Egg quality – meeting consumer expectations

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The European Consumer Association (BEUC) has indicated some of the attributes (food quality factors) that are valued by consumers but, until recently, there had been little detailed information published specifically regarding consumer perception of egg quality.

However, data from consumer surveys performed over recent years has added greatly to our knowledge in this area.

In 2001, a study, involving 3,085 people, was performed in Spain with the specific objective of validating and ranking in eggs those attributes proposed by BEUC.

Not surprisingly, the survey showed that for consumers 'safety' and 'freshness' were the most important quality factors with 'nutritional value' and 'sensory characteristics' also being key parameters.

With regards to 'sensory characteristics', the results of surveys performed over the last 10 years in a number of European countries (France, Germany, Italy, UK, Spain, Poland and Greece) indicate that consumers value a number of tangible characteristics of the egg, most especially shell strength, albumen consistency and yolk colour.

Yolk colour

Yolk colour, both in terms of the colour per se and the variability in colour between eggs, is a very important parameter by which consumers judge the quality of eggs.

In the surveys, when offered samples of eggs with different yolk colours (measuring 8, 10, 12 and 14 on the DSM Yolk Color Fan (DSM-YCF – formerly the Roche YCF)), the majority of the people questioned in all countries expressed a preference for the egg yolks with the darkest colour hue (colour score 14).

Yolk colour in laying hens is primarily determined by the content and profile of pigmenting carotenoids present in their feed and can easily be adapted via feed ingredients to match consumer preferences. In this regard, it is surprising to note that in data published in 2004 by an independent quality control laboratory auditing eggs for supermarkets in Spain (analysis of 12,000 eggs during 2002/3 – see Fig. 1), yolk colour was the highest non-compliance to egg quality specifications (8.8% eggs below specification).

The DSM Yolk Color Fan.

There are several explanations as well as some potential solutions which may help minimise this effect.

In many cases, egg producers understand the target yolk colour as the average yolk colour they need to obtain.

Taking the example of a producer with a target DSM-YCF score of 12 (tolerance -1) in their retailer specification (see Fig. 2), by producing eggs to the target (DSM-YCF score 12 – red line), a percentage of the eggs produced will fail against the retailer specification due to normal biological variation.

The most straightforward way to counteract this and avoid such a high level of non-compliances is to increase the average yolk colour of the total egg production (blue line).

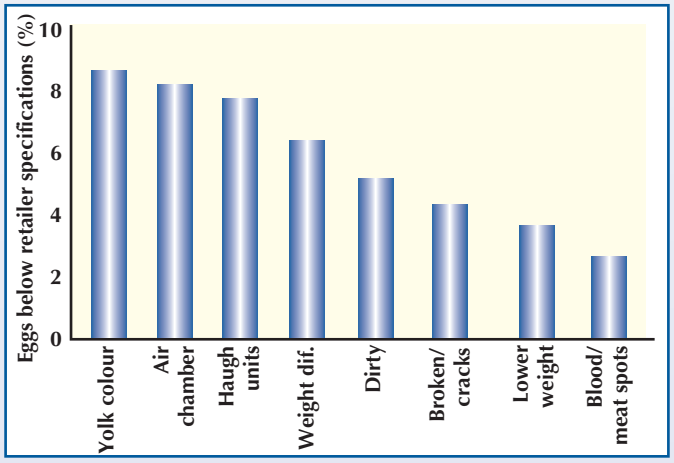
In addition to inherent biological variation, it is also important to minimise the effect of other factors which can also reduce the consistency of the yolk colour produced – the wider the distribution of yolk colours about the mean value, the higher will be the potential for non-compliance with the retailer specification.

For example, in order to achieve both the target level and homogenous distribution of the carotenoids in the feed, it is important to use reliable, uniform products which have both good stability (tel quell/premix/feed) and mixability characteristics.

Likewise, it is also important to provide an adequate level of yellow carotenoids in the feed to provide a good yellow base for the development of the required golden yellow colour in the egg yolk.

By achieving the correct levels of the most appropriate carotenoids in the feed, it is possible to routinely achieve the yolk colour expected by consumers whilst, at the same time minimising the degree of variability and thereby reducing the potential for non-compliances.

