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# Effect of sepiolite supplementation on broiler growth performance and carcass yield

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## Abstract

The effects of incorporating sepiolite into diet on growth performance were studied in broilers. A total of 600 one day-old Hubbard JV chicks of both sexes were divided into 12 litter pens (50 chicks per pen). Pens were allotted randomly to four diets: diet 0 (D0), diet 0.5 (D0.5), diet 1 (D1), and diet 2 (D2) (with 4 replications x 50 birds/diet). Dietary treatments were achieved by incorporating 0%, 0.5%, 1%, and 2%, respectively, of sepiolite into rations based on corn and soybean meal, for starter, grower, and finisher periods. Growth performance, mortality rate (MR), feed intake (FI), and feed conversion ratio (FCR) were evaluated weekly. At 36 days of age, twelve male and female broilers from each pen were slaughtered to evaluate hot carcass yield (HCY). Results showed that overall growth performances were significantly enhanced by increasing the percentage of sepiolite in the diet and the best results were obtained for the lot fed D2. Live body weight at 36 days of age and daily gain were improved ($P<0.05$) by about 11%, while overall FI and FCR were reduced ($P<0.05$) by 6% and 15%, respectively. The effect of sepiolite on chicks' performances was more important ($P<0.01$) between 1 and 21 days of age than in the rest of the experimental period. Furthermore, the dose of sepiolite in the diet had no effect ($P = 0.23$) on either MR (1.4%) or HCY (73%). Incorporating sepiolite into broiler diets improved growth performances and feed efficiency particularly in starter and grower periods, and a 2% dose seemed to generate the best results. However, economic aspects for using optimal sepiolite doses in broiler diet formulation should be addressed.

**Keywords:** Broiler, Sepiolite, Feed Efficiency

## Introduction

Sepiolite is a natural ingredient; a hydrated magnesium silicate used often as an adhesive in granulated concentrates. The addition of sepiolite facilitates the transport and conditioning of nutrients, and improves the quality of elements rich in fat (Melcion, 1995; Angulo et al., 1995). Sepiolite also enhances physical stability of concentrates, reduces dust losses, and decreases bacterial development (Pontes Pontes and Castello LLobet, 1995). Furthermore, this additive may replace growth factors, antibiotics, and anticoccidians such as avoparcin, monensin, and tylosin in rations of monogastric animals. The use of sepiolite in poultry and swine diets improved growth performances and carcass quality (Castaing, 1994; Parisini, 1993). In Tunisia, the use of sepiolite in animals' nutrition is still limited. The objective of this trial was to assess the effects of incorporating sepiolite in broilers diets on growth performances and carcass yield.

## Materials and Methods

The trial was conducted in a controlled environment on 600 Hubbard JV one day old chicks. Birds were divided into 12 groups of 50 chicks each. They were logged in 1.9 m x 1.7 m pens (15-16 birds/m$^2$) and received 24 hours light. All birds were vaccinated against Marek, Newcastle, Infectious Bronchitis and Gumboro diseases. Four treatments (diets) were used by incorporating into starter, grower, and finisher concentrates for broilers 0 (D0), 0.5 (D0.5), 1 (D1), or 2% (D2) of sepiolite. Composition and forms of aliments are given in Table 1, 2 and 3. Each treatment was randomly assigned to four groups of birds fed starter, grower, and finisher concentrates during 1-13, 14-23, and 24-36 days of age, respectively. Growth performance, mortality rate (MR), feed intake (FI), and feed conversion ratio (FCR) were evaluated weekly. At 36 days of age (end of the trial), twelve male and female broilers from each pen were slaughtered to evaluate hot carcass yield (HCY). Treatment means for growth performances, MR, FI,

