The Professional Animal Scientist 32 (2016):99–105; http://dx.doi.org/10.15232/pas.2015-01433

Effect of anise oil fed to lactating sows and nursery pigs on sow feed intake, piglet performance, and weanling pig feed intake and growth performance[1]

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ABSTRACT

Anise oil (AO) was fed to lactating sows and to pigs after weaning to determine its effect on feed intake and performance of nursery pigs. Sows (24) were fed either (1) control or (2) AO (control + 50 mg/kg of AO). At weaning, within sow treatment, 168 pigs were assigned to control or AO. Pigs were fed a 3-phase nursery program (1 wk each), and feed intake was determined daily during wk 1. On d 2, 3, or 7, daily feed intake tended to be greater for progeny of sows fed AO ($P < 0.10$). Pigs fed AO also tended to consume more feed on d 1, 5, and 7 ($P < 0.10$). On d 7 and phase 1, progeny of sows fed control tended to have the least ADFI when fed control and the highest when fed AO ($P < 0.10$). Pigs fed AO had greater ADFI, ADG, and G:F ($P < 0.05$) in wk 2. In wk 3, progeny of sows fed control had the least ADFI when fed control and the highest when fed AO ($P < 0.05$). Overall, progeny of sows fed control tended to have the least ADFI when fed control and greatest when fed AO ($P = 0.06$). Pigs fed AO during the nursery phase tended to have greater ADG and BW ($P < 0.10$). Feeding AO did not affect sow performance but increased ADFI in pigs immediately after weaning.

Key words: anise oil, nursery pig, sow, weaning

INTRODUCTION

At weaning, pigs do not consume an adequate amount of energy to meet their requirement for protein accretion (Mahan and Newton, 1993; Van Dijk et al., 2001). After weaning, selecting new feed may take between 3 and 7 d (Naranjo et al., 2010). These short periods of anorexia may compromise intestinal integrity, decrease gut functionality, and increase the susceptibility of the piglet to enteric diseases (Mahan, 1992; Mahan and Newton, 1993; Van Dijk et al., 2001; Naranjo et al., 2010). Offspring learn to select food by the exposure to olfactory markers produced by skin, feathers, fur, feces, diet, breath, or amniotic fluid (Morrow-Tesch and McGlone, 1990; Bilkó et al., 1994; Oostindjer et al., 2009) of their mother. Prenatal and perinatal exposure to plant aromatics increases acceptance of feed with the same flavor in dogs (Hepper and Wells, 2006), humans (Mennella et al., 1995), rabbits (Coureaud et al., 2002), rats (Arias and Chotro, 2007), and pigs (Figueroa et al., 2013). However, perinatal sensory exposure to flavors has not consistently increased feed preference (Bilkó et al., 1994), probably related to the use of oil mixtures that limit recognition (Wilson et al., 2004; Windisch et al., 2008). Anise oil (**AO**) has been used as an aromatic in mammals with positive recognition after reexposure (Kreydiyyeh et al., 2003; Hepper and Wells, 2006; Figueroa et al., 2013) and is a generally recognized as a safe substance (Newberne et al., 1999). *Trans*-anethole comprises ~90% of the volatile components of star AO (*Illicium verum*; Gholivand et al., 2009; Wang et al., 2011) and has been used as a flavoring substance for human food (from 2.5 mg/kg in gravies to 1,500 mg/kg in gum). Lambs and pigs have responded positively to prena-

[1] Approved for publication by the director of the Louisiana Agricultural Experiment Station as Publ. No. 2015-230-22599.
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tal and perinatal exposure to anise flavored feed in the double choice gate test, the Y maze test, the novel environment test, and the rooting test (Simitzis et al., 2008; Oostindjer et al., 2009). Therefore, the objective of this study was to assess further whether perinatal exposure to AO would affect pig or sow performance, and whether the potential effects from lactation would improve feed intake during the first week after weaning, as well as affect growth performance during the nursery phase.

Table 1. Composition of the basal lactation diet, as-fed basis

Item	Value
Ingredient, %	
Corn	65.85
Soybean meal, 48% CP	27.00
Dry fat[1]	2.76
Soybean oil	0.22
Monocalcium phosphate	1.47
Limestone	1.00
Salt	0.50
Mineral premix[2]	0.10
Vitamin premix[3]	0.50
Sodium bentonite[4]	0.50
Choline chloride[5]	0.10
Calculated composition, %	
Ca	0.77
P	0.68
Total Lys	0.94
Total Met + Cys	0.58
Total Thr	0.68
Total Trp	0.21
Total Ile	0.74
Total Val	0.83
ME, kcal/kg	3,265

[1]Fat-Pak 100 (100% animal fat, Milk Specialties Co., Dundee, IL).

