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THE BENEFITS OF CAGE-FREE

COMMUNICATING THE BENEFITS OF CAGE-FREE EGG PRODUCTION

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INTRODUCTION

Animal-friendly products are considered healthier, tastier, more hygienic, safer, acceptable, authentic, environmentally friendly, and traditional by consumers.[1]

But just because consumers think it, doesn't mean it's true.

As a strong coalition of animal protection organisations calling for the end of caged egg production, it is critical we hold up to scrutiny, and maintain the integrity of our campaigns. Here, we look at the science behind the perceived benefits of cage-free egg production to help ensure we, as advocates for animals, present only the most compelling reasons for adopting higher welfare, cage-free egg production, without ever undermining our primary position: that battery cages result in unacceptable suffering and must be eliminated from global egg supply.

As well as outlining the welfare benefits, we review the evidence base for some of the most commonly held beliefs[1,2,3] about cage-free eggs and egg production:

1. Animal Welfare
2. Consumer Demand
3. Health Benefits
4. Appearance and Taste
5. Antibiotic Use
6. Zoonoses and Foodborne Diseases
7. Environmental Impacts

[1]Alonso, M.E., Gonzalez-Montana, J.R.& Lomillos, J.M. (2020). Consumers' concerns and Perceptions of Farm Animal Welfare, *Animals*, **10:** 385

[2] https://faunalytics.org/people-buy-free-range-eggs/

[3] https://www.foodnavigator-asia.com/Article/2017/05/24/Reasons-for-buying-free-range-eggs-Assumptions-turned-upside-down#

ANIMAL WELFARE

Key message: Cage-free systems allow birds to perform highly motivated natural behaviours, whilst cruel cage systems cannot.

The strongest argument for adopting cage free egg production will always be animal welfare. Hens in cage-free systems are provided with the space and resources to perform their highly motivated natural behaviours, including: dustbathing, scratching / foraging, running, comfort behaviours (such as wing flapping), perching and laying their eggs in a nest. In conventional cages hens cannot properly perform ***any*** of these behaviours and subsequently suffer from poor bone health, fear, high levels of reproductive disease and disorders, stress and frustration.

It is estimated that the switch from caged to cage free production equates to ***thousands of hours of pain prevented for every hen raised in an indoor cage-free aviary instead of a cage***.[4] Some of the key drivers of this reduction in pain (including both physical and psychological) include:

- Ability to nest: Laying hens are highly motivated to lay eggs in a nest and will work hard to gain access to a discrete nest site prior to egg laying. Research has shown they will exert more effort to obtain access to a nest prior to laying than to gain access to food after 4h food deprivation, demonstrating it is a high priority behaviour.[5] Cage-free systems include discrete, secluded nesting sites; by switching from cage to cage-free systems, producers can ensure hens can perform this important behaviour.

- Ability to forage: Hens in commercial cage-free systems will spend up to 40% of their waking hours foraging (scratching and ground pecking), even though food is freely available. It is a deeply ingrained behaviour. Frustration and a redirection of foraging behaviour to other birds' feathers (injurious pecking) can be caused when litter access is restricted.[6] A lack of litter - as in caged systems - is therefore a welfare concern.

- Performance of comfort behaviours: Hens will not only be frustrated by an inability to properly perform a range of comfort behaviours (e.g. wing stretching, wing flapping, feather ruffling, preening and stretching) in cages, but are likely also to experience a feeling of permanent discomfort

[4] Alonso, W.J. & Schuck-Paim, C 2021. The Comparative Measurement of Animal Welfare: the Cumulative Pain Framework. In: Quantifying Pain in Laying Hens: a blueprint for the comparative analysis of welfare in animals; https://tinyurl.com/bookhens

[5] Cooper, J.J. & Appleby, M.C., 2003. The value of environmental resources to domestic hens: a comparison of the work-rate for food and for nests as a function of time. *Animal Welfare,* 12, pp.39-52.

[6] Nicol, C. J., C. Pötzsch, K. Lewis, and L. E. Green. 2003. "Matched Concurrent Case-Control Study of Risk Factors for Feather Pecking in Hens on Free-Range Commercial Farms in the UK." *British Poultry Science* 44 (4): 515–23.

