Effect of selenium from selenium-enriched Kale sprout (*Brassica oleracea var. alboglabra L.*) on selenium concentration in tissues of spent hens

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ABSTRACTS: The objectives of this research were to determine the effect of selenium (Se) from Se-enriched kale sprout (*Brassica oleracea* var. alboglabra L.) on Se concentrations in tissues of spent hens. One hundred and sixty hens were divided into five treatments. Each treatment consisted of four replicates and each replicate contained eight hens in a Completely Randomize Design. The experiment was conducted for 4 weeks. The treatments were T1: control diet, T2: control diet plus 0.2 mg Se/kg from sodium selenite, T3, T4 and T5: control diet plus 0.2, 0.5 and 1.0 mg Se/kg from Se-enriched kale sprout, respectively. The results showed that Se from sodium selenite and Se-enriched kale sprout increased ($p<0.05$) Se concentrations in liver, kidney and heart tissues of spent hens when compared to control group. Se concentrations in liver, kidney and heart tissues of spent hens increased ($p<0.05$) with increasing Se concentration from Se-enriched kale sprout. The results demonstrate that the effectiveness of Se from Se-enriched kale sprout and sodium selenite on tissue Se concentration in spent hens is similar.
Keywords: Organic selenium, Selenium-enriched plant, Spent hen

Introduction

Selenium (Se) is an essential component of several major metabolic pathways, including thyroid hormone metabolism, antioxidant defense system, and immune function (Brown and Arthur, 2001). The animal nutritionists has, therefore, paid more attention for supplementing Se to enhance productive performance of animals and to produce Se-enriched animal products to increase Se status of consumers. Therefore, several studies revealed that Se-enriched yeast in organic form (selenomethionine) is more bioavailable than inorganic Se in animals (Zhan et al., 2007; Chantiratikul et al., 2008; Calamari et al., 2010). However, the production process of Se-enriched yeast requires complex and high technology (Ouerdane and Mester, 2008). On the other hand, the production of Se-enriched plants is more practical (Tsuneyoshi et al., 2006). Presently, there is little information of utilization of Se from Se-enriched plant in animal nutrition. Jiakui and Xiaolong (2004) reported that Se-enriched malt did not affect productivity and it had similar metabolic route with Se from sodium selenite in laying hens. Chinrasri et al. (2009) found that Se-enriched bean sprout (*Vigna radiate*) was comparable to Se-enriched yeast in egg Se accumulation in laying hens. The production of Se-enriched kale sprout (*Brassica oleracea* var.

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alboglabra L.) has been recently developed in our laboratory and its effectiveness in animal is required. Thus, the aim of this research was to determine effect of Se from Se-enriched kale sprout on tissues Se concentrations in spent hens.

Materials and Methods

The sand was cleaned and dried in hot-air oven at 150°C for 10 h. 1000g of dried sand was poured in the opaque plastic containers (22x36x11 cm) prior to application of 400 ml distilled water containing 60 mgSe from sodium selenate/L. The Chinese kale seeds were cultivated on the above sand after soaking in distilled water for 8 h. The container was fully covered by a black plastic bag. The kale spouts were harvested after cultivation for 7 days, thoroughly washed, dried at 50 ºC and ground. Total Se content and Se speciation in Se-enriched kale sprout was performed by inductively coupled plasma-mass spectrometer (ICP-MS Model Elan-e, Perkin-Elmer SCIEX, USA) according to Joaquim *et al*. (1997) and by HPLC-ICP-MS technique (Casiot et al., 1999). Se-enriched kale sprout contained 846.71 mgSe/kg and consisted of 63.90% selenate, 32.92% Se-methyselenocysteine and 3.18% selenomethionine (Chantiratikul et al., 2011).

One hundred and sixty spent hens, 71 week-old, were used under appropriate animal care regulation in this experiment. The spent hens were randomly divided by their body weight into five treatments in a Completely Randomize Design. Each treatment consisted of four replicates and each replicate contained eight spent hens. The spent hens were placed in wire cages. Water from nipple drinkers was freely available in the cages. The dietary treatments were T1: control diet, T2: control diet plus 0.2 mg Se/kg from sodium selenite (Na_2SeO_3), T3, T4 and T5: control diet plus 0.2, 0.5 and 1.0 mg Se/kg from Se-enriched kale sprout. The control diet contained 16 % of CP and 2,900 Kcal/kg diet of ME, without Se supplementation. The hens fed with control diet for 6 days prior to the beginning of the experiment and fed dietary treatments *ad libitum* during 4 experimental weeks. Feed consumption was daily recorded. At the end of the experiment, the spent hens from each treatment were weighed, stunned and slaughtered. Afterward, breast meat, liver, heart and kidney tissues were collected. The tissue samples were dried, ground and analyzed for selenium concentration (Joaquim *et al*., 1997).

