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Original Research Article

Effects of parity on the reproductive performance of Nigerian indigenous sows and progeny survivability rates in Enugu State, South East Nigeria

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ABSTRACT

The effects of parity on the reproductive performance of Nigerian indigenous sow breed, progeny survivability and mortality in a commercial breeding farm in Enugu State Nigeria were investigated in this study. One hundred apparently healthy third trimester pregnant sows were randomly assigned to four treatment groups of twenty five sows per group in a completely randomized design (CRD) according to their reproductive parities as groups I, II, III and IV representing the first (P1), second (P2), third (P3) and fourth (P4) parities respectively. This study lasted for two years. The mean number of piglets born alive (NBA) of P1 (6.00±0.71 Head) and P2 (6.00±0.71 Head) were significantly decreased when compared to P4 (8.50±0.65 Head) but showed no significant difference when compared to P3 (7.50±0.50 Head). Second parity sows recorded the highest number of piglets' deaths after birth while P1 and P3 litters recorded the lowest deaths after birth. Mean pre-weaning survival of progenies was highest in P3 (91.43±5.09 %) and lowest in P2 (84.38±11.83 %) while mean piglet mortality was highest in P2 (15.63±11.83 %) but lowest in P3 (8.57±5.09 %). It can be concluded from this research work that PIII sows provided adequate requirements necessary for their litter nourishment, growth and survival more than the other parities. Therefore progeny growth performance was best at third parity of reproduction.

Keywords: Nigeria, performance, pigs, reproduction, survivability.

INTRODUCTION

The continual rise in global food demand coupled with the push for higher quality protein worldwide presents challenges as well as opportunities for livestock producers and food industries (Henchion *et al.,* 2014; Keating *et al.,* 2014). Representing 37% of total meat consumption worldwide, pork serves as one of the primary sources of animal protein (FAO, 2014) although there are religious barriers to the consumption of pork in Nigeria when compared to other livestock species. Considering the 34% growth in population expected to occur by the year 2050, our food supply is pressured to increase to meet the predicted demand (United Nations, 2013). With this call for greater food production, swine producers must continually strive for improved productivity. Maximizing sow lifetime productivity is critical for the sustainability and profitability of a sow herd (Stalder *et al.,* 2004); with the objective of having females produce multiple parities while providing adequate nourishment to wean a maximum number of full value pigs with as few non-productive days as possible.

When insufficient litters or an inadequate number of full value pigs are weaned per litter, the opportunity for a sow to offset the initial investment and contribute profit to an enterprise is reduced. Based on a variety of reasons, different culling strategies may be utilized on a sow farm to ensure the most productive and genetically current females remain in production. With young females, producers experience increased costs associated with initial purchasing, development, and acclimation of new replacement gilt (Stalder *et al.,* 2003), as well as increased opportunity cost due to decreased productivity through the first parity (Lucia *et al.,* 1999). In today's industry, reproductive failure accounts for approximately 35% of females culled from breeding herd and are the primary reason for female removal (Koketsu *et al.,* 1997; Mote *et al.,* 2009). Selecting for reproductive performance, however, is difficult due to the

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complexity of traits associated with reproductive success and the large influence environmental factors may have (Serenius & Stalder, 2006).