- Improved health: bone health is poorer in caged hens because of an inability to perform load bearing exercise, resulting in a high likelihood of fracture at depopulation. Hens in caged systems are predisposed to fatty liver haemorrhagic syndrome[7] (FHS). Mortality due to egg peritonitis syndrome is higher in birds from conventional cages, probably due to higher fat deposition in these birds - a risk factor for the disease.

- Positive experiences: positive experiences and behavioural freedoms are not only positive in themselves, they can also help to counter the negative impact of painful experiences, enabling hens in cage-free systems to better cope with stresses.

[7] Shini, A., Shini, S. and Bryden, W.L. (2019) 'Fatty liver haemorrhagic syndrome occurrence in laying hens: impact of production system', *Avian pathology: journal of the W.V.P.A*, 48(1), pp. 25–34.

CONSUMER DEMAND

Key message: consumers want eggs from higher welfare, cage-free systems, perceive them to be a better quality and more nutritious product & will pay more for them.

Consumers are becoming increasingly aware of animal welfare, with a growing perception that the conditions for farmed animals should be protected and improved.[8] Recent studies from around the globe - including Kenya,[9] Taiwan,[10] China,[11] Spain[12] and the US[13] - show consumer concern for animal welfare, including a willingness to pay a premium for higher welfare standards.

In response to consumer demand, multinationals have developed higher welfare products[14] and, increasingly, cage-free policies covering their global supply chains.[15] It is expected that these markets for higher welfare eggs will continue to increase. In Australia, for example, consumer demand for cage-free is predicted to increase industry revenue at an average rate of 1.1% a year over the next 5 years.[16] In Kenya, a transformation to middle level income by 2030 (Kenya Vision 2030), is expected to result in changing food consumption patterns more focused on healthy, convenient and superior value foods.[17]

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[8] Alonso, M.E., Gonzalez-Montana, J.R.& Lomillos, J.M. (2020). Consumers' concerns and Perceptions of Farm Animal Welfare, *Animals*, **10:** 385

[9] Otieno, D.J. & Ogutu, S.O. (2019). Consumer willingness to pay for chicken welfare attributes in Kenya, *Journal of International Food and Agribusiness Marketing*, DOI: 10.1080/08974438.2019.1673275

[10] Yang, Y.-C. (2018) 'Factors affecting consumers' willingness to pay for animal welfare eggs in Taiwan', *International Food and Agribusiness Management Review*, 21(6), pp. 741–754.

[11] Lai, J. *et al.* (2018) 'Factoring Chinese consumers' risk perceptions into their willingness to pay for pork safety, environmental stewardship, and animal welfare', *Food control*, 85, pp. 423–431.

[12] Rahmani *et al.* (2019) 'Are consumers' egg preferences influenced by animal-welfare conditions and environmental impacts?', *Sustainability: Science Practice and Policy*, 11(22), p. 6218.

[13] Spain, C.V. *et al.* (2018) 'Are They Buying It? United States Consumers' Changing Attitudes toward More Humanely Raised Meat, Eggs, and Dairy', *Animals*, 8(8), p. 128.

[14] Abubakar, M., Manzoor, S., & Iqbal, A. (2018). Introductory Chapter: Animal Welfare—Global Perspective.

[15] THL (2021). Celebrating 100+ Globa Cage-Free Policies. Available at: https://thehumaneleague.org/article/100-global-cage-free-policies. (Accessed 25.10.2021)

[16] Blaikie, V. 2012, *IBISWorld AU Industry Report A0172. Egg Farming in Australia,* viewed 25 October 2021, IBISWorld.

[17] Ndenga, C., Kabuage, L.W. and Bett, E.K. (2018) 'Economic analysis of Consumer demand for indigenous chicken eggs in Kenya', *Economic analysis and policy*, 9(17). Available at: https://core.ac.uk/download/pdf/234648541.pdf.

HEALTH BENEFITS

Key findings: while some studies found cage-free eggs to have some nutritional benefits, others found no differences - or conflicting findings - regarding the nutritional values of eggs from different systems. Benefits are often related to pasture access in free-range and organic systems.

