THE ECONOMICS OF EGG SIZE

BFREPA have shown that many more consumers are buying large eggs rather than medium or mixed weight boxes.

More than half the eggs laid in Britain by free range hens are classed as large or very large which results in the other half being small or medium. By consumers changing their habits this will support what the hen lays naturally, as egg size will increase over time as the hens get older. BFREPA launched a campaign to encourage consumers to change buying habits. It has been explained that a medium and a large egg have the same size yolk, which is where the main nutritional value is contained, just a larger quantity of white. However, to incentivise the production of more large eggs, the price to producers for these eggs has increased whilst the price of mediums has decreased. Zoe Kay explores this important but contentious issue, getting the thoughts of industry professionals.

Size issue

Egg size can be affected by many variables, such as genetics, diet, and lighting. The longer it takes to extend the daylight hours from 10-16, the more sexually mature hens will be when they come into lay, and therefore the larger the eggs will be. Usually, hens that are free range will lay 55% large and 45% medium, small and second-class eggs combined. Many people think that the demand for large eggs is being driven by the retailer, because of their promotions, and therefore the perception of added value. Consumers

buying more large eggs than medium has created an imbalance, however if they were to buy more mixed weight boxes, this would support what the hen lays naturally.

Pushing birds beyond their natural capacity for egg production puts them at risk of a range of health issues. There is the potential for increased stress, feather loss or higher feed consumption – at the less severe end. In extreme cases, where birds are encouraged to lay large eggs, can result in high rates of second-quality eggs, prolapsed oviducts and secondary issues like egg peritonitis. It is important to consider the genetics, rearing, early and late lay diets, when looking to control egg size – as well as ensuring good health of the flock.

Veterinary matters

Ian Jones from the Hafren Veterinary Group is concerned about the effect that producing more larger eggs has on the health and welfare of laying hens. "My practical experience has shown that when egg size goes 1-2 grams over target for age in most breeds, you can see issues. Some flocks cope with laying more large eggs, whilst others don't." He said that's it's important to remember that looking at average egg size only gives part of the picture. "There will naturally be a spread of egg weights in the flock so if the average weight is two grams over target, then some eggs will be four grams heavier. It is these very large eggs that can cause damage to the vent and cloaca."

This damage can then lead to contamination and infection of the reproductive tract as the birds continue to lay further eggs. "E. coli can colonise the bird through the uterus causing peritonitis and salpingitis, infection of the ovary. This is when you start to see elevated mortality levels and the vet is called in to do post mortems and we see where the infection is getting to." Large eggs can also cause physical damage and result in prolapse, when blood on the eggs is seen. "This increases pecking from other hens, resulting in lesions and further damage of the vent. It is important to stress that these issues don't affect every flock. However, large eggs are one of the key causes of mortality in laying hens."

Ian has started working with a major packer to collect data on mortality and compare it with egg size. "It's very early days but the aim is to collect data to see if there is a correlation between average egg size and mortality. We will also look at other reasons why mortality may be high, such as stress during the housing order."

He explained that although a large egg is 63 grams, for producers to achieve over 50% large eggs they need to aim for an average egg size of 65 grams. "Target egg size is therefore significantly greater for those wanting to maximise large eggs. This means you will get some eggs that are 68 or 69 grams - it is these that cause mortality issues. Hens can be laying an egg that is too big for their body size."

Ian also described how management and nutrition of birds in rear differs, when large eggs are required. "They are often at a higher body weight at the end of rear, but it is day length that stimulates the hens to come into lay. "Breed manuals provide changes to lighting patterns depending on average body weight. So, if birds are heavier than expected for an age, they may start producing eggs when their bodies aren't ready for it. Just because they are heavier doesn't necessarily mean that their reproductive organs are more developed. Flocks bought into lay more quickly can become stressed and an increase in aggressive behaviour is seen. I'm seeing a lot of stressed flocks; I think we need to be cautious and not push hens too hard."

Why egg size matters
Martin Humphrey explained the thoughts behind the company's decision to produce their 'Why egg size matters' site. "The aim of the website is to support producers who are under pressure to increase their production of large eggs. They can link to this site from their own, to help educate the public that 'bigger isn't better'. Hens lay a range of egg size throughout their life – this is natural and should be backed up by what is available on the supermarket shelves."

The website provides consumers with information on how eggs develop in a chicken, detailing the formation of the yolk, white, membranes and shell. Humphrey Feeds & Pullets are keen to make the point that egg quality is completely unrelated to egg size. Martin stressed, "as producers are well aware, a good quality egg depends on several factors, including the health of the laying hen, the hen's welfare (particularly if she is stressed), the suitability of her feed and degree to which it is tailored to her needs." The public are advised that 'the best way to ensure your eggs are high quality is therefore to buy from a supplier whom you trust to treat their hens properly and focus on their health and welfare.'

