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The Marl as a Natural Supply on Broiler Chicken Feed: Effects on the Starter Performance, the Abdominal Fat and the Dropping Moisture

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Abstract: In a poultry farming context marked by strong economic and social pressures, many of substitute products to antibiotics were put on the market. Among these products, appear mainly, probiotics, essential oils, acidifiers, enzymes and others. Clay is a natural supply that could be used in poultry feed to achieve the same goals because it is a very abundant product in nature, inexpensive, widely used by hens raised outdoors. For this purpose, the incorporation of 3% of marl was tested on broiler chicken, at the young age and at 56 days. In this trial, the growth performances at 10 days, we again study (at 56 days) the state litter quality, the abdominal fat and the relative weight of the bursa of Fabricius. Results of starting period showed, on one hand, a significant increase of the weight gain of 16.2% ($p = 0.001$) and an improvement of the feed consumption ratio of 8.1% ($p = 0.02$) and on the other hand, at the finisher period, results showed that clay contribute significantly to increase dry matter of droppings (+18%; $p = 0.02$) and enhance the immunity by a higher relative weight of bursa of Fabricius (+24.3%; $p = 0.01$). Also, at slaughter, clay reduces significantly the abdominal fat by 5.08% ($p = 0.04$). Results of this trial confirm our previous observations and demonstrate the importance of the marl use in the diet of broiler chickens.

Key words: Marl, broiler, starter period, droppings, abdominal fat, bursa of fabricius

INTRODUCTION

To extend the biological poultry farming of its isolation and find substitutes able to replace growth factor antibiotics and antioxidants, research on poultry were focused during the last years on alternatives involving the use of natural additives. To achieve these goals and promote more favorable terms and less stressful to the digestive tract, the clay was tested and recommended in animal feed as a natural substance that can improve the digestibility, health status, growth performances and quality of products (Ouhida *et al*., 2000a,b; Wester, 2002; Xia *et al*., 2004; Abdesssmed, 2008; Ouachem *et al*., 2010; Ouachem, 2011). Clays are also recommended for their pro digestive properties to increase feed efficiency and for their antitoxic capacity to many undesirable substances in the gut (biogenic amines, mycotoxins, endotoxins). According to Jondreville *et al*. (2007), in natural breeding farms, hens consume the soil fauna voluntarily or by eating earthworms and insects. As an indication, the consumption of soil is a natural phenomenon observed in all animal species. Chaumande (2011) has reported in his study that all animals that have the kaolinite, consume it daily despite unlimited nutritional intake. The spontaneous consumption of kaolinite has been shown in other situations, especially in cases of digestive disorders or for reducing a state of unrest (Andrews and Horn, 2006). Moreover, in the (Vajra, 2011) report it was described that animals did not hesitate to immerse himself in clay for health care, their natural instinct guiding them to the welfare, the woodcock was found with a link plant covered with clay, the boar becomes covered with mud to treat a wound deep, some birds of Peru gorge themselves with clay to purge toxic seeds ingested, the pigeons are better protected against various infections by clay distribution as a dietary supplement, pigs are looking for many trace elements for their intestinal balance, men and animals often have recourse to the Earth that without respite offers its full potential life to treat us in a constant and natural synergy.

The aim of this work is to study the effects of the incorporation of 3% of marl on the growth performances and the digestive efficiency of young broilers during the starting period and at the age of 56 days, the consequences on the moisture droppings, the bursa of fabricius and the abdominal fat.