**Table 1 : Control feed Characteristics**

| Feeds | days | Corn | Soya | CMV | EM* (kcal/kg) | %CP* | Form |
|---|---|---|---|---|---|---|---|
| Starter | 1-13 | 62.0 | 35.0 | 4.0 | 2800 | 21 | Pelleted |
| Grower | 14-23 | 64.2 | 32.2 | 3.6 | 2830 | 20 | Pelleted |
| Finisher | 24-36 | 67.3 | 29.1 | 3.6 | 2860 | 19 | Crumbled |

* EM (kcla/kg) et de MAT(%): valeurs estimées

**Table 2: Composition of CMV**

| | Démarrage | Croissance Finisher |
|---|---|---|
| $CaCO_3$ | 1.25 | 0.9 |
| Bicalcic Phosphate | 1.75 | 1.7 |
| NaCl | 0.34 | 0.34 |
| Lysine | 0.075 | 0.09 |
| Methionine | 0.175 | 0.165 |
| Choline | 0.085 | 0.085 |
| Robenidine | 0.075 | 0.07 |
| Premix | 0.25 | 0.25 |

**Table 3: Premix composition**

| Components | Stater | Grower Finisher |
|---|---|---|
| *Oligo-elements (mg/kg) | | |
| Zinc | 1750 | 1750 |
| Manganese | 75 | 250 |
| Copper | 20 | 25 |
| Iode | 3 | 10 |
| Selenium | 5 | 5 |
| Cobalt | 1000 | 1250 |
| *Vitamins (mg/kg) | | |
| Vit A | 300000 | 300000 |
| Vit D3 | 50000 | 62500 |
| Vit E | 750 | 750 |
| Vit B1 | 25 | 50 |
| Vit B2 | 150 | 125 |
| Vit B5 | 250 | - |
| Vit B6 | 75 | 75 |
| Vit B12 | 0.37 | 0.37 |
| Vit K3 | 125 | 50 |
| Pantothenate | - | 250 |
| Acide folic | - | 18 |
| Niacine | 750 | 750 |
| Choline | 12500 | 12500 |

FCR, and HCY were compared by TUKEY test following a one way ANOVA (SAS, 1989). Variations of daily gains and feed efficiency with the dose of sepiolite were also studied by linear regression at 22 and 36 days of ages.

## Results and Discussion

Live weights and weight daily gains of birds are given in Table 4. Average daily feed intake and feed conversion ratio are shown in Table 5. Growth performance was enhanced by incorporating sepiolite into chicks' rations. At the end of the trial (36 days), the live body weight of birds receiving sepiolite was significantly higher ($P<0.015$) than that of birds receiving the control diet (D0). D2 birds were around 200 g heavier than D0 birds at 36 days of age. Furthermore, D2 resulted in heavier birds compared to those receiving D0.5 and D1. D2 birds had heavier weights by the end of the trial because they made the highest daily gains among all birds between 1 and 21 days (Table 2). Daily gains of birds receiving D2 were around 11% higher ($P<0.05$) than control (D0) birds. It seems that the effect of sepiolite on chicks' performances was more important ($P<0.01$) between 1 and 21 days of age than in the rest of the experimental period. Plots of body weights for the four diets (D0, D0.5, D1, and D2) at 22 and 36 days of ages are shown in figure 1. And variations of global daily gains and feed conversion ratios with the percentage of sepiolite in the ration are illustrated by figure 2 and figure3 respectively.

Overall FI and FCR were reduced ($P<0.05$) by 6% and 15%, respectively (Table 3). Although D2 birds had the highest body weights, they converted feed better than other diet birds, mainly the control ones (Table 3, Figure 3). The FCR was 1.96 for the D0 birds but only 1.65 for the D2 birds (Table 3, Figure 3). Those of D 0.5 and D1 birds were intermediate. FCR for all bird groups were the highest in the last week of the trail compared to other experimental periods. This increase was obviously the result from mainly increased feed intake and relatively reduced weight gains (Table 3).

