European study on the comparative welfare of laying hens in cage and non-cage systems

Vergleichende europäische Studie zum Wohlbefinden von Legehennen in Käfig- und Nicht-Käfig-Systemen

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Introduction

In laying down minimum standards for the protection of laying hens EU Council Directive 1999/74/EC (1999) defines three major categories of housing system; alternative (non-cage) systems, unenriched (conventional) cage systems and enriched (furnished) cage systems. According to this Directive, conventional cages will be prohibited on 1st January 2012, leaving only two categories of housing system. All categories however comprise a wide variety of different models, and it has been difficult to compare bird welfare between these systems. A better indication of welfare in relation to housing system can be made by including sub-categories of housing system (FIKS-VAN NIEKERK and ELSON, 2005).

Conventional cages (CCs), described in the Directive as unenriched cage systems, are small and barren and provide little or no opportunity for behaviours such as nesting, perching, foraging and wing flapping. Furnished cages (FCs), called enriched cages in the Directive, contain nest boxes and perches, have litter areas for foraging, are fitted with suitable claw-shortening devices, have greater height than conventional cages and are operated from the outside of the system. There are three categories of group size in FCs; large ones. (FCLs) accommodating over 30 hens, medium sized ones (FCMs) with between 15 and 30 hens and small ones (FCSs) with up to 15 hens. Non-cage systems (NCs), known as alternative systems in the Directive, are operated from inside the system. They allow greater movement of hens and a wider behavioural repertoire than CCs and FCs, and provide nesting, perching, foraging and dust bathing facilities. There are several categories of NCs; barn systems which are single-tiered, multi-tiered aviaries both with integrated or non-integrated nest boxes, and portal systems that have elevated perforated floors, the top tier of which is a single level under which operators can pass, with integrated nest boxes and the whole of the ground floor surface covered with litter. Some NCs allow the hens no access outside, some have limited access to outside enclosures (winter gardens/verandas) and some have continuous daytime access to land mainly covered with vegetation (free range). Free-range houses may be static or mobile.

The present study was designed to include all these systems and categories on farms in the United Kingdom, Germany and the Netherlands. The objective of this study is to provide information about the comparative welfare of laying hens housed in this wide variety of egg production systems, using evaluation criteria based on the Swedish poultry welfare monitoring system (TAUSON and HOLM, 2002). In earlier welfare studies, as affected by housing system, for example FREIRE et al. (2003), VITS et al. (2005) and WALL et al. (2004), attempts have been made to assess the level of bird welfare within individual systems. In others, bird welfare has been compared between a limited number of systems (usually two), for example LEYENDECKER et al. (2005), MICHEL and HUDONIC (2003) and TAUSON and HOLM (2001). Few, if any, such studies have encompassed a wide range of systems and included the free-range system.

Thus, as far as is known, this is the first such study in which bird welfare has been assessed in a consistent way across a wide range of production systems and designs and the systems then compared on that basis. The LayWel project (2006) probably came closest and covered many more farms in more European countries but, since it was based on historic data from many sources, several different methods of welfare assessment were involved rather than a standard consistent one. The results obtained in the present study reported here should also indicate how good a tool the Swedish Welfare Standards monitoring one is for the purpose of comparing bird welfare across systems. This interim report includes data and results up to about two thirds of the way through the study. The information provided and the tentative conclusions drawn should therefore be treated with caution and checked against the final report which will be produced in mid 2007.

Materials and methods

This three year study, due to conclude in 2007, involves assessments on thirty-nine flocks in eight modern CCs, ten FCLs, four FCMs and two FCSs. Some of these flocks are housed in a variety of NCs including three single and three multi-tier aviaries (barns) with and without verandas as well as nine free-range systems, both fixed and mobile house.

Production and mortality are recorded throughout the laying period for each flock. Feed usage is recorded between 16 and 72 weeks of age in weekly periods on a house basis. Body weight between 16 and 72 weeks of age is recorded at regular intervals, including about 35 and 60 weeks of age, to check whether the hens follow the breed-
ers recommended growth curve. The number of hens housed at 16 weeks of age and all deaths between 16 and 72 weeks of age are recorded in four-week periods. The total number of eggs collected each day is recorded for each house between 20 and 72 weeks of age.

