

Comparison of three hatching systems

2: chick welfare

This article continues the investigation into three hatching systems: on-farm hatched (HO), hatchery-fed (HF) and conventionally hatchery hatched (HH). Part one, published in International Hatchery Practice Vol 35 No. 5, dealt with chick performance and addressed the multifunction of the chick's yolk sac, the importance of feed and water immediately after hatching, the effect of the hatch-window on chick immune systems, and the effects of early post-hatch feeding.

In the UK, the welfare of farm animals has been considered a formal discipline since 1965, when the Brambell Committee suggested that farmed animals should have five basic 'freedoms' of movement, such as the freedom to stretch and the freedom to turn around. These can be considered the original components of animal welfare.

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However, they are rather narrow, so to take account of a broader range of animals' physical and behavioural needs, these Five Freedoms were modified in 1979 by the United Kingdom's Farm Animal Welfare Council (FAWC, 1979).

The new modifications proposed that all farm animals should have the following:

- Freedom from hunger and thirst.
- Freedom from discomfort.
- Freedom from pain, injury and disease.
- Freedom to express normal behaviour.
- Freedom from fear and distress.

The Five Freedoms have been highly influential, and OIE accepts them as one of the guiding principles governing animal welfare. They are also referenced in most European welfare legislation, by veterinary and animal welfare organisations worldwide, and form the basis for OIE Terrestrial Animal Health Code Article 7.1.1.

However, they also have drawbacks. In particular, it is not easy to decide which normal or innate behaviours are important for animals in captive environments. Recently, the European Welfare Quality consortium has expanded and clarified the components of animal welfare, proposing a set of four principles and 12 criteria, as shown in Table 1.

Table 1. Welfare principles and criteria as defined by welfare quality.

Welfare principles	Welfare criteria
Good feeding	Absence of prolonged hunger Absence of prolonged thirst
Good housing	Comfort around resting Thermal comfort Ease of movement
Good health	Absence of injuries Absence of disease Absence of pain induced by management procedures
Appropriate behaviour	Expression of social behaviours Expression of other behaviours Good human-animal relationship Positive emotional state

Navel condition (% per class)	HH	HF	HO
Good	46.3	40.9	28.2
Moderate	53.5	58.8	70.2
Poor	0.2	0.4	1.6
Red hocks	0.9	0.4	10.7
Total culled during 39 days	1.39	2.3	1.57

Table 2. Chick quality (Silva et al.2021).

Major welfare issues

Poultry welfare is affected by genetics, by the hatching, rearing and adult housing environments, by the methods of transport and slaughter employed, and to a great degree by the attitudes and standards of care of the stock persons. The term animal welfare is defined as 'the welfare of an individual is its state in regards to its attempts to cope with its environment' (Broom, 1986).

In 2018, the Dutch revised a domestic law to ensure chicks have access to feed within 36 hours of hatch rather than the current 72 hours. The regulations, made by the Council of the European Union in 2005, state that chicks should be

transported to their grow-out destination within 72 hours of hatch.

Van de Ven et al. 2013, indicated that, at hatch, no difference was found in bodyweight (BW) or yolk-free body mass (YFBM) among chicks of different hatching times; Higher weights were presently found in the heart, liver, stomach, intestines, and lungs in patio chicks (on-farm hatching) compared with traditional hatchery chicks, whereas no organ weight differences were noted in the previous study.

The authors summarised that chicks hatching early in the hatch window seem less matured at hatch, based on lower organ weights compared with later hatching chicks.

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Table 3. Production performances: values calculated from table results.

Body weight (g)/hatching system	HH	HF	HO
Day 0	36.9	43.4	46.6
Day 7	167	182.3	188.4
Day 39	2,634	2,718	2,750
Total culled (%)	1.39	2.3	1.57
Diff. live weight compared to HH	0	84	116
Cumulative growth rate (%)	7138	6263	5901
Cumulative feed intake (g/chicken)	3823	3,962	4,045
Diff. feed intake (g/chicken)	0	139	222
FCR for extra live weight and feed intake	0	1.65	1.91
FCR non-significant (NS)	1.45	1.46	1.47
European Production Efficiency Factor (EPEF) (NS)	426.9	434.8	442
Net Live weight	2,597	2,675	2,703
Net FCR	1.47	1.48	1.50

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In patio chicks, increased body and organ weights, yolk uptake, glucose, and T3 levels indicate an advanced metabolic rate and physiological development, probably as a result of early feeding, and developments were more pronounced in earlier hatching chicks.

The present data indicate that at the moment of chick pulling, the physiological status of chicks is affected both by hatching time and by the length of exposure to post-hatch conditions, especially feed and water deprivation, or access.

