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Effect of birth weight and colostrum intake on mortality and performance of piglets after cross-fostering in sows of different parities

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ABSTRACT

The objective of this study was to evaluate the effect of colostrum intake on mortality and growth performance of piglets until 42 days of age, taking into account the birth weight, and parity order of sows. Colostrum intake from birth to 24 h after birth was estimated in 300 piglets each from primiparous and multiparous sows. The piglets were cross-fostered in 25 primiparous and 25 multiparous sows at 25.9 ± 0.09 h after farrowing. The concentration of serum immunoglobulin G (IgG) was determined in the sows after the end of farrowing and in the piglets before cross-fostering (24 h after farrowing), at 10 and 20 days of age. For high birth weight piglets (HBW – >1.3–1.7 kg) the probability of death was low regardless of their colostrum intake. Intermediate birth weight (IBW – >1.2–1.3 kg) and low birth weight (LBW – 1.1–1.2 kg) piglets had the same probability of death compared to HBW piglets, when colostrum intake reached 200 and 250 g, respectively. The probability of low performance (<9.5 kg) was lower in HBW than in LBW and IBW piglets, regardless of colostrum intake. HBW piglets had higher weight at 14, 20, 28 and 42 days of age ($P < 0.05$) than LBW piglets, and higher weight than IBW piglets at 28 and 42 days. Colostrum intake >250 g increased ($P < 0.05$) the weight of piglets at 28 and 42 days of age, regardless of their birth weight. Piglets from primiparous biological dams consumed less colostrum ($P < 0.003$) than piglets from multiparous dams, but their serum IgG concentrations at 24 h after birth and their performance were similar ($P > 0.05$). Piglets suckled by primiparous foster sows showed lower weight ($P < 0.05$) at 20, 28 and 42 days than piglets suckled by multiparous sows. Piglets that died before 42 days of age had lower ($P < 0.05$) birth weight, colostrum intake and serum IgG at 24 h after birth compared to surviving piglets, and lower values were also observed in piglets with low performance compared to high (>9.5 kg) performance piglets. There were no differences in serum IgG concentrations at 10 and 20 days of age ($P > 0.05$) between high and low performance piglets. In conclusion, both colostrum intake and birth weight are important for survival and growth of suckling piglets. LBW and IBW piglets are more dependent on colostrum intake than HBW piglets to assure higher survival and better development up to 42 days of age. Piglets suckled by multiparous sows have better development than those suckled by primiparous sows.

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1. Introduction

Selection for higher prolificacy in pig production has been accompanied by great variability in birth weight and pre-weaning mortality (Quiniou et al., 2002). The mortality rate of suckling piglets varies widely among countries and farms, with reported values varying from 4.7% (Furtado et al., 2012) to 12% (Kilbride et al., 2012). Neonatal mortality is a major cause of pre-weaning losses and the first 24 h after birth is the most critical period (Quesnel et al., 2012), when 28% of pre-weaning mortality occurs (Kilbride et al., 2012). Low birth weight (14%), starvation (7%), crushing of sick piglets (5%) and diarrhoea (4%) are among the most prevalent causes of death in maternity (Fix et al., 2010; Kilbride et al., 2012). Piglets that do not ingest colostrum or consume an insufficient amount of colostrum are subjected to starvation and therefore predisposed to crushing and diarrhoea. Adequate colostrum intake can reduce the mortality rate until weaning, hence decreasing losses in the productive system (Devillers et al., 2011; Quesnel et al., 2012).

Colostrum provides energy required for body temperature regulation and growth (Herpin et al., 2002; Le Dividich et al., 2005) in addition to growth factors that stimulate intestinal growth and maturation (Xu et al., 2000). Due to the epitheliochorial placenta, piglets are born without plasma immunoglobulins (Bland et al., 2003), so one of the most important functions of colostrum is to provide passive immunity necessary to protect piglets (Rooke and Bland, 2002). Immunoglobulins assist this protection, particularly immunoglobulin G (IgG), which is available in large quantities in colostrum during the first 3 h after farrowing (Foisnet et al., 2010). However, a minimal amount of colostrum must be ingested to provide protection to piglets. According to Devillers et al. (2011), the ingestion of 200 g colostrum provides passive immunity to piglets, reducing their risk of death before weaning and affording them a slight weight gain.