Pig appears to be superior in its reproductive ability when compared to other domestic animal species. This ability is based on the extremely high rate of fertility. Over the past three decades, efficient breeding and management has almost doubled the litter size of the domestic sow breeds (Oliviero, 2019). During the same period, the duration of farrowing (from the first to the last expelled foetus) has extended remarkably and is now four to five times longer than in the early 1990s (Oliviero *et al.,* 2019). This may have resulted in an increase in farrowing complications such as postpartum dysgalactia syndrome (PDS) (Kaiser *et al.,* 2018a, 2018b) and retention of placenta and a decrease in subsequent fertility (Bjorkman *et al.,* 2017; Bjorkman *et al.,* 2018). Along with this development, there have been a constant downward trend in the birth weight of piglets and a similar trend in colostrum intake, which are connected and are the most important risk factors for piglet mortality (Oliviero *et al.,* 2019). On the other hand, we have seen a tremendous increase in efficiency of production, which has considerably improved farming economy and related industry in a highly positive way. However, this may have come, at least to some extent, at the expense of animal health and welfare. A large litter may be challenging for the metabolism of the sow such that there may be difficulties in resumption of ovarian cyclicity after weaning, especially in young sows in certain breeds (Oliviero *et al.,* 2013; Peltoniemi *et al.,* 2016; Bjorkman *et al.,* 2018; Oliviero *et al.,* 2019). Therefore, there appear to be major challenges associated with increasing litter sizes that are evident at farrowing, lactation and after weaning, which are periods when the foundations of the subsequent pregnancy are laid (Algers & Uvnas-Moberg, 2007; Martineau *et al.,* 2012). The highest percentage of mortality in commercial pig production occurs prior to weaning and decreasing pre-weaning mortality is of high economic value to swine producers (Roehe & Kalm, 2000). Numerous factors impact pre-weaning mortality and piglets with low individual birth weight have an increased risk of stillbirths and mortality throughout all phases of production (Fix *et al.,* 2010). Selection of a larger litter size has led to higher variation of birth weight within litter weight and more low birth weight piglets, which is associated with an increase in deaths (Milligan *et al.,* 2002a). Lighter birth weight piglets have been shown to consume less milk and colostrum due to being at a competitive disadvantage and often have reduced pre-weaning growth (Hartsock & Graves, 1976). Because newborns partially acquire antibodies from colostrums, the first 0-7 days of life is crucially important with respect to survival (Ozcan & Yalcin, 1985). Low birth weight piglets are also more likely to be of poorer quality at weaning, finisher placement and 16 weeks into finishing and were less likely to be at full value at harvest (Fix *et al.,* 2010). Poorer quality piglets require a higher level of management and slow down production throughout the nursing and finishing phases, while reducing value and profitability for producers (Fix *et al.,* 2010). Milligan *et al.* (2002a) reported increased litter variation and pre-weaning mortality with older sows. Milligan (2002c) reported a significant effect of parity on survival rate and indicated high variations in survival rates of piglets in the first and later parities. The reproductive traits of pigs have low heritability of approximately 0.10 (Holm *et al.,* 2004; Crovetti *et al.,* 2010; Lee *et al.,* 2015), which is influenced by various factors, including breed, parity, and environment (Leite *et al.,* 2011; Knecht *et al.,* 2015). Study of birth weight variation between litters with similar mean birth weight found that pre-weaning survival was higher in litters of 11 piglets with reduced birth weight variation (English *et al.,* 1977), however, another study found that in healthy litters of average birth weight, the amount of variation in birth weight had little effect on piglet survival or weight gain (Milligan *et al.,* 2001a). Litters with high levels of birth weight variation are claimed to have lower survivability because of direct competitive exclusion of light litter-mates from access to functional and productive teats (English *et al.,* 1977; English & Morrison, 1984). Larger piglets may also compete indirectly with their litter-mates by stimulating and/or draining their teats more effectively and may thus direct a larger fraction of hormones and nutrients involved in milk production to their respective teats (Fraser *et al.,* 1979; Fraser & Thompson, 1986; Algers *et al.,* 1991). Such indirect competition between or among litter-mates may explain why the differences in body weight at birth are often maintained or increased throughout lactation. Pig producers are commonly encouraged to intervene so that less competitive piglets will survive by achieving adequate milk intake. Therefore the objective of this study was to estimate the effect of parity of litter on the sow's reproductive performance and piglet's survivability rates.

MATERIALS AND METHODS

This experiment was carried out on sows obtained from controlled breeding of Nigerian Indigenous sows in a commercial pig production farm in Enugu, Nigeria. One hundred apparently healthy third trimester pregnant sows were randomly assigned to four groups of twenty five sows per group in a completely randomized design (CRD) according to their reproductive parities as groups; I, II, III and IV representing the first (P1), second (P2), third (P3) and fourth (P4) parities respectively. This study lasted for two years. Individual sows were kept in separate pens from third trimester of gestation until farrowing and were maintained in

Table 1: Mean sow performance and piglets survivability rates at different parities of reproduction

Parameters	P1	P2	P3	P4
Total pigs born alive (PBA)	6.00±0.71[a]	6.00±0.71[a]	7.50±0.50[ab]	8.50±0.65[b]
Male pigs born alive (MBA)	2.75±0.85	3.00±1.23	3.75±0.85	3.00±0.41
Female pigs born alive (FBA)	3.25±1.03	3.25±1.32	3.75±0.95	5.50±0.87
Total survivability (TS) (%)	88.69±6.97	84.38±11.83	91.43±5.09	86.32±5.01
Male survivability (MS) (%)	100.00±0.00	65.00±23.63	87.50±12.50	75.00±25.00
Female survivability (FS) (%)	70.00±23.81	83.33±16.67	91.92±8.08	86.61±7.77

[ab]Mean values in the same row with different superscripts are significantly different (P<0.05)

Table 1I: Mean mortality of piglets at different parities of reproduction

Parameters	P1	P2	P3	P4
Total pigs dead after birth (PDB)	0.75±0.48	1.25±0.95	0.75±0.48	1.25±0.48
Male pigs dead after birth (MDB)	0.00±0.00	0.75±0.48	0.25±0.25	0.50±0.50
Female pigs dead after birth (FDB)	0.75±0.48	0.50±0.50	0.50±0.50	0.75±0.48
Total pig mortality (TM) (%)	11.31±6.97	15.63±11.83	8.57±5.09	13.68±5.01
Male pig mortality (MM) (%)	0.00±0.00	35.00±23.63	12.50±12.50	25.00±25.00
Female pig mortality (FM) (%)	30.00±23.81	16.67±16.67	8.33±8.33	13.39±7.77

these separate pens throughout lactation with their newborn piglets until weaning at 28 days postpartum. Sows were fed twice daily while the piglets received breast milk only from their mothers until weaning. Sows and piglets were provided with clean fresh water *ad libitum*. All the piglets were delivered during the rainy season. Piglets were identified with tag letters and weighed not later than 12 hours after birth. Two hundred milligrams dose of iron dextran was given to the piglets via intramuscular injection 1-7 days postpartum to prevent piglet anaemia (Svoboda & Drabek, 2005). The total number of piglets born alive and the number of piglets' dead after birth were counted manually (heads) while their percentage survivability (%) and mortality (%) rates were obtained by calculation.