MATERIALS AND METHODS

Diets and clay: During the trial of growth performance and digestive assessment, two treatments were compared: control group without supplementation (C) and experimental starter diet with 3% of Marl (M). The diets were prepared according to the recommendations of NRC (1994). Chemical composition and nutritional characteristics of the diets are represented in Table 1. Clay used in this experiment was a gray marl abundant in the area of study (Aures-Algeria), it contains 65% of clay, low rate of organic matter (0.6%) and its

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Table 1: Percentual and chemical composition of experimental diets

	Starter	Grower	Finisher
Corn	58.00	61.00	63.50
Soybeanmeal 48	31.00	27.50	25.00
Wheat bran	4.00	5.00	5.00
Marl	3.00	3.00	3.00
Premix	1.00	1.00	1.00
Dicalcium phosphate	1.90	1.50	1.60
$CaCO_3$	0.90	0.80	0.70
Salt	0.20	0.20	0.20
Chemical composition[1] (%)			
EM (Kcal/kg)	3000.00	3100.00	3150.00
Crude protein	21.00	20.00	18.00
Lysine	1.10	0.90	0.70
Methionine	0.42	0.38	0.35
Meth+Cyst	0.85	0.83	0.78
Ca	1.20	0.85	0.65
P	0.75	0.55	0.50

[1]Formulated according to NRC (1994)

physicochemical composition (in milli equivalent/100 g of soil) is: (Ca^{2+} = 4.6); (Mg^{2+}= 2.87); (Na^{+}= 0.33); (K^{+} = 0.1); (cation exchange capacity = 20.5).

Animals, methods and analysis: The experiment was carried out in an open sided house, in the research poultry unit, Institute of Agronomic and Veterinary Sciences, University of Batna - Algeria. A total of 352 day old chicks of ISA15 commercial broiler, were individually weighed, identified and randomly allocated to two treatments groups (C and M) with 8 replicates of 20 birds for each group. During the trial of growth performances, all chicks (2 x 160) were given *ad-libitum* access to feed and water, Feed Intake (FI), Body Weight Gain (BWG) and Feed Consumption Ratio (FCR) were recorded at the end of the starter period (d10). Parallaly, to study the effect of the marl on the moisture droppings, 16 chicks per treatment with similar body weight were reared in wire cages (8 cages of 2 birds per treatment) between 49 and 51 days. The moisture droppings content was determinated almost every hour in order to ovoid dehydration of droppings. Samples of droppings were collected from each cage, their weight was recorded, the wet samples were dried at 80°C for 72 h, the dry weight calculated to assess the litter state.

At the end of the rearing period (56 days), 32 chickens per treatment (4 broilers per repetition) were slaughtered in order to determine the rate of the abdominal fat and the relative weight of the bursa of fabricius.

Statistical analysis was carried out using t-Student test. Values represented in the tables are the means ± standard error and the statistical significance was set to $p \leq 0.05$.

RESULTS AND DISCUSSION

The effects of the dietary treatments on chicks average Weight Gain (WG), Feed Intake (FI) and Feed Conversion Ratio (FCR) data obtained from 1-10 days are presented in Table 2. Results of moisture droppings, the abdominal fat and the relative weight of Bursa of Fabriciusare shown in Table 3.

Table 2: Results of weight gain (WG), feed intake (FI) and feed conversion ratio (FCR) at 10 days

	Growth performance at 10 days		
Performances diets	WG (g)	FI (g)	FCR (g/g)
Control (C)	161^{b}±8	218±19	1.35^{b}±0.03
Marl group (M)	187^{a}±17	232±25	1.24^{b}±0.30
p-value	p = 0.001	NS	p = 0.020

The means affected of different letters in the same column are statistically different; (WG): weight gain; (FI): feed intake; (FCR): feed consumption ratio; (NS): No Significant

Table 3: Effects of the marl on the dry matter of droppings (%), the abdominal fat (%) body weight) and the relative weight of bursa of Fabricius (%) body weight) at 56 days

	Performances at 56 days		
Diets	DM droppings (*)	Abdominal fat	Bursa of fabricius
Control (C)	17.8^{b}±1.1	1.77±0.17	0.070^{b}
Marl group (M)	21.0^{a}±1.5	1.68±0.22	0.087^{a}
p-value	p = 0.02	0.04	p = 0.01

The means affected of different letters in the same column are statistically different; (DM): Dry Matter; (*): Estimated in cage between d49 and d51

