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EFFECTS OF THE MARL ON THE PERFORMANCE OF CHICKEN FEEDING STARTING DIET CONTAINING ACID OIL

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Abstract. Following the prohibition of the animal products use in animal food and the rise in the prices of the basic raw materials, various products were offered like alternative to the poultry food industry. Among these products, various acid oils have been tested to substitute partially the corn in poultry feed. However, the digestive constraints restrained their use. Clay is an excellent natural substance that could be used to improve digestibility of lipids and growth performances (Ouachem et al., 2009). For this purpose, the incorporation of 5 % soybean acid oil with and without 3 % of Marl was tested on broiler chicken. In this trial, the growth performance between 1 and 10 days, a digestive assessment between d9 - 12 and the state litter quality were studied. Comparatively to the control diet, the use of acid oil tended to reduce the growth performances and the digestive effectiveness. While the addition of 3% of marl for the diet containing acid oil, showed a significant increase of the weight gain (+13.5 %; p = 0.001) and improvement of the feed conversion ratio (-10.3 %; p = 0.02), and on the other hand, a significant increase of the proteins utilisation (+ 18 %; p = 0.001) and fatty matter (+5.1 %; p = 0.02). The results showed also that clay contribute significantly to improve the litter quality by the highest rate of dry matter (+ 33.7 %; p = 0.03). Under our experimental conditions, it is suggested that acid oil may be included with 3 % of marl in the diet of chicken.

Key words: Marl; Acid oil; Litter state; Digestive assessment; Growth performance; Chicken

Introduction

Since the removal of the antibiotics growth promoters and following the increase in the price of corn, the food industry is faced with a number of challenges, not only regarding the availability of feed ingredients but also the ability to produce high quality products in a cost effective manner. In response to this shift, a search for alternatives in need to find new feed sources has gained increasing interest in animal nutrition during recent years. So, various other feed sources were offered like substitute for the poultry food industry. Among these products, appear mainly plant extracts, probiotics, enzymes, vegetable oils, clays and others. The needs of Algeria in table oil are covered by the raw vegetable oil trituration. This activity generates a significant amount of acid oils which can be made to replace partially corn in poultry feeding, but the responses in terms of productive performance of chickens has been widely variable and their use has been limited on account of the low digestive efficiency of lipids and the constraints of poor absorption observed at the young chicks [LARROUDE et al., 2005]. Recently, use of clay as a natural supply during the chicken starter period, highlights an increase on the digestive efficiency of lipids with an important immunological and health status [PASHA et al., 2007; OUACHEM et al., 2009]. For this purpose, the aim of this study was to evaluate the effects of 3% of marl on poultry start diet containing 5% of soya acid oil on the growth performances, the digestive assessment and on the wet droppings.

Material and Methods

Diets, Clay and Acid oil

During two trials (growth performance and digestive assessment), three treatments were compared: control group without supplementation ©; experimental starter diet 1 with 5% of soya acid oil (AO) and experimental starter diet 2 with 5% of soya acid oil and 3% of marl (AOM). The diets were prepared according to the recommendations of NRC (1994). The nutritional characteristics of these diets were: 3000 kcal ME/kg ; 21% of crude proteins ; 0.9% of C_a ; 0.6% of total P and 0.9% of lysin. Clay used in our experiment was a gray abundant marl in the area of study (Aures-Algeria), it contains 65% of clay, low rate of

organic matter (0.6%) and its physicochemical composition (in milli equivalent/100g of soil) is: (C_a^{2+}= 4.6); (Mg^{2+}= 2.87); (N_a^{+}= 0.33); (K^{+}= 0.1); (cation exchange capacity = 20.5). The soya acid oil was characterised by: total chromatographic fatty acids (85.6%); an average oleic acidity (66.2 g/100g of oil); peroxide value (10.3 meqO_2/kg) and by a low rate of trans isomers fatty acids (0.1% of total fatty acids).

Animals, methods and analysis

ISA15 commercial broiler day old chicks (n = 270), were individually weighed, identified and randomly allocated to three treatments groups (C; AO; AOM) with 6 replicates of 15 birds for each group. During the growth performance trial, all chicks were given ad-libitum access to feed and water, feed intake (FI), body weight gain (BWG) and feed conversion ratio (FCR) were recorded at the end of starter period (d10). Parallaly, for the digestive balance study, 12 chicks per treatment with similar body weight were reared in wire cages (6 cages of 2 birds per treatment) to evaluate the digestive assessment between 9 and 12 days and the litter state quality during a rearing period of 56 days. During the digestive trial (5h of starvation, 72h of adlibitum feeding and 5h of starvation), regularly (practically each hour to ovoid dehydration), litter moisture samples were taken from each cage, their weight was recorded, the wet samples were dried at 80°C for 72 hours, the dry weight calculated and the state litter quality evaluated through their rate of humidity. Samples of diets and droppings were ground, homogenised and stored until analyzing their contents of proteins and lipids. The analytical methods adopted were those described by AFNOR (1985) and Carré et al.(2002). Data were compared by the Anova analysis followed by the test of Newman and Keuls with the significance threshold of 5%.

Results and Discussion

The effects of the dietary treatments on chicks average body weight gain (BWG) and feed conversion ratio (FCR) data obtained from 1 to 10 days are presented in table 1 and the results of the digestive assessment and the state litter quality in table 2.