What we can say: ***Cage-free eggs, especially those from free-range and organic systems, are shown to have some nutritional benefits compared to caged eggs.***

What we cannot say: ***Cage-free eggs are healthier than caged eggs.***

Caged eggs have been found to have higher levels of unhealthy saturated fatty acids, but also healthy monounsaturated fats, whilst organic eggs had higher healthy polyunsaturated fats (n-6 and n-3).[18]

Hens with pasture access were shown to lay eggs with significantly vitamin E and total omega-3 fatty acids than hens in cages,[19] whilst the ratio of omega-3 and -6 was found to be nutritionally more beneficial in eggs from organically reared hens.[20] Organic hens were found to produce eggs with higher levels of some fatty acids beneficial to human health, but lower levels in others, when compared to those from caged systems.[3]

The beneficial effects found in birds with range access is likely due to the supplementation of their standard diet with grass, insects and worms, and thus the effects may vary.[21] Hens' diets can be supplemented to improve the nutritional value of eggs, in any system.[22]

[18] Dalle Zotte, A. *et al.* (2021) 'Is the farming method (cage, barn, organic) a relevant factor for marketed egg quality traits?', *Livestock science*, 246, p. 104453.
[19] Karsten, H.D. *et al.* (2010) 'Vitamins A, E and fatty acid composition of the eggs of caged hens and pastured hens', *Renewable Agriculture and Food Systems*, 25(1), pp. 45–54.
[20] Terčič, D., Žlender, B. and Holcman, A. (2012) 'External, Internal and Sensory Qualities of Table Eggs as Influenced by Two Different Production Systems', *АГРОЗНАЊЕ*, 13(4), pp. 555–562.
[21] Réhault-Godbert, S., Guyot, N. and Nys, Y. (2019) 'The Golden Egg: Nutritional Value, Bioactivities, and Emerging Benefits for Human Health', *Nutrients*, 11(3). doi:10.3390/nu11030684.
[22] Zaheer, K. (2015) 'An updated review on chicken eggs: Production, consumption, management aspects and nutritional benefits to human health', *Food and nutrition sciences* , 06(13), pp. 1208–1220.

APPEARANCE AND TASTE

Key findings: Although consumers perceive there to be an improved taste, research suggests this is not the case, with often contradictory results

What we can say: ***Consumers associate cage-free eggs with improved taste and quality.***

What we cannot say: ***Cage-free eggs have superior taste and other quality attributes compared to caged eggs.***

Darker yolks are generally considered healthier and more appealing by consumers. One study, comparing eggs from caged and organic hens, found the eggs from caged hens had a darker colour because of the ability to include synthetic pigments in the feed of conventional birds.[20] Other studies have found the opposite, with hens able to forage on grass, alfalfa, nettle[23] or saltbush[24] producing eggs with improved yolk colour. The area of range hens have access to can also affect egg colour, with greater range access (4m2 / hen to 10m2/hen) resulting in more deeply coloured yolks.

There are few studies investigating the effect of different systems on taste. One American consumer panel preferred the taste of hard-boiled eggs from caged hens compared to those from free-range hens, but had no preference when the eggs were scrambled,[25] whilst a Chilean panel found no difference in the taste of eggs from different systems.[26]

[23] Hammershøj, M. and Johansen, N.F. (2016) 'Review: The effect of grass and herbs in organic egg production on egg fatty acid composition, egg yolk colour and sensory properties', *Livestock science*, 194, pp. 37–43.
[24] de Koning, C. *et al.* (2019) 'Saltbush (Atriplex nummularia and A. amnicola) as potential plants for free-range layer farms: consequences for layer performance, egg sensory qualities, and excreta moisture', *Poultry science*, 98(10), pp. 4555–4564.
[25] Al-Ajeeli, M.N. *et al.* (2018) 'Consumer acceptance of eggs from Hy-Line Brown layers fed soybean or soybean-free diets using cage or free-range rearing systems', *Poultry science*, 97(5), pp. 1848–1851.
[26] Berkhoff, J. *et al.* (2020) 'Consumer preferences and sensory characteristics of eggs from family farms', *Poultry science*, 99(11), pp. 6239–6246.

