The benefits of hydroxy-selenomethionine on eggs

World population is expected to grow by over a third, reaching over nine billion people in 2050, with the main consequence being that the world will have to produce 70% more food. Eggs, due to their low production costs and the absence of cultural or religious obstacles to their consumption, represent the most promising and affordable source of animal protein.

by Michele De Marco, Global Scientific and Technical Manager, and Aurélie Moal, Global Marketing Manager, Adisseo. feedsolutions.adisseo.com

Fig. 2. The effect of dietary selenium on egg freshness (Haugh unit) (Thailand, 2016). Left, sodium selenite 0.3ppm. Right, Selisseo 0.3ppm.

Indeed, from a functional point of view, eggs have a moderate calorie content (about 150kcal/100g) and are a good source of excellent quality protein (6g per egg).

Eggs are also relatively rich in fat-soluble compounds. They can easily be enriched with some key nutrients and, therefore, be a nutritious inclusion in the diet for people of all ages and life stages.

Moreover, eggs offer great culinary versatility. They have the potential to provide essential nutrients to nutritionally vulnerable populations on limited food budgets.

Each person on the planet consumes, on average, 165 eggs per year, a figure that continues to increase globally.

Eggs can be consumed in different forms. They can be sold as whole eggs (table eggs) or processed (egg products) and are widely used in food manufacture, as a powder or in liquid form. In the industry, eggs are appreciated for their colouring, binding, gelling, foaming, emulsifying and nutritional properties.

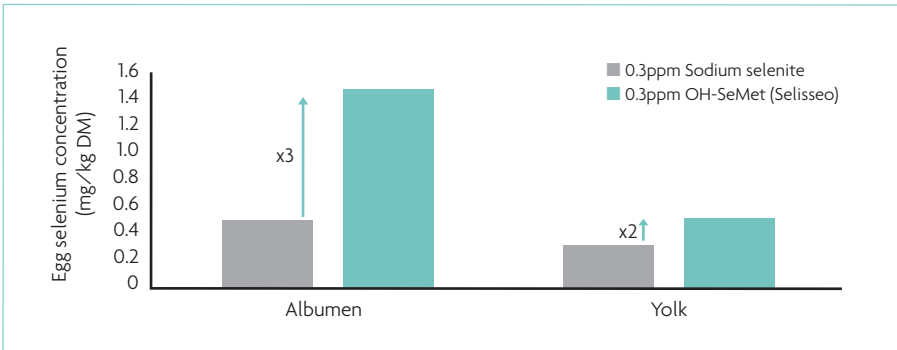
Selenium in eggs

Selenium (Se) is an essential nutrient and as an antioxidant participating in protective metabolic processes against lipid, protein and DNA oxidation. It has been shown that, together with other antioxidants (vitamin E), it is important for the support of embryo development. Se is transferred from the albumen to the embryo during the first two weeks of development.

The source and level of Se in laying hen diets will impact the Se content of eggs.

When organic selenium in the form of hydroxy-selenomethionine (OH-SeMet, Selisseo 2% – Adisseo France SAS) is fed to laying hens, the level of Se in eggs increases significantly. Selenium is almost equally distributed between egg yolk (58%) and albumen (42%). Compared to an inorganic selenium source, the use of OH-SeMet increases Se concentration in albumen (x3) and in the egg yolk (x2) – after four weeks of dietary administration at 0.3ppm Se (Fig. 1).

Fig. 1. Selenium concentration in albumen yolk (Egg trial in Asia, 2014).



Effect of OH-SeMet on the technological properties of eggs

Viscosity

Viscosity is a measure of a fluid's resistance to flow. The viscosity of the albumen is an important quality variable as it is related to its functional characteristics, such as its whipping, emulsifying and gelling properties. OH-SeMet significantly improves albumen viscosity, which is visually important to ensure the egg yolk stays in the middle of the white when fried (mirror eggs).

Foaming properties

Bulk foam is an agglomeration of gas bubbles separated from each other by thin liquid films. Foam quality is the percentage of volume that is gas, at a specified pressure and temperature. The foaming property of egg white is a major issue for the food industry and the factors influencing are still poorly understood. OH-SeMet improved

Continued on page 31

Continued from page 29
egg white cohesion from 29-week-old White Leghorn laying hens compared with negative control and sodium selenite.

● Gelatinisation properties
For cooked eggs, high rupture levels can be observed, but it does not appear to be a major problem in the food industry. Industries prefer eggs with a low gelatinisation temperature, in order to pasteurise egg without causing protein coagulation. OH-SeMet showed a better resistance to the rupture test and a lower speed of gelatinisation compared to sodium selenite.