Physical condition assessments are carried out on thirty hens from each flock at about 35 and 60 weeks of age according to the Swedish poultry welfare monitoring system (Tsusso et al., 2005). A limited number of carefully trained ADAS scientific officers conduct these assessments on all sites including those abroad to ensure consistency. Feather scores are carried out separately for both the back and wing areas of the hens. A feather hygiene score is carried out on a whole bird basis. Hens are assessed for the number of peck wounds to the comb and for rear and back wounds, including the base of the tail. Hens are assessed for evidence of keel bone deformity and a bumblefoot score is carried out. Hens are also assessed for the number of broken claws per hen.

Environmental assessments are taken at about 35 and 60 weeks of age for each flock. On the day of sampling, environmental monitoring is carried out of ammonia level (ppm), carbon dioxide level (%), dust level (mg/m3), inside and outside temperature (°C) and inside relative humidity (%).

The basics of the evaluation programme are results obtained on physical condition, mortality and production in relation to minimum requirements stipulated by the Swedish Board of Agriculture. The physical condition assessments are given as percentages of defect birds. Each physical condition parameter is scored from 1 to 4, where 1 means a serious defect and 4 means very good condition. For the physical condition assessments, only scores of 1 and 2 are included in the minimum requirements. Those hens are counted in the total percentage of defect hens. Hens that score 3 or 4 for any parameter count as a non-event.

As the study is still not finished, results are presented as arithmetic means, only.

Results

The following are only interim results and as such should be treated with caution until all the relevant data is complete. The 60 weeks of age monitoring has not yet been carried out for nine of the flocks. However, there is already some indication that the results from the complete data set may differ in some respects from the interim results presented here.

Production and mortality

The feed usage (see Figure 1) for hens in CCs (116.7 g/b/d at 35 weeks and 113.5 g/b/d at 60 weeks) and FCs (110.9 g/b/d at 35 weeks and 104.7 g/b/d at 60 weeks) is considerably lower than for hens in NCs (142.5 g/b/d at 35 weeks and 123.1 g/b/d at 60 weeks). Despite their lower feed usage, at 30 weeks of age, the average bodyweight of hens in CCs (1.88 kg) and FCs (1.89 kg) is higher than that of hens in NCs (1.83 kg).

Egg production in most flocks is good throughout lay, although it is higher in cages than in NCs. In cages there is a peak in production at around 23 weeks of age between 89% and 98%, and egg production remains between 77% and 82% at 70 weeks of age. In NCs there is a peak in production at around 25 weeks of age of between 72% and 82%, and egg production remains between 62% and 81% at 70 weeks of age.

Mortality in CCs, most FCs and some NCs remains low to 70 weeks of age (see Figures 2, 3 and 4). Evidence to date suggests that mortality may be highest in free-range systems and that several flocks in this system will fail the Swedish standard of 9% cumulative mortality at 80 weeks of age since they have either or almost have reached that figure by 45 weeks of age (see Figure 4).

Physical condition

At 35 weeks of age, the percentage of hens with naked back areas (see Figure 5) is below the maximum limit of 25% for all flocks to date except three free-range systems (flocks 28, 40 and 41). At 60 weeks of age, flocks 2, 4, 7, 11, 13, 17, 20, 21, 28, 32, 33, 34, 36, 38 and 39 have a percentage of hens with naked back areas that is higher than the maximum limit of 25% (see Figure 5). These flocks, which are mainly NCs, some FCLs and a CC with hens with intact beaks, do not meet the Swedish welfare standards for back area. Therefore, all FCMs and FCSs and some FCLs meet the Swedish welfare standards for back area.

Figure 1. Average feed usage (g/b/d) for hens in CCs, FCs and NCs at 35 and 60 weeks of age.

Figure 2. Cumulative mortality (%) between 16 and 70 weeks of age for the conventional cage flocks in relation to a maximum limit of 9% as stated in the Swedish poultry welfare monitoring system.

Kumulative Mortalität (%) zwischen der 16. und 70. Lebenswoche der Hennen in den konventionellen (CC) und ausgestalteten (FC) Käfigen sowie in den Nicht-Käfighaltungen (NC) in der 35. und 60. Lebenswoche.
At 35 weeks of age, the percentage of hens with naked wing areas is below the maximum limit of 25% for all flocks to date. At 60 weeks of age the percentage of hens with naked wing areas is below the maximum limit of 25% for the majority of FCSs, FCMs and a few NCs. Therefore, these systems meet the Swedish welfare standards for wing area.