ANTIBIOTIC USE

Key findings: there is evidence in some species that higher welfare farming results in lower antibiotic use; we do not have data for antibiotic usage in caged vs cage-free egg production

What we can say: ***Higher welfare farming is associated with reduced antibiotic usage compared with conventional farming.***

What we cannot say: ***Cage-free egg production is associated with reduced antibiotic usage compared to conventional egg production***

Consumers are generally concerned regarding the use of antibiotics in livestock farming, perceiving a human health risk.[27] An estimated 66% of global antibiotics are used on livestock,[28] and higher welfare farming systems have been shown to be associated with reduced use, e.g. in pig[29,30] and broiler production.[31,32] Although we are aware of no firm figures regarding the use of antibiotics in conventional versus alternative egg production, the UK's largest egg producer, Noble Foods, reports lower antibiotic use in its free-range compared to its caged production in the 3 years from 2017-2020.[33]

[27] Busch, G. *et al.* (2020) 'Perceptions of antibiotic use in livestock farming in Germany, Italy and the United States', *Livestock science*, 241, p. 104251.
[28] "Farm Antibiotic Use." n.d. Accessed April 11, 2022. https://www.saveourantibiotics.org/the-issue/antibiotic-overuse-in-livestock-farming/.
[29] Tarakdjian, J. *et al.* (2020) 'Antimicrobial use on Italian Pig Farms and its Relationship with Husbandry Practices', *Animals : an open access journal from MDPI*, 10(3). doi:10.3390/ani10030417.
[30] Nielsen, C.L. *et al.* (2021) 'Antibiotic and medical zinc oxide usage in Danish conventional and welfare-label pig herds in 2016-2018', *Preventive veterinary medicine*, 189, p. 105283.
[31] 'Abstract-Book-ESPWelfare.pdf#page=165' (no date). Available at: https://wpsa.fr/images/publications/Abstract-Book-ESPWelfare.pdf#page=165.
[32] Vissers, L.S.M., Saatkamp, H.W. and Oude Lansink, A.G.J.M. (2021) 'Analysis of synergies and trade-offs between animal welfare, ammonia emission, particulate matter emission and antibiotic use in Dutch broiler production systems', *Agricultural systems*, 189, p. 103070.
[33] https://www.noblefoods.co.uk/wp-content/uploads/2020/08/NOBL3434_CSR_TREND_REPORT_A4_DIGITAL_AW_V2-1.pdf

ZOONOSES AND FOODBORNE DISEASES

Key findings: Disease incursion in all systems is dependent on biosecurity, local poultry density and bird stress as well as a number of other factors. However, overall evidence points to a lower occurrence of Salmonella in non-cage compared to cage systems[34]

What we can say: ***Overall evidence points to a lower occurrence of Salmonella in non-cage compared to cage systems***

What we cannot say: ***Cage-free eggs are safer than caged eggs***

Cage free farming appears to convey some advantages, for example lower rates of *Salmonella* contamination of eggs, however, risks are dependent on farm location (e.g. poultry density), structural design, farm management & bird stress, rather than system per se.[34] Risk of egg contamination and disease incursion can be managed well within cage-free systems, but never eliminated.

Bacterial cell counts on eggshells were higher from enriched cages compared to free-range systems in a 2021 study[35], whilst an Italian study from the same year found higher levels of certain dioxins and polychlorinated biphenyls in free-range systems compared to barn, caged and organic, however, all levels were within permitted parameters.[36]

FAO[37] notes that the H5N1 HPAI panzootic *cannot be attributed to any one production system, as farms in all systems have been affected and played some role in the persistence and spread of this disease*. It does not call for the housing or intensification of poultry in order to reduce risk, instead to enhance biosecurity as appropriate in different systems. In Britain, however, government data shows there were a greater number of outbreaks in 'commercial' vs 'commercial free-range' poultry flocks in Great Britain between October 2021 and March 2022.[38]

