Preventive Veterinary Medicine 115 (2014) 166–172

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

Climatic factors associated with peripartum pig deaths during hot and humid or cold seasons

Ryosuke Iida, Yuzo Koketsu*

School of Agriculture, Meiji University, Higashi-mita 1-1-1, Tama-ku, Kawasaki, Kanagawa 214-8571, Japan

ARTICLE INFO

Article history:
Received 7 September 2013
Received in revised form 19 March 2014
Accepted 23 March 2014

Keywords:
Climate condition
Cold stress
Porcine mortality
Seasonality
High temperature

ABSTRACT

Our objective was to quantify the associations between climatic factors and a death occurrence of peripartum pigs from 16 to 19 weeks after successful service during hot and humid or cold seasons. The study used lifetime records of 93,837 females entered into 98 Japanese commercial herds from 2003 to 2007. The climate data were obtained from 21 weather stations close to the studied herds. Average daily maximum (HT) and minimum temperature (LT), and relative humidity for week 15 of gestation for each pregnant pig were coordinated with the respective pig's performance data. Multilevel logistic regression models were applied to two of the three separate datasets. One dataset included females due to farrow during the hot and humid season (June–September), and another comprised females due to farrow during the cold season (December–March). Of the 8381 females that died throughout the year, 11.5% of pregnant pigs died between 16 and 17 weeks after service, and 44.3% of farrowed females subsequently died from 16 to 19 weeks after service. Mean (ranges) HT in the hot and humid season and LT in the cold season were 28.7 (13.4–39.8) °C and 1.6 (−14.8 to 17.6) °C, respectively. Means of relative humidity in the hot and humid season and cold season were 73.6 (35–98)% and 64.9 (21–99)%, respectively. In the hot and humid season, a higher HT was associated with a higher occurrence of death for parity 0–1 females ($P < 0.05$), but not for parity 2 or higher sows ($P \geq 0.38$). The odds ratio was 1.030 (95% confidence intervals: 1.005–1.056) for HT in parity 0–1 females. Also, higher relative humidity was associated with a higher occurrence of death for parity 0–3 females ($P < 0.05$), but not parity 4 or higher sows ($P \geq 0.21$). In the cold season, a higher occurrence of death of parity 4 or higher sows was associated with lower LT ($P < 0.05$). Also, the occurrence of death of parity 6 or higher sows was associated with higher relative humidity in the cold season ($P < 0.05$). For parity 0–3 females, there were no associations between the occurrences of death and either LT or relative humidity during the cold season ($P \geq 0.11$). Therefore, it is recommended to install cooling systems and thick insulation to prevent increases in occurrences of pig deaths due to HT or LT.

1. Introduction

Annually 3.0–12.2% of female pigs die in commercial breeding herds (D'Allaire and Drolet, 2006). The economic loss caused by these female deaths includes not only the cost of replacement gilts and salvaged sows, but also the opportunity cost of the litter that could have been

* Corresponding author. Tel.: +81 44 934 7826; fax: +81 44 934 7902.
E-mail address: koket001@isc.meiji.ac.jp (Y. Koketsu).

http://dx.doi.org/10.1016/j.prevetmed.2014.03.019
0167-5877/

produced, because many of these dead females are pregnant, or could be pregnant (Stein et al., 1990; Huirne et al., 1991; D'Allaire et al., 1996). A higher incidence of sow death during summer months was reported in Canadian and U.S.A. herds (Chagnon et al., 1991; Koketsu, 2000), whereas Jones (1967) observed that in U.K. herds more than 55% of the dead sows had died during the winter months. In addition, during the peripartum period high parity sows are at higher risk of dying than lower parity females (Sasaki and Koketsu, 2008). Gilts in their prefarrowing and parturition have also been shown to be at high risk (Sasaki and Koketsu, 2008).

Previous studies reported associations between high temperatures measured at local meteorological stations and occurrences of reproductive failure, such as returns to service, low farrowing rate or delayed gilt puberty (Bloemhof et al., 2008; Tummaruk, 2012; Iida and Koketsu, 2013a). However, no studies have determined any association between climatic temperature and the occurrence of female deaths in peripartum periods, nor have they examined associations between parity and climatic factors for the occurrence of death. Therefore, the objective of this study was to quantify the associations between climatic factors and the occurrence of death in peripartum pigs (16–19 weeks after successful service or last service) during either hot and humid or cold seasons.

