Eggspectation

Organic egg verification tool

Eggs are nutritious, inexpensive, consumed worldwide, and they have been collected and eaten for centuries. Chicken eggs are the most widely accepted type of egg. They contain all the essential amino acids and provide many vitamins and minerals,e.g. vitamin A, folic acid, riboflavin, vitamin B12, choline, iron, potassium, phosphorus and zinc.

The colour of the yolk in eggs greatly affects consumers' purchasing behaviour, and pigments are commonly used as colourants. Carotenoids are a family of compounds containing over 600 fat-soluble plant pigments that are used as a colourant in egg production. They are supplied to the hens in their feed. Animal species vary in their abilities to assimilate carotenoids from feed, and in chickens, the factors affecting absorption of carotenoids are breed, fat content in feed, vitamins in feed, and gender. Therefore, the colouring effect of carotenoids on eggs depends on the interactions between the carotenoid composition of the feed and the animal itself. In organic egg production these pigments are supplied by feeding the hens particular natural plant-based products. Hens in conventional production often receive these pigments as artificial feed additives.

Organic produce integrity

Organic produce, including eggs, tends to retail at a higher price than their conventional counterparts, and the premium price makes them susceptible to fraud. Fair competition between producers and sustained consumer confidence are important for a sustainable organic food market. Paper trailing plays an important role, but at the same time tools that can verify end products present complimentary value. End verification of organic produce is complex, and is very dependent on the product examined. Therefore, it is unlikely that a unique marker that discriminates between organic and conventional produce will be found. However, a range of naturally present compounds that serve as a fingerprint may highlight the organic typicality of a particular organic product and may be used for discriminating organic from conventional.

Egg authentication

Wageningen University and Research Centre (RIKILT) in the Netherlands, has developed a method to verify the organic nature of eggs. The fingerprint of the natural carotenoids (carotenes and xanthophylls) in eggs are used to discriminate between production systems. The method requires an extraction step, followed by High Pressure Liquid Chromatography, a technique routinely used in laboratories worldwide. The fingerprints are subsequently compared by statistical methods.

The eggspectation study

In 2009 RIKILT conducted a study on about 2,000 eggs to evaluate three different analytical verification methods: carotenoid profiling, fatty acid profiling and isotope ratio mass spectrometry. The methods were chosen based on a literature review, which revealed methods that used commonly available laboratory equipment. The eggs were collected from about 50 Dutch farms, selected with the help of CPE, the Dutch poultry and eggs authority (Controlebureau voor Pluimvee, Eieren en Eiproducten) and Skal, the Dutch control body for organic production. The selection was based on the farms' location and size, and production methods: organic, free range and barn raised. At each farm, on three separate occasions, three eggs were collected and pooled into a single sample which was tested for carotenoid content by each of the three laboratories. Carotenoid profiling showed a 100% correct prediction of the identity (organic vs. conven-

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tional) for the organic eggs in this 'training set'. Furthermore, the eggs of 24 out of the 26 free range/barn farms were correctly predicted. These farms were located at the demarcation line between organic and conventional eggs.

Subsequently a validation set of Dutch and New Zealand eggs was collected and assessed with the carotenoid profiling method. All samples were correctly classified further supporting the robustness of this method. Results of this trial were recently published in the scientific journal Food Chemistry. In 2010 the training set was expanded to include more organic, free range and barn eggs, as well as eggs from caged birds. Again excellent results were obtained.

Practical applications

Although the trial was preliminary, the training set was of a sufficient size with regard to Dutch eggs to determine that carotenoid profiling can be used in practice for verifying the organic status of eggs. A single analysis of three pooled eggs costs about €75, but larger sets, and eventually further automation of the procedures will reduce sample analysis prices. At present, the method is applied in national surveys.

The models worked well for Dutch and New Zealand eggs, but for application of the method for eggs from other geographical origins further confirmation is still required. Italian eggs, for instance, showed a slight shift in profile compared to the Dutch eggs, but differences between Italian organic and conventional eggs appeared just as consistent as for the eggs from the Netherlands. Presently, funding is being sought for the testing the method on eggs from other origins within the EU context.

For discerning the underlying factors for identifying organic eggs, the poultry feeds used by the Dutch farms were examined as well. The methodology linked the egg and feed composition, in addition it also appeared to be able to discriminate between organic and conventional layer hen feeds. Furthermore, with this type of fingerprinting the typicality of specialty eggs (omega-3, or eggs with high animal welfare ratings) can also be highlighted.

In conclusion, it appears that the laboratory verification of organic eggs is a useful complimentary tool to paper trailing organic eggs. The method has attracted ample attention, since it is one of the first practical applications for verifying organic produce in the lab. ■

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Further information:

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Skal feedback on eggspectation

TOS asked Skal about their collaboration with the eggspectation study, and what they felt about the practical applicability of this test. Jan Hoekman, from the Skal Team Certification responded.

TOS: Could this test be applicable in practice by organic certification bodies and/or organic processors or traders to control the integrity of organic eggs?

Skal: In my opinion this test is a large opportunity for every certification body or processor/trader to carry out a random control on organic eggs checking them on the organic source. By using this test certification bodies also give a signal to the processors/traders and then maybe prevent some fraud.

TOS: Do you think it could be applied worldwide?

Skal: A confirmation of the test results for each country would be needed, but after confirmation, I expect that these tests will be applicable in every country of the world, as in New Zealand, which took part in the assessment.

TOS: Does SKAL plan to apply this method for the control of the integrity of organic eggs?

Skal: We have already used this test – in December 2010 – with good results, and we will use it regularly in the future.

TOS: What about the cost? Would it be affordable for a practical use?

Skal: Skal doesn't have a problem with the cost of the test, and the price will be lower when larger numbers are tested.