Effect of dietary supplementation of dry extract of boldo (*Peumus boldus*, mol.) on growth and antioxidant status of broiler chicken

M.A. FELLENBERG\(^1\)*, C. DELPORTE\(^2\), N. BACKHOUSE\(^2\), I. PEÑA\(^1\) AND H. SPEISKY\(^2,3\).

\(^1\)Facultad de Agronomía e Ingeniería Forestal/Animal Science Department/Pontificia Universidad Católica de Chile/Av. Vicuña Mackenna 4860, Macul, Santiago, Chile. \(^2\) Facultad de Ciencias Químicas y Farmacéuticas, Universidad de Chile. \(^3\)Instituto de Nutrición y Tecnología de los Alimentos, Universidad de Chile.

\(*\) Corresponding autor: mafellen@uc.cl

Chicken because of their accelerated grown are more susceptible to suffer oxidative stress. This situation occurs when the oxidative equilibrium is broken and the oxidative process is more than the antioxidant process in the live chicken. The incorporation of antioxidants in the poultry feed helps to maintain the antioxidant equilibrium. In Chile we have a tree named boldo that their barks, steams and leaves have certain substances with well known antioxidants characteristics. In this research we prepared a dried extract of boldo leaves and putted it in the broiler feed with the purpose to known if that extract could improve the antioxidants status. The dietary antioxidant extract of boldo did not improve the parameters of antioxidant status of chicken but it increased the tiols contents (GSH) in the liver tissues.

**Keywords:** Broiler, boldo, antioxidants, TBARS

**Introduction**

It has been observed that the dietary supplementation of certain antioxidants (AOX) improves the antioxidants status of the broilers. Polyphenol molecules present in the vegetable world can act like AOX, in fact, the incorporation of tea polyphenols to the broiler diet protects liver and muscle tissue against oxidative stress induced by corticosterone (Eid *et al.*, 2003). **Boldo** (*Peumus boldus*, Mol.) is a native species of Chile that has several molecules with antioxidant activity (Speisky *et al.*, 1991). Hence, in the present work, the effect of supplementing the feed with a dry watery extract of boldo, on the growth and antioxidative status of broilers during their development was evaluated.

**Materials and methods**

This work took place in the Chilean Central Region during 2003. A group of 225 1-day-old male chicks (ROSS 208) were raised for 42 days. A commercial feed was offered *ad libitum*, modified according to the treatments. Feed intake and weight gain of the birds were measured periodically. A dry extract of boldo (DEB) was prepared and standardized based on its antioxidants characteristics. Three levels of DEB (low-DEBL, medium-DEBM and high-DEBH), and Vit E (200 mg/Kg) were included in the feed of broiler chicks during 6 weeks. Antioxidant capacity of plasma (CAOXpl) was determined by the FRAP method (Langley-evans, 2000), tiols (GSH) content by the Ellman’s method (Ellmans, 1959), and basal and induced lipoperoxidation of liver, leg and breast tissue by the thiobarbituric acid reactive substances (TBARS) method. All of them performed at 2, 4 and 6 weeks of age. The model used in the statistical analysis \((y = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + \epsilon_{ij})\) was a factorial design \((\alpha \text{ and } \beta)\), with levels i and j of each factor. The effect of each factor was analyzed separately and also the interaction of both \((\alpha\beta)\) was analyzed. The Statistical Analysis System (SAS Institute Inc., 1999)
software was utilized for the analysis of variance. For the determination of mean differences the t of student with \( p<0.05 \) was utilized.

**Results and discussion**

No significant differences for both weight increase and feed intake were found when compared to the control.

CAOXpl increased with age until 6-weeks-old chicks, but it was not affected by the inclusion of DEB in any of its doses, which could be due to the interaction between ingredients and specifically proteins present in the diet. Serafini et al. (1996) found that tea polyphenols had a diminished antioxidant effect in the plasma when they were given with milk in tests with humans. They attributed this effect to the formation of complexes between polyphenols of the tea and proteins of milk. Furthermore, Langley-Evans (2000) found that also soybeans milk decreased the antioxidant power of tea polyphenols. In broiler feeds soybean meal (protein \( >40\% \)) is the main protein source, which could form a complex with polyphenols of DEB, therefore it is possible that the lack of effect is a reflection of the bioavailability.

On the other hand, GSH is an important endogenous antioxidant that protects cells from the attack of free radicals (FR) and reactive oxygen species (ROS). In this case, DEB increased the content of GSH in liver (Table 1), which could indicate that this supplementation would be giving a greater antioxidant protection to these birds.

<table>
<thead>
<tr>
<th>Age/Trat</th>
<th>Control</th>
<th>DEBL</th>
<th>DEBM</th>
<th>DEBH</th>
<th>Vit E</th>
<th>Age Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 weeks</td>
<td>5.29±0.44(^{AB})</td>
<td>5.97±0.37(^{AB})</td>
<td>5.68±0.44(^{AB})</td>
<td>6.41±0.96(^{aA})</td>
<td>5.82±0.60(^{aAB})</td>
<td>5.83</td>
</tr>
<tr>
<td>4 weeks</td>
<td>5.90±0.55(^{aA})</td>
<td>5.49±0.68(^{aA})</td>
<td>5.91±0.39(^{bA})</td>
<td>5.60±0.60(^{bA})</td>
<td>5.47±0.24(^{aA})</td>
<td>5.68</td>
</tr>
<tr>
<td>6 weeks</td>
<td>4.88±0.47(^{bC})</td>
<td>5.83±0.44(^{AB})</td>
<td>6.47±0.44(^{AB})</td>
<td>5.01±0.59(^{BC})</td>
<td>5.43±0.64(^{ABC})</td>
<td>5.52</td>
</tr>
<tr>
<td>Trat average</td>
<td>5.36</td>
<td>5.77</td>
<td>6.02</td>
<td>5.68</td>
<td>5.57</td>
<td></td>
</tr>
</tbody>
</table>

It was also observed that liver-tissue susceptibility to lipoperoxidation was higher than leg-tissue and this one higher than breast-tissue. This could be due to the fact that the content of fat in liver is greater than in muscle. Furthermore, the leg is an oxidative muscle while breast is a glycolytic muscle. In none of these tissues a protective effect of DEB from lipoperoxidation was observed.

**Conclusions**

Although DEB presented a high content of polyphenols and a high antioxidant capacity in vitro, it did not demonstrate a protective effect (AOX) of the extract on the antioxidant status of the birds. This could be due to different reasons. First of all DEB could have not been absorbed enough in the small intestine of the birds, in terms of having the sufficient bio-availability to assure an antioxidant effect. A second reason could be that DEB is constituted mainly by hydrosolubles molecules that would have probably been insufficiently deposited in tissues making difficult any antioxidant effect on these last ones. Finally, other reason could be that DEB polyphenols had a short life in the chicken body being metabolized before they exert their antioxidant function.

Despite the above mentioned, the high content of polyphenols and the high antioxidant activity in vitro shown by DEB, makes it interesting to continue researching on its properties as a possible natural antioxidant. In addition, it showed the interesting quality of increasing the content of GSH in the liver. New research must be made, to reveal its mechanism of action, because it could be a natural product with different pharmacological uses.
References


ELLMANS, G.L. (1959) Tissue sulfhydryl groups. *Archives of Biochemistry and Biophysic.* **82**:70-77