Alison Colville-Hyde, South West Poultry Specialist at Humphrey Feeds & Pullets believes it is important for consumers and producers alike to understand that too many large eggs can harm a hen. "We know that naturally a laying hen will produce a range of egg sizes over her lifetime. However, if only the larger eggs sell, there is pressure on producers to disrupt this natural cycle and encourage their flocks to produce a larger egg than is usual for their age and breed." As a hen's reproductive system changes with age, the eggs she lays naturally become larger. Maximum egg size can be expected when birds are around one year old.

Website facts

The average hybrid hen will comfortably lay well over 330 eggs from the time she starts to lay at 18-21 weeks of age to the end of her laying period around 72 weeks.

At her peak she will lay one a day for many weeks, but over time eggs are less regular. These eggs will range in size from small to medium, large and a few extra-large. The age, breed and nutrition of the flock, their management and even the weather will affect the size of the eggs.

- **Small eggs (under 53g) initially for several weeks, and sometimes very small or oddly shaped eggs.**
- **Medium sized eggs (53g to 63g) follow as the hen develops, from around 22 to 37 weeks old.**
- **Large eggs (63g to 73g) may be produced from 33 weeks of age onwards, but more commonly start from 40 weeks or later. This will depend on the breed and the feed being used.**
- **Extra Large eggs (over 73g) are rarer, sometimes produced at the onset of lay when a bird produces two yolks at the same time, or towards the end of the laying period.**

Across the world, families rely on eggs as a basic food source: rich in vital nutrients and ready for use in breakfast or baking, picnics or pasta. British poultry farmers follow high quality standards and companies like Humphrey Feeds & Pullets work hard to keep the flocks in their care healthy and productive.

https://www.humphreyfeedsandpullets.co.uk/egg-size-matters

"However, physiological factors such as bird genetics, pullet quality, age, feed; and environmental factors such as lighting and temperature, can also play a role. By tweaking some of these factors a flock can be encouraged to produce a greater proportion of larger eggs within the constraints of the supplier's breed targets."

She stated that it is not just the hen that can suffer as egg size increases, as larger eggs tend to have thinner shells. "There is a limit to the amount of calcium carbonate a hen can access from her diet and bones (around 4g) so there is a finite quantity of shell she can produce for each egg. If she lays larger eggs for any reason, the shell must stretch more thinly, making the egg less robust. This will increase the number of seconds, causing waste as well as financial loss to the egg producer."

Egg practicalities

Martin postulated that, "the fact that 'large eggs' are now stipulated in many recipes, rather than a total weight of eggs (a more accurate measure) may be behind this false demand for large eggs." BFREPA have highlighted that the demand for large eggs is having a major impact on poultry farmers by devaluing the smaller egg. They wrote to celebrity chefs last year, asking them to stop their obsession with large egg and several have come out in support of the campaign.

Research into the effects of the pandemic on the egg market showed that at the height of lockdown consumers would buy any egg they could find on supermarket shelves, regardless of size or colour. About 13 billion eggs are eaten in Britain every year and consumers have generally always bought more large eggs than medium. If consumers were to buy more mixed weight boxes, this would support what the hen lays naturally; a trend that appeared in consumer surveys as a result of COVID19.

Retail pressure and effects of the pandemic

Ideally, egg producing farms would find a ready market for all good quality eggs produced by their flocks, irrespective of size. This is possible when selling eggs as mixed sizes into the independent marketplace, where consumers occasionally demand larger eggs for specific meals but generally accept natural variations in size (and therefore price). Schools, restaurants, and those using eggs on a larger scale have always understood that provided the right total weight of eggs is used, how many or what size they are does not matter.

However, most producers have contracts with packers who market the eggs, largely for retail sale through supermarkets. Supermarkets dictate the size of the eggs they want on their shelves, and have recently demanded more large eggs, meaning consumers are led to buy these rather than considering what they actually need.

This supermarket drive for large eggs has left suppliers with too many smaller eggs.

Closure of many schools and restaurants due to COVID-19 has further reduced the market for these eggs, leaving producers with unsold eggs, or forced to reduce their price on small and medium eggs. Without action to correct the imbalance, millions of healthy hens laying high quality eggs are at risk, along with the livelihoods of egg producers, farm employees and all those along the egg-production chain whose goal is to provide pocket-sized nutrition to the nation.

