Can vitamin E and organic Se help stabilize omega-3 enriched eggs during cooking and storage?

Y. Ren, J. Wu, R. A. Renema, T. Perez, M. Betti, M. J. Zuidhof

SUMMARY

Vitamin E and Se are key components of the antioxidant system to reduce lipid peroxidation. In omega-3 eggs, omega-3 polyunsaturated fatty acids (ω-3 PUFAs) are susceptible to oxidative damage during cooking and storage. Furthermore, reactive oxygen species which appear during PUFAs oxidation can trigger the breakdown of cholesterol into cholesterol oxidation products (COPs).

This research focussed on the stability of n-3 PUFAs enriched eggs fortified with vitamin E and/or organic selenium (Sel-Plex) following cooking and storage. We found vitamin E and Se both decreased the oxidative damage of ω-3 PUFAs and cholesterol during cooking, however, vitamin E and Se has no effect during storage since 4 weeks storage had no effect on COPs and TBARs.

PROBLEM

Omega-3 polyunsaturated fatty acid (ω-3 PUFA) enriched eggs are a viable way to increase ω-3 fatty acids intake in the human diet. Vitamin E is normally added to poultry diets as an antioxidant to protect the ω-3 PUFA from breakdown. The double-bonds in the molecular structure of the ω-3 PUFA make them more susceptible to oxidative damage. Breaking down the ω-3 PUFA can trigger breakdown of cholesterol into cholesterol oxidative products (COPs). COPs should be minimized to protect human health.

Testing the stability of ω-3 PUFA through storage and/or cooking, and the exploration of multiple antioxidants to stabilize them have not received much attention. In addition to vitamin E, and the mineral, selenium had shown promise by supporting an antioxidant enzyme system that can minimize oxidation in the egg. Can we help the egg industry to produce better ω-3 enriched eggs by providing vitamin E and organic selenium in hens' diet? Can these results be used to promote healthy eating?

OUR APPROACH

- Eggs were collected from 120 laying hens (37wk old), which were randomly allocated to one of four ω-3 PUFAs enriched diets: Control (base diet only), Vitamin E (base + 200 IU/kg), Se (base + 0.3 mg/kg Sel-Plex), and E + Se(base + 200 IU/kg Vit E and 0.3 mg/kg Sel-Plex). Eggs were collected after 4 wk of feeding. Half of the eggs were sampled immediately, and half were stored at 4° C for 4 wk prior to sampling.
- Vitamin E content, fatty acid profile, COPs content (for testing the break down of cholesterol) and TBARs (for testing the break down of ω-3 PUFAs) were measured on raw, boiled and fried eggs.

OUR OBSERVATION

- The present of vitamin E and/or organic selenium were not significantly changed the total omega 3 and total omega 6 fatty acids during cooking or storage.
- Additional vitamin E and/or Se did not reduce the oxidation reaction during 4 wk storage, however, during cooking, TBARs results were significant changed by adding vitamin E and/or Se (Figure 1).

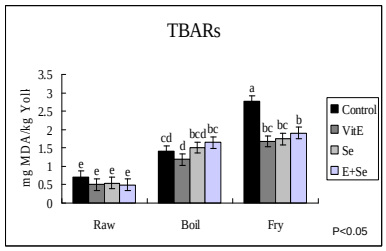

Figure 1. Vitamin E and/or Se effect on TBARs during cooking

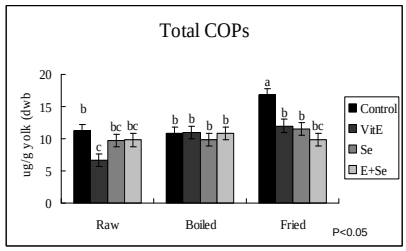

Figure 2. Vitamin E and/or Se effect on COPs during cooking

- Similarly, the amount of total COPs were lower when vitamin E and/or Se presented in ω-3 PUFAs eggs during cooking (Figure 2). But vitamin E and/or Se did not effect the COPs content after 4 wk storage.
- Breakdown of PUFAs and cholesterol were related, as results of COPs and TBARs analysis were correlated (r=0.7171; P <.0001).

WHAT DOES THIS MEAN

- Both Vitamin E and organic selenium offer protective effects by reducing oxidation in raw eggs, allowing a better ω-3 enriched egg to be marketed. A mix of antioxidants was beneficial for stabilizing long chain ω-3 PUFAs and is something for the industry to consider as they improve this product.
- Frying was the most damaging cooking method. It generated the most breakdown products. Other cooking methods may be preferable for health.

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CONTACT INFORMATION

- Dr. Jianping Wu
  Phone: 780-492 -6885
  E-mail: jwu3@ualberta.ca
- Dr. Robert Renema
  Phone: 780-492-3234
  E-mail: robert.renema@ualberta.ca