The amount of colostrum intake depends not only on the ability of sows to produce it but also on the capacity of piglets to withdraw the colostrum from teats (Quesnel et al., 2012). Lactation requires a large mobilization of body reserves and this is aggravated in primiparous sows because a portion of their energy must be directed towards their development. Piglets from primiparous sows have lower birth weight compared to piglets from females of higher parities (Carney-Hinkle et al., 2013). Furthermore, primiparous sows produce less milk (Beyer et al., 2007) and wean lighter piglets.

Although colostrum intake has been shown to be important for survival and growth of piglets (Devillers et al., 2011; Quesnel, 2011), there is a lack of information concerning the importance of colostrum intake for piglets of different birth weights. The IgG concentration in piglets has been evaluated according to the parity of the sows (Hinkle, 2012; Carney-Hinkle et al., 2013), but the amount of colostrum intake was not measured in those studies. It would also be important to know whether a low growth performance, due to a low colostrum intake, can be compensated by piglets being suckled by higher parity sows. The definition of the enough amount of colostrum that should be ingested, according to piglet's birth weight, can be an important management tool, allowing focusing on care with piglets that have lower survival chance. The aim of this study was to evaluate the effect of colostrum intake on mortality and growth performance of piglets until 42 days of age, taking into account the birth weight, and parity order of the sows.

2. Materials and methods

The experimental protocol described in this experiment was approved by the Institutional Animal Care and Use Committee (CEUA-FAVET-UFRGS) under an experimental license (Project number 24003).

2.1. Animals and housing

The study was carried out in a breeding herd typical of swine production with 4300 sows in the Midwest of Santa Catarina State, Brazil, from July to October 2012.

Large White × Duroc × Landrace (Camborough 25®, Agroceres PIC genetics) sows were used in this study. Either primiparous or multiparous (parity order 4–6) sows were used as biological and foster dams. Two groups of biological dams were formed: primiparous (PrimBiol; $n = 57$) and multiparous (MultBiol; $n = 59$). These sows were used to study colostrum yield and served as donors and recipients of piglets in order that none of the piglets evaluated remained with their biological dam after cross-fostering. As IgG concentration in colostrum declines dramatically up to 24 h after farrowing, being the higher absorption period (Klobasa and Butler, 1987), the piglets were cross-fostered at 25.9 ± 0.09 h after farrowing and uniformly distributed among the foster sows according to their birth weight and gender.

In total, 600 piglets (300 piglets from PrimBiol and 300 piglets from MultBiol) weighing between 1.1 and 1.7 kg at birth were used. Piglets with respiratory distress, umbilical cord rupture or malformation were not included in the study. Foster sows were selected and distributed in pairs ($n = 25$), each pair consisting of a primiparous (PrimFoster) and a multiparous (MultFoster) sow. To study the effect of the parity order of both biological and foster dams, twelve piglets were allocated to each PrimFoster (six piglets from PrimBiol and six piglets from MultBiol) or MultFoster (six piglets from PrimBiol and six piglets from MultBiol) sow.

The sows were housed in gestation crates until sixty days post-insemination and afterward in gestation pens. Five days before the estimated farrowing date, the females were moved into the farrowing house where they were individually housed in crates until weaning. The farrowing house consisted of 66 farrowing crates per room with curtains at the lateral walls, which were used to manage the temperature inside the room. Crates were equipped with nipples and automatic feeders and had a full plastic slatted floor. In front of each farrowing crate, there was a creep box containing a heated floor, heat lamp and an opening to permit free access to piglets.

During gestation, the sows were given a standard corn soybean gestation diet (14% CP, 0.65% lysine and 3217 kcal ME), offered in specific amounts, in three meals, depending on the gestation phase and body condition score of the