EFFECT OF FEEDING *OCIMUM* SPECIES WITH SELENIUM ON ANTIOXIDANT ENZYME STATUS IN BROILER CHICKS

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ABSTRACT

An experiment was conducted in broiler chicken to evaluate the effect of dietary supplementation of *Ocimum sanctum, Ocimum basilicum* and selenium on antioxidative enzyme levels. Forty two broiler chickens of day old divided into 6 groups of 7 each were used for this study. *O. sanctum* leaf powder (0.5%), *O. basilicum* leaf powder (0.5%) and organic selenium (0.3 ppm) and their combinations were added to the basal diet. Superoxide dismutase (SOD), glutathione peroxidase (GSH-px) and catalase levels in plasma were measured at the end of 3rd and 6th week of age. Dietary supplementation of selenium itself significantly ($p<0.01$) increased GSH-px activity and supplementation of both *Ocimum* species significantly increased SOD and catalase levels. However, *O. basilicum* and *O. sanctum* in combination with selenium effectively enhanced the levels of SOD, GSH-px and catalase. Between *O. basilicum* and *O.sanctum* with combination of selenium, no significant variations in antioxidant levels were seen. Both the plant sources showed similar potency in scavenging free radicals. It is concluded that dietary supplementation of *O.sanctum or O. basilicum* at 0.5% level and its combination with selenium (0.3ppm) can combat oxidative stress in broilers, by enhancing antioxidative enzyme levels.

Key words: Antioxidants. *Ocimum sanctum, Ocimum basilicum*, Selenium, SOD, GSH-px, Catalase, Broiler chickens.

INTRODUCTION

Oxidative stress is the major causes of reduction in growth rate in broilers and it increases the incidence of infectious and metabolic diseases in poultry minimized. Herbal antioxidants are effective in many cases.

Antioxidants are substances present in lower concentrations and significantly delay or prevent oxidation of substances like protein, lipids, DNA and carbohydrates (Halliwell and Gutteridge, 2007). Herbal plants posses excellent free radical quenching potency (Shivmurat and Usha, 2011). Of the several plants which are found to posses anti oxidant properties, the ubiquitous herb, belongs to *Lamiaceae* family is a fairly economic therapeutic agent for several pathological conditions as well as anti-stress (Javanmardi *et al*., 2003) and antioxidant agent (Kaurinovic *et al*., 2011). External sources of antioxidant essential for antioxidant protection include vitamins C, E, carotenoids, phytoflava noids and mineral selenium.

Organic selenium is a natural seleno-aminoacid (methionine-selenium) which has been shown to posses excellent antioxidant properties and improves resistance against oxidative stress (Mahmoud and Edens, 2003). The present study was conducted to evaluate the

antioxidative effect of *Ocimum sanctum* and *Ocimum basilicum* with organic selenium.

MATERIALS AND METHODS

Forty two cob broiler day old chickens were randomly divided into 6 groups comprising of 7 birds in each group with following dietary regimes.

Group I: Standard diet

Group II: Standard diet + *Ocimum sanctum* (0.5%)

Group III: Standard diet + *Ocimum basilicum* (0.5%)

Group IV: Standard diet + Organic selenium (0.3ppm)

Group V: Standard diet + *Ocimum sanctum* (0.5%) + organic selenium (0.3ppm)

Group VI: Standard diet + *Ocimum basilicum* (0.5%) + organic selenium (0.3ppm)

The birds were reared in cages under standard managemental practices from day old to 6th week of age. Freshly collected *O. sanctum* leaves and *O. basilicum* leaves were shade dried and powdered. The leaf powders were added at the rate of 0.5% level in feed based on the reports of Vara Prasad Reddy *et al*. (2009) along with 0.3ppm of organic selenium.

Blood samples were collected at the end of 3rd and 6th week from the wing vein using heparinised vacutainer for separating plasma. The levels of superoxide dismutase (SOD) activity in plasma was measured by the method of Marklund and Marklund (1974), glutathione peroxidase (GSH-Px) activity as per the method described by Rotruk *et al*. (1973) and catalase activity as per the method of Caliborne (1985). Statistical analysis of the data was done by completely randomized block design as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Superoxide dismutase is considered as critical antioxidative enzyme that acts as a scavenger of oxygen anion to form hydrogen peroxide and hence diminishes the toxic effects due to the free radical. This primary defense widely distributed in oxygen metabolizing cells to protect aerobic cells from deleterious actions of free radicals (Yamaguchy, 1991). The mean plasma SOD values of broilers at 3rd and 6th week of age as influenced by dietary supplementation of *O. sanctum*, *O. basilicum* and selenium is presented in Table 1. In the present study, dietary supplementation of *O. sanctum* at 0.5% its in combination with selenium at 0.3ppm significantly ($p<0.01$) enhanced plasma SOD activity when compared to either supplementation of *O. sanctum* alone or organic selenium alone to broiler chickens.

Table. 1. Effect of dietary supplementation of *Ocimum sanctum, Ocimum basilicum,* organic selenium and their combinations on plasma SOD levels in broilers.

