PERFORMANCE AND QUALITY OF CHICKEN BREAST MEAT FROM BROILERS FED NATURAL ANTIOXIDANTS AND VITAMIN E

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Introduction

It is well established that lipid oxidation is the major cause of deterioration in meat and meat products and the interest in exploring the use of herbs and spices as natural antioxidants to protect those products has increased recently (Andersen et al., 2003). The addition of dried herbs to pre-cooked chicken breast meat provides significant quality improvements (Racanicci et al., 2004); on the other hand, supplementation of feed with natural extracts suggests efficient protection against oxidation in chicken breast and thigh meat (Bostoglou et al., 2002). The aim of this work is to evaluate the dietary supplementation of essential oils from herbs and spices on broiler performance and meat quality parameters.

Material and Methods

The total phenolic quantification using the Folin-Ciocalteu method accordingly to Kähkönen (1999) and DPPH radical scavenging described by Hinneburg et al. (2006) were performed in essential oil samples of 18 herbs and spices. Based on those results, six herbs (HERBS: rosemary, thyme, oregano, sage, bay and basil) and three spices (SPICES: cinnamon, clove and ginger) were selected and microencapsulated by a commercial company and fed to 1,400 female one-day old Cobb chicks until 40 days of age. Animals were allotted to 30 pens, in groups of 45 birds and randomly assigned to 5 experimental treatments. Treatments consisted of a basal corn-soy diet (Rostagno et al., 2005) with supplementation of α-tocopherol, herbs or spices, as follows: CONTROL (basal diet containing α-tocopherol from premix and feed ingredients); VITE (basal diet supplemented with 200 mg α-tocopheryl acetate/kg); HERBS (basal diet supplemented with 200 mg of herbs mix/kg); SPICES (basal diet supplemented with 200 mg of essential oil of spices mix/kg); HER+SPI (basal diet supplemented with 200 mg of herbs and spices mix/kg). Birds weight and feed consumption were recorded weekly to determine weight gain and feed conversion ratio.

At 40 days of age, 10 birds of each treatment were transported during the day for 1.5 h at average temperature of 25.5 ºC and average humidity of 72.5% in cages (10 birds/cage) and slaughtered under commercial conditions. After evisceration, carcasses were cooled during 30 min in chilled water and pectoralis major (PM) was deboned for color and pH measurements. Color (L*, a* and b*) was evaluated at the ventral side of PM using Minolta Chroma Meter equipment and pH was measured using the direct probe method. Meat quality parameters were performed 24 h after slaughter, as follows: (a) water-holding capacity (WHC) was evaluated accordingly to Nakamura and Katok (1985); (b) drip loss (DL) was determined based on methods described by Honikel and Hamm et al. (1994), Dirinck et al. (1996) and Van Laack et al. (2000) with some modifications; (c) cook-loss (CL) was performed accordingly to Mead (1987); (d) shear force (SF) was evaluated as described by Froning and Uijttenboogaart (1988). The effects of treatments were tested by ANOVA and averages of chicken performance and meat quality parameters were compared by Tukey test using GLM procedures of SAS® (SAS Institute, 1998).

Results and Discussion

Performance. In agreement with previous results (Botsoglou et al., 2002), body weight at 40 days of age (average: 2.216 kg ± 0.056), weight gain (average: 2.161 kg ± 0.056), feed intake (average: 3.818 kg ± 0.055) and feed conversion ratio (average: 1.768 ± 0.028) were not affected by the addition of natural antioxidants in broilers diets.

Meat quality. Dietary treatments had no effects on color development (L*, a* and b*) and pH measured in PM 30 min after slaughter, as shown in Table 1. Likewise, drip-loss, cook-loss and shear force were not affected by dietary treatments. Contrary to previous findings described by Jensen et al. (1998), supra-nutritional addition of α-tocopheryl acetate did not improve fresh meat color and reduced significantly ($P < 0.05$) WHC value. The supplementation of herbs alone (HERBS) or in combination with spices (HER+SPI) resulted in similar WHC when compared to CONTROL samples. Although not significantly different from CONTROL, breast meat from chickens in the SPICES treatment showed improvements in WHC and L* value.