Martin believes that education is key to helping people understand that eggs naturally vary in size. "Eggs can be easily weighed if quantity is important, and the distinction between a medium egg of 62g and a large egg of 63g does not make it a better egg, just a bit bigger." He also thinks people would benefit from a guide of which eggs to use for what purpose. "Just as potatoes are now sold as 'for baking, roasting or salads', savvy packers such as St Ewes are marketing larger eggs for breakfast boiling, medium 'all-rounders' for kids and baking, and 'flavourful mixed size eggs' as a natural selection box. With the right help it is likely that consumers would understand that they needn't always buy large eggs – especially if this will help laying flocks lead healthier lives."

Nutritional basis

Ralph Bishop from Premier Nutrition explains the cost implications of feeding hens to produce larger eggs. "In general, you use a higher density ration particularly in early lay, which includes higher methionine levels to boost egg size. The increased inclusion of this amino acid along with linoleic acid increases the cost of the diet. However, it is important to remember that nutrient intake is also influenced by feed intake. Sometimes in later lay nutrient intake increases with an increase in feed intake, which can lead to increased egg size. It's about nutritional and financial investment in the bird in early lay to establish desired egg size."

He discussed further how it's important to focus on the egg size you are aiming for from the start. "By 30 weeks you need a rock-solid layer that is ready for next 40 to 50 weeks of production. If egg weight gets too high, too soon, it will affect the longevity of bird." Ralph reiterated that although average egg size is important, the distribution of egg size is critical. "Close monitoring of egg size, feed intake and diet specification, allows producers to best manage their egg size profile for the optimal economic return." Managing egg size will also

assist in managing egg quality to prevent producers getting too many seconds, which aren't as valuable. Ralph stated that it is important to measure feed intake vs. egg mass output, in order to optimise feed efficiency and therefore economic efficiency. "Egg mass output is egg mass x production %, or what are they are producing each day."

When producers want to increase laying cycle by six to eight weeks, egg size can become limiting. "Producers need to get eggs of the right size but also the right quality, to maximise the profitability of the flock. It comes down to feeding the right diet at the right time, to optimise nutrient efficiency; as monitoring production data."

The premium offered to producers for large eggs in recent years is considerable, which warrants extra consideration, planning and investment – to maximise profitability and meet the demands of the consumer. Producing these large eggs creates physiological and metabolic stresses on the birds, particularly in young and smaller hens - requiring careful management." This financial premium and the need to produce large eggs early on, also puts financial pressures on the poultry enterprise.

EggNomics

Harbro has been working with producers to help them evaluate and cost out changes to their business, using a programme called EggNomics, designed in house by Iain Lyle, Harbro monogastric Technical Support Manager. Not only is the programme used as a tool to monitor and benchmark numerous production KPIs, Iain explained how it can also be used by producers to evaluate changes in production targets.

"Our poultry specialists use EggNomics as an essential tool using existing farm data to work out the viability of potential changes and the impact it will have both on production and profitability. Using 'What If' calculations, informed decisions can be made relating to all aspects of production, from infrastructure to nutrition or duration of lay."

Table 1 - Flock Profitability Scenarios

Variables	Current Egg Prices				If one price for mixed sizes	
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Seconds	4	8	4	8	4	8
Mortality	2	10	2	10	2	10
Egg Size Aim	Large	Large	Medium	Medium	Mixed	Mixed
Flock Length	72	72	80	80	80	80
Egg Production	320	300	350	320	350	320
Egg Price	106	106	91	91	90.9	90.9
Profit	**Economic modelling using EggNomics**					
Per Flock		-£46,434		-£68,632		-£27,461
Per Bird Housed		-145p		-215p		-97p
Egg Size	61.4g	63.5g	63.0g	62.0g	62.1g	61.6g

For this article he ran several scenarios through the model to see the combined effects of egg price, cycle length, egg production, seconds and mortality have on flock profitability, outlined in Table 1. The feed costs and average egg prices were taken from those published in the August issue of the Ranger.

The scenarios were compared in pairs to look at the difference in profitability, depending on performance of farms aiming for large (egg weight 64g) or medium eggs (egg weight 63g) and if there was a standard price for all eggs (egg weight 62g). "There were a lot of assumptions made to allow for the comparison, those aiming for a large egg kept hens until 72 weeks whilst it was presumed that for medium or mixed size eggs the flock length could be extended to 80 weeks. Obviously, there are a lot of reasons why performance may be poor. For example, when considering mortality, we presumed that on average birds would die at a point 90% of the way through their life. This fits with the assumption that as the birds age and eggs get bigger there will be more problems, although egg size was slightly reduced in poor performing flocks." Iain also assumed that feed intake per bird would be the same in each pair, but certain disease issues could in fact cause a reduction.

