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# Assessment of post-farrowing performance in sows having a high number of pigs born dead on commercial farms

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ABSTRACT

The objectives of the present study were to investigate the relationship between number of pigs born dead (PBD) and both post-farrowing performance and culling risk in sows, and to determine the repeatability of PBD within sow. The present study used 256,527 parity records of 51,907 sows on 110 commercial farms. Five groups for PBD were categorized: PBD 0, 1, 2, 3 and ≥4 pigs. Linear mixed-effects models were used to analyze the data. Variance components analysis was separately conducted for three groups based on parity at culling. Mean value (±SEM) of PBD was 1.1±0.01 pigs. Relative frequency of PBD 0, 1, 2, 3 and ≥4 pigs were 44.7, 24.8, 14.6, 7.5 and 8.4%, respectively. The relative frequency of PBD ≥4 pigs increased from 4.2 to 14.4% as parity increased from 2 to ≥6, whereas the frequency of PBD ≥4 pigs in parity 1 was 6.0%. Sows with PBD ≥4 pigs had 3.4% lower subsequent farrowing rate than those with PBD 0 pigs ($P<0.01$). In parities ≥3, sows with PBD ≥4 pigs had fewer pigs born alive at subsequent parity than those with PBD 1 pigs ($P<0.01$). However, in parities 1 and 2, no differences were found between the PBD groups in number of pigs born alive at subsequent parity. No difference was also found between the PBD groups in their subsequent weaning-to-first-mating interval. At each farrowed parity, culling risk for sows increased as PBD increased ($P<0.01$). Furthermore, the values of the repeatability of PBD in sows culled in parities 2–5, 6–7 and ≥8 were relatively low, 0.14, 0.16 and 0.15, respectively. In conclusion, culling for low-parity sows based on PBD is not justified as the value of repeatability of PBD is low. Additionally, assisted farrowing is recommended for high-parity sows and parity-1 sows to reduce the PBD.



## 1. Introduction

Both numbers of stillborn piglets and mummified piglets have been routinely measured to monitor sow performance and herd health on commercial farms. However, it is difficult for producers to correctly distinguish the two categories of pigs born dead (PBD), and the number of stillborn piglets may include piglets that died during late gestation (Dial et al., 1992). A measurement of PBD that combines stillborn piglets with mummified piglets may be more valid than the two separate measurements. In the present study, we use PBD as a measurement for farrowing performance of sows on commercial farms.

Sows having low litter performance are at high risk of being culled (Friendship et al., 1996; Brandt et al., 1999). Producers may cull sows with high PBD, because they assume that sows with high PBD have low number of piglets born alive and high PBD at subsequent parity. A positive association between preweaning mortality of pigs born alive and PBD was reported (Leenhouwers et al., 1999). No other studies have reported an association of PBD with subsequent reproductive performance and culling risk. Additionally, stillborn piglets and mummified piglets are commonly observed in low- and high-parity sows (Leenhouwers et al., 1999; Tantasuparuk et al., 2000; Lucia et al., 2002). However, no studies have reported an interaction between parity and PBD for subsequent performance. Additionally, no studies have reported the repeatability of PBD, nor on the PBD repetition pattern at subsequent parities. The objectives of the present study were to investigate the relationship between PBD and both

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subsequent performance and culling risk, in addition to determining the repeatability of PBD on commercial farms.

## 2. Materials and methods

### 2.1. Data

All producers (approximately 140 farms) who used a recording software system (PigCHAMP, U.S.A.) in Japan were requested to mail their data files to Meiji University, every time they renewed their annual maintenance contract. By August 31, 2007, 123 farms had mailed their data to the university; however, seven farms that were growing–finishing operations and six farms that had no records of the sow's herd-entry date were excluded from the present study. In the current study, the sows on the farms were mainly F1 crossbreds between Landrace and Large White, either produced within the farms or replacement gilts purchased from national and international breeding companies. The breeding stocks were originally imported from the United States or Europe and have been further improved in Japan. Fostering at early ages of piglets and nursing sows have been commonly used on the study farms. The proportion of nursing sows in the weaned sow records was approximately 3.5% in Japan (Tanaka and Koketsu, 2008). The percentage of piglets fostered in the weaned piglets across farms was not reported in Japan.

The data of the remaining 110 farms contained 265,762 parity records of 52,469 sows that entered the farms in the period from 2001 to 2003. Data files were checked for missing records. Sows with no records of lactation length were excluded (769 parity records and 24 sows). Sows with total pigs born ≤4 were also excluded (8466 parity records and 538 sows). Hence, 256,527 parity records in 51,907 sows were used for further study.