Improving effects of sepiolite on growth performances in poultry and swine were reported by Pontes Pontes and Castello LLobet (1995), Ouhida et al. (2000), Castaing (1994), and Parisini et al. (1993). These authors reported similar results to those found in this study with respect to weight gains and feed efficiency. Increased gains and reduced feed intake by animals fed rations with sepiolite might be explained by the fact that the specific physical structure of sepiolite may reduce the by pass of nutrients and consequently improve their absorption. Lengthened transit of nutrients enhances digestibility and mineral absorption.

The dose of sepiolite in the diet had no effect ($P = 0.23$) on either MR or HCY (MSE = 0.40). The overall MR was low (1.4%) and HCY was between 72.1 (D0) and 73.9% (D2).

**Table 4: Live weights (g) and weight daily gains (g/d) of chicks fed rations with 0, 0.5, 1, and 2% of sepiolite**

| Sepiolite in concentrate (%) | Live weight[1] (N=3) | | | | | |
|---|---|---|---|---|---|---|
| | 1 day | 8 days | 15 days | 22 days | 29 days | 36 days |
| 0 | 38.87 | 171.40[a] | 425.58[a] | 756.87[d] | 1233.47[c] | 1866.13[c] |
| 0.5 | 38.76 | 175.96[ab] | 441.85[b] | 803.80[c] | 1268.73[b] | 1951.33[bc] |
| 1 | 38.84 | 175.94[ab] | 465.20[a] | 841.33[b] | 1299.33[b] | 1988.47[ab] |
| 2 | 38.82 | 181.10[b] | 469.49[a] | 872.87[a] | 1358.60[a] | 2068.13 [a] |
| MSE[2] | 0.399 | 2.0124 | 2.980 | 6.015 | 8.718 | 28.29 |
| Probability | 0.998 | 0.100 | 0.0001 | 0.0001 | 0.0001 | 0.015 |
| Sepiolite in concentrate (%) | Daily gain[1] (N=3) | | | | | |
| | 1-8 day | 9-15 day | 16-22 day | 23-29 day | 30-36 day | Aggregate |
| 0 | 18.9 | 36.3[b] | 47.3[c] | 68.1 | 90.4 | 52.2[c] |
| 0.5 | 19.6 | 38.0[b] | 51.7[b] | 66.4 | 97.5 | 54.6[bc] |
| 1 | 19.6 | 41.3[a] | 53.7[b] | 65.4 | 98.4 | 55.7[ab] |
| 2 | 20.3 | 41.2[a] | 57.6[a] | 69.4 | 101.4 | 58[a] |
| MSE[2] | 0.322 | 0.615 | 0.8545 | 1.3337 | 3.4987 | 0.9411 |
| Probability | 0.087 | 0.001 | 0.001 | 0.237 | 0.23 | 0.015 |

[1]Means in same column with different superscripts are significantly different at P = 0.05; [2]Standard error of mean

**Table 5: Average feed intake (g) & feed conversion ratio for chicks fed rations with 0, 0.5, 1 & 2% of sepiolite**

| Sepiolite in concentrate (%) | Average feed intake[1] (N=3) | | | | | |
|---|---|---|---|---|---|---|
| | 0-8 day | 9-15 day | 16-22day | 23-29 day | 30-36 day | Global |
| 0 | 27.8 | 57.1[a] | 96.6[a] | 120.9[a] | 207.7 | 102.0[a] |
| 0.5 | 26.6 | 58.9[a] | 94.1[ab] | 114.3[ab] | 199.0 | 98.6[b] |
| 1 | 26.2 | 52.7[b] | 93.5[ab] | 115.9[ab] | 197.3 | 97.1[b] |
| 2 | 25.4 | 56,9[a] | 91.4[b] | 109.4[b] | 195.0 | 95.6[b] |
| MSE[2] | 0.61 | 0.81 | 0.97 | 1.96 | 3.14 | 0.89 |
| Probability | 0.17 | 0.006 | 0.06 | 0.04 | 0.17 | 0.011 |
| Sepiolite in concentrate (%) | Feed conversion ratio[1] (N=3) | | | | | |
| | 0-8 day | 9-15 day | 16-22day | 23-29 day | 30-36 day | Global |
| 0 | 1.47[a] | 1.57[a] | 2.09[a] | 1.78 | 2.32 | 1.96[a] |
| 0.5 | 1.36[ab] | 1.55[a] | 1.85[b] | 1.72 | 2.04 | 1.80[ab] |
| 1 | 1.34[b] | 1.27[c] | 1.75[c] | 1.77 | 2.01 | 1.74[b] |
| 2 | 1.27[b] | 1.36[b] | 1.59[d] | 1.56 | 1.96 | 1.65[b] |
| MSE[2] | 0.031 | 0.023 | 0.024 | 0.052 | 0.113 | 0.050 |
| Probability | 0.025 | 0.001 | 0.001 | 0.118 | 0.209 | 0.028 |

