Effects of Increasing Concentrations of Corn Distiller's Dried Grains with Solubles on Chemical Composition and Nutrients Content of Egg

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Summary and Implications

Four diets were formulated to contain 0, 17, 35 or 50% corn DDGS. A total of 240 54-week-old single-comb White Leghorn laying hens were assigned to one of four dietary treatments and fed for a 24-week experimental period. Two sets of the experimental diets were formulated and each diet was fed for 12 weeks. Chemical composition and nutritional components in egg yolk were measured. Egg yolk from hens fed DDGS-containing diet tended to have higher fat content and lower protein content. Total polyunsaturated fatty acids were significantly increased by DDGS diet. The contents of choline and cholesterol were initially higher in 50% DDGS treatment group, but were not different in the later period, especially during last 4 weeks. Lutein content increased linearly as DDGS level increased. The results indicated that feeding high level of DDGS can increase the content of lutein and polyunsaturated fatty acids in egg yolk, but may not affect the content of cholesterol or choline.

Introduction

Distiller's dried grains with solubles (DDGS) have been available for feed industry for many years, and have been considered a nutritional and economical feed ingredient. DDGS are often used at low concentrations (10 or 15%) as a feed ingredient for laying hens without affecting laying performance and egg quality. As large amounts of DDGS become available in feed market, the possibility of using higher DDGS inclusion rate in poultry feed has become an interest for many researchers and poultry producers. Previous study showed that DDGS could be incorporated at 69% level in laying hen diet for short-term without negative effects on egg production, metabolic conditions, and egg quality.

DDGS contain high levels of protein, fiber and fat, and also contain considerable amounts of other important nutrients, such as lutein, choline, and long chain unsaturated fatty acids. The differences in component and nutrient concentration of DDGS diet may influence the chemical composition and nutrient content of eggs, especially when DDGS are used at high levels in the diet. Yolk is the most nutritive part of egg, and contains many functional nutrients such as choline and lutein. Phosphatidylcholine (PC) constitutes around 80% of the total phospholipids in the egg yolk, and has many physicoshemical functions. Choline is very important for brain development, liver function and cognitive function for cellular membranes. Deficiency in choline may result in higher risk of cancer and neural tube defects.

Egg yolk carotenes are classified as xanthophylls and carotenes. Xanthophylls include lutein, zeaxanthin and cryptoxanthin, present at level of 0.1, 0.2 and 0.03% of egg yolk, respectively. Lutein plays an important role in preventing age-related macular degeneration. DDGS contain high levels of xanthophyll, and thus diets containing DDGS can increase lutein content in egg yolk.

Cholesterol content of egg yolk can range from 11-15 mg/g yolk, which is around 5% of total yolk lipids. The cholesterol of egg yolk can come from the feed ingredient, such as animal fat, with the major part synthesized when egg yolk is formed in the ovary. High dietary fiber content in DDGS diets may have positive effect on controlling cholesterol levels in eggs, since many researchers have found a positive relationship between high fiber diets and low serum cholesterol in human.

Egg is a very important component of human food, and it is important to evaluate its chemical composition and the content of important nutrients in egg yolk from high level DDGS diet. Interest of increasing DDGS content in laying hen diet has been rekindled; however, little work has been done to determine the effect of high inclusion rate of DDGS on egg yolk composition and nutrients content of egg yolk.

The objective of this study is to investigate the changes of chemical composition and nutrients content of egg yolk by diets with high DDGS inclusion rates.

Materials and Methods

- A total of 240 54-week-old Single-comb White Leghorn laying hens were used.
- Diets were formulated to have four levels of corn DDGS (0, 17, 35, and 50%) and fed for 24 wks.
- After the first 12-week experiment period, diet formulas were modified by addition of lysine and methionine in an attempt to meet the production requirements of laying hens fed the 50% DDGS diets.
- The composition of egg yolk (lipid, moisture, protein, cholesterol, lutein, and choline) was determined.

