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Effect of Azomite With Low Energy Diet on Growth, Carcass Performance and Blood Biochemical Indexes in Broiler Chickens

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ABSTRACT

The present trial was investigated the dietary effect of Azomite with low energy on growth, carcass and biochemical indexes in broiler chickens. A total of 180 AA broiler chicks were randomly allotted in to three treatment groups with six replicates and 10 birds/replicate: Control fed a basal diet, (2) Low ME fed (basal diet -100kcal kg1 (3) AZO-0.25 fed (Low ME +AZO-0.25). The results showed that, birds fed diet with AZO-0.25 had higher average daily gain (ADG) than that in Low ME group (P>0.05), while feed conversion ratio (FCR) was lower (P>0.05) compared to Low ME. Percentage of eviscerated carcass, breast muscle and leg muscle were higher significantly (P<0.05) in the AZO-0.25 than Low ME. Serum TP, IgG and CT levels significantly (P<0.05) higher in AZO-0.25 than Low ME. Overall, 0.25% Azomite showed positive effect on growth and carcass performance and it could compensate the negative effect of low-energy diet for broiler chickens by improving the digestion and utilization of nutrients.

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Introduction

Now a days, feed cost increasing globally in poultry production, approximately 60 -70% cost of energy ingredients spent on poultry diet. Therefore, one strategy to lowering the production cost is dietary reduction of nutrient supply through improved feed efficiency and management [1]. Although, various studies have been reported that reduction in nutrient supply may retard the growth performance, FCR, carcass traits and lead to metabolic disorders and accumulation of fat in carcass and visceral organs [2-5].

Therefore, poultry researchers and scientists feel immense pressure to find the natural feed additives which may improves the growth performance and optimize nutrient utilization. Moreover, the influence of certain mineral supplements on broiler performance, health status has been attracting current research interest. In this regard combination of rare earth elements (REE) and trace minerals are being actively researched for their effects on growth performance, FCR, carcass performance and immune response and body health of broiler chickens [6-9].

Azomite is an inorganic, 100% natural mineral compound without any additional synthetic elements. Azomite is the mixture of animal, plants residues and variety of minerals. It contains more than 70 trace and other minerals, especially rich in rare earth elements (REE). Subsequently, trace and rare earth element which are essential in animal diet because they play major role in physiological processes which required the proper growth, immunity and body health of bird [7, 10, 11]. These elements increase the activity of many enzymes and hormones and, as a result, influences the body growth, enzyme structure and functions [12].

Azomite is the trade name for a naturally occurring mineral product that has been used in agriculture, livestock and aquatic feed throughout the world for over a decade. In poultry production, Azomite have not gained as much attention as in aquatic species. High level of production and better FCR are need of the modern poultry industry which to a certain extent could be achieved using specific feed additives. Over last two-decade Azomite is widely used as a mineral and immune booster in aquatic feed industry as well as in livestock and organic agriculture. Some research findings reported that Azomite improves the feed quality, weight gain, nutrient digestibility, feed conversion ratio and immunity in shrimp, tilapia and Catfish [13-18].

Azomite also increases the activity of digestive enzymes in tilapia "Ctenopharyngodon idellus" [13, 15, 16].

In addition, Azomite improved the serum protein and immunoglobulin concentration in koi carp fingerlings [19]. reported that supplementation AZO-0.25 in broiler diet improves the weight gain, FCR and digestibility of nutrients. Moreover, summarized 13 field and commercial experiments concerning using Azomite in chicken production and found that adding Azomite to the diet improved breast meat yield [20]. These findings verified that Azomite may improve the growth performance, nutrient utilization by improving digestibility and digestive enzymes. Therefore, it

may possible to compensate the negative effect of low energy diet by supplementation of Azomite. However, there are limited reports investigating the effect of adding Azomite to low energy diet consequently, the main purpose of present study to investigate the impact of low energy diet with supplementation of Azomite on growth, carcass performance and biochemical indexes of broiler chickens [21].

Materials and Methods

Dietary Treatments and Bird's Management

All experimental procedures, protocols and animal care for this study was approved by Feed Research Institute, Graduate School of Chinese Academy of Agricultural Sciences, Beijing China. A total number of 180 one-day old male chicks were purchased from Beijing Huadu Broiler Company. Chicks were weighed and randomly allocated into three treatments with six replicates of 10 chickens per replicate. The experiment was conducted in two phases, starter (1-21) and finisher phase (22-42). The three dietary treatments for this experiment consisted of control containing 2950 kcal kg^{-1} starter phase and 3050 kcal ME kg^{-1} finisher phase; low energy (Low ME) was 100 kcal kg-1 or 200 kcal of ME lower in starter or finisher phase than control; Low ME + 0.25% azomite (AZO-0.25). The ingredient composition and calculated nutrients analysis showed in Table 1. The azomite sample was provided by Lytone Company, Taiwan, China.