### 2.2. Categories and definitions

The term PBD was defined as the number of stillborn piglets plus the number of mummified piglets. Litters were grouped into five categories, according to PBD: 0, 1, 2, 3 and ≥4 pigs. Litters with higher parity number than 6 were grouped into parity 6. Adjusted 21-day litter weight was adjusted to parity 3–6 sows nursing 10 piglets to be weaned at 21 days of age (PigCHAMP, 1996). Risk of removal of the sows (culling risk) for each parity was estimated as the number of culled sows divided by the number of farrowed sows multiplied by 100 for each parity. Culled sows included culled, dead, euthanized, transferred and removed sows with no recorded reason or type. Relative frequencies of culled, dead, euthanized, transferred and type-unrecorded sows were 88.5, 9.6, 0.4, 0.9 and 0.6%, respectively.

### 2.3. Statistical analysis

All statistical analyses were conducted using the SAS software (SAS Inst. Inc., Cary, NC). The observational unit was the individual litter. A chi-squared test was used to analyze the association between PBD groupings of the sow in consecutive parities. The standard error of the farrowing rate and the culling risk was obtained as a standard equation (Rosner, 1989): $\sqrt{p \times (1-p)/n}$ (where $p$ and $n$ are the probability of occurrence and sample numbers, respectively). Linear mixed-effects models with Tukey–Kramer multiple comparisons were applied for continuous data in Model 1 using the MIXED procedure. Root transformation was carried out for subsequent PBD when it was used as a dependent variable. Mixed-effects logistic regression analysis with contrasts was applied for binary data in Model 2 using the GLIMMIX procedure. The fixed effect variables in Models 1 and 2 were the five PBD groups, parity groups and lactation length. A two-way interaction between the PBD groups and parity groups was included. Lactation length was included as a covariate. The farm, farrowing year, three periods based on four-farrowing month intervals of the year and the farm-year-period interaction were included as random effects. The three-way interaction was used to account for a part of the correlations of the data within a sow in the model. Model 1 was:

$$Y_{ijklmn} = \mu + \mathrm{PBD}_i + \mathrm{PY}_j + \mathrm{PBD}_i \times \mathrm{PY}_j + \mathrm{LL}_k + F_l + P_m + Y_n + F_l \times P_m \times Y_n + e_{ijklmn},$$

where $Y_{ijklmn}$ was the performance (e.g. pigs born alive); $\mu$ is the overall mean; $\mathrm{PBD}_i$ was the fixed effect of the $i$th PBD group ($i$ = 0, 1, 2, 3, ≥4); $\mathrm{PY}_j$ was the fixed effect of $j$th parity groups ($j$ = 1 to ≥6); $\mathrm{PBD}_i \times \mathrm{PY}_j$ was the fixed interaction effect between the $i$th PBD group and the $j$th PY group; $\mathrm{LL}_k$ was a covariate; $F_l$ was the random effect of $l$th farm ($l$ = 1 to 117); $P_m$ was the random effect of $m$th period of four-month interval ($l$ = 1, 2, 3); $Y_n$ is the random effect of $n$th farrowing year ($n$ = 1, 2, 3, 4, 5); $F_l \times P_m \times Y_n$ was the random interaction effect between the $i$th farm, the $m$th period and the $n$th year; and $e_{ijklmn}$ was the random error. Model 2 was:

$$\mathit{Logit}\left(p_{ijklmn}\right) = \alpha + \mathrm{PBD}_i + \mathrm{PY}_j + \mathrm{PBD}_i \times \mathrm{PY}_j + \mathrm{LL}_k + F_l + P_m + Y_n + F_l \times P_m \times Y_n,$$

where$p_{ijklmn}$ was probability of a sow farrowing (farrowing rate) or probability of a sow being culled (culling risk); $\alpha$ was

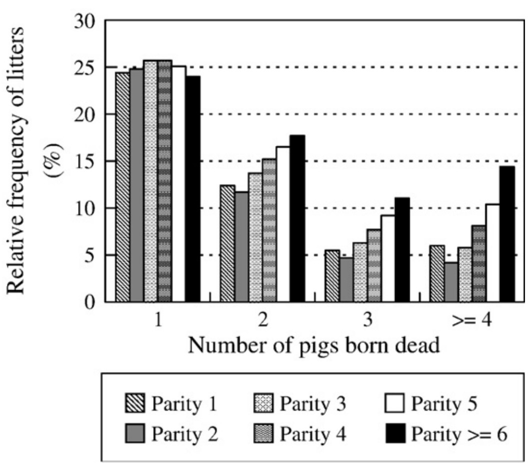


**Fig. 1.** Relative frequency (%) of litters with the number of pigs born dead, grouped by parity.