At both 35 and 60 weeks of age, all flocks to date meet the Swedish welfare standards for rear and back wounds, feather hygiene and broken claws. To date, all CCs, all FCs and some NCs (all barn systems, a few free-range systems and most multi-level aviaries) meet the Swedish welfare standards for comb wounds. All CCs, FCMs and FCSs monitored so far have met the Swedish welfare standard in terms of keel bone deformity. The multi-tier aviaries exhibited the greatest keel bone deformation. To date, all flocks except a barn system have met the Swedish welfare standards for bumblefoot.

**Environment**

To date, air condition has been mostly good with low to moderate levels of dust and low levels of ammonia and carbon dioxide. However, ammonia and dust levels are higher in NCs than in cages. Fluctuations in temperature are partly due to seasonal variation, as measurements are carried out at different times of the year and relate to normal conditions in the UK, Germany and the Netherlands.

**Discussion**

**Production and mortality**

Early indications show that feed usage of hens in cage systems (both CCs and FCs) is lower than in NCs, even though the body weight and egg production of hens is higher in cage systems than in NCs. Feed usage also appears to be lower in FCs than CCs. Probable factors affecting these differences in feed usage include activity level, feather cover and environmental temperature.

Although high levels of performance are unlikely to be achieved unless hens are in good health (LayWel report, 2006) productivity on its own is not a good indicator of bird welfare (EFSA AHAW 2005). Thus, the apparent lower egg output of barn and especially free-range flocks should not, on its own, be taken to establish poorer welfare. It may be partially explained by the fact that mortality is also generally higher in such flocks. However, taken together with other factors, for example the apparent higher mortality, it may well put poor welfare under suspicion and therefore warrant further investigation. Drops in egg production, particularly sudden ones, may well expose temporary welfare problems in affected flocks, especially in certain cages or areas of a house. The cause may be simple, for example deprivation of water in certain areas that would not be noticeable in the whole flock (EFSA AHAW 2005).

In conjunction with other parameters, mortality can be considered an important indicator of bird welfare, since hens generally suffer poor welfare during the period of morbidity preceding death (LayWel report, 2006). Results from this study to date suggest that, with the exception of flocks with intact beaks during the early part of the laying period and those housed in the same buildings and therefore also detrimentally affected, mortality is low or very low in CCs and all sizes of FC, moderate in barns/aviaries and highest in the free-range systems. If mortality progresses to 72 weeks of age at a similar rate to that pertaining at 45 weeks of age flocks in the former systems will comfortably meet the Swedish Welfare Standard whereas the free range system will exceed it, possibly by a consider-
able margin. If this proves to be the case it will have important implications for the standard of welfare in free-range laying systems and will require further investigation into the causes of the deaths, for example injury, cannibalism, predation, infestation and disease.

**Physical condition**

To date, all systems studied have met the Swedish welfare standards for rear and back wounds, feather hygiene and broken claws. The highest percentage of naked back areas in some flocks probably indicates more feather pecking in those flocks and it may well be associated with increased mortality due to cannibalism. This and other causes of mortality in flocks where it is high will be investigated during the final stage of this study. The most favourable housing systems for laying hens in terms of comb wounds, keel bone deformity and bumblefoot are CCs and FCs. The increased number of comb wounds in several aviary and free-range flocks may be an indication of more aggressive pecking in those systems. Keel bone deformity is generally associated with greater perch usage and/or inappropriate perch design. It is unlikely that the keel bone deformity found in this study indicates poorer welfare since the keel bone deformity observed did not involve skin lesions, and twisted keel bones may not be any disadvantage to hens. The occurrence of bumblefoot is usually associated with poor perch design, especially if the perch is contaminated with faeces.

**Environment**

Air condition is mostly good with low to moderate levels of dust and low levels of ammonia and carbon dioxide. However, dust levels are higher in NCs than in cages. This is likely to be due to the greater use of litter in those systems. The highest ammonia levels are found in barn systems and the lowest levels in FCs. All carbon dioxide readings are in the normal range but the higher readings were recorded in the winter months. Fluctuations in temperature are partly due to seasonal variation, as measurements are carried out at different times of the year and relate to normal conditions in the United Kingdom, Germany and the Netherlands. As would be expected, the internal temperatures recorded during winter were generally lowest in free-range systems.

Full term results are not yet available for all flocks in this study and therefore firm conclusions should not be drawn at this stage. However, it appears likely that differences in welfare assessments between housing systems will be established. Some parameters, for example mortality, could be considered to be good indicators of bird welfare whereas others, like egg production and keel bone deformity, provide much less definite welfare