Table 1.

Results of Weight Gain (WG), Feed intake (FI) and Feed Conversion Ratio (FCR) at 10 days.

Performances / Diets	Growth performance at 10 days		
	WG (g)	FI (g)	FCR
Control ©	$155^{b} \pm 7$	$210^{a} \pm 6$	$1.35^{b} \pm 0.03$
Acide Oil (AO)	$141^{c} \pm 33$	$194^{b} \pm 23$	$1.37^{b} \pm 0.3$
Acide Oil- Marl (AOM)	$176^{a} \pm 29$	$213^{a} \pm 33$	$1.21^{a} \pm 0.02$
Signification	P = 0.001	P = 0.04	P = 0.02

The means affected of different letters in the same column are statistically different.

Table 2.

Results of Digestive Balance (J9 à J12) and the wet droppings (% of dry matter)

Performances / Diets	Bilan Digestif		Wet Droopings
	Lipids (%)	Crudes Protein (%)	
Control ©	$78^{b} \pm 3$	$59.6^{b} \pm 1.5$	$16.6^{b} \pm 6$
Acide Oil (AO)	$65^{c} \pm 5$	$67.4^{a} \pm 2.5$	$17.0^{b} \pm 3$
Acide Oil – Marl (AOM)	$82^{a} \pm 6$	$70.3^{a} \pm 2$	$22.2^{a} \pm 2$
Signification	P = 0.02	P = 0.001	P = 0.03

The means affected of different letters in the same column are statistically different.

A trend toward less (BWG) and high (FCR) were observed in the acid oil diet (AO), as compared to the control group. These performances supported results recorded by Laffite et al.(2003). However, when the marl is added (3%) to the feed containing acid oil, the performances are more significant of the body weight gain (+ 13.5% ; P = 0.001) and a decrease of the feed conversion ratio (-10.3% ; P = 0.02). the same response was observed in the digestive trial; the digestive balance of crude proteins and

lipids are higher with (AOM) treatment. Birds feeding diet containing marl shown a significant digestive efficiency of lipids (+ 5.1% ; P = 0.03) and crude proteins (+ 18% ; P = 0.001). This result may explain the growth performance obtained in the first trial. Moreover, the improvement of the digestive balance, marl diet decrease significantly the wet droppings rate (-33.7% ; P = 0.03) and participate to the improvement of the litter quality. Contrary to the bibliographic founds, marl addition allowed significantly to correct the negative effects of acid oil on the performances and the digestive assessment recorded by Sanz et al.(2000), Laffite et al.(2003) and Larroude et al.(2005). Previous studies with clays suggested a significant effect, only during the starting period. In contrast, use of sodium bentonite (Collings et al., 1980) and sepiolite (Ouhida et al., 2000b), had an effective weight gain at the young age. Some other positive responses on weight gain have been observed with zeolite (Miazzo et al., 2004) or with sodium bentonite (Pasha et al., 2007).

Nevertheless, the effect of clay on the weight gain at the first rearing period is not absolute since a positive response were recorded at 56 days old with kaolinite by Nowar et al. (1989) and with montmorillonite at 49 days by Xia et al. (2004).

The great starter is an important factor to promote growth for an optimal weight at slaughter. Indeed, according to Picard et al. (2003), the food starter can influence the chicks development durably. Moreover, according to Larroude et al. (2005), at the young age, chickens are characterised by a critical period of under feed and a low absorption might contribute to a decrease of the digestive efficiency.

The digestive assessment shown that in spite of the immature enzymatic activity which characterized the young chicken reported by Noy and Sklan (1995), the positive effect of the marl on digestive efficiency of lipids, which may be partially explained by the protect effect of clay on biliary salts (Prvulovič et al., 2008). According to the same authors, the adsorptions properties of clays and their microbial immobilization will be at the origin of the protecting effect of biliary acids.

The contribution of the (AOM) diet in the improvement of the general litter state by a decrease of the humidity of the droppings is a good sign for a hygienic litter favourable for the poultry welfare and better performances. This result was consistent with the previous studies of clays (Ouhida et al., 2000b; Xia et al., 2004 and Ouachem et al., 2009). It has been reported that the important adsorption capacity and the physic-chemical characteristics of clay, allow protecting the intestinal mucosa, to reduce the viscosity, to prolong the retention time of digesta in the gut and to increase the digestive efficiency. The presence of relationship between the intestinal viscosity and wet droppings has been described by Francesch (2005) and Tiwari (2007). While, clays remain an efficient means to improve the general litter state (Lucca et al., 2004). Further, according to Huyghebaert et al. (2003), the improvement of proteins digestibility could lead to drier droppings. In fact, a high rate of proteins makes the chicken to drink enough water in order to excrete them through the kidneys.

Conclusion

This study highlights the practical advantages of using clay and demonstrates that addition of 5% of acid oil with 3% of marl of starting diet might be interesting for a better digestive effectiveness and high performances, allowing the chicks to realize a good start in order to maintain a durable growth favourable for an optimal slaughtering weight. The recourse to the use of marl, bring some solutions to the problems usually encountered in the poultry breeding by the wet droppings. 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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