Results

- DDGS diet can influence egg yolk composition and other important nutrients content in egg yolk.
- Fat and protein content of egg yolk was affected by 50% DDGS treatment.
- The proportion of polyunsaturated fatty acids in egg yolk increased significantly by DDGS diet.
- The contents of choline and cholesterol were initially higher with 50% DDGS treatment, but were not affected by the DDGS treatments in the later period, especially during last 4 weeks.
- Lutein content increased linearly as DDGS level increased.

Conclusion

The results indicated that feeding high levels of DDGS can increase the content of lutein and polyunsaturated fatty acids in egg yolk, but may not affect the content of cholesterol or choline.

Acknowledgement

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Table 1. Fat, moisture and protein content of egg yolk from hens fed diets with various levels of corn distiller's dried grains with soluble (DDGS)[1]

Chemical component (%)	DDGS diets (%)				SEM
	0	17	35	50	
Fat	32.13[b]	32.53[b]	32.31[b]	33.41[a]	0.24
Moisture	48.54	48.74	48.66	48.61	0.08
Protein	16.89[a]	16.88[a]	17.02[a]	16.24[b]	0.09

[a,b,c]Means with no common superscript in the same row differ significantly ($P < 0.05$)

[1]Values are means of 24 wk sampling period.

Figure 1. Effect of diets with various levels of corn distiller's dried grains with solubles on cholesterol content of egg yolk during the 24-week-long period. *[4]Denotes that 50% DDGS dietary treatment is significantly higher than the 0% DDGS dietary treatment ($P < 0.05$). *[2.4]Denotes that 17 and 50% DDGS dietary treatments are significantly higher than the 0% DDGS dietary treatment $P < 0.05$). *[3.4]Denotes that 35 and 50% DDGS dietary treatments are significantly higher than the 0% DDGS dietary treatment ($P < 0.05$). The ratio of corn and soybean meal base in diet reduced as DDGS level increased. Each data point means averaged cholesterol content of egg yolk on a two-week basis. Diet was changed to second formula at 13 wks of age. N = 4.

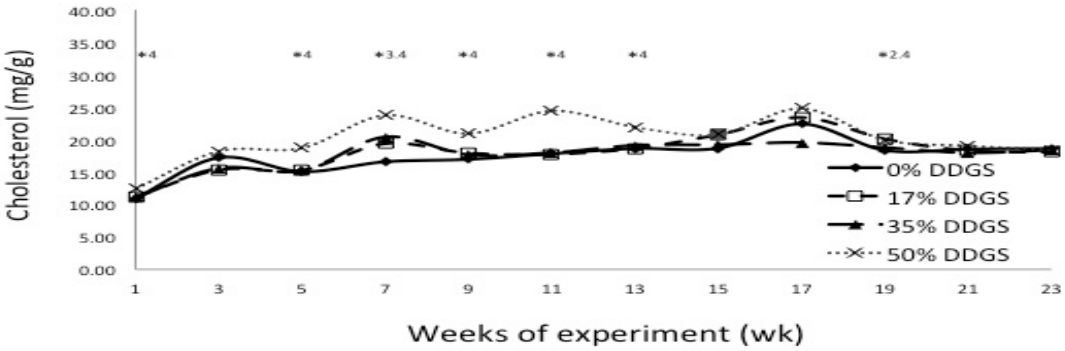

Figure 2. Effect of diets with various levels of corn distiller's dried grains with solubles on lutein content of egg yolk during the 24-week-long period. *[2.3.4]Denotes that 17, 35 and 50% DDGS dietary treatments are significant higher than 0% DDGS dietary treatment ($P < 0.05$). The ratio of corn and soybean meal base in diet reduced as DDGS level increased. Each data point means averaged lutein content of egg yolk on a two-week basis. Diet was changed to second formula at 13 wks of age. N = 4.