Before arrival of broiler chicks, the house was cleaned and disinfested. The experiment was conducted in stainless steel wired battery cages, the house temperature maintained during 1st week at 32 °C and the gradually decrease 2 °C each until it reached the 22 °C at the last week. Relative humidity was maintained at 55 to 65 %, and lighting procedure of 23 h lighting:1hr darkness was provided. The *adlibitum* access of feed and water provided to the broilers.

Table 1: Ingredients composition and nutrients content of basal diets

Ingredients	Control		LME	
	Starter	Finisher	Starter	Finisher
Corn	57.47	58.98	58.53	63.60
Soybean oil	1.50	4.32	0	0.58
Soybean	30.96	25.05	30.76	24.16
CSM	5.00	7.00	5.00	7.00
Table salt	0.35	0.35	0.35	0.35
Dicalcium phosphate	1.53	1.39	1.52	1.36
Limestone	1.54	1.40	2.18	1.42
Lys hydrochloride	0.24	0.22	0.25	0.24
DL-Methionine	0.14	0.15	0.14	0.15
L-Cystine	0.07	0.04	0.07	0.04
Choline Chloride	0.20	0.10	0.20	0.10
Premix	0.50	0.50	0.50	0.50
Zeolite	0.50	0.50	0.50	0.50
Total	100	100	100	100
Calculated nutrients content				
AME (kcal/kg)	2950	3050	2850	2950
CP (%)	21.50	19.50	21.50	19.50
Lys (%)	1.20	1.05	1.20	1.05
Met (%)	0.45	0.44	0.45	0.44
Ca (%)	1.00	0.90	1.01	0.91
P (%)	0.68	0.55	0.68	0.56
Avail P (%)	0.45	0.42	0.45	0.42

The premix provided (for 1 kg of diets) VA 10000IU, VB1 1.8mg, VB2 40mg, VB12 0.71mg, VD3 2000IU, VE 10IU, VK3 2.5 mg, biotin 0.12mg, folic acid 0.5mg, D-pantothenic acid 11mg, Cu (as copper sulfate) 8mg, Fe (as ferrous sulfate) 80 mg, Mn (as manganese sulfate) 60 mg, Zn (as zinc sulfate) 40mg, I (as potassium iodide) 0.35 mg and Se (as sodium selenite) 0.15 mg.

Growth Performance

At the 21d and 42d of the experiment, live body weight (LBW) and feed consumption were recorded on cage basis. The average daily feed intake (ADFI), average daily gain (ADG) and feed conversion ratio (FCR) was calculated. The FCR were corrected by dead birds.

Carcass Characteristics

Two birds aged 42 days were selected from each replicate and slaughtered. The breast, leg muscles were cut and separate and weighed individually. To measure the slaughter percentage, half eviscerated percentage, eviscerated percentage, breast muscle percentage, leg muscle percentage and abdominal fat percentage and immune organ index was calculated using following formula:

$$\text{Eviscerated (EV) \%} = \frac{\text{Eviscerated carcass weight}}{\text{Live body weight}} \times 100$$

$$\text{Breast Muscle (BM) \%} = \frac{\text{Breast muscle weight}}{\text{Carcass weight}} \times 100$$

$$\text{Leg Muscle (BM) \%} = \frac{\text{Leg muscle weight}}{\text{Carcass weight}} \times 100$$

$$\text{Abdominal Fat (AF) \%} = \frac{\text{Abdominal fat weight}}{\text{Live Body weight}} \times 100$$

$$\text{Immune Organ Index} = \frac{\text{Immune Organ weight}}{\text{Live Body Weight}} \times 100$$

Serum Biochemical Indices

At the age of 42 days two birds were selected randomly from each replicate and take blood samples from wing vein. Ten milliliters of blood was collected into sterilized tubes and centrifuged at 3000 rpm for 15 minutes at 4°C to harvest serum. Serum samples were stored at -20°C for biochemical analysis. The content of total protein (TP), glucose (GLU), total cholesterol (TC), creatinine (CREAT), uric acid (UA) was analyzed by using an automated IDEEX Vet Test Chemistry Analyzer (IDEEX Laboratories, Inc). The blood concentration of immunoglobulins (IgA, IgG and IgM) were determined following chickens specific ELISA kits instructions (Shanghai Lengton Biosciences Co., LTD, Shanghai, China). The serum concentration of and growth hormone (GH), Parathyroid Hormone (PTH) and calcitonin (CT) were analyzed using commercial kits (Immutopics, Inc., San Clemente, CA), the immunoradiometric assay method, and gamma counter (Bio Source International, Camarillo, CA).