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[34] EFSA Panel on Biological Hazards (EFSA BIOHAZ Panel) *et al.* (2019) 'Salmonella control in poultry flocks and its public health impact', *EFSA journal*, 17(2), p. e05596.
[35] Kulshreshtha, G. *et al.* (2021) 'Impact of Different Layer Housing Systems on Eggshell Cuticle Quality and Salmonella Adherence in Table Eggs', *Foods (Basel, Switzerland)*, 10(11). doi:10.3390/foods10112559.
[36] Ghidini, S. *et al.* (2022) 'The influence of different production systems on dioxin and PCB levels in chicken eggs from Emilia-Romagna and Lombardy regions (Italy) over 2017-2019 and consequent dietary exposure assessment', *Food additives & contaminants. Part A, Chemistry, analysis, control, exposure & risk assessment*, 39(1), pp. 130–148.
[37] Sims, L.D. (no date) *Risks associated with poultry production systems*. Available at: https://www.fao.org/WAICENT/FAOINFO/AGRICULT/againfo/home/events/bangkok2007/docs/part2/2_1.pdf (Accessed: 6 April 2022).
[38] 'hpai-europe-220207.pdf' (no date). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1054058/hpai-europe-220207.pdf.

ENVIRONMENTAL IMPACTS

Key findings: Environmental impact differs between systems depending on the impact being measured, often favouring more intensive production. But environmental impacts should not be a barrier to the uptake of cage-free systems as good management and management interventions can help to improve environmental performance. Some novel cage-free systems operate as carbon-neutral.

What we can say: ***Cage-free systems can be managed to minimise their environmental impact, without compromising animal welfare***

What we cannot say: ***Cage-free egg production has a reduced environmental impact / is better for the environment than caged egg production***

The environmental impact of an egg production system is dependent on the impact being measured. Studies have shown, for example, that ammonia and dust levels are highest in non-cage systems, whilst methane levels did not differ.[39] A 2017 lifecycle inventory and impact assessment of the main production systems, found all non-organic systems to have similar results, whilst organic systems had lower resource use and emission intensities.[40] A 2022 study showed that organic systems had the lowest impacts in 9 of the 10 measures studied, whilst conventional cages had the lowest impacts of the non-organic systems.[41] The authors note that across *all* systems GHGs and acidifying emissions have declined due to improved feed efficiency.

Controlling mortality brings environmental benefits, important to many consumers. It is estimated that if UK producers improved mortality rates inline with the top performing 25% of producers, GHGs could be reduced by 25%.[42] Mortality in cage-free systems was found to be comparable with caged, averaging 3-6% at 60 weeks.[43] Year on year reductions in mortality were achieved as producers gained experience of the systems. Further adjustments to systems and breeds, as we learn more about how to manage their interactions, are expected to lead to further improvements. As a good commercial example, *Noble Foods*, the UK's largest egg producer, has reported continued reductions in their

[39] Molnár, S. and Szőllősi, L. (2020) 'Sustainability and Quality Aspects of Different Table Egg Production Systems: A Literature Review', *Sustainability: Science Practice and Policy*, 12(19), p. 7884.
[40] Pelletier, N. (2017) 'Life cycle assessment of Canadian egg products, with differentiation by hen housing system type', *Journal of cleaner production*, 152, pp. 167–180.
[41] Turner, I., Heidari, D. and Pelletier, N. (2022) 'Life cycle assessment of contemporary Canadian egg production systems during the transition from conventional cage to alternative housing systems: Update and analysis of trends and conditions', *Resources, Conservation and Recycling*, 176, p. 105907.
[42] Weeks, C.A., Lambton, S.L. and Williams, A.G. (2016) 'Implications for Welfare, Productivity and Sustainability of the Variation in Reported Levels of Mortality for Laying Hen Flocks Kept in Different Housing Systems: A Meta-Analysis of Ten Studies', *PloS one*, 11(1), p. e0146394.
[43] Schuck-Paim, C., Negro-Calduch, E. and Alonso, W.J. (2021) 'Laying hen mortality in different indoor housing systems: a meta-analysis of data from commercial farms in 16 countries', *Scientific reports*, 11(1), pp. 1–13.

free-range mortality levels despite an increased longevity of their flocks. In 2018 and 2020, mortality was higher in its caged farms than its free-range.

With feed being the biggest contributor to an egg's carbon footprint,[25] adjustments in feed (namely a movement away from imported soya) can help to reduce the carbon footprint of egg production (again in all systems).

There are two carbon neutral cage-free systems currently in operation that we are aware of: *Kipster Farm* in the Netherlands and *Respectful Eggs* in the UK. *Morrisons supermarket*, also in the UK, has plans to introduce a carbon neutral egg brand in 2022