EFFECT OF ILLITE ADDITION ON GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND MEAT QUALITY TRAITS OF BARROWS

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Abstract— This study was conducted to investigate the effect of illite addition on growth performance, carcass characteristics and meat quality traits of barrows. A total of 50 pigs (LYD) were randomly allocated into 5 treatments. Dietary treatments were control(basal diet), T1(basal diet+0.5% illite), T2(basal diet+1.0% illite), T3(basal diet+1.5% illite)and T4(basal diet+2.0% illite). During entire experimental period, growth performance was measured weekly. When the mean weight of barrows in a pen reached market weight, barrows were conventionally slaughtered and then chilled overnight. At 24h postmortem, carcass measurements and carcass grading were collected. Then, the *longissimus* muscle from left side between the 5th and 13th rib was removed and meat qualities were evaluated. Feeding illite had no effects($p>0.05$) on growth performance and carcass characteristics among treatments while feeding illite(T2 and T3) showed slightly higher incidence of carcass A grade compared to control. In the meat quality traits, all treatments had no significant differences in pH, water holding capacity, drip loss and cooking loss. In the meat color, T3 group showed higher Hunter a^* and b^*($p<0.05$) values than control. In the subjective evaluation, marbling score was improved in T2 and T4 groups. In the panel test, feeding illite showed higher($p>0.05$) tenderness score compared to control. These results showed that incidence of carcass A grade and some meat quality traits were improved by feeding of 1.0% and 1.5% illite in barrows.

Keywords— Illite, Growth performance, Pork quality

INTRODUCTION

Feed additives have been added to diets for the purpose of enhancing animal performance, carcass characteristics and meat quality in Korea. In the recent years, both synthetic and natural feed additives have become important issue to livestock producers and consumers. Illite is a non-expanding, clay-sized mineral mixture. This natural clay contains Mg, Ca, K, Mn, Zn, P, Fe, Al, Si, Co, Se, Mo as well as other minor elements. It is a layered silicate and structurally quite similar to muscovite or sericite with slightly more silicon, magnesium, iron and water and slightly less tetrahedral aluminium and interlayer potassium(Sarker and Yang, 2010). According to Mitchell(1993), illite could be used in feed supplement with claimed benefits that range from bowel function to reduction of heavy metals in the blood. Illite is yellow soil-derived product which could be used in animal feeding to improve the growth performance, carcass characteristics and meat quality of livestock. This natural feed additive has recently acquired increasing interest, especially for use in hog and chicken due to its remarkable ability(Kim et al, 2000; Kim and Kim, 2007, Kim and Yoon, 2008). However, the optimum addition level of dietary illite supplementation on growth performance, carcass characteristics and meat quality of barrows were not clearly investigated yet. The objective of this study was to investigate effect of feeding illite on growth performance, carcass characteristics and meat quality measurements of barrows at different levels.

MATERIALS AND METHODS

A total of 50 pigs(LYD) were randomly allocated into 5 treatments. Dietary treatments were 1) control (basal diet), 2) T1(basal diet + 0.5% illite), 3) T2(basal diet + 1.0% illite), 4) T3(basal diet + 1.5% illite) and 5) T4(basal diet + 2.0% illite). Pigs were housed in half-slotted concrete floored pen and were allowed *ad libitum* access to water and diet during entire experimental period. Body weight and feed consumption for growth performance were measured weekly. When the mean weight of pigs in a pen reached market weight, pigs were conventionally slaughtered and then chilled overnight. At 24 h postmortem, carcass measurements including backfat thickness, carcass length and carcass grading evaluated by Animal Products Grading Service(2001) were collected. Then, the *longissimus* muscle from left side between the 5th and 13th rib was removed and meat qualities were evaluated. The results were analyzed statistically using the SAS statistical package(2002).

RESULTS AND DISCUSSION

During the experimental period, 1.0% or 2.0% illite groups(T2 and T4) had higher($p<0.05$) final body weight than control group(Table 1). Feeding illite had no effect($p>0.05$) on total body gain, average daily gain and feed efficiency of barrows.

Table 1. Effect of illite addition on growth performance of barrows

Items	Control	T1	T2	T3	T4
Initial body wt. (kg)	53.08 ±6.56	52.10 ±5.47	51.94 ±5.25	52.42 ±4.69	53.28 ±4.15
Final body wt. (kg)	102.70^{b} ±11.24	107.70^{ab} ±7.51	111.78^{a} ±2.91	109.80^{ab} ±4.42	114.44^{a} ±6.23
Total body gain (kg)	49.63 ±7.78	54.45 ±6.66	58.89 ±4.95	56.45 ±3.13	61.17 ±5.07
Average daily gain(kg)	0.77 ±0.06	0.81 ±0.04	0.80 ±0.04	0.81 ±0.11	0.86 ±0.02
Feed / Gain	3.32 ±0.40	3.16 ±0.52	3.21 ±0.35	3.22 ±0.50	3.18 ±0.35

Control (basal diet), T1(basal diet + 0.5% illite), T2(basal diet + 1.0% illite), T3(basal diet + 1.5% illite)and T4(basal diet + 2.0% illite).
$^{a, b}$ Means with different superscription within the same row differ($p<0.05$).

Feeding illite had no effects($p>0.05$) on carcass measurements such as carcass yield, backfat thickness and carcass length of barrows(Table 2). But illite treatments(T1, T2, T3 and T4) had higher($p<0.05$) hot carcass weight than control. In the carcass grades, 1.0% or 1.5% illite groups(T2 and T3) showed slightly higher incidence of carcass A grade compared to control.