Results

Growth Performance

Data presented in Table 2 indicated that ADG was significantly (P<0.05) higher in birds fed diet with AZO-0.25 compared to Low ME, while ADFI found no significant difference among all treatments. Moreover, AZO-0.25 showed significantly (P<0.05) lower FCR than Low ME.

Table 2: Effect of Azomite with low energy diet on growth performance of broiler chickens

Parameters	Control	LME	AZO- 0.25%	P Value
ADG	66.46±5.31[a]	59.13±4.2[b]	67.76±4.28[a]	0.047
ADFI	105.45±5.9[a]	104.93±5.6[a]	103.37±6.2[a]	0.731
FCR	1.58±0.21[b]	1.78±0.23[a]	1.57±0.18[b]	0.042

[a,b,c] Means in same row with no common superscript differ significantly ($P<0.05$). Control; Low ME= Low energy; AZO-025= Low ME+ 0.25% azomite; ADG=average daily gain; ADFI=average daily feed intake; FCR=feed conversion ratio.

Carcass Characteristics

The effect of dietary treatment on carcass performance were shown in Table 3. The main significant effect in this study were increased (P<0.05) of EV, BM and LM percentage when birds were supplemented with AZO-0.25. However, AF percentage showed similar effect among all treatments. There was no significant effect of Azomite on immune organ index among all treatments, however numerical difference was observed when birds fed diet with AZO-0.25.

Table 3: Effect of Azomite with low energy diet on carcass percentage of broiler chickens

Parameters	Control	LME	AZO- 0.25	*P* Value
EV (%)	70.74±0.83[b]	69.69±0.82[b]	72.88±1.04[a]	0.000
BM (%)	15.15±0.41[b]	14.74±0.28[c]	16.45±0.72[a]	0.000
LM (%)	10.71±0.19[b]	10.55±0.76[b]	11.37±0.48[a]	0.002
AF (%)	1.95±0.28[a]	1.59±0.27[a]	1.89±0.37[a]	0.185
Thymus (%)	1.24±0.41[a]	1.01±0.25[a]	1.23±0.31[a]	0.410
Bursa (%)	0.38±0.10[a]	0.36±0.60[a]	0.46±0.15[a]	0.222
Spleen (%)	0.84±0.17[a]	0.93±0.33[a]	1.12±0.28[a]	0.228

[a,b,c] Means in same row with no common superscript differ significantly (P<0.05). Control; Low ME= Low energy; AZO-025= Low ME+ 0.25% azomite; SP=Slaughter percentage; EV=eviscerated carcass; BM=breast muscle; LM= leg muscle; AF=abdominal fat.

Serum Biochemical Indices

The results of serum biochemical indices in broilers fed low energy diet supplemented with AZO-0.25 are summarized in Table 4. There is no significant effect showed among all treatments for serum biochemical indices, but TP, IgG and CT concentration was significantly (P<0.05) increased in AZO-0.25 compared to Low ME treatment. While no significant difference found between control and AZO-0.25 groups.

Table 4: Effect of Azomite with low energy diet on serum biochemical parameters of broiler chickens

Parameters	Control	LME	AZO- 0.25	P Value
TC (mmol/L)	2.91±0.23[a]	3.16±0.40[a]	3.00±0.30[a]	0.559
CREAT (mmol/L)	13.6±0.11[a]	13.2±0.33[a]	13.5±0.30[a]	0.331
UA (µmol/L)	319±44[a]	290±14.6[a]	311±9.6[a]	0.841
GLU (mmol/L)	10.29±1.6[a]	10.32±1.2[a]	10.58±1.02[a]	0.942
TP (g/L)	25.86±3.3[a]	22.44±2.7[b]	27.78±2.5[a]	0.035
IgA (g/L)	0.99±0.08[a]	0.94±0.09[a]	1.12±0.19[a]	0.174
IgG (g/L)	7.15±1.01[a]	6.23±0.65[b]	7.86±1.03[a]	0.049
IgM (g/L)	0.73±0.06[a]	0.72±0.06[a]	0.82±0.13[a]	0.247
GH (ngml)	3.31±0.31[a]	3.16±0.24[a]	3.53±0.14[a]	0.159
CT (pg./ml)	93.1±10.2[a]	74.6±8.06[b]	110.2±23.5[a]	0.025
PTH (pg./ml)	24.43±5.65[a]	27.69±1.37[a]	23.9±3.87[a]	0.662

[a,b,c] super scripts with different letters in a row showed significant ($P<0.05$) difference. Control; Low ME= Low energy; AZO-025= Low ME+ 0.25% azomite; TC=total cholesterol; `CREAT= creatinine; UA=uric acid; GLU= glucose, Ig = immunoglobulins; GH= growth hormone; CT= calcitonin; PTH= parathyroid hormone.

