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Short communication

Effects of dietary supplementation of sericite on growth performance, nutrient digestibility, blood profiles and fecal microflora shedding in growing pigs

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ABSTRACT

A total of 60 growing pigs with an average initial BW of 32.51 ± 1.75 kg were randomly allotted into one of three groups for a 24-d study to determine effects of sericite (silicate clay) supplementation on growth performance, apparent nutrient digestibility, blood profiles and fecal microflora. Treatments were: Sericite-0.0%, control diet; Sericite-0.5%, control diet + 0.5% sericite and Sericite-1.0%, control diet + 1.0% sericite. Pigs fed the diet supplemented with 0.5% sericite had 6.6% higher (P<0.05) ADG and 5.1% higher (P<0.05) G/F ratio compared with their control counterparts. Dietary supplementation with 0.5% and 1.0% sericite increased (P<0.05) the CTTAD of DM by 3.9% and 7.5%, as well as the CTTAD of N by 4.9% and 5.7%, respectively. Simultaneously, the CTTAD of Ca and P were increased by 5.0–19.1% when pigs were fed supplementation of 0.5% and 1.0% sericite. Dietary supplementation of 1.0% sericite decreased (P<0.05) blood iron concentration by 34.2% compared with other two treatments. The blood IgG concentration, lymphocyte and monocyte percentage in pigs fed 0.5% and 1.0% sericite were increased (P<0.05) by 5.2–24.9% compared with control group. Supplementation of 0.5% and 1.0% sericite decreased (P<0.05) fecal *E. coli* population counts by 12.6% and 11.6% and increased (P<0.05) fecal *Lactobacillus* counts by 9.5% and 14.7% respectively. The results suggest that sericite has the potential to enhance nutrient digestibility and the performance of pigs and to alter indicators of immune status and gut microflora and warrants further investigation.

1. Introduction

Various studies have been reported that, silicates including kaolinites, zeolites, bentonites, vermiculites, biotites and aluminosilicates can prevent or reduce mycotoxin bioavailability thus exert beneficial effects for livestock (Yan et al., 2010, 2011).

Most silicates are classified as clay minerals with three-dimensional structures, which could create interconnecting channels and are capable of binding specific molecules (Shurson et al., 1984). It is suggested silicates are effective in adsorption and binding cations such as ammonia (NH_4^+) ions due to the high ion exchange capacity (Mumpton and Fishman, 1977).

Abbreviations: ADFI, average daily feed intake; ADG, average daily gain; BW, body weight; Ca, calcium; CTTAD, coefficient of total tract apparent digestibility; DM, dry matter; Fe, iron; G/F, gain/feed; Hb, hemoglobin; HCT, hematocrit; IgG, immunoglobulin G; N, nitrogen; NH_4^+, ammonia; P, phosphorus; RBC, red blood cell; SE, standard error; TIBC, total iron-binding capacity; WBC, white blood cell.

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Table 1
The composition and chemical composition of the experimental diets.[a]

Item	Sericite-0.0%	Sericite-0.5%	Sericite-1.0%
Ingredients (g/kg)			
Ground corn	599.3	594.3	589.3
Soybean meal	237.5	237.5	237.5
Rice bran	50.0	50.0	50.0
Molasses	40.0	40.0	40.0
Animal fat	26.1	26.1	26.1
Rapeseed meal	20.0	20.0	20.0
Phosphorus defluoronized	11.6	11.6	11.6
Calcium carbonate	4.4	4.4	4.4
L-Lysine, 780 g/kg	3.4	3.4	3.4
Salt	1.5	1.5	1.5
Vitamin premix[b]	2.0	2.0	2.0
Mineral premix[c]	1.5	1.5	1.5
Sericite	–	5.0	10.0
DL-Methionine, 980 g/kg	1.0	1.0	1.0
Choline chloride, 600 g/kg	0.8	0.8	0.8
L-Threonine, 980 g/kg	0.9	0.9	0.9
Analyzed composition			
Digestible energy (MJ/kg)	14.4	14.4	14.4
Crude protein (g/kg)	178.4	178.2	178.0
Calcium (g/kg)	6.8	6.8	6.7
Phosphorus (g/kg)	5.7	5.7	5.6

[a] CON, control diet; T1, control diet + 0.5% sericite; T2, control diet + 1.0% sericite.
[b] Supplied per kg diet: 4000 IU vitamin A, 800 IU vitamin D_3, 171 IU vitamin E, 2 mg vitamin K, 4 mg vitamin B_2, 1 mg vitamin B_6, 16 μg vitamin B_{12}, 11 mg pantothenic acid, 20 mg niacin and 0.08 mg biotin.
[c] Supplied per kg diet: 220 mg Cu, 175 mg Fe, 191 mg Zn, 89 mg Mn, 0.3 mg I, 0.5 mg Co and 0.4 mg Se.

Previous studies indicated that dietary supplementation with different silicate clay mineral products such as zeolite, kaolin, bentonite, clinoptilolite and biotite improved growth performance (Castro and Iglesias, 1989; Kwon et al., 2003) and nutrient digestibility (Chen et al., 2005a,b; Poulsen and Oksbjerg, 1995). Effects of silicates on blood profiles (Yuan et al., 2004) and gut micro flora (Gonzalez et al., 2004; Trckova et al., 2009) have also been reported in pigs.

Sericite is a white variety of muscovite or paragonite and member of the phyllosilicates (sheet silicates) (Allaby and Allaby, 1999). As fine grained mica, sericite has a variety of characteristics of mica minerals and clay minerals because of the similar chemical composition, structure and construction.

However, to the best of our knowledge, the sericite has not been investigated in pigs. The study reported here was conducted to evaluate the effects of sericite supplementation on growth performance, apparent nutrient digestibility, blood profiles and fecal microflora shedding in growing pigs.

2. Materials and methods

2.1. Acquisition and chemical composition of sericite

Sericite used in this study was provided by a commercial company (Jangwon Materials, Seoul, Korea), and the primary compositions of sericite had been analyzed by the supplier, including 43.13–49.04% SiO_2, 27.93–37.44% Al_2O_3, 9–11% $K_2O + Na_2O$, and 4.13–6.12% H_2O.

2.2. Experimental design, animals, and housing

Sixty pigs [(Landrace × Yorkshire) × Duroc] with average body weight of 32.51 ± 1.75 kg were used in a 24 d feeding study. Pigs were assigned by body weight and sex (two barrows and two gilts) with five pens per treatment and four pigs per pen, and were kept in the same room.

Dietary treatments included (1) CON (control diet), (2) T1 (CON + 0.5% sericite) and (3) T2 (CON + 1.0% sericite). Sericite was added to the control diet at the expense of ground corn and all diets contained sufficient amino acids, vitamins and minerals to meet or exceed the levels recommended by NRC (1998) for 20–50 kg growing pigs (Table 1). Pigs were housed in concrete-slatted slurry pens (1.5 m × 2.5 m) and were allowed *ad libitum* access to water and diets throughout the experimental periods. The Animal Welfare Committee of Dankook University approved the animal care protocol used for this experiment. Body weight and the amount of feed consumed were recorded weekly for calculating average daily gain (ADG), average daily feed intake (ADFI) and gain/feed (G/F) ratio.