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Effects of high feed intake during early gestation on sow performance and offspring growth and carcass characteristics☆

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Abstract

A total of 715 sows and their 4193 offspring were used to evaluate effects of increasing feed intake during gestation on sow performance and carcass characteristics of offspring. Two experiments were conducted in southwestern Minnesota on a commercial 3000 sow (PIC, C22 sows × line 337 boars) farrow-to-wean facility, with offspring followed through offsite nursery and finishing complexes. In Exp. 1, sows ($n = 321$) were allotted to one of three treatments: 1.81 kg/d of complete (145 g CP/kg, 7 g/kg lysine, 10 g P/kg, and 9 g Ca/kg) feed (control), 1.81 kg/d complete feed plus 1.81 kg/d of ground maize (added maize), or 3.63 kg/d of complete feed (extra feed) from days 30 to 50 of gestation. Sows were fed 1.81 kg/d of the same diet from breeding until day 30 and between days 50 and 100. All sows were fed 2.72 kg/d after day 100 of gestation until farrowing (day 114). Sows fed increased complete diet from days 30 to 50 of gestation had fewer ($P < 0.05$) pigs born alive than control sows; however, this decrease was not observed for sows fed added maize. Increased complete diet fed from days 30 to 50 of gestation resulted in heavier ($P < 0.05$) offspring at slaughter than controls with offspring from sows fed additional maize being intermediate. Gilt offspring from sows that were provided extra feed

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or maize had increased ($P < 0.05$) percentage lean and fat free lean index. In Exp. 2, sows ($n = 394$) were fed 3.63 kg/d of complete diet for one of three periods; days 10–30 (embryonic), 30–50 (early fetal), or 10–50 (embryonic + early fetal) of gestation, versus a control level of 1.81 kg/d from days 10 to 50. Contrary to Exp. 1, increased complete diet treatments did not affect the number of pigs farrowed, and sows fed 3.63 kg/d of feed from days 30 to 50 produced offspring with greater backfat and lower percentage lean than other treatments. It is not known why the positive treatment effects on offspring carcass characteristics in Exp. 1 were not repeated in Exp. 2. Possible explanations are differences in the weight of offspring at harvest, sow parity, and differences in number of pigs born alive. Additional research is needed to identify and evaluate these factors which are influencing this variation.

Keywords: Gestation; Leanness; Offspring; Sow

1. Introduction

Improvements in fetal muscle fibre growth in fetal-pigs have been observed when maternal feed is increased during gestation (Dwyer et al., 1994), or the sows are treated with added somatatropin (Rehfeldt et al., 1993; Kelly et al., 1995), or supplemental L-carnitine (Musser et al., 2001). The increased fetal muscle fibre development may result from improvements in glucose utilization and homeostasis, leading to stimulated fetal growth through increased production of IGF-I by the fetuses (Bassett et al., 1990; Magri et al., 1991).

Muscle fibre number is determined prenatally and, if hypertrophy is not limited after birth, increasing the number of muscle fibres would result in a larger total muscle volume (Luff and Goldspink, 1970; Miller et al., 1975). Development is based on the formation of primary muscle fibres in the early embryonic period (Wigmore and Stickland, 1983). These primary fibres are surrounded by secondary muscle fibres (fast-twitch, white) by day 90 of gestation to form several individual fibre bundles (Kelly and Zacks, 1969; Wigmore and Stickland, 1983; Duxson and Usson, 1989). After secondary muscle fibres form, a steady rate of transformation between muscle fibre types occurs throughout life to a muscle with the appropriate fibre phenotypes, specific to muscle load and function.

Studies have identified two gestational periods for that influence muscle fibre number (Rehfeldt et al., 1993; Dwyer et al., 1994). These are the embryonic period (days 10–30), when differentiation of germ layers provides the development of tissues and organs of the fetus, and the early fetal period (days 30–50), which immediately precedes secondary muscle fibre differentiation. Therefore, our objective was to determine if manipulation of feed intake during gestation could alter fetal muscle development and carcass characteristics.

2. Materials and methods

2.1. General

The experimental protocols used in these studies were approved by the Kansas State University Animal Care and Use Committee. Both experiments were conducted on a 3000-