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QUALITY AND OXIDATIVE STABILITY OF BROILER MEAT AS AFFECTED BY DIETARY SUPPLEMENTATION OF THE BIOFLAVONOIDS NARINGIN AND HESPERIDIN

Υποβλήθηκε για παρουσίαση στο 31st Poultry Science Symposium on "Sustainable Poultry Production in Europe", στο Chester (UK), 8-10 Σεπτεμβρίου 2014 που διοργανώθηκε από το UK branch of World Poultry Science Association.

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ABSTRACT

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QUALITY AND OXIDATIVE STABILITY OF BROILER MEAT AS AFFECTED BY DIETARY SUPPLEMENTATION OF THE BIOFLAVONOIDS NARINGIN AND HESPERIDIN

Goliomytis, M.; Simitzis, P.; Kartsonas, N.; Charismiadou, M.; Kominakis, A.; Deligeorgis, S.

Introduction and Aims
Naringin and hesperidin are natural occurring flavonoids well known for their antioxidant properties. They are abundant in citrus fruits, especially in pulp, a by-product of the citrus processing industry, which often is treated as waste. Hesperidin concentration in orange peels is between 13 and 24 g/kg, whereas naringin concentration in grapefruit peels is between 0.7 and 17 g/kg. In the present study we evaluated the effect of dietary supplementation with naringin and hesperidin on broiler meat quality parameters and oxidative stability.
Materials and Methods
Two hundred and forty day old broiler chickens, as hatched, were randomly assigned into 6 treatment groups. The control group C, without any flavonoid dietary supplementation, the N1 and N2 groups dietary supplemented with 0.75 and 1.5 g naringin per kg feed, respectively, the E1 and E2 groups supplemented with 0.75 and 1.5 g hesperidin per kg feed, respectively, and finally the VE group that was supplemented with 0.2 g á-tocopheryl acetate per kg feed. Dietary supplementation with bioflavonoids and á-tocopheryl acetate lasted from 11d to 42d of age when 10 broilers per treatment group were slaughtered for pectoralis major meat quality assessment (colour-CIE L*a*b*, pH24, cooking loss and shear force). Oxidative stability, expressed as ng malondialdehyde (MDA) per g tissue, was assessed, on 6 out of the 10 slaughtered birds per treatment, in the pectoralis major and biceps femoris after 3 d and 6 d of storage at 4^{o} C and 120 d of storage at -18°C. MDA is a secondary lipid oxidation product formed by the hydrolysis of lipid hydroperoxides during lipid oxidation. High levels of MDA indicate high rates of lipid oxidation. MDA data were subjected to ANOVA with dietary treatment, muscle and their interaction as fixed effects. No muscle effect or interaction of muscle by added substances was detected and therefore data for MDA determinations were pooled. Finally, all data were analyzed with dietary treatment as the fixed effect. The linear dose response (P-linear) to hesperidin or naringin was determined with contrasts among C and E or N group means.
Results
Dietary supplementation with the bioflavonoids did not affect meat quality traits measured except from red color that was lower in VE group compared with the E1 group ($P<0.05$). Oxidative stability improved with increasing levels of both dietary naringin and hesperidin at 6

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and 120 d (P-linear<0.05) but not at 3 d of storage (P-linear>0.05) compared to C group. Statistical differences (P<0.05) were obtained, at 6 d of storage, between the C group (12.2 ng/g tissue) and E2, N1 and N2 groups, 8.1, 9.0 and 8.8 ng/g tissue, respectively. At 120 d of storage MDA differences (P<0.05) were obtained between the C group (16.6 ng/g tissue) and N1 and N2 groups, 12.1 and 13.1 ng/g tissue, respectively. At 6 d of storage the MDA value for the VE group (6.6 ng/g tissue) was lower (P<0.05) than that of the E1 group (10.1 ng/g tissue) but not than any of the naringin group. At 120 d of storage the VE group (10.3 ng/g tissue) had lower MDA values than the E1, E2 and N2 groups, 14.2, 13.7 and 13.1 ng/g tissue, respectively.

Conclusion

Present results indicate that dietary supplementation with the flavonoids naringin and hesperidin to broiler chickens' diet improved meat oxidative stability without affecting its quality parameters. Hesperidin supplementation improved meat oxidative stability to a lesser extent compared to vitamin E whereas naringin's improvement was comparable to that of vitamin E. Further research is warranted in evaluating the efficiency of the citrus pulp as a dietary agent that may increase broilers' meat oxidative stability and quality since it is the main source of the naturally occurring antioxidants hesperidin and naringin.

*This research project was implemented within the framework of the Project "Thalis -- The effects of antioxidant's dietary supplementation on animal product quality", MIS 380231, Funding Body: Hellenic State and European Union.

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QUALITY AND OXIDATIVE STABILITY OF BROILER MEAT AS AFFECTED BY DIETARY SUPPLEMENTATION OF THE BIOFLAVONOIDS NARINGIN AND HESPERIDIN

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Introduction and Aim

Naringin and hesperidin are natural occurring flavonoids well known for their antioxidant activity. They can be found in the plant kingdom and they are abundant in citrus fruits especially in pulp, a by-product of the citrus processing industry. Hesperidin concentration in orange peels is between 13 and 24 g/kg, whereas naringin concentration in grapefruit peels is between 0.7 and 17 g/kg. The aim of the study was to investigate the effects of dietary supplementation of naringin and hesperidin on broiler meat quality and oxidative stability.