Discussion

The present study was planned to investigate the dietary Azomite supplemented into low energy diet improves the growth performance of broiler chickens. To the best of our knowledge few studies are currently available on the use of Azomite in aqua culture species. However, only few academic reports are available on broiler chickens. The research results of current study shown that reduction of energy in broiler diet reduced the LBW, ADG and increased the FCR. Nevertheless, addition of Azomite with low energy in broiler diet improved the LBW, ADG and lower the FCR, indicating the efficient utilization of feed [18]. stated that addition of Azomite in

catfish diet improves the ADG and reduced the feed efficiency significantly. Likewise, observed that significant improvement in BWG, ADG and FCR was reported when tilapia was fed a diet added with Azomite [16]. Also reported that supplementation of 0.2% Azomite to the diet have great impact on weight and FCR in white shrimp due to the improvement in nutrient digestibility [15]. Found that supplementation of AZO-0.25 improved the growth performance of broiler chickens. These findings are in agreement with Azomite supplemented birds contributed their nutrient needs for their productivity when Azomite supplemented to reduced energy diets [21]. The findings of current study revealed that feeding broiler chickens with low energy diets will results dramatic reduction in eviscerated percentage, breast meat yield and leg muscle yield percentage. Our research findings are consistent with findings of other researchers who reported that the broilers fed diet with low energy has negative effect on carcass characteristics. Interestingly, when birds fed low energy diet with Azomite improved the slaughter percentage, half eviscerated percentage, eviscerated percentage, breast meat yield and leg muscle yield percentage. The supplementation of Azomite to low energy diets can improve the energy utilization and lessen the negative effect of feeding low energy diet. Our results implied that Azomite could increases the metabolism and feed utilization and digestibility of nutrients [1, 4, 5].

Azomite maintain the normal physiological range of serum biochemical indicators without any adverse effect in broiler chickens in current study. The serum TP were improved with supplementation of AZO-0.25 in diet. These similar findings documented by who found that that serum TP was increased significantly by dietary supplementation of Azomite in koi carp fingerlings [19]. These improved results could attribute due to higher absorptive capacity, efficient digestion and feed utilization in GIT of broiler chickens. It could speculate that Azomite paly important role for protein metabolism. The concentration of blood immunoglobulins is currently an important indicator associated with immunity, because these immunoglobulins defend against pathogenic microorganisms and maintain good health status of birds [22]. IgG is the main immunoglobulin in serum which produces humoral activity and activates the compliment system against pathogens. The findings of current study stated that birds fed with AZO-0.25 increased concentration of IgG in broiler chickens. This is consistent with the findings of who revealed that improvement in IgG concentration was found in broiler chickens fed with AZO-0.25. The increased level of IgG with Azomite supplementation indicated clearly that IgG play important role in humoral immunity [23]. The AZO-0.25 also increased CT concentration in broilers. The improvement in CT level generally indicated as an available uptake and storage of dietary calcium, which enhance the metabolic pathway in the bone formation [24]. The potential effect of Azomite on CT concentration examined in this study would enhance the metabolism of calcium in order to inhibition of osteoclast and activating the bone forming osteoblasts which improves the deposition of calcium.

Fascinatingly, the results of current study showed that Azomite with low energy diet has unique characteristics in terms of enhancing the growth and carcass performance in broilers and decreases the cost of feed. In general, improvement in growth and carcass performance by enhancing the nutrient digestibility in GI tract of broiler chickens induced by dietary supplementation of Azomite in a comparison with more or same beneficial effect of control diet [25, 26].

Conclusion

In conclusion, dietary inclusion of Azomite 0.25% in low energy diet could increase the growth, carcass performance in broiler chickens. Moreover, supplementation of Azomite to low energy diet increased the TP, IgG and CT in broilers without any negative impact on other biochemical indicators. Azomite compensate the negative effect of low energy in diet. Thus, Azomite could be an effective supplement in broiler diet with low energy and reduce the feed cost.

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