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Effects of estradiol implantation on growth, carcass traits and circulating concentrations of insulin-like growth factors (IGFs) and IGF-binding protein-3 in finishing barrows☆

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Abstract

Eighty crossbred barrows aged 120 to 141 days and weighing 71.2±0.8 kg were randomly divided into eight pens, after which each of 40 animals in four pens was implanted with 24 mg of estradiol-17β (E_2; Compudose®). The animals were allowed an unrestricted access to water and a finisher diet containing 16% crude protein and 3.4 Mcal DE/kg and slaughtered at 107.4±0.8 kg. Blood samples were obtained by jugular venipuncture at day 0 before the implantation and at days 21 and 42. Serum concentration of E_2 increased between days 0 and 21 after the implantation and declined to a level above that of day 0 ($P<0.01$) by day 42. E_2 implantation caused a decrease ($P<0.01$) in feed intake and backfat thickness and a tendency ($P=0.08$) of decreased average daily gain. However, feed conversion efficiency (FCE; live weight gain/feed intake) did not change due to the implantation ($P=0.20$). The E_2 implantation did not affect physicochemical characteristics of longissimus muscle including percentages of protein ($P=0.17$) and fat ($P=0.43$), 24-h pH ($P=0.39$), drip loss ($P=0.99$), L^* (lightness; $P=0.78$) and a^* (redness; $P=0.49$) values. Serum concentration of insulin-like growth factor (IGF)-I decreased between days 0 and 21 ($P<0.01$) and also between days 21 and 42 ($P<0.05$) in unimplanted pigs, but not in implanted pigs ($P>0.05$), which resulted in a greater ($P<0.05$) mean IGF-I concentration in the implanted vs. unimplanted group. By contrast, serum concentrations of IGF-II and IGF-binding protein-3 did not differ between the two groups ($P>0.05$). In summary, results suggest that E_2 suppresses voluntary feed intake and backfat deposition without significantly affecting growth efficiency and muscle characteristics in barrows and that effects of E_2 may be partly mediated by IGF-I.

Keywords: Estrogen; Anabolics; Growth; IGF; Pig

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1. Introduction

Barrows have a reduced feed efficiency and a greater backfat thickness than boars and gilts resulting primarily from an excessively greater feed intake compared with that of the latter (Field, 1971). It is known that the reduced growth efficiency of barrows can be improved by restricted feeding (Leymaster and Mersmann, 1991) or by feeding a low-energy diet (Coffey et al., 1982). Implantation of Revalor H, which contains estradiol-17β and a synthetic androgen trenbolone, has also been reported to reduce the excessive fat deposition as well as feed intake without affecting the physicochemical characteristics of the carcass (De Wilde and Lauwers, 1984; Lee et al., 2002). The Revalor H implant, however, turned out not to be desirable for barrows, because trenbolone contained in the implant induced a development of external genitalia causing the carcass of the implanted barrow to be misjudged as that of a boar's at the slaughterhouse (Lee et al., 2002).

Only limited information is available as to the effect of each of the androgen and estrogen on growth measures in barrows. In this regard, Rempel and Clapper (2002) have reported that estradiol-17β implant (Compudose®) had varying effects on growth and its efficiency measures in finishing barrows depending on the dose and duration of the implant as well as animal's body weight at the time of implantation. The present study was therefore undertaken primarily to delineate the effect of a low dose of the Compudose implant on growth and carcass characteristics in finishing barrows.

2. Materials and methods

2.1. Animals

Eighty barrows of Landrace×Yorkshire dams×Duroc sires' progenies aged 106 and 121 days and weighing approximately 60 kg were randomly divided into eight 19-m^2 pens, with control and implant groups assigned four pens each and 10 animals accommodated per each pen. The animals were adapted for 2 weeks until day 0 of the experiment to the new environment and a finisher diet (Table 1) which had been formulated to contain 3.4 Mcal DE/kg, 16% crude protein and 0.85% lysine basically following the guideline of NRC (1998). At day 0 of the experiment, the animals were weighed, after which each of the 40 implant group animals received a Compudose® implant (Elanco, Indianapolis, IN, USA) containing 24 mg of estradiol-17β at the base of an ear. Water and the diet were provided ad libitum up to the day previous to slaughter. Blood samples were taken from the jugular vein at day 0 before the implantation, days 21 and 42. The animals were slaughtered at 107.4±0.8-kg body weights on 4 days at 1-week intervals at the abattoir of Pusan and Kyungnam Cooperative Swine Farms Association. Following overnight chilling of the carcass, backfat thickness was measured at the last rib and between the 11th and 12th ribs. The average of the two measurements were adjusted for 110-kg live weight using the equation suggested by NSIF (1997) as previously described (Lee et al., 2002).

Table 1
Diet composition (as-fed basis)

Item	Content
Ingredient (%)	
Corn	70.50
Soybean meal (44% CP)	22.80
Limestone	0.48
Tricalcium phosphate	1.80
Salt	0.30
Vitamin premix[a]	0.30
Mineral premix[b]	0.30
Animal fat	0.50
Molasses	3.00
L-lysine	0.02
Calculated chemical composition	
DE (Mcal/kg)	3.40
Crude protein (%)	16.00
Lysine (%)	0.85
Crude fat (%)	3.59
Crude fiber (%)	3.28
Crude ash (%)	4.85
Ca (%)	0.85
P (%)	0.70

[a] Provided per kilogram of diet: 8100 IU vitamin A, 1200 IU vitamin D_3, 45 IU vitamin E, 2.55 mg vitamin K, 1.5 mg thiamin, 0.6 mg riboflavin, 2.55 mg pyridoxine, 0.03 mg vitamin B_{12}, 19.5 mg pantothenic acid, 39 mg niacin, 0.09 mg biotin, and 0.75 mg folic acid.

[b] Provided per kilogram of diet: 102.7 mg $FeSO_4$, 0.442 mg $CoSO_4$, 67 mg $CuSO_4$, 54.18 mg $MnSO_4$, 69 mg $ZnSO_4$, 0.546 mg $CaIO_3$, and 0.338 mg Na_2SeO_3.