STATISTICAL ANALYSIS:

The data collected were subjected to One Way Analysis of Variance (ANOVA) using SPSS statistical package (version 20.0). Variant means were separated using Duncan's New Multiple Range Test (Steel & Torrie, 1980). Probability values < 0.05 were considered significant

RESULTS

The mean number of piglets born alive (NBA) for P1 and P2 were significantly (P<0.05) reduced when compared to that of P4 but showed no significant (P>0.05) difference when compared to that of P3. Second parity sows recorded the highest number of dead piglets after birth while P1 and P3 litters recorded the lowest deaths after birth. Mean pre-weaning survival of progenies was highest in P3 and lowest in P2 while mean piglet mortality was highest in P2 and lowest in P3 (Tables I and II).

DISCUSSION

Tables I and II show the effect of parity on the reproductive performance of sows, progeny mortality and survival. The number of piglets born alive from first parity sows (P1) was significantly reduced when compared to fourth parity. Findings from first parity dams in this study corroborates the findings of other authors in fewer live pigs per litter (Mahan, 1991, 1994, 1998; Averette *et al.,* 1999; Peters *et al.,* 2010; Smits *et al.,* 2011), smaller litter weights (Hendrix *et al.,* 1978; Wilson and Johnson, 1980; Mahan, 1994; Mahan *et al.,* 2000; Peters *et al.,* 2010) and decreased pig gain (Hendrix *et al.,* 1978; Mahan, 1991; Kemme *et al.,* 1997; Mahan, 1998; Averette *et al.,* 1999; Smits *et al.,* 2011), as well as fewer stillbirths, mummies, and mortality (Mahan, 1994; Averette *et al.,* 1999). Research reports by Mahan (1994, 1998) and Mahan *et al.* (2000) indicate that the number of pigs born alive and pig weights may peak at P3, then decline at subsequent parities. Similar trend was seen in this study with regards to birth weight but in contrast with respect to total number born alive. More deaths (P>0.05) were recorded in the 2nd parity litters compared to other parities. Pre- weaning survivability of piglets is attributable to the sow and hence if lactating sows are not able to suckle the young ones adequately, mortalities during that stage will be high. Survival rates of piglets are due to the suckling ability (mothering ability) of the sow, hence higher litter numbers at birth might sometimes pose challenges if the sow does not get enough feed to produce enough milk during the first 14 days postpartum. It was observed that the 2nd parity sows probably were unable to suckle their young ones well hence, more pre-weaning deaths were recorded. The lower survivability observed with increased litter size can be attributed to reduced birth weight of offspring (Snyman, 2010), as increasing litter size reduces their chances of survival. Awemu *et al.* (1999) observed maximum kid survivability at the sixth parity and in the study by Hagan *et al.* (2014), maximum pre-weaning survivability was observed in the second parity.

These findings are in contrast to the findings of this study as the highest pre-weaning survivability and least mortality were observed in P3 progenies. The overall mean pre-weaning survivability of 87.70% in this study was higher than 79.10% reported by Baiden (2007) in goat. The difference in survivability seen in this study compared to the work of other researchers may be because of the difference in the breeds used, as pigs were used in this study while they did theirs with goats. Although pre-weaning mortality was not significantly influenced by parity, there is however no special trend. The highest pre-weaning mortality was recorded in 2nd parity piglets with the least mortality recorded in the 3rd paritysows progeny. The finding of this study was in total disagreement with the work by (Hagan and Etim, 2019) who reported that the highest pre-weaning mortality was recorded in fourth parity with the least mortality recorded in the second parity sows. This is probably because young sows are continuously growing and therefore need to channel some of their energies for their own physiological activities with little left for milk production. As a result, they were not able to produce enough milk to suckle the piglets, or sometimes there was complete lack of milk or poor maternal responsiveness resulting in deaths brought about by starvation. Pre-weaning piglet mortality from early parity sows might be due to the immaturity or inexperience of primiparous sows vis-a-vis poor mothering ability. Birth weight could also affect mortality in that highly overweight piglets might also tend to be delivered with difficulty (dystocia) or with prolonged labour and are likely to die at birth.

CONCLUSION

It was observed from this study that the dam's parity influenced their performance and that of their progeny growth performance. These observed differences between dams parity could possibly affect the pig's health performance. Furthermore, the result of this work showed that the reproductive performance of sows and their progeny growth performance were best at third parity of reproduction. The variations in progeny performance suggest that third parity sows (older parity sows) provided their progeny with the necessary requirements for greater performance than the younger first and second parity gilts/sows. Therefore the highest return on investment by swine breeders should be expected at the third parity of reproduction.

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