Statistical analysis

All experimental data were analyzed by analysis of variance technique appropriate for Completely Randomized Design (SAS 1996). The differences among means of each parameter were compared by Duncan's New Multiple Range Test. A probability level of $P<0.05$ was considered to be statistically significant.

Results and Discussion

The actual concentrations of Se in control diet, control diet supplemented with 0.2 mgSe/kg from sodium selenite, control diet supplemented with 0.2, 0.5 and 1.0 mgSe/kg from Se-enriched kale sprout were 0.27, 0.40, 0.43, 0.86 and 1.11 mg/kg, respectively (**Table 1**).

Feed intake and final body weight of spent hens were not influenced ($p>0.05$) by Se supplementation. Similarly, the previous studies found that feed intake and productive performance of poultry were not altered by Se sources (Yoon et al., 2007; Chinrasri et al., 2009; Chantiratikul et al., 2011). Se concnentration in breast muscle was not different among dietary treatments ($p>0.05$). Selenium from sodium selenite and Se-enriched kale sprout increased ($p<0.05$) Se concentrations in liver, kidney and heart tissues of spent hens when compared to those in control group. Se concentrations in liver, kidney and heart tissues of spent hens increased ($p<0.05$) with increasing Se concentration from Se-enriched kale sprout (**Table 2**). The current results are consistent with Chantiratikul et al., (2011) who summarized that the effectiveness on tissue Se concentration of Se from Se-enriched kale sprout and sodium selenite was identical in growing quails. On the other hands, numerous studies reported higher Se concentrations ($p<0.05$) in breast muscle and liver tissue of poultry fed organic Se from Se-enriched yeast than inorganic Se from sodium selenite (Payne and Southern, 2005; Leeson et al., 2008). Those present and previous outcomes indicated that the effectiveness of Se from Se-enriched plants was similar to that of selenite, but lower than that of selenomethionine from Se-enriched yeast for tissue Se concentration.

Table 1 Selenium concentrations in dietary treatments

Items	Se (mg/kg)
Control diet	0.27
Control diet plus 0.2 mg Se/kg from sodium selenite	0.40
Control diet plus 0.2 mg Se/kg from Se-enriched kale sprout	0.43
Control diet plus 0.5 mg Se/kg from Se-enriched kale sprout	0.86
Control diet plus 1.0 mg Se/kg from Se-enriched kale sprout	1.11

Table 2 Feed intake, final body weight and tissue Se concentrations of spent hens fed diets supplemented Se from sodium selenite and Se-enriched kale sprout

Items	Dietary Treatments[1]					SEM
	T1	T2	T3	T4	T5	
Feed intake (g/h/d)	61.52	62.00	59.57	58.89	62.99	1.16
Final body weight (kg)	1.57	1.58	1.59	1.53	1.56	0.01
Tissue Se concentration (mg/kg DM)						
- Breast muscle	1.82	2.10	2.26	2.64	2.76	0.19
- Liver tissue	2.13^{d}	2.60^{c}	2.80^{c}	3.45^{b}	4.42^{a}	0.14
- Kidney tissue	3.35^{d}	4.38^{c}	4.89^{bc}	5.53^{b}	6.89^{a}	0.24
- Heart tissue	2.56^{c}	3.19^{b}	3.27^{b}	3.47^{b}	4.11^{a}	0.11

[1]T1 = control diet; T2=control diet plus 0.2 mg Se/kg from sodium selenite; T3, T4 and T5 = control diet plus 0.2, 0.5 and 1.0 mg Se/kg from Se-enriched kale sprout, respectively.

^{abcd} Means in the same row with different superscripts are significantly different ($P<0.05$).

Conclusion

The effectiveness of Se from Se-enriched kale sprout and sodium selenite was identical in tissue Se concentration in spent hens.

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