[2]Provided the following per kilogram of diet: Fe (ferrous sulfate·H_2O), 127 mg; Zn (zinc sulfate), 127 mg; Cu (copper sulfate), 12.7 mg; Mn (manganese sulfate), 20 mg; I (calcium iodate), 0.80 mg; and Se (sodium selenite), 0.30 mg.

[3]Provided the following per kilogram of diet: vitamin A, 11,023 IU; vitamin D_3, 3,307 IU; vitamin E, 88 IU; niacin, 88 g; pantothenic acid, 50 mg; riboflavin, 13 mg; menadione, 8 mg; pyridoxine, 4 mg; thiamin, 4 mg; folic acid, 3 mg; vitamin B_{12}, 61 μg; biotin, 441 μg; and vitamin C, 110 μg.

[4]AB-20 (Prince Agri Products Inc., Quincy, IL).

[5]Contains 750,000 mg/kg of choline.

MATERIALS AND METHODS

All experimental animal use was in compliance with the Louisiana State University Agricultural Center Animal Care and Use Committee. Animals were obtained from the Louisiana State University Agricultural Center Swine Unit.

Sows

Two consecutive groups of 12 gestating Yorkshire and crossbred (Yorkshire × Landrace) sows were allotted to 2 dietary treatments on d 110 of gestation. The treatment groups were balanced by breed, parity, and weight. The lactation treatment diets (Table 1) were corn and soybean meal diets: (1) control or (2) AO (control + 50 mg/kg of AO). The diets were formulated to meet or exceed the requirements for lactating sows with anticipated weight change of −10 kg and pig daily gain of 0.20 kg (NRC, 1998). Both diets contained 0.94% total Lys and 3,265 kcal/kg of ME (as-fed basis). The ratios of total AA to Lys were 0.60, 0.72, 0.22, 0.78, and 0.88 for Met + Cys, Thr, Trp, Ile, and Val, respectively. Vegetable oil was used as a source of energy and as the carrier of the AO. Before allotment, all sows were fed a typical corn–soybean meal gestation diet that met or exceeded the requirements for gestating sows (NRC, 1998).

On d 110 of gestation, sows were weighed, moved into the farrowing facility, and immediately started on the experimental diets. The facility was environmentally controlled and consisted of 28 individual farrowing stalls with hard plastic, slotted floors and an under flush system. Each farrowing stall (1.5 × 2.1 m) had a stainless steel self-feeder, a nipple waterer inside the crate for the sows, and a small nipple waterer outside of the crate for the pigs. Water was provided ad libitum. From d 110 of gestation to farrowing, the sows were fed approximately 2.8 kg/d (as-fed basis) of their treatment diets. After farrowing, feed was gradually increased until the sows were fed ad libitum by about d 7. Feed additions were recorded for calculation of ADFI. Piglets were weighed, were ear notched, and received 1 mL of iron dextran (Ferrodex 100; Agri Laboratories Ltd., St. Louis, MO) within 48 h after farrowing. At this time, piglets were cross-fostered within treatment group to adjust litters to approximately 10 pigs per litter by including pigs from nonresearch sows. Pigs were weaned at 20 ± 2 d after farrowing. Sows and piglets were weighed at weaning, and the piglets were allotted to nursery dietary treatments. Changes in BW, 10th-rib backfat, and BCS were determined for sows. For BCS the visual assessment (sow rear aspect) method suggested by Coffey et al. (1999) was used (1 = lowest to 5 = greatest). After weaning, all sows were checked twice daily for signs of estrus. Days to estrus were recorded when the sow stood to be mounted by a boar.

Pigs

Ninety-six (sow group 1) and 72 (sow group 2) mixed-sex weanling pigs were housed (groups of 4 or 3, respectively) in a temperature controlled building in 0.97 × 1.47 m pens with plastic, slotted floors, one nipple waterer, and a 4-hole self-feeder. Nursery pigs were fed a 3-phase feeding program lasting 1 wk each. Feed intake was determined daily at 0700 h during nursery phase 1 (d 1–7 after weaning); then BW and feed intake were determined weekly after wk 1. Pigs were allotted within lactation treatment to 2 nursery dietary treatments in a randomized complete block design with dietary treatments arranged in a 2 × 2 factorial arrangement in a split-plot design. The main plot was lactation dietary treatment (control or AO) and nursery diet within the plot. The nursery diets (Table 2) were based on corn and