of piglets weaned after completion of 6 weeks (42 days) was recorded and the total number of live piglets weaned in a litter was included in the present study.
Litter weight at weaning (kg)	The sum total weight of piglets in a litter at weaning age (42 days) by weighing the total born piglets by placing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams
Weaning weight/ piglet (kg)	Weaning weight per piglet refers to the average weight of a piglet at the time it is separated from the sow
Farrowing interval	Total number of actual days between the intervals of two farrowings (from the day of one farrowing till the day of next farrowing)
Post-weaning estrus (days)	The number of days between weaning and the first day of standing heat in sows
Service interval (days)	Total number of actual days between weaning to next service
Pre-weaning mortality rate	The percent mortality was calculated as number of dead piglets till weaning divided by the total number of piglets born multiplied by 100
Weight gain at 21st day/ piglet (kg)	The weight of piglet at 21st day of its age by weighing them in pre weighed bag. The former weight was subsequently subtracted from the later weight to express the weight of animal in grams

the second parity, with no further significant changes in subsequent parities. Meanwhile Arango *et al*. (2005) noted a trend of increasing litter size from the first to the third parity. Additionally, Knetch *et al*. (2015) noted that sows achieved better reproductive performance in the third and fourth parities. Hoving *et al*. (2011) reported a farrowing rate of 81.2% for first-parity sows from the first insemination, which decreased slightly to 79.9% in second-parity sows, and then reached a peak of 85.2% for sows in its third parity and beyond.

Yang *et al*. (2019) noted that sows had better reproduction performance like total number of piglets born, number of piglets born alive, litter weight at birth, weaning characteristics such as litter size at birth and at weaning with parity one than parity six sows. On contrary, Singh *et al.* (2019) noted, average live litter size at birth (no.) and at weaning (no.) was 9.9±3.6 and 8.1±3.3 piglets per farrowing, respectively and litter size at birth showed no significant difference for parity in swine farms of Punjab. However, Segura *et al.* (2020) evaluated how parity number impacts sow reproductive performance and found that piglets born to first-time (primiparous) sows had significantly lower birth weights compared to those born to sows in their second or fourth litters.

Klimas *et al.* (2020) noted that neither litter weight (kg) nor average piglet weight (kg) was influenced by parity. Nonetheless, weaning tended to occur at increasingly older ages as the parity number rose, indicating a pattern with more litters. At the time of weaning, piglet weights varied from 10.7 kg (parity 2) to 11.0 kg (parity 5). Notably, pre-weaning mortality rates differed significantly between parities, with the lowest rate in first parity and the highest in seventh parity. Beyga *et al*. (2010) compared the reproductive performances of primiparous and multiparous sows and concluded that the number of piglets born or piglets born alive were higher for multiparous sows. The litter weight at birth was notably higher for multiparous sows, with a difference of 2.93 kg.

The observed variation in litter traits across different parities can be attributed to several scientific factors related to sow physiology and reproductive performance. Sows in fifth and sixth parities may experience declines in reproductive efficiency due to factors such as uterine aging, decreased ovarian function, or accumulated physiological stress, which can negatively impact both litter size at birth and at weaning.

The weaning-to-service interval, pre-weaning mortality, and inter-farrowing interval were shortest in second and third parities, with the longest intervals observed in fifth and sixth parities. The minimum observed weaning-to-service interval was 4.27 ± 0.55 days, and the shortest inter-farrowing interval was 7.61 ± 0.43 months (Table 2). The lowest pre-weaning mortality was recorded in third parity (24.99±8.02%). Sows in their second and third parities typically demonstrate peak reproductive performance, characterized by shorter weaning-to-service intervals, and higher conception rates, attributed to more efficient uterine involution and quicker return to estrus. Conversely, older sows in their fifth and sixth parities tend to experience prolonged weaning-to-service intervals and increased rates of reproductive failure, likely due to extended postpartum recovery periods and greater susceptibility to reproductive disorders.