When comparing scenarios 1 and 2 where a large egg was the target, there was a significant reduction in profit when performance was poor. However, looking at 3 and 4 which were focused on a medium egg, there was less overall income due to the lower egg price and the production of more smalls. "In the case of a poor performing flock, they would lose 30 eggs per bird and have an even greater reduction in profit. If producers had a mixed egg size contract, then the reduction in profit would be intermediate to the large and medium egg scenarios." In this last comparison producers wouldn't be making a lot at the start of the laying period but would have less profit to lose. "In all cases the reduction in egg size based on overall poor performance had the greatest influence on profitability. However, if for example a producer lost a lot of birds at the start due to smothering, egg size wouldn't have been affected and therefore there would be less of a reduction in profits. This analysis only compares the difference in profit between the scenarios and cannot ascertain what producers would make overall without knowing their individual situation."

Longer cycles

Iain carried out another modelling exercise to evaluate the financial benefit of increasing flock length for someone focusing on medium eggs, with the results shown in Table 2 below.

Table 2 - Financial benefits of increasing flock length for medium egg production

Whole flock economic model		
Current situation	**Criteria**	**What if...**
32,000	**Flock Size**	32,000
95%	**Liveability**	95%
72	**Weeks Housed**	80
53	**Weeks in Lay**	61
646 tonnes	**Total Egg Mass**	723 tonnes
2.31	**Feed Efficiency**	2.38
322 per bird	**Production**	362 per bird
4%	**Seconds**	6%
(12,390)	**Flock Profit**	(£221)
-	**Annual difference**	£10,790

All data is fictional, and not based on actual results. Harbro do not accept any financial liability for business decisions made as a result of this calculator.

"The assumptions included both flocks being housed at 16 weeks of age and there being a three-week turnaround period. Other financial indicators were the same as in the previous models."

"By increasing the life of the flock, the time the unit is not producing is reduced. In the situation modelled for a flock laying to 72 weeks the producer would lose £12,000. By increasing the length of lay by 8 weeks that lose reduced to £221; a difference of nearly £11,000."

This exercise shows that these is a significant positive improvement on profitability of increasing flock length. There is a slight reduction in feed efficiency as happens naturally in the older bird, but you get more eggs laid. An increase in seconds is also to be expected with older birds, as the shells get thinner, and more cracks appear.

"Everyone's situation is different, but it shows the economic advantage of extending the cycle, without having to push the birds to lay larger eggs. If anyone would like to use the EggNomics model to evaluate potential changes in their production strategy, they should get in touch."

Doug Steele *(Harbro Poultry Sales Manager Scotland)* – 07775 724766

Sam Parker *(Harbro Poultry Specialist England)* – Sam Parker – 07384 254115

"Producers would need to evaluate their situation on an individual basis, these are imaginary situations only. In these scenarios we assumed that the producer had no debt and that the cost of the shed was written off within 12 years." All the fixed costs of production were included in the model such as labour, power, vets etc. The cost of an overdraft of £150,000 was also included to cover the cost of buying pullets and feed up to the start of lay.

Considering this exercise, Iain posed a question for the future of egg production. "As genetics improves along with management and nutrition it would be interesting to see how the economics stack up for even longer cycles. We could compare the profits of a long-lived medium egg producing flock, of say 100 weeks – to a large egg producing flock of 80 weeks. At this point perhaps the price differential between medium and large eggs wouldn't have such a large effect to profitability and certainly sustainability would be improved."

Conclusions

The greater potential loses of a poor performing medium egg flocks, along with the greater potential profit are clear reasons why producers want to focus on the large egg market. However, there are wider sustainability issues to consider when thinking about the pressure to produce more large eggs. Longer cycles are more challenging in this situation, but longer cycles increase efficiency and hence sustainability. There has been a lot of discussion about food waste, both in the home and at retailers. For eggs, shell quality is key to minimising wastage and there is no doubt that large eggs have thinner shells. This increases the potential for wastage at the packer and retailer – even before it reaches the consumers kitchen.

In the end it comes down to supply and demand – supermarkets say than the consumer wants a large egg. But during the pandemic they didn't care, they just wanted eggs – the desire for any egg overriding the preference for size, colour etc. There are now more boxes of mixed weight eggs on the shelves. This has been the case for some organic and specific breed brands for some time. However, it is interesting to note that certain brands, such as Golden Yolks, state simply '6 free range eggs' on the front of the

box, focusing instead on the 'delicious, deep golden yolk'. And 'Egg of mixed sizes' listed in small print on the side of the box.

The question is that if the public understood fully the welfare, environmental and financial implications of buying large eggs perhaps they would see they may not be the best choice. Just as the UK public have moved to buying more free-range egg than colony eggs. Campaigns by BFREPA, feed companies and producers are important to educate the public to make informed buying choices. However, whilst there is a high demand for large eggs, it is imperative that egg size is managed and it isn't allowed to 'run away', which can have both financial and welfare implications.