In this experiment, the use of clay results in a significant increase in weight gain at the starter period (+16.2%) and an improvement on feed consumption ratio (-8.1%). This supports our anterior results (Ouachem *et al.*, 2010; Ouachem, 2011) and confirms the positive effect of marl in the improvement of growth performances of young chicken. These authors have explained this performance by the significant effect of clay on the increase of the protein and lipid digestibility. Also, with a diet containing 3% of clay, similar responses have been reported in broilers by Mekaoussi (2007) and Haddad (2009). This means that clay can improve the growth rate and body weight at slaughter. Furthermore, with other clays, similar effects have been reported by Ouhida *et al.* (2000c), whereby the addition of 2% sepiolite supported an increase in weight gain of 6% in young broilers. Moreover, with diets deficient in macro and micro elements, the addition of 5% bentonite, may increase feed intake and improves weight gain in broiler chickens (Southern *et al.*, 1994 cited by Trckova *et al.* (2004). According to Ouhida *et al.* (2000a), the addition of 1% of sepiolite in the feed of broilers during the first twenty days brings a slight improvement in feed consumption ratio. Moreover, through their comparative study of the effects of zeolite addition, alone or in combination with a probiotic, Rawghani *et al.* (2007) showed that the zeolite is more efficient on feed efficiency (2.17 against 2.19 and 2.49, respectively with zeolite, zeolite-probiotic and control diets). Moreover, the use of clays would be

favorable to enhance the FCR of broilers receiving contaminated diets. In fact, Hesham *et al.* (2004) reported with diets contaminated with aflatoxins, that the addition of 0.5% of kaolin has made a significant improvement in feed efficiency of about 18.5%. According to Xia *et al.* (2005) and Prvulovic *et al.* (2007), the animal responses of clay addition depended on the type and the purity of clay, the rate of its incorporation, the level of animal performance, the rearing phase and the food composition.

Taking account this result, the use of clay during the starting period can be recommended to optimize the performances at the age of slaughter. Indeed, according to Larroude *et al.* (2005), the first days of the poultry rearing are characterized by a critical period of under-feeding and a low absorption and digestive use. Further, according to Picard *et al.* (2003), the starting diet is suitable to induce persistent metabolic changes of the young chick and can influence its development durably.

About the meat quality, the marl effect has been marked by a significant decreased rate of abdominal fat (-5.08%) and it means that clay improves the proteins use for the muscular production and contribute to achieve a lower fat - chicken. This effect was reported with zeolite addition which has reduced the rate of abdominal fat by 45% Prvulovic *et al.* (2008). Additively, Hoppenbrock *et al.* (1998) and Luca *et al.* (2004) reported that the use of sepiolite promotes a high yield of lean meat in grower pigs.

The significant increase of the relative weight of Bursa of Fabricius observed at the slaughter age (56 days) seems to enhance the immune response and maintains a favorable condition for optimum growth. This report is in agreement with the observations of Hesham *et al.* (2004) with kaolin and those of Pasha *et al.* (2007) with sodium bentonite. Indeed, according to these authors, an increase in the weight of the Bursa of Fabricius is accompanied by an improvement of immunity.

The significant decrease in the droppings moisture content observed in broilers receiving the marl diet seems presumably to be motivated by a low intestinal viscosity and a better nutrients digestibility. In fact, according to Huyghebaert *et al.* (2003), the effective use of nutrients promotes a litter less moist. However, Ouhida *et al.* (2000b); Francesch (2005) and Tiwari (2007) have also relates a relationships between the droppings moisture and the intestinal viscosity.

Finally, the lower rate of the droppings moisture contents with diet containing clay may be attributed to the high water-absorption capacity of clay, promoting producing drier droppings, less odour and thus fewer fly problems.

Conclusion: In the term of this study, it emerges that the use of clay insures a good starting up which allows maintaining a sustainable growth favourable for an optimal slaughtering weight characterized by a chicken production with less fat. The use of clay seems to provide solutions to the problems of wet droppings in poultry farms and consequently improves the health status and animal welfare. These results seem to encourage the poultry food industry to support the involved product. Finally, a complementary studies under other experimental conditions are however necessary to bring further information making it possible to validate these results.

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