● Eggshell quality
The eggshell plays a crucial role in protecting the contents of the egg from the microbial and physical environment. It also controls the exchange of water and gases. Eggshell quality is made up of a number of factors including: soundness of the shell, as well as egg shape and colour. Improving eggshell quality means increasing shell thickness and breaking strength – in order to reduce the number of cracked eggs and thus increase the number of saleable eggs. OH-SeMet tended to improve eggshell quality through enhanced static stiffness and fracture force.

● Freshness
Haugh units are indicative of the protein content of the egg white and therefore the quality of the egg (freshness). Haugh units are known to decrease with age. OH-SeMet tended to improve egg freshness after eight days of storage, compared to sodium selenite in 56-week-old Brown Rhode Island laying hens (INRA Agrocampus, France, 2016). In another trial carried out in Thailand, OH-SeMet was shown to improve Haugh units (Fig. 2).

OH-SeMet not only improves selenium deposition in eggs, but also enhances the technological properties of eggs (viscosity, foaming properties, gelatinisation properties, eggshell quality, freshness).

All of which contribute to profitability in the egg industry. OH-SeMet also positively influences the nutritional properties of eggs, which benefits human health.

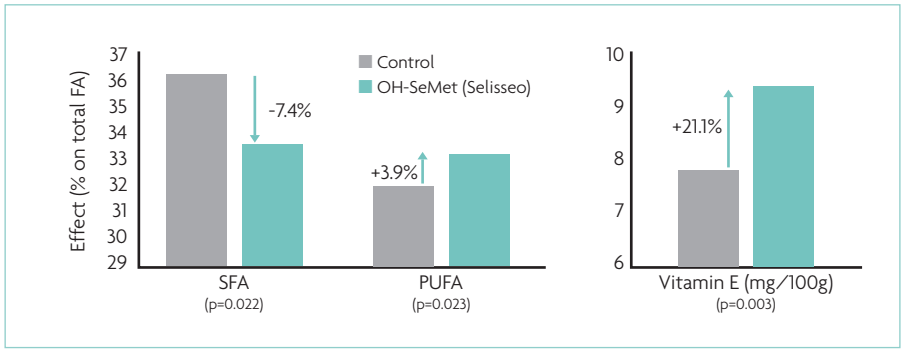


Fig. 3. Effect of dietary selenium on egg yolk fatty acid profile (% on total FA) and vitamin E content (University of Bari, Italy, 2015).

Benefits of selenium-enriched eggs

Selenium, found in the soil, is an essential trace element with recommended dietary allowances for humans that varies between 50 and 60µg per day – with small variations between genders and for particular categories (children, pregnancy).

Selenium is important for immunity and antioxidant defences, to protect the human body from stressors.

It has numerous benefits, including susceptibility to cardiovascular diseases, diabetes, certain cancers and the risk of infertility.

However, Se content of most food is normally low and highly variable (depending on geographical area of origin). Problems related to the deficiency of Se are an emerging issue for human health worldwide.

Many factors can affect the Se content of foodstuffs, including a different uptake rate by plants.

This in turn is related to plant type, soil, pH, microbial activity, rainfall and other biogeochemical parameters.

Human Se intake and status has been shown to be correlated to the Se concentration of soil in different geographical areas and hence the Se concentrations of edible plants grown in these soils. In China, Se deficiency is associated with Keshan disease, which is found in populations living in the Se-poor areas of Central China; that stretches from the northeast (Heilongjiang Province) to the southwest (Yunnan Province).

People could therefore consume Se-enriched foods with the aim of increasing their Se body level.

Many poultry farms in Asia and Eastern Europe produce Se-enriched eggs, which are sold at a price between 10 and 50% higher than standard eggs. Feeding laying hens with 0.3ppm Se as OH-SeMet enriched eggs to approximately 25µg Se per egg. Therefore, eating one egg a day can meet about 50% of the daily Se requirements.

Moreover, the supplementation of the diet of 18-week-old laying hens with 0.2ppm Se as OH-SeMet for 10 weeks positively influenced the egg yolk fatty acid profile compared to the control. It increased the content of polyunsaturated fatty acids (such as long chain n-3 fatty acid DHA – docosahexaenoic acid) and decreased the saturated fatty acid content.

Supplementing OH-SeMet (Selisseo) in the diet also markedly increased yolk total vitamin E level and reduced yolk cholesterol level (Fig. 3). ■

References are available from the author on request