[1]Means in same column with different superscripts are significantly different at P = 0.05; [2]Standard error of mean

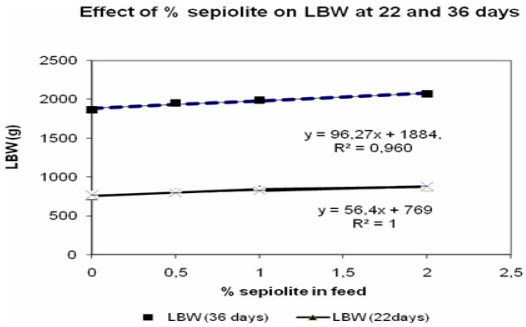


**Fig. 1: Variations of live body weights of Hubbard JV chicks with sepiolite percentage in the ration**

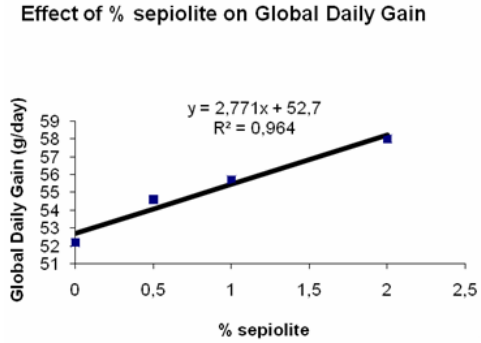


**Fig. 2: Variations of global daily gains and feed conversion ratios of Hubbard JV chicks with sepiolite percentage in the ration**

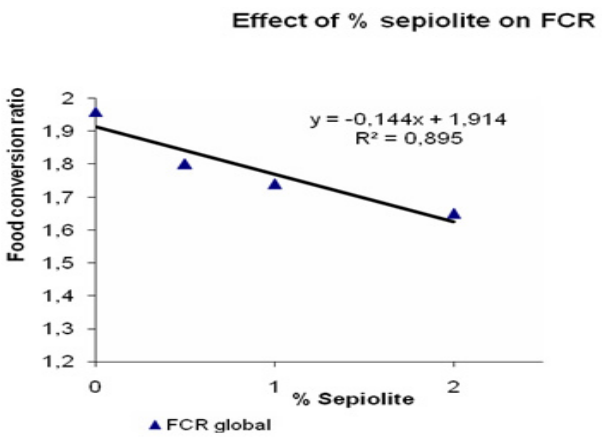


**Fig. 3: Variations of feed conversion ratios of Hubbard JV chicks with sepiolite percentage in the ration**

## Conclusion

Incorporating sepiolite into broiler diets improved growth performances and feed efficiency. Although relations of weight gains and feed conversion ratios with the percentage of sepiolite in rations seemed linear, better performances were obtained in starter and grower periods. Adding a 2% dose seemed to generate the best results. The use of sepiolite may be limited to the starter and the beginning of grower periods. However, economic aspects for using optimal sepiolite doses in broiler diet formulation should be addressed.

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