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Effect of natural extracts on nutritional quality and protein oxidation of chicken nuggets enriched trough diet with organic Zn and Se (#639)

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Introduction

Increasing concerns about nutrition and health have resulted in new trends towards "natural products" that are, free from synthetic food additives. This is the origin of "Clean label" meat products that are increasingly demanded by consumers in some european countries and the USA (Naveena et al. 2008). The aim of the present study was to evaluate the effect of adding natural extracts from food industrial by-products (rosemary eseential oil: Rosmarinus officinalis (RH and RL); fruit juices: *Punica granatum* (P); wine: grape (*Vitis vinífera*) seed (GS)) and the broiler feed addition of Zinc (Zn) and Selenium (Se) (both organic and inorganic forms) on the nutritional, and protein oxidation of frozen chicken nuggets under frozen storage for 12 months.

Methods

Samples: Eight different chicken nugget samples were elaborated, before they were separated into two batches: four samples enriched endogenously with inorganic Zn and Se (C) and four samples enriched with organic Zn and Se (SZ). Chicken nugget samples were enriched exogenously with natural extracts obtained from plants (Rosemary (RH and RL), Pomegranate (P), and Grape Seed (GS), according to Table 1.

Animal diet: 500 broilers, from 1 to 40 days old, were randomly placed in two different floor pens with 12 replicate pens for each group. Each pen was assigned two dietary treatments: (C) basal diet - supplemented with inorganic mineral (0.3 ppm of Na_2SeO_3 and 80 ppm of ZnO) and (SZ) basal diet- supplemented with organic mineral (0.2 ppm and 50 ppm of Se and Zn proteinate).

Plant extracts: The plant extracts used were: Rosemary (*Rosmarinus officinalis*) extract (RH and RL), *Punica granatum* (P), and Grape (*Vitis vinifera*) Seed (GS). All were supplied by Nutrafur-Frutarom group (Alcantarilla, Murcia, Spain).

Proximate composition. Chicken nugget samples were analysed for their moisture, ash, lipid, and total protein contents according to AOAC methods (2002) at day 0 after elaboration. The mineral concentrations of samples were measured by plasma spectroscopy (ICP-OES) using an ICAP THERMO DUO 6500 computer.

Protein oxidation. Protein oxidation was related with the thiol concentration. The concentration of thiol groups was determined spectrophotometrically after derivatisation by Ellman's reagent, 5, 5-Dithiobis (2-nitrobenzoic acid) (DTNB). The analysis was carried out at 0, 3, 6, 9 and 12 months.

*Statistic analysis.*Data were analyzed with the statistical package SPSS 15.0 (Statistical Package for the Social Science for Window (IBM, Armonk, New York, USA). The antioxidant and antimicrobial capacity were analyzed using ANOVA. A value of $p < 0.05$ was considered statistically significant.

Results

The proximate composition of the chicken frozen nuggets enriched with natural extracts from fuits, seeds and herbs is shown in Table 3. The moisture, ash, protein and lipid contents (%) represented in this table point to no significant differences between samples. The moisture percentage ranged from 63 %, in CRH+P to 67 % in CRL+GS, while the ash content ranged from 1.17 % in SZRL+GS to 1.61 % in SZRH+P. Similar results were obtained for the protein and lipid contents. The protein content ranged from 10.84 % in C to 11.26 % in CRH+P and SZRH+P, while the lipid percentage was from 3.90 % in sample C to 5.36 % in sample CRH+P.

By contrast, there were significant difference ($P < 0.05$) between samples in terms of the Se and Zn contents (mg/100 g). Samples elaborated with meat from chicken broilers fed with organic forms of Zn and Se showed higher concentrations of Zn and Se than the samples made from meat enriched with inorganic Zn and Se.

Protein oxidation was determined by reference to thiol groups (see Figure 1 in which it can be seen that their concentration slightly decreased during frozen storage). Nevertheless, samples that incorporated rosemary and grape seed extract (CNOS+GS and SZNOS+GS) showed much higher concentrations of thiol groups than C and SZ. In the same way, the incorporation of organic forms of Zn and Se in SZ decreased protein oxidation compared with C, due to the antioxidant capacity of the minerals.

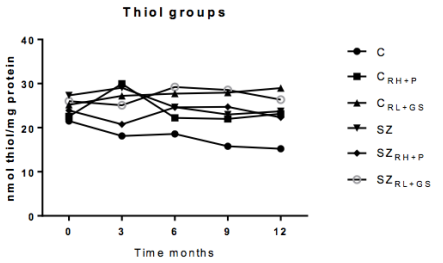
Conclusion

The present study showed that the addition of phenolic compounds in form of natural extracts from seeds, herbs and fruits, together with organic forms of Zn and Se, can reduce oxidation, of chicken nuggets during 1 year of frozen storage. In particular, the SZRH+P and SZRL+GS samples were significantly more resistant to oxidative reactions. The chicken nugget samples enriched with minerals did not show significant differences regarding to proximate composition. Therefore, the incorporation of minerals in animal

Notes

feed combined with the use of antioxidant natural sources may be considered a good way to replace synthetic additives in meat products and a further step towards obtaining "Clean label" meat products. Due to the health benefits of these extracts, as a source of antioxidants, their application in the meat industry its desirable in order to substitute or reduce the concentration synthetic additives.

Figure 1. Results of protein oxidation, thiol groups (nmol thiol/mg protein of chicken frozen nuggets for twelve months of storage.



C: Control; CRH+P: 1000 ppm Rosemary extract + 1500 ppm Pomegranate extract; CRL+GS : 1000 ppm Nutrox OS + 1500 ppm Grape seed extract; SZ: Control fortified with Zn and Se meat; SZRH+P : 1000 ppm Rosemary extract + 1500 ppm Pomegranate extract; SZRL+GS : 1000 ppm Nutrox OS + 1500 ppm Grape seed extract.

Table 1

Table 2

Figure 1

Ingredients (g)	Chicken emulsion					
	Enriched with inorganic forms of Zn and Se			Enriched with organic forms of Zn and Se		
	C	**C_{RH+P}**	**C_{RL+GS}**	**SZ**	**SZ_{RH+P}**	**SZ_{RL+GS}**
Chicken meat (g)	675	672.5	672.5	675	672.5	672.5
Plant extract (ppm)						
- → R_H		1000			1000	
- → P		1500			1500	
- → R_H			1000			1000
- → GS			1500			1500
Water (ml)	150	150	150	150	150	150
Ice (g)	100	100	100	100	100	100
Commercial mix® (g/kg)	75	75	75	75	75	75
Total	**1000**	**1000**	**1000**	**1000**	**1000**	**1000**

RH: Rosemary extract; P: Pomegranate; RL: Rosemary extract (Nutrox OS); GS: Grape Seed
C: Control; CRH+P: 1000 ppm Rosemary extract + 1500 ppm Pomegranate extract; CRL+GS : 1000 ppm Nutrox OS + 1500 ppm Grape seed extract; SZ: Control fortified with Zn and Se meat; SZRH+P : 1000 ppm Rosemary extract + 1500 ppm Pomegranate extract; SZRL+GS : 1000 ppm Nutrox OS + 1500 ppm Grape seed extract.
Commercial mix ®: mix of spices for the preparation of chicken nuggets, without preservatives neither synthetic colours, supplied by Pimursa S.L. (Murcia, Spain).

Notes