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The effect of chlorocholine chloride in diets of laying hens on selected egg physical parameters

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Abstract

The effect of chlorocholine chloride (CCC; a plant growth regulator) inclusion in diets of laying hens was evaluated. One hundred and fourteen chicks (initially 3 weeks old) were randomly divided into 4 groups. The chicks were fed a basal diet containing 170 g/kg DM crude protein (CP) for the first 3-8 weeks, 140 g/kg DM CP from 9-20 weeks and 165 g/kg DM CP up to one year. The dietary energy was 11, 10.6, and 11 MJ ME/kg DM in the three growth phases, respectively. To the basal diet, CCC was included at 0 ppm (0PPMC), 5 ppm from 15 weeks (5PPMA), 5 ppm from the beginning (5PPMB) and 50 ppm from the beginning (50PPMB) and offered to the respective four groups. Eggs were collected for the assessment of egg weight, yolk and white, shell weight, thickness and strength. There were no significant (P>0.05) differences in egg weight across treatments. Average egg weight was 59.0 ± 0.678 g. In contrast, there was a significant (P<0.05) 6.14 % depression in egg yolk only in 50PPMB compared to 14.963 g in 0PPMC. There was also a trend of a depression in egg yolk weight with inclusion of CCC in both 5PPMA and 5PPMB groups. There were no significant differences (P>0.05) in egg white and shell weight across the treatment groups. They were 38.7 ± 0.248 and 5.58 ± 0.0716 g, respectively. Proportion of egg yolk, white and shell were also not significantly different (P>0.05). They averaged 24.8 ± 0.408, 65.5 ± 0.325, 9.62 ± 0.0825 %, respectively. However, there was a significant (P<0.05) depression in % egg yolk and increased % white and shell in 50PPMB compared only to the control treatment on the samples collected in the early stages of egg laying. Shell strength and thickness were not significant (P>0.05) across the dietary treatments. They were 3.382 ± 0.0589 kg and 0.385 ± 0.00265 mm, respectively. This study shows that CCC inclusion in diets of laying hens particularly at 50PPMB has a depressive effect on egg yolk content and a tendency to lowering egg weight, but no effect on shell quality.

Introduction

Chlorocholine chloride (CCC), known as a plant growth regulator was introduced to agricultural crop production in order to obtain a shortening effect on stem elongation which reduces the problem of lodging. According to its wide use and relative high dose of application, there is concern that the residues of CCC in cereal grain obtained from plants treated with CCC may have an effect on animals ingesting this grain. CCC has been reported to inhibit the enzyme for cholesterol synthesis (Paleg, 1970a,b; Paleg and Sabine, 1971), phosphatidyl choline synthesis in mammary cell (Infante and Kinsella, 1973), lower liver fat content in laying hens (Tamir, 1996), and rat (Tassissa, 1996). Of more importance is the finding that CCC have a negative effect on litter size, pigging interval and estrus behavior in pigs (Danielsen, V.; Larsen, A. E.; Binder, M.;1989). In laying hens, the significantly lower egg production and egg weight during the early period of egg laying in laying hens fed 5 ppm CCC in feed has been reported by Tamir (1996) and the tendency of lower egg weight obtained from laying hens fed with 5 ppm CCC in diet has been observed during the whole period of egg production. This experiment was conducted to evaluate the effect of CCC on egg composition; egg content and shell quality.

Materials and Methods

One hundred and fifteen 3-week old chicks were randomly allocated into 4 groups and were kept in individual cages during the laying period. Three different basal diets were formulated based on the growing period. The basal diet composition of each growing period is shown in Table 1.

Table 1. The composition of experimental feed for each growing period.

Feedstuff	3-8 weeks	9-20 weeks	Laying period
Wheat*	50	50	50
Corn	35	40	29.5
Fish meal	13	8	13
Calcium carbonate	-	-	7
Vitamin-Mineral	2	2	0.5
Nutrient Content			
Energy , ME (MJ)	12.71	12.72	12.00
Crude protein (%)	17.97	15.22	17.20
Lysine (%)	0.93	0.69	0.95
Methionine+Cystein (%)	0.70	0.59	0.68
Calcium(%)	1.10	0.87	3.27
Phosphorus (%)	0.67	0.56	0.60

* CCC free wheat was used.

To the basal diet, CCC was included at 3 different levels as follows; 0 ppm (0PPMC), 5 ppm from the 15th week (5PPMA), 5 ppm from the beginning (5PPMB) and 50 ppm from the beginning (50PPMB). The experiment was conducted as a completely randomised design. The individual hens were used as the experimental unit. Egg samples were collected and weighed once a week for two months. Physical measurements as weight of whole egg and egg content; yolk, albumen and shell were taken. Shell quality: shell strength and shell thickness were measured. The data was analysed using the Proc GLM procedure of SAS (1988). Treatment means were separated using Duncan's Multiple range test.

Results and Discussion

Results on egg composition and shell characteristics are presented in Table 2 and 3. Inclusion of CCC at 5 ppm either at the beginning or from the 15th week into the experimental diets showed no effect on the parameters measured. The average egg weight was 59.0 ± 0.754. There were no significant (P>0.05) differences in egg weight across treatments. However, a tendency of lower egg weight with increased CCC inclusion in feed was observed (Fig. 1).