In the present study, it was noted that pig farmers across all agro-climatic conditions maintained their sows up to the sixth parity. In contrast, Klimas *et al*. (2020) reported that 69.2 % of sows in pig farms were culled before reaching fourth parity. The duration of the weaning to estrus interval (WEI) remained consistent between primiparous and multiparous sows. In this study, we observed that the weaning-to-estrus interval (WEI) was significantly shorter in second parity (3.04 ± 0.21 days) compared to sixth parity (4.60 ± 0.89 days) ($P < 0.01$). The interval from weaning to oestrus represents non-productive days for sows, which is economically critical in commercial swine production. Extended non-productive days lead

Table 2. Reproductive performance of crossbred sows in different parity **(**Mean±SE)

Reproductive traits*	Parity					P-value
	2	3	4	5	6	
Litter size (No.) at birth	11.82±1.4^{a}	10.94±1.1^{a}	9.32±1.1^{b}	7.43±0.5^{c}	7.8±0.8^{c}	<0.001
Birth weight/ piglet (kg)	1.41±0.1^{a}	1.38±0.1^{a}	1.16±0.1^{b}	1.1±0.1^{c}	1.1±0.1^{c}	<0.001
Litter weight at birth (kg)	13.17±2.4^{a}	12.32±1.5^{a}	10.3±1.2^{b}	9.2±0.8^{c}	10.1±1.7^{c}	<0.001
Litter size (No.) at weaning	8.91±0.8^{a}	8.65±0.9^{a}	6.86±1.2^{b}	5.6±0.5^{c}	5.6±0.6^{c}	<0.001
Weaning weight/piglet (kg)	12.12 ±2.0^{a}	11.79±1.4^{a}	10.00±1.3^{b}	8.3±2.1^{c}	8.5±1.2^{c}	<0.001
Litter weight at weaning (kg)	86.4±14.1^{a}	82.8±15.7^{a}	64.5±17.7^{b}	53.5±23.2^{c}	49.4±13.8^{c}	<0.001
Post-weaning oestrus (days)	3.04±0.21^{a}	3.24±0.55^{a}	3.82±0.59^{b}	4.43±0.98^{c}	4.60±0.89^{c}	<0.001
Weaning to service interval (days)	4.27±0.55^{a}	4.26±0.51^{a}	5.00±0.31^{b}	6.29±1.25^{c}	6.10±0.55^{c}	<0.001
Farrowing interval (months)	7.61±0.43^{a}	7.73±0.37^{a}	8.45±0.60^{b}	9.29±0.76^{c}	8.90±0.55^{c}	<0.001
Weight gain / piglet (kg) (on 21st day)	2.11±0.5^{a}	2.03±0.4^{a}	1.71±0.3^{b}	1.3±0.6^{c}	1.3±0.1^{c}	<0.001
Pre-weaning mortality (%)	25.7±10.8^{a}	24.99±8.0^{a}	29.00±9.8^{b}	33.4±5.3^{c}	33±5.3^{c}	0.002

^{a,b,c} Mean values with different superscripts within rows differed significantly (P<0.05)

to higher maintenance costs and reduced reproductive efficiency overall. The current study can be considered as a preliminary finding from the state which concluded that total litter weight at birth, weaning weight in piglets, litter weight at weaning, and weight gain per piglet in sows were highest in parity two, followed by parity three and also the weaning-to-service interval, pre-weaning mortality, and inter-farrowing interval were shortest in second and third parity sows compared to higher parity sows.

Conclusion

The present survey findings at different agro-climatic conditions demonstrated that sows in their second and third parities showed better reproductive performances, including shorter weaning-to-service intervals, higher conception rates, and increased litter sizes at birth and weaning. These findings underscore the relevance of parity-specific management practices to optimize the reproductive efficiency and overall productivity of swine herds.

Conflicts of interest

The authors declare no conflict of interest

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