Fig. 1. Main 'non-compliances' with retailer specifications (QC laboratory, Spain, 2002-2003; 12,000 eggs). DSM Nutritional Products Egg Quality Symposium, Spain 2004.



Shell quality

Egg shell quality is an important factor both for consumers and for egg producers. In addition to being highlighted as a tangible egg quality attribute in the surveys, the loss of marketable eggs due to poor shell quality represents a significant financial loss to the industry.

Although a large number of factors including genetics, management practices, environment and nutrition are known to influence eggshell development, one of the key parameters involved is the high requirement (for example approximately 1.8-2.2g per egg) of calcium (Ca) for eggshell formation. If the required Ca is not available from the feed, then the

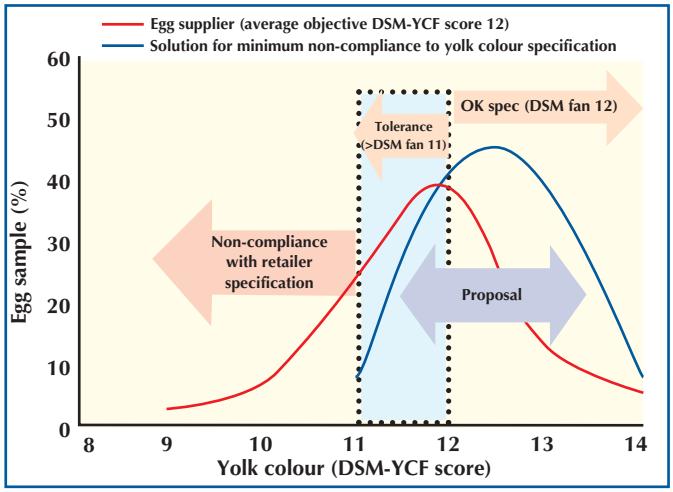


Fig. 2. Proposal for reducing 'non-compliances' for egg yolk colour. Hernandez, DSM Poultry Symposium, Netherlands 2004.

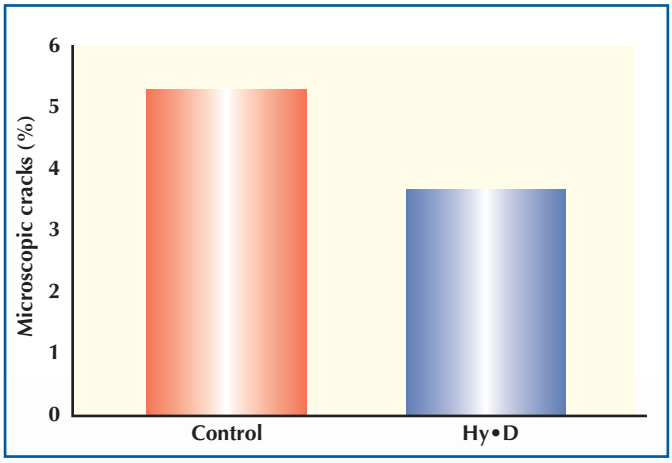


Fig. 3. Effect of Hy•D on the incidence of egg shell cracks in laying hens. Compilation of data from two field trials including 8,000+ laying hens. Calabotta (1997), Maryland Nutrition Conference.

hen will mobilise skeletal reserves. In the laying hen, Ca and phosphorus (P) homeostasis is, to a large extent, controlled by Vitamin D.

As such, vitamin D plays an important role in both skeletal development/maintenance and in egg shell formation.

However, although it is best recognised for its role in Ca and P metabolism, vitamin D has also been demonstrated to be involved in a number of other important physiological processes including cell growth/differentiation, immuno-modulation and fertility.

Besides photo-conversion of 7-dehydrocholesterol in the skin, feed represents the major source of vitamin D3 to most animals including laying hens.

However, for activity, vitamin D3 must first be metabolised, initially in the liver to 25-hydroxyvitamin D3 (25-OH-D3: the most abundant form of vitamin D in the serum) and then in the kidney to a number of different metabolites, the most important of which is 1,25-dihydroxyvitamin D3 (1, 25-(OH)2-D3). One of the most exciting developments in vitamin D nutrition in recent years has been the commercialisation of 25-OH-D3 (Hy•D from DSM Nutritional Products) in poultry feeds.