In the proximal analysis of *longissimus* muscle(Table 3), control group showed higher($p<0.05$) moisture and lower($p<0.05$) protein content compared to other illite treatments. In fat content, 1.5% or 2.0% illite groups(T3 and T4) showed higher($p<0.05$) value compared to control. There were no significant differences in ash content among treatments. In the meat quality traits, all groups showed similar pH, water holding capacity, drip loss and cooking loss. However, control group showed slightly higher($p>0.05$) shear force value compared to the illite fed groups. In the meat color, T3 showed higher($p<0.05$) Hunter a^{*} value than control to result in redder surface meat color. In the subjective evaluation, feeding illite treatment had no effects on marbling, firmness and color scores. However, marbling score was slightly improved in T2 and T4 groups. In the panel test, feeding illite treatment had no effects($p>0.05$) on tenderness, juiciness and flavor scores. However, feeding illite treatment seemed to improve tenderness score compared to control.

Table 2. Effect of illite addition on carcass characteristics of barrows

Items	Control	T1	T2	T3	T4
Hot carcass wt., kg	65.70^{c} ±6.50	73.28^{ab} ±6.73	74.78^{ab} ±3.31	71.55^{ab} ±2.63	77.67^{a} ±5.27
Carcass yield (%)	63.65	67.10	66.43	65.93	67.28
Backfat thickness, mm	12.92 ±3.35	15.30 ±4.45	16.56 ±3.75	14.71 ±3.20	17.00 ±1.94
Carcass length, cm	79.74 ±1.51	80.85 ±2.11	79.95 ±2.16	80.20 ±1.48	80.33 ±1.94
Carcass grades (%)					
A	3	4	5	5	3
B	3	4	4	4	2
C	1	2	•	1	2
D	3	•	•	•	2

Control (basal diet), T1(basal diet + 0.5% illite), T2(basal diet + 1.0% illite), T3(basal diet + 1.5% illite)and T4(basal diet + 2.0% illite).
$^{a, b, c}$ Means with different superscription within the same row differ($p<0.05$).

CONCLUSIONS

Feeding illite had no effect on growth performance and carcass characteristics of barrows. However, incidence of carcass A grade and some meat quality traits such as shear force and meat color were improved by feeding of 1% illite(T2) and 1.5% illite(T3) in barrows.

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Table 3. Effect of illite addition on meat quality traits of *longissimus* muscle from barrows

Items	Control	T1	T2	T3	T4
Proximal analysis(%)					
Moisture	77.87^{a} ±0.92	74.65^{bc} ±0.85	74.93^{b} ±1.46	74.18^{bc} ±1.01	73.68^{c} ±0.88
Protein	19.48^{b} ±0.78	22.21^{a} ±0.58	22.06^{a} ±1.25	22.39^{a} ±0.44	22.47^{a} ±0.56
Fat	1.49^{c} ±0.53	2.05^{abc} ±0.61	1.94^{bc} ±0.63	2.34^{ab} ±0.69	2.75^{a} ±1.14
Ash	1.16 ±0.15	1.09 ±0.07	1.07 ±0.07	1.09 ±0.08	1.10 ±0.07
Ultimate pH	5.37 ±0.07	5.34 ±0.08	5.29 ±0.06	5.30 ±0.12	5.38 ±0.10
Water holding Capacity, %	64.28 ±3.17	65.48 ±4.75	65.24 ±4.37	64.42 ±4.93	62.42 ±4.35
Drip loss, %	4.58 ±0.84	5.28 ±1.05	4.65 ±0.52	4.63 ±1.16	4.75 ±0.88
Cooking loss, %	32.27 ±1.90	31.49 ±1.93	30.30 ±0.87	31.73 ±1.00	31.57 ±0.95
Shear force, kg	19.06 ±0.61	13.64 ±0.23	12.76 ±0.12	12.51 ±0.35	13.95 ±0.29
Hunter L*	60.06 ±1.70	59.94 ±2.78	61.33 ±3.73	60.71 ±4.66	61.45 ±4.13
Hunter a*	4.67^{b} ±0.92	5.33^{b} ±1.46	5.46^{b} ±1.12	6.75^{a} ±1.76	5.62^{ab} ±1.30
Hunter b*	6.53^{b} ±0.66	8.16^{a} ±1.03	8.43^{a} ±1.54	8.92^{a} ±2.09	8.84^{a} ±1.18
Marbling score	1.85 ±0.54	1.85 ±0.68	2.82 ±0.46	2.15 ±0.43	2.52 ±0.94
Firmness score	2.74 ±0.12	2.56 ±0.33	2.45 ±0.51	2.72 ±0.47	2.62 ±0.36
Color score	2.73 ±0.30	2.63 ±0.45	2.47 ±0.53	2.74 ±0.44	2.57 ±0.34
Tastepanel tenderness score	2.95 ±0.54	3.05 ±0.49	2.98 ±0.49	3.06 ±0.55	3.02 ±0.42
Tastepanel juiciness score	2.70 ±0.44	2.85 ±0.57	2.89 ±0.38	2.63 ±0.27	2.86 ±0.37
Tastepanel flavor score	2.70 ±0.31	2.60 ±0.54	2.56 ±0.38	2.69 ±0.33	2.68 ±0.37

Control (basal diet), T1(basal diet + 0.5% illite), T2(basal diet + 1.0% illite), T3(basal diet + 1.5% illite)and T4(basal diet + 2.0% illite).

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