Materials & Methods

Two hundred and forty day-old broiler chickens, as hatched, were randomly assigned into 6 treatment groups as shown in Table 1.

Table 1. Supplementation levels of antioxidants fed to broiler chickens from 11 d to 42 d of age.

Antioxidant	Dietary group, g/kg feed					
	C	N1	N2	E1	E2	VE
Naringin	-	0.75	1.5	-	-	-
Hesperidin	-	-	-	0.75	1.5	-
Vitamin E	-	-	-	-	-	0.2

At 42 d of age:

-Ten chickens per treatment group were slaughtered and meat quality traits were assessed in *Pectoralis major* muscle

-Oxidative stability, measured as ng malondialdehyde (MDA) per g tissue, was also assessed on six out of the 10 slaughtered chickens per treatment group in two muscles (*pectoralis major* and *biceps femoris)* at two days (3 and 6 d) of typical storage temperature (4°C) as well as at 120 d at deep freezing -18° C. MDA is a secondary lipid oxidation product formed by the hydrolysis of lipid hydroperoxides during lipid oxidation. High levels of MDA indicate high rates of lipid oxidation.

Because, no muscle effect or interaction of muscle by added substances was detected, data for oxidative stability determinations were pooled. Analysis was performed separately for each treatment group and storage time, testing for linear dose response (P-linear) with contrasts among C and E or N group means.

Results

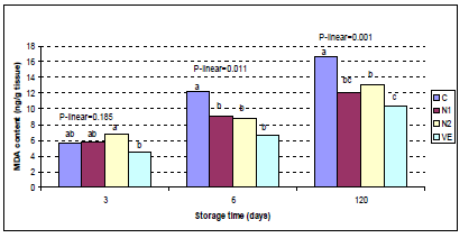

Figure 1. Effect of dietary supplementation of naringin on broiler meat oxidative stability (n=6)
C: no additive, N1 and N2: 0.75 and 1.5 g naringin per kg feed, respectively, VE: 0.2g a-tocopheryl acetate (vitamin E) per kg feed
[abc] Least square means sharing no common superscript are different (P<0.05)
P-linear refers to C and N1 and N2 groups

Results (continued)

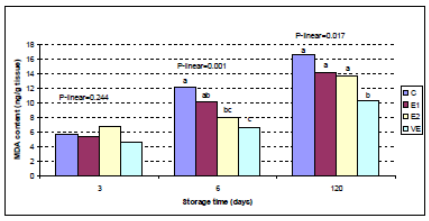

Figure 2. Effect of dietary supplementation of hesperidin on broiler meat oxidative stability (n=6)
C: no additive, E1 and E2: 0.75 and 1.5 g hesperidin per kg feed, respectively, VE: 0.2g a-tocopheryl acetate (vitamin E) per kg feed
[abc] Least square means sharing no common superscript are different (P<0.05)
P-linear refers to C and E1 and E2 groups

Table 2. Effect of dietary supplementation of naringin and hesperidin on broiler meat instrumental quality traits (n=10)

Antioxidant[1]	L*	a*	b*	Cooking loss (%)	Shear force N x 100/mm²	pH_{24}
C	55.6	5.81[ab]	14.1	14.3	8.23	5.40
E1	56.2	6.03[a]	14.4	17.1	8.51	5.38
E2	54.8	5.30[ab]	13.2	16.5	8.33	5.41
N1	54.4	5.83[ab]	13.9	16.9	9.63	5.40
N2	56.8	5.09[ab]	13.7	15.6	7.77	5.41
VE	54.4	4.65[bc]	13.7	15.5	9.92	5.41
SE	0.7	0.28	0.4	0.9	0.69	0.03
P-linear						
C-E1-E2	0.399	0.237	0.170	0.084	0.906	0.783
C-N1-N2	0.244	0.116	0.427	0.378	0.654	0.825

[1] C: no additive, E1 and E2: 0.75 and 1.5 g hesperidin per kg feed, respectively, N1 and N2: 0.75 and 1.5 g naringin per kg feed, respectively, VE: 0.2g a-tocopheryl acetate (vitamin E) per kg feed
[abc] Least square means within a column sharing no common superscript are different (P<0.05)

Conclusion

- Dietary supplementation with the flavonoids naringin and hesperidin to broilers improved shelf life of meat by decreasing its lipid deterioration during storage. Hesperidin supplementation improved meat oxidative stability to a lesser extent compared to vitamin E whereas naringin improvement was comparable to that of vitamin E. Meat quality instrumental parameters were not affected by flavonoids supplementation.
- Further research is warranted in evaluating the efficiency of citrus pulp as a dietary agent that may increase broiler meat oxidative stability and quality since it is the main source of the naturally occurring antioxidants hesperidin and naringin.

This research project was implemented within the framework of the Project "Thalis -- The effects of antioxidant's dietary supplementation on animal product quality", MIS 380231, Funding Body: Hellenic State and European Union.

Η Επιτροπή Πιστοποίησης Παραδοτέων

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