Table 2. Egg composition.

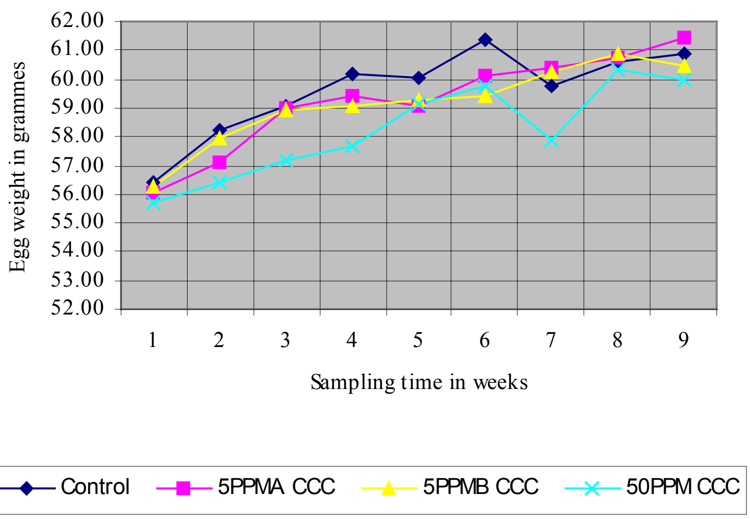
Parameter	Treatment				MSE
	0PPMC	5PPMA	5PPMB	50PPMB	
N	34	28	27	12	
Egg weight (g)	59.547[a]	59.243[a]	59.203[a]	58.016[a]	12.2685
Egg yolk (g)	14.959[a]	14.789[a]	14.766[a]	14.044[b]	1.0298
Albumen (g)	38.875[a]	38.767[a]	38.760[a]	38.323[a]	8.8502
Egg shell (g)	5.711[a]	5.678[a]	5.678[a]	5.650[a]	0.1238

Means in the same row with different superscript differ significantly (P<0.05)

Table 3. Shell characteristic.

Parameter	Treatment				MSE
	0PPMB	5PPMA	5PPMB	50PPMB	
N	34	28	27	12	
% shell	9.569	9.610	9.603	9.755	0.2362
Shell thickness (mm)	0.387	0.386	0.382	0.392	0.0003
Shell strength (kp)	3.346	3.321	3.448	3.414	0.1500

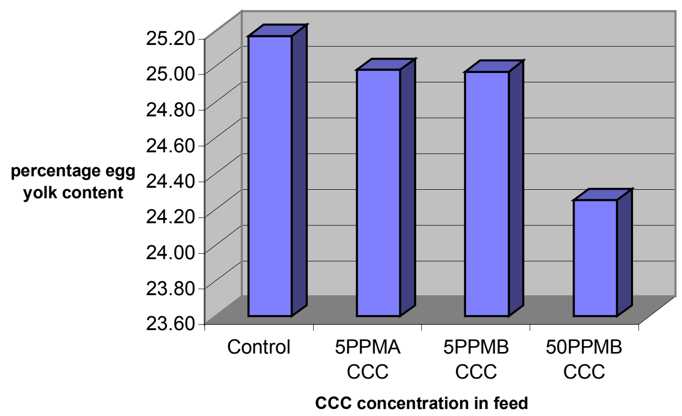
Figure 1. Pattern of changes in egg weight in laying hens receiving diets varying in chlorocholine chloride (CCC) concentration



These results agree with those of Tamir (1996). With 5 ppm CCC in diet he reported 2.2 % depression in egg weight compared to the control. In contrast to egg weight, there was a significant (P<0.05) depression in egg yolk in laying hens fed 50 ppm CCC compared with the other treatments.
The percentage of yolk tended to be lower with inclusion of CCC although the results did not reach statistical significance (P>0.05) (Fig. 2). There were no significant

differences (P>0.05) in albumen and egg shell weights as well as shell strength and shell thickness across treatments. Probably the differences obtained in egg yolk content could be seen related to the tendency in egg weight depression with inclusion of CCC. However, the depression in egg yolk was more severe than that in egg weight. CCC has been reported to have an inhibitory effect on cholesterol production (Paleg, 1970a,b; Paleg and Sabine, 1971); interference with phosphatidyl choline synthesis in mammary cell (Infante and Kinsella; 1973); and an effect to lower liver fat content in rats (Tassesa,1996) and laying hens (Tamir, 1996). Since fat is a major component of yolk solid (approximately 65%), inclusion of CCC could have had an effect of lowering egg yolk content through any of these pathways. CCC could also affect egg formation through hormonal regulation, through lowering of cholesterol content which is a precursor of sex hormones. As the precursor of sex hormone synthesis, the lowering of cholesterol could have resulted in such response.

Figure 2. Pattern of changes in percentage egg yolk in laying hens receiving diets varying in chlorocholine chloride (CCC) concentration



Conclusion

The inclusion of CCC in the diet of laying hens up to a level of 50 ppm has a depressive effect on egg yolk content and a tendency to lower egg weight but no effect on shell quality. This might be due to the interference of CCC on fat metabolism as well as its indirect effect on egg formation through influence on the hormonal regulation.

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