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Studies On The Production Of The Selenium Eggs In Chicks.

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ABSTRACT

Selenium (Se), a potent antioxidant, exists in inorganic and organic forms and serves as a dietary source to replenish its loss from the body either through urine, faecal matter, or sweat. Considering this as concept experiments on the effects of dietary Se supplementation on hen's laying performance, egg Se content. A total of 90 white leghorns laying hens were randomly divided into three dietary groups with three replicates and ten hens per replicate. Results showed that compared to control group, bodyweight daily feed intake, feed conversion ratio were significantly improved in SY and SS groups. Conversely, daily feed intake, bodyweight, egg mass, egg weight were significantly lower in the SS group than in the SY group. On the other side, selenium concentration were significantly in egg yolk, egg albumen, and whole eggs in SY and then followed by SS groups. Therefore, we concluded that dietary SY supplementation at 0.3 mg Se/kg diet could meet the Se requirement of laying hens for optimum growth and more positive effects on laying hens and enriched Se content safe for human consumption. Thus, organic Se from SY is more effective than inorganic Se from SS.

Keywords: selenium-enriched yeast, sodium selenite, selenium eggs.

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INTRODUCTION

Selenium (Se) is an essential micronutrient for humans and animals, can serve as a potential mineral antioxidant [1]. This Se after incorporation into various biomolecules is exerting several biological functions in all living systems, such as antioxidant defence, thyroid metabolism, reproduction, and immune function, fertility [2,3]. However, Se deficiency may contribute to keshan disease, cancer, diabetes, and hypothyroidism in humans, exudative diathesis, nutrition muscular dystrophy, nutritional pancreatic atrophy in chicks [4,5]. In the poultry diet, Se is supplemented mainly in the two major forms: inorganic sodium selenite or selenate, whereas organic forms from selenium selenium-enriched yeast, DL-Selenomethionine, nano-selenium, Selenized glucose are used as a new type of organic selenium diets [6,7]. Different guidelines of Se intake for adults recommended by various organizations and society include, Chinese Society of Nutrition, Americans, World Health Organization, European Food Safety Authority was 26 µg per day, 55 µg per day, 50-55 µg per day, 70 µg per day respectively [8]. Hence, it is necessary to increase Se content in human foods. Therefore, consumption of two Se-enriched eggs per day shall meet over at least 70% of Se recommended dietary allowances levels for humans [9]. Therefore, the present study aimed to evaluate the effect of similar Se levels at 0.3 mg Se/kg diet and different sources of Se on laying performances, and egg Se distribution in chicks.

MATERIALS AND METHODS

In this study, a total of 90 commercial white leghorns laying hens at the age of 16-18 wk with similar performance were randomly allotted to three dietary treatment groups, comprising the control and two experimental groups. Each group consisted of 30 hens with three replicates in 15 different cages (two hens per cage). The size of each cage was H40 x W40 x D40 cm. Water and experimental diet were offered *ad libitum,* and the room temperature was maintained at 20 ± 3^{o}C. All hens were exposed to16 h of light and 8 of the dark cycle, and relative humidity were maintained at 65-75%. Hens were acclimated to a basal diet for 2 wk. At the end of wk 18, the hens were administrated diet following the group as follows: Control group consists of the hens fed corn-soybean basal diet only for 8 wk, SS group consists of the hens fed a basal diet + 0.3 mg/kg. b. wt of Se from sodium selenite (SS) for 8 wk, SY group consists of the hens fed a basal diet + 0.3 mg/kg. b. wt of Se from selenium-enriched yeast (SY) for 8 wk. The basal diet consists of a corn-soybean meal and used as a control diet was formulated to meet or exceed the requirement of laying hens (NRC, 1994) except Se. The experiment was established with two different Se sources, including the sodium selenite was provided by a commercial company (purity was ≥45.6%; Maruthi Chemical Company, Gujarat, India). Similarly, Se-enriched yeast (3000 mg/kg Se content, Selsaf®3000; Phileo by Lesaffre, France). Two eggs per replicate from each treatment group (6 eggs per group) were randomly collected on ten wk. Egg white, egg yolk, and eggshell were separated for selenium assay. Another two eggs were broken, and their egg albumen and yolk were mixed to prepare the whole egg samples to estimate egg Se content. Egg Se concentrations in egg albumen, egg yolks, and whole-egg were analysed by inductively coupled plasma optical emission spectrometer. Results of the present study were expressed as mean ± standard deviation. One-way analysis of variance followed by a *Post hoc* Tukey HSD multiple comparison tests the significance levels and plot the difference between the variable among each group at p values < 0.05 were considered statistically significant. This statistical analysis was performed by IBM SPSS 20.0 software.

