Livestock Science 144 (2012) 218–229

Contents lists available at SciVerse ScienceDirect

Livestock Science

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

Piglet uniformity and mortality in large organic litters: Effects of parity and pre-mating diet composition

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ARTICLE INFO

Article history:
Received 2 September 2011
Received in revised form 24 November 2011
Accepted 26 November 2011

Keywords:
Organic sows
Parity
Piglet birth weight
Piglet mortality
Piglet uniformity
Pre-mating diet

ABSTRACT

In large organic litters, relationships between piglet birth weight, piglet uniformity and pre-weaning piglet mortality were studied. Furthermore, effects of parity and insulin-stimulating diets during the pre-mating period on piglet birth weight, uniformity, and mortality were investigated. Organically kept sows (n = 137 sow cycles) were fed a control diet during lactation and weaning-to-insemination interval (CON), or an insulin-stimulating diet (sucrose plus lactose, both 150 g/d) during only the weaning-to-insemination interval (WII) or during the last two weeks of a 41 ± 4 d lactation and the weaning-to-insemination interval (LAC + WII). Piglets (live born and stillborn) were weighed individually within 24 h after birth. Cross-fostering was allowed within treatments within the first 3 d after birth. Litter size was higher for parities 3 and 4 sows compared with older sows, whereas parity 2 sows had an intermediate litter size (the number of total born piglets was 17.0, 18.8 and 16.3 for sows of parities 2, 3 + 4 and ≥5, respectively; $P<0.01$). Mean birth weight (1.26 ± 0.02 kg) was not influenced by parity, but birth weight CV and percentage of piglets <800 g increased with increasing parity class, after corrections for number of total born piglets (for parities 2, 3 + 4 and ≥5, respectively, CV of birth weights were 21.3, 23.2 and 24.8%, $P=0.05$; and % piglets <800 g were 6.2, 8.7 and 13.6%, $P=0.02$). Pre-weaning piglet mortality also increased with parity class (20.9, 24.2, and 33.3% for parities 2, 3 + 4 and ≥5, respectively; $P=0.01$). Litter characteristics at birth and pre-weaning piglet mortality were not affected by the insulin-stimulating diets before mating. Piglet mortality from d0 to 3 was strongly related with the number of total born piglets ($\beta=1.47$%/piglet; $P<0.001$), mean birth weight of the piglets ($\beta=-30.99$%/kg; $P<0.001$), CV of birth weights ($\beta=1.08$%/%; $P<0.001$) and % piglets <800 g ($\beta=0.58$%/%; $P<0.01$). It is concluded that piglet birth weight and birth weight uniformity affect pre-weaning piglet mortality in organic sows with large litters. Piglet uniformity and piglet mortality were also affected by parity, but not by pre-mating insulin-stimulating diets.

1. Introduction

Dutch organic sows farrow larger litters than conventional sows (Leenhouwers et al., 2011). However, organic sows wean fewer piglets per litter compared with conventional sows, due to a high pre-weaning piglet mortality during their six-week lactation period (Leenhouwers et al., 2011).

Two important factors affecting pre-weaning piglet mortality are piglet birth weight and piglet uniformity (Milligan et al., 2002; Quiniou et al., 2002). Both piglet birth weight and uniformity are negatively related with litter size (Milligan et al., 2002; Quesnel et al., 2008), at least in sow populations with average litter sizes up to 13–14 total born piglets. Piglet birth weight and uniformity are also affected by parity (Damgaard et al., 2003; Milligan et al., 2002; Quesnel et al., 2008), as is pre-weaning piglet mortality (Marchant et al., 2000; Milligan et al., 2002; Weber et al.,

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1871-1413/$ – see front matter
doi:10.1016/j.livsci.2011.11.018

2007, 2009), but it is not clear whether this is related with differences in litter sizes amongst parities.

A way to improve piglet birth weight and litter uniformity could be the use of insulin-stimulating sow diets (dextrose plus lactose) before mating (Van den Brand et al., 2006, 2009), probably through beneficial effects of insulin on follicle development (as reviewed by e.g. Poretsky and Kalin, 1987, and Quesnel, 2009) and subsequent embryo and luteal development (Wientjes et al., 2011b,c). These studies have been performed in conventional sows with lactation lengths of 24–28 d, which have a strong catabolic state until weaning, associated with suppressed insulin levels and suppressed follicle development (as reviewed by e.g. Quesnel, 2009). The question arises whether insulin-stimulating diets during the pre-mating period can also improve the low piglet birth weight and piglet uniformity in organic sows, with much longer lactation lengths (approx. 40 d), which may affect sow metabolic state until weaning.