	Control	Hy•D + OVN	Difference
Egg weight (g)	65.88	66.36	+0.7
XL eggs (%)	7.5	10.1	+25.4
Broken eggs (%)	1.43	1.14	-20.3
Daily feed intake (g)	117.2	114.5	-2.3
Lay (%)	80.2	82.4	+2.7
Egg mass (g/d)	52.84	54.68	+3.5
Cumulative feed efficiency	2.218	2.094	-5.6

Table 1. Effect of Hy•D + OVN on the performance of laying hens. Soto and Hernandez, XXII World's Poultry Congress, Turkey, 2004.

Hy•D provides the nutritional benefits of vitamin D3 with additional advantages not possible even with increased amounts of vitamin D3.

Importantly, neither layers nor broiler breeders are able to convert sufficient vitamin D3 into 25-OH-D3 to provide optimum levels of this metabolite to support the birds skeletal development under the stresses of production and/or enteric disease insult.

Hy•D has been demonstrated to support the homeostatic function of vitamin D3 in pullet replacements and laying hens, this being important for the provision of sufficient minerals for incorporation into the bone matrix and for egg shell formation.

By maximising bone mineral density prior to lay and subsequently helping to maintain bone mass during production, birds receiving Hy•D have been shown to be less likely to succumb to problems later in the laying cycle resulting from a significant demineralisation of the bones such as osteoporosis/cage layer fatigue and reduced egg shell quality.

Supplementation with Hy•D has been demonstrated to have a positive effect on egg shell quality, both in terms of egg shell thickness and egg shell strength.

Based on data from two large-scale field trials, Calabotta (1997) reported a reduction in the 'percent cracks' in laying hens following supplementation with Hy•D (see Fig. 3).

Similarly, in a practical commercial trial in laying hens designed to assess the effects of Hy•D + Optimum Vitamin Nutrition (OVN) supplementation, Soto-Salanova and Hernandez (2004) reported a reduction in the number of cracked/broken eggs together with an improvement in productivity and feed efficiency in those birds receiving feeds containing the Hy•D and OVN vitamin levels (see Table 1).

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Fig. 4. Weight loss of Hy•D + OVN eggs during storage at room temperature for 21 days (90 days on trial). Soto-Salanova and Hernandez, XXII World's Poultry Congress, Turkey 2004.

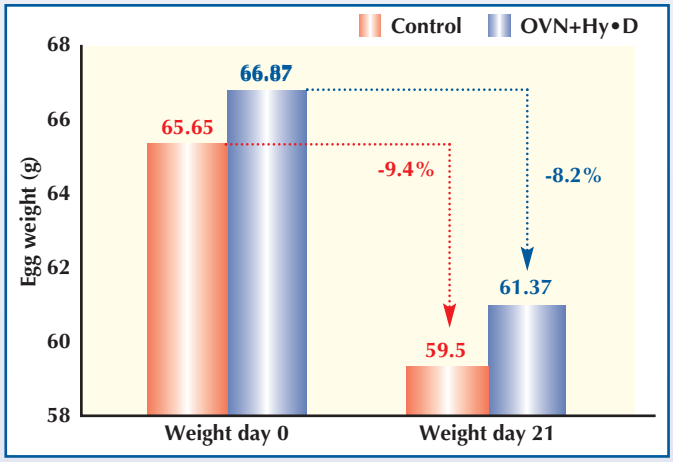
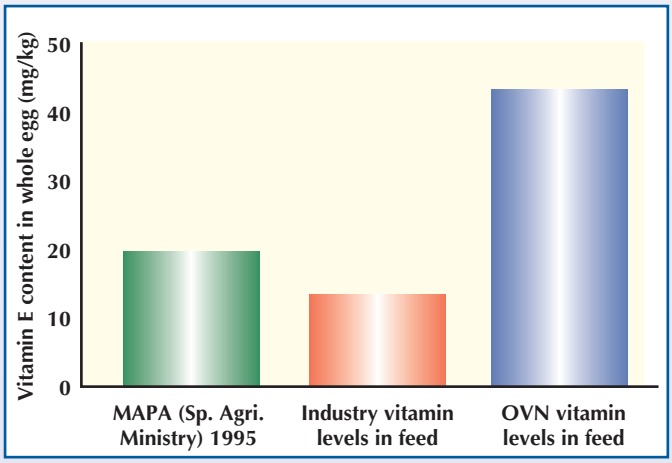