De Jong et al. 2018 studied the comparison of performance, health and welfare aspects between commercially housed, hatchery-hatched and on-farm hatched broiler flocks. The on-farm hatching was compared to conventional hatching. In two successive production cycles on seven farms, a total of 16 on-farm hatched flocks were paired to 16 control flocks, housed at the same farm.

They reported that on-farm hatching resulted in a higher bodyweight at day zero and day seven, but day-old chick quality as measured by navel and hock quality was worse for on-farm hatched birds.

Body weight, first week and total mortality, and feed conversion ratio at slaughter age were similar for both on-farm hatched and control flocks. On-farm hatched flocks had less footpad dermatitis, which was likely related to a tendency for better litter quality in on-farm hatched flocks at 21 days of age in

Conventionally hatched chicks at Bromarço, Poland.



Breast myopathies	HH	HF	HO
Distribution (%) of WB scores in the total sample ¹			
0 = Normal consistency	24.56	16.07	15.60
1 = Hard consistency	34.72	35.76	36.97
2 = Very hard consistency	40.70	48.17	48.33
Distribution (%) of WS scores in the total sample ¹			
0 = Normal, no distinct white lines	9.81	5.14	5.22
1 = Moderate, small white lines (<1mm thick)	37.02	31.53	21.61
2 = Severe, large white lines (1-2mm thick)	48.87	57.69	66.86
3 = Extreme, thick white bands (>2mm thick)	4.30	5.64	6.31

Table 4. The HO and HF chickens had higher, thus worse, WB and WS scores compared with HH chickens (Silva et al.2021).

comparison to control flocks. No major differences in gross pathology or in intestinal morphology at depopulation age were found between treatments.

De Jong et al. 2018 measured chick welfare and reported that gait and latency-to-lie (LTL) scores and observations of femoral head necrosis (FHN) and tibial dyschondroplasia (TD) in dissected birds did not indicate differences in these leg disorders or walking ability between on farm hatching and traditional hatching.

Also, the same author De Jong et al. 2020, reported that although the score of footpad dermatitis (FPD) was higher for traditional hatchery than hatching on-farm – the scores for chicken gait, hock burn, cleanliness, and injuries were all significantly increasing, that is getting worse, with increasing age, but was slightly higher for on-farm hatching than the traditional hatchery. On-farm hatching did not significantly improve body weight and feed conversion ratio at slaughter age, thus does not seem to have a long-term effect on productivity.

Souza da Silva et al. 2021 investigated three hatching systems, on-farm hatched (HO), hatchery-fed (HF), or conventionally hatchery-

hatched (HH). They reported that, for hatch of fertile and cases of embryonic mortality, residual yolk sac weight had no significant differences.

Chick quality data of navel condition, shown in Table 2, reflects one of the important chick quality measures. Poor chicks (mostly cull chicks) compared to the traditional system (HH) were extremely high – by 800% and 200% of HO and HF, respectively. Moreover, the HO group had less quality navel and higher red hocks than the other two groups. Finally, the total culled chicks were significantly less for HH, as shown in Table 3.

Data in Table 3 shows that despite a higher slaughter live weight and higher feed intake, both were better for HO, but FCR and EPEF was not significantly different between the three systems. This suggests that there was a hidden financial cost of using hatch-fed and on-farm systems (as shown in Table 3) indicating a high mortality, lower chick quality and, in addition, lower meat quality.

A higher prevalence of breast myopathies (BMM) at slaughter age in hatched and hatchery-fed chickens was found compared with conventionally hatched chicks.

Table 4 shows both HF and HO chickens had worse woody breast

(WB) and white striping (WS) scores at slaughter compared with HH chickens. The WB and WS are muscle myopathies observed in fast-growing broiler chickens. The WB often appears together with WS and there seems to be a relationship between fast growth rate and the occurrence of these breast myopathies in broilers. Thus, heavier chickens with high breast muscle yield and faster growth have consistently showed higher WB and WS scores, and this also seems to be the case for the OH and HF broilers.

Xi Huang and Dong Ahn (2018) found that the dramatic improvements in the growth rate and breast muscle size and yield in broilers through the intensive genetic selection, and the improvement in nutrition and management over the past 50 years have introduced serious abnormalities that influenced the quality of breast meat.

The abnormalities include pale-soft-exudative (PSE) conditions, deep pectoral muscle (DPM) myopathy, spaghetti meat (SM), WS and WB that have serious negative implications to the broiler meat industry. The incidences of PSE and DPM have been known for several decades, and their prevalence, aetiology and economic impact have been well discussed.

However, other abnormalities, such as SM, WS and WB conditions, have been reported just for a few years although these conditions have been known for some time.

The newly emerging quality issues in broilers are mainly associated with the Pectoralis major muscles, and the incidences have increased dramatically in some regions of the world in recent years. As high as 90% of the broilers are affected by the abnormalities, which are expected to cause from \$200 million to \$1 billion economic losses to the US poultry industry per year. ■

References are available from the author on request