Groups	SOD (50% pyrogyllol auto-oxidation/min/mg)	
	3rd week	6th week
I	1.26 ±0.08^{a}	2.43 ±0.06^{a}
II	1.93 ±0.06^{c}	3.15± 0.03^{c}
III	1.98 ±0.04^{c}	3.21± 0.06^{d}
IV	1.48 ±0.04^{b}	2.61 ±0.03^{b}
V	2.08± 0.04^{d}	3.26 ±0.02^{e}
VI	2.06 ±0.08^{d}	3.28 ±0.04^{e}

Means bearing common superscripts in column do not differ significantly ($p<0.05$)

Table. 2. Effect of dietary supplementation of *Ocimum sanctum, Ocimum basilicum,* organic selenium and their combinations on plasma GSH-Px levels in broilers.

Groups	GSH-Px (µM of GSH utilized/min/mg)	
	3rd week	6th week
I	2.01 ±0.03[a]	2.73 ±0.05[a]
II	2.25 ±0.04[b]	2.98± 0.02[b]
III	2.22 ±0.03[b]	2.92± 0.04[b]
IV	2.55 ±0.03[c]	3.24 ±0.05[c]
V	2.72± 0.03[d]	3.35 ±0.04[d]
VI	2.69 ±0.04[d]	3.32 ±0.06[d]

Means bearing common superscripts in column do not differ significantly ($p<0.05$)

The group supplemented with 0.5% *O. basilicum* with organic selenium also showed enhanced activity plasma SOD, comparable to *O. sanctum* with selenium, but an insignificant increase was noted in this group. On comparison with selenium supplementation, both *O. sanctum* and *O. basilicum* showed more enhanced scavenging potency of super oxide ion by increased SOD activity. The results of the present study are in accordance with the earlier reports of Holovska *et al*. (2003) who observed that SOD activity significantly ($p<0.01$) increased with dietary supplementation of organic selenium in chicken. Similar findings were also recorded with dietary supplementation of selenium which significantly increased activity of SOD with erythrocytes and tissue to minimize oxidative stress in chicken by inhibiting the oxygen free radical production and scavenging the super oxide ions (Ozturk-Urek *et al*., 2001).

The glutathione peroxidase, present in the cytosol and mitochondria matrix, catalyses the degradation of various peroxides by sacrificial oxidation of glutathione. Selenium is an essential component of selenium dependant glutathione peroxidase enzyme that reduces peroxides and protects cells against the damaging effects of oxidation. The mean plasma GSH-Px values of broiler chickens at 3rd and 6th week of age as influenced by dietary supplementation of *O. sanctum*, *O.basilicum* and selenium is presented in Table 2.

In the present study, there is a significant increase in plasma GSH-Px activity with selenium supplementation and its combination with of *O. sanctum* and *O. basilicum* at 0.5% level. Fidler *et al*. (1980) reported that hydrogen peroxide induced oxidative stress was effectively inhibited by the dietary selenium supplementation by increasing plasma GSh-Px activity in white leghorn chicken. Payne and Southern (2005) and He-Jianhua *et al*. (2000) also reported that dietary selenium supplementation enhanced plasma GSH-Px activity. This enzyme played a vital role in the detoxification of hydrogen peroxide and protects the cell from injury caused by peroxides.

The catalase catalyses the reduction of hydrogen peroxides and protects the tissues from highly reactive hydroxyl radicals. During stress the accumulated free radicals causes the inactivation of this enzyme by simple glycation which reduces structural abnormality and thus limits the activity of catalase (Yamaguchy, 1991). The mean plasma catalase value of broiler chickens of 3rd and 6th week of age as

Table. 3. Effect of dietary supplementation of *Ocimum sanctum, Ocimum basilicum* organic selenium and their combinations on plasma catalase levels in broilers.

Groups	Catalase (μM of H_2O_2 decomposed/min/mg)	
	3rd week	6th week
I	30.25 ±0.64[a]	42.69 ±0.51[a]
II	32.07 ±0.36[c]	44.80± 0.44[d]
III	32.01 ±0.27[c]	44.81± 0.49[d]
IV	31.35 ±0.28[b]	43.74 ±0.25[b]
V	32.49± 0.18[d]	44.75 ±0.32[c]
VI	32.42 ±0.28[d]	44.72 ±0.36[c]

Means bearing common superscripts in column do not differ significantly ($p<0.05$)

influenced by dietary supplementation is presented in Table 3.

The catalase activity was highest with *O. sanctum* supplemented with selenium followed by *O. basilicum* supplemented with selenium when compared to group IV, indicating organic selenium has little influence on moderating plasma catalase level. Similar findings were reported by Aydemir *et al*. (2000) in erythrocytic catalase activity in chicken supplemented with selenium. The enhanced catalase activity in the group with combination of selenium and both *Ocimum* species indicates synergistic effect of *Ocimum* species and selenium on scavenging free radicals and hydrogen peroxides.

In the present study also increase in SOD, GSH-Px and catalase activity at 6th week as compared to 3rd week in all groups as reported by Wang *et al*. (1998) and Holovska *et al*. (2003). These increased enzyme activity could be due to combination supplementation which might have enhanced the enzyme levels to scavenge reactive oxygen species (ROS) and free radicals which are produced more during rapid growth phase. Hence it is concluded that the combination of both *O. sanctum* (0.5%) with organic selenium (Group V) and *O. basilicum* (0.5%) with organic selenium (Group VI) have been considered as better in combating oxidative stress caused by rapid growth rate in broilers there by effectively enhancing the SOD, GSH-Px and catalase activities in the body.

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