Fig. 5. Nutritional value of OVN eggs – vitamin E. Perez-Vendrell et al, Xth European Symposium on the Quality of Eggs, France 2003.



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Interestingly, the authors also reported that the weight loss of eggs stored for 21 days at room temperature was lower for the treatment versus the control group (Fig. 4), an important finding and one which should be re-evaluated in future research.

However, based on the information available to date, it is clear that the use of Hy•D can potentially help the egg industry to reduce the financial losses associated with shell quality problems and to satisfy the requirements of consumers for a good quality egg shell.

Yolk colour is a very important parameter by which consumers judge the quality of eggs.

Egg nutritional value

In addition to being an excellent source of high quality and easily digestible protein, eggs are also a good source of certain vitamins and minerals, the levels of vitamins found in eggs being directly linked to the levels present in the diet of the hen.

However, as layer feed conversion rates have improved dramatically (by approximately 40%) during last 30 years, it is necessary to re-evaluate the vitamin levels in feed if we want to offer eggs to consumers with at least the same nutritional value as in the past.

Recently, a trial was performed in laying hens to compare the effects of two different dietary levels of vitamins (control diet based on the average layer vitamin supplement level used in Spain versus a diet supplemented to OVN levels on the vitamin content of eggs produced).

The results from the trial indicated that, in comparison with the control group, eggs from the hens fed the OVN diet had significantly higher concentrations of almost all vitamins (A, E, B1, B2, B12, pantothenic acid, folic acid and biotin – see Table 2), resulting in eggs with a higher nutritional value in this respect than the control eggs.

A further interesting observation from the trial was that for some vitamins (for example vitamin E, see Fig. 5), the levels found in the control eggs were lower than the corresponding levels for those vitamins given in the official nutrition tables published by MAPA (Spanish Ministry of Agriculture, 1995).

This fact is probably related to the improvement in feed conversion efficiency (mainly due to better animal genetics and management) without a corresponding adaptation of vitamin levels in the feed.

In comparison, OVN eggs contained a higher level of those vitamins which allowed eggs to have a nutritional value similar to or even better than the ones published in official nutritional tables. What is clear is that by optimising the vitamin nutrition of laying hens, the vitamin content and, thereby, the nutritional value of eggs can be improved.

Table 2. Effect of OVN on the vitamin content in whole eggs. Perez-Vendrell et al, Xth European Symposium on the Quality of Eggs, France, 2003.

	Control	OVN	Difference (%)
Vitamin A (IU/kg)	5782[a]	6185[c]	7
Vitamin E (mg/kg)	12.94[a]	43.06[d]	233
Vitamin B1 (mg/kg)	0.52[a]	0.65[c]	25
Vitamin B2 (mg/kg)	3.95[a]	4.11[b]	4
Vitamin B12 (mg/kg)	14.22[a]	22.32[d]	57
Calcium pantothenate (mg/kg)	14.95[a]	18.50[c]	24
Folic acid (mg/kg)	0.49[a]	0.67[d]	37
Biotin (µg/kg)	219.80[a]	324.90[d]	48

Within each row: [a,b] significantly different at P<0.05, [a,c] significantly different at P<0.01, [a,d] significantly different at P<0.001

Summary

In this article we have reviewed a number of the egg quality aspects that are important to consumers and for which, the Industry has already developed a significant amount of scientific and marketing knowledge.

Meeting consumer's expectations is very important as, in addition to reinforcing their perception of eggs as a quality product, reducing the potential for 'non-compliances' can represent a significant financial saving to the industry.

As such, quality can very much be viewed as a value to the industry and the efforts and advances made in this area should be communicated to consumers at every opportunity. ■