Therefore, the aim of this experiment was to study relationships between piglet birth weight, uniformity and pre-weaning mortality in organic sows with large litters and of different parities, and to investigate whether insulin-stimulating diets during different stages of the pre-mating period can improve piglet birth weight and uniformity, and thereby reduce piglet mortality, of these large litters.

2. Material and methods

2.1. General design

Organic sows were followed from entering the farrowing stable until weaning of the subsequent litter, and were fed a control diet during lactation and weaning-to-insemination interval, or an insulin-stimulating diet during the weaning-to-insemination interval or during the last two weeks of lactation and the weaning-to-insemination interval. Care and treatment of animals was according to Dutch animal welfare legislation.

2.2. Animals and housing

At Pig Research Centre Raalte of Wageningen University and Research Centre, in total 137 sow cycles of 89 organically kept Topigs 20 sows (Topigs, Vught, the Netherlands) were studied in 14 consecutive batches of 9–15 sows.

From 14 ± 6 days before farrowing, sows were kept individually in indoor farrowing pens, which consisted of a solid floor bedded with straw (2.0 × 2.25 m) and a slatted floor (2.0 × 1.5 m), with access to an outdoor pen (2.0 × 1.75 m). Sows were exposed to 11 h of artificial light per day (0700–1800 h). The farrowing pens contained a piglet area, separated from the sow, also bedded with straw. The solid floor and piglet area contained floor heating; in the piglet area floor heating was on from expected farrowing until weaning (gradually declining from 35 °C to 19 °C), in the lying area of the sow floor heating only started when room temperature dropped below 16 °C. To standardise litter sizes, cross-fostering of piglets was allowed within treatments within the first 3 days after birth. Weighing of piglets (within 24 h after birth) was combined with iron injections and ear tagging. Within 7 d after birth male piglets were castrated under general anaesthesia.

After weaning (at 41 ± 4 d) and during gestation, sows were group housed (in stable groups of 9–15 sows) in pens that were partly bedded with straw, and with access to an outdoor pen. Sows were fixated in stalls during feeding and during estrus. From April to October, pregnant sows had free access to pasture. Sows were exposed to 24 h of artificial light per day from weaning until 3 d after weaning, and 11 h of artificial light per day (0700–1800 h) thereafter.

From 3 d after weaning, sows were checked for estrus twice daily (at 0800 h and 1330 h) using a mature boar. All sows were inseminated each day of estrus with a dose of commercially available semen (containing 2×10^9 sperm cells) of a Pietrain boar line. At 18–22 days after insemination sows were checked for estrus using a mature boar. At 28 days after insemination sows were checked for pregnancy using transcutaneous ultrasonography.

2.3. Feeding and dietary treatments

In the farrowing rooms, sows were fed twice daily (at 0730 h and 1400 h). From entering the farrowing room until d109 of pregnancy sows received a standard organic gestation feed (12.2 MJ ME/kg; 151 g/kg CP; 6.8 g/kg lysine). From d109 until d113 of pregnancy, sows were gradually switched to a standard organic lactation feed (CON diet; Table 1).

From entering the farrowing room until farrowing, sows received 3.6–4.2 kg feed/d, depending on room temperature. On the day of farrowing, sows received 1.5 kg feed. During the first 6 days after farrowing, feed allowance was gradually increased to 6.5 kg/d. From d14 of lactation until weaning, sows received 7.5 kg feed/d. Piglets were fed an organic creep feed from two weeks of age onwards.

Within each batch, sows were allocated to one of three dietary treatments, based on parity and sow body weight at entering the farrowing stable: CON: control diet during lactation and weaning-to-insemination interval; WII: sucrose plus lactose (both 150 g/d) during the weaning-to-insemination interval; or LAC + WII: sucrose plus lactose (both 150 g/d) during the last two weeks of lactation and weaning-to-insemination interval. Sucrose and lactose (both organic) were used as insulin-stimulating feed components. Sucrose was used as an alternative for dextrose, because no organic dextrose was available. Dextrose and sucrose do not differ in their insulin-stimulating effect in sows (Wientjes et al., 2011a).

During lactation, sows of the CON and WII treatments received the standard organic lactation feed (CON diet, Table 1). The LAC + WII sows received the standard organic lactation feed (CON diet, Table 1) until 2 weeks before weaning. Thereafter, they received an isocaloric lactation diet with 20 g/kg sucrose plus 20 g/kg lactose (SL diet; Table 1), resulting in a daily intake of approximately 150 g sucrose plus 150 g lactose at a feeding level of 7.5 kg.

From weaning until insemination, all sows were fed 3 kg of the standard organic lactation feed (CON diet; Table 1) once daily, and the WII and LAC + WII sows received a top-dressing of 150 g sucrose plus 150 g lactose/d.