2. Materials and methods

2.1. Herds

One hundred fourteen pig producers in Japan that use the PigCHAMP recording system (PigCHAMP, Ames, IA, U.S.A.) were requested to mail their data files to Meiji University in 2010. By August 31, 2010, data files were received from 100 breeding herds. Two of these herds were excluded from the present study because the herds were producing only purebred pigs. The remaining 98 commercial breeding herds were located throughout Japan from Northern to Southern areas. During the study period a mechanical ventilation system was used in the farrowing barns of 8 herds and a natural ventilation system in the other 90 herds. Females in the 98 herds were mainly crossbreds between Landrace and Large White, either produced within the herds or they were replacement gilts purchased from national or international breeding companies. The breeding stocks in the national breeding companies were originally imported from the U.S.A. or Europe.

Mean herd measurements, i.e. herd size and pigs weaned per mated female per year (which is used as a measure of herd productivity), were abstracted from the 98 herd data files for seven 1-year periods from 2003 to 2009. Mean (±SEM) herd size was 412 ± 55.8 females with a range between 47 and 3447 females. Mean pigs weaned per mated female per year was 22.4 ± 0.18 pigs with a range between 17.8 and 25.8 pigs.

2.2. Female pig performance data

Lifetime data of females entered between 2003 and 2007 were extracted from the PigCHAMP recording system, amounting to records of 93,837 female pigs in the 98 herds. This included female data from 2003 to 2010 because females lived for up to 3 years in the herds. Of the females, 5559 (5.9%) were still alive when the data were collected. Data omitted were records of pregnant pigs with a service-to-death interval of 18 weeks or more (96 females); the service-to-death interval was defined as the number of weeks from last service to death. In addition records of sows that had farrowed and subsequently died 26 weeks or later after service (120 females) were also omitted. The records of the females that died 18 weeks or later after service were assumed to be missing records of farrowing (e.g. not pregnant or non-recorded abortion). In addition, records of farrowed females that died 26 weeks or more after service were also assumed to be missing records of services.

Three separate datasets were created: the first one comprised females due to farrow during the hot and humid season (June–September), the second one comprised females due to farrow during the cold season (December–March), and the third included females due to farrow outside these two seasons. Due date was calculated as the last service date for any given female plus 115 days, which is the average gestation length on commercial farms (Sasaki and Koketsu, 2007). The first and second datasets contained 146,832 and 144,361 parity records, respectively. A previous study defined the peripartum period as from 3 days before to 3 days after parturition (Chagnon et al., 1991). However, preliminary analysis showed that there was no clear cut-off point in deaths of females after last service (Fig. 1). Therefore, we defined the peripartum period for all pigs as 16–19 weeks, i.e. 112–139 days, after the date of successful service or last service based on the range of gestation length (Sasaki and Koketsu, 2007). Weeks 16–19 would be approximately the period from 3 days before to 24 days after parturition. The third dataset was, which contained 141,717 parity records, created to examine whether or not the occurrence of death outside the two studied seasons was much different from those in the studied seasons.

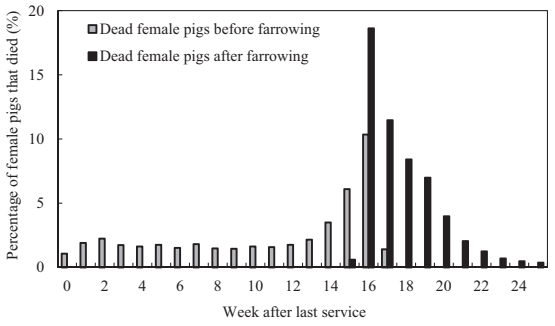

Fig. 1. Relative frequency (%) of the number of females[1,2] that died after last service. [1]Data omitted were records of pregnant pigs that died 18 weeks or later after service (96 females) and sows that farrowed and subsequently died 26 weeks or later after service (120 females). [2]Dead females were classified into females that died before due date or after farrowing.