Table 1. Means of lightness (L*), redness (a*), yellowness (b*), pH, water-holding capacity (WHC), drip-loss (DL), cook-loss (CL) and shear force (SF) of PM from female broilers fed different dietary treatments (n=10)

Treatments	Color			pH	WHC (%)	DL (%)	CL (%)	SF
	L*	a*	b*					(kgf/cm^2)
CONTROL	47.71	3.68	9.30	6.72	50.39^{ab}	2.53	25.20	3.91
VITE	48.04	3.69	10.39	6.77	47.50^{b}	3.37	27.82	3.94
HERBS	47.60	3.39	10.06	6.63	48.18^{ab}	3.29	26.05	4.49
SPICES	46.81	3.01	9.56	6.80	51.55^{a}	3.47	25.91	3.51
HER+SPI	47.16	3.25	9.66	6.91	50.95^{ab}	3.10	27.46	3.79

^{a,b} Means in the same column with no common superscript letter differ significantly ($P < 0.05$)

Conclusions

The addition of 200 mg of essential oil of herbs (rosemary, thyme, oregano, sage, bay and basil) and spices (cinnamon, clove and ginger) per kg of feed, as well as α-tocopheryl acetate, did not improve performance of female broilers or quality parameters of breast meat.

References

1. Andersen M.L., Lauridsen R.K. and Skibsted L.H. (2003). In: Johnson I, Williamson G (eds). Optimising the use of phenolic compounds in foods, 1st edn. Cambrige, England. p. 315-346.
2. Botsoglou, N.A., Christaki, E., Fletouris, D.J., Florou-Paneri, P. and Spais, A.B. (2002). The effect of dietary oregano essential oil on lipid oxidation in raw and cooked chicken during refrigerated storage. *Meat Science*, 62, 259-265.
3. Dirinck, P., De Winne, A., Casteels, M. and Frigg, M. (1996). Studies on vitamin E and meat quality. 1- Effect of feeding high vitamin E levels on time-related pork quality. *Journal Agricultural and Food Chemistry*, 44, 65-68.
4. Froning, G.W. and Uijttenboogaart, T.G. (1988). Effect of *post mortem* electrical stimulation on color, texture, pH, and cooking loses of hot and cold deboned chicken broiler breast meat. *Poultry Science*, 67, 1536-44.
5. Hinneburg, I., Damien-Dorman, H.J. and Hiltunen, R. (2006). Antioxidant activities of extracts from selected culinary herbs and spices. *Food Chemistry*, 97, 122-129.
6. Honikel, K.O. and Hamm, R. (1994). Measurement of water-holding capacity and juiciness. In: Pearson, A.M., Dutson, T.R. (eds). Quality attributes and their measurement in meat, poultry and fish products. Adv. Meat Res. 9, p.125-159.
7. Jensen, C., Lauridsen, C. and Bertelsen, G. (1998). Dietary vitamin E: quality and storage stability of pork and poultry. *Trends in Food Science and Technology*, 9, 62-72.
8. Kähkönen, M.P., Hopia, A.I., Vuorela, H.J., Rauha, J.P., Pihlaja, K., Kujala, T.S. and Heinonen, M. (1999). Antioxidant Activity of Plant Extracts Containing Phenolic Compounds. *Journal of Agriculture and Food Chemistry*, 47, 3954-3952.
9. Mead, G.S. (1987). Recommendation for a standardized method of sensory analysis for broilers. *World's Poultry Science Journal*, 43, 64-67.
10. Nakamura, M. and Katok, K. (1985). Influence of thawing method on several properties of rabbit meat. *Bulletin of Ishikawa Prefecture College of Agriculture*, 11, 45-49.
11. Racanicci, A.M.C., Danielsen, B., Menten, J.F.M., Regitano-d´Arce, M.A.B. and Skibsted, L.K. (2004). Antioxidant effect of dittany (*Origanum dictamnus*) in pre-cooked chicken meat balls during chill storage in comparison to rosemary (*Rosemarinus officinalis*), *European Food Research and Technology*, 218, 521-524.
12. Rostagno, H.S. Tabelas brasileiras para aves e suínos: composição de alimentos e exigências nutricionais. Viçosa: UFV, Departamento de Zootecnia, 2000. 141 p.
13. Van Laack, R.L., Liu, C.H., Smith, M.O. and Loveday, H.D. (2000). Characteristics of pale, soft, exudative broiler breast meat. *Poultry Science*, 79, 1057-1061.