RESULTS AND DISCUSSION

Results shows the effect of the different Se sources with similar Se levels at 0.3 mg/kg on laying performance using daily feed intake, body weight gain,, feed conversion ratio, egg mass, egg weight, were significantly improved in the SY groups compared to control groups. (Table 1). These results supported by the recent finding of Aliyu et al. who found that the same Se levels and different Se sources (SS, SY or bacterial organic Se, ADS18 at 0.3 mg Se/kg) in diet were significantly affected laying performances in terms of egg mass, bodyweight change in Lohman brown classic laying hen at 23 wk of age [10]. Bakshalinejad et al. showed that chickens fed different Se sources and their levels in diet had did not influence daily feed intake and feed conversion ratio during the experimental period [11]. The present study also revealed that control group hens fed a basal diet without selenium supplementation did not show any selenium deficiency symptoms during the experimental period. This finding proved that 0.11 mg Se/kg of basal diet was adequate and met the NRC (1994) requirements (0.05-0.1) to sustain growth and performance for white leghorns strains of laying hens. Therefore, the findings mentioned above clearly, indicate that the laying performance of laying hens is influenced not only by Se sources and Se levels but also by many other factors such as age and avian species strain. Thus, dietary supplementation of Se-enriched yeast as an organic Se source and their levels could alleviate the poor production performance of white leghorn laying hens.

Results revealed the Se concentration of egg albumen, egg yolk, and whole eggs are presented in Table 2. In detail, Se concentration in the yolk of laying hens fed diet SS (12 ± 1.52 mg kg^{-1}) was higher than that of laying hens fed the diet without Se supplementation (6.00 ± 1.56 mg kg^{-1}). On the other side, Se concentrations in egg albumen of laying hens fed a diet supplemented Se from SY diet (8 ± 2.04 mg kg^{-1}) were significantly higher when compared to control diet (6.5 ± 1.20 mg kg^{-1}). Se concentrations in whole egg of laying hens fed a diet supplemented Se from SY diet (28 ± 1.58 mg kg^{-1}) were significantly higher when compared to control diet (12.5 ± 1.55 mg kg^{-1}). These results are similar to that literature by other. According to Payne et al. showed that Se concentration transfer to egg depends upon its sources and levels of Se in the diet [12]. Several authors stated that egg Se concentrations were linearly increased with the supplemental Se level irrespective of the different Se sources. For instance, Kai and co-worker indicated that the content of Se in egg albumen, egg yolk, and whole-egg increased when adding various Se levels at 1, 2, 5, or 10 mg/kg from organic Se source from selenium conjugated to insect protein in the diet for 30 days [13]. Therefore, this study discloses an organic selenium-enriched egg production with 50% (30-35 μg) of the human selenium RDA is developed as an essential delivery system of this trace mineral for humans.

Table 1: Effect of dietary supplementation of different selenium sources and levels on reproductive performance of laying hens.

	Dietary treatment		
Parameters	**Control**	**SS**	**SY**
Body weight	5.67±1.01^{a}	3.67±1.02^{a,b}	6.58±1.06^{a,b}
Daily feed intake	20.32±1.01^{a}	21.25±1.20^{a,b}	24.87±1.00^{a,b}
Feed conversion ratio	26.85±0.45^{a}	32.85±0.55^{a,b}	38.87±0.47^{a,b}
Egg mass	71.13±1.54^{a}	75.02±1.01^{a,b}	82.00±4.83^{a,b}
Egg weight	40.72±5.29^{a}	44.62±0.47^{a,b}	49.43±3.72^{a,b}

Data reported as the means ± SD for 6 hens. Bars with common letters 'a' denotes significant difference between Control and SS, SY groups. In contrast, those with common letters 'b' denotes significantly different from SS and SY groups was evaluated One-way ANOVA, followed by Tukey's HSD multiple range *post hoc* test. Dietary treatments groups: Control, a basal diet without Se supplementation; SS, a basal diet plus 0.3 mg/kg of Se from sodium selenite, SY, a basal diet plus 0.3 mg/kg of Se from selenium-enriched yeast.

Table 2: Effect of dietary supplementation of different selenium sources on egg selenium concentration.

	Dietary treatments		
Parameters	**Control**	**SS**	**SY**
Egg yolk	6.0 ± 1.56^{a}	12 ± 1.52^{a,b}	10 ± 1.69^{a,b}
Egg albumen	6.5 ± 1.20^{a}	8 ± 2.04^{a,b}	18 ± 1.50^{a,b}
Whole egg	12.5 ± 1.55^{a}	20 ± 3.74^{a,b}	28 ± 1.58^{a,b}

Data reported as the means ± SD for 6 hens. Bars with common letters 'a' denotes significant difference between Control and SS, SY groups. In contrast, those with common letters 'b' indicates significantly different from SS and SY groups ($p < 0.05$) was evaluated One-way ANOVA, followed by Tukey's HSD multiple range *post hoc* test. Dietary treatments groups: CON, a basal diet without Se supplementation; SS, a basal diet plus 0.3 mg/kg of Se from sodium selenite, SY, a basal diet plus 0.3 mg/kg of Se from selenium-enriched yeast.

CONCLUSION

The results data from the present study indicated that hens supplemented with selenium from different sources and Se levels at 0.3 mg/kg in laying hens' diet and improving laying hens' performance. However, the Se content in the egg albumen, egg yolk, and whole egg increased to produce Se-enriched eggs. Therefore, SY improves the increase in Se deposition in eggs to achieve the desired Se content in whole eggs. It could be used to enhance human Se status, particularly in Se-deficient areas in the world. Therefore, this study indicates that SY-0.3 mg Se/kg exhibited more effectiveness than SS-0.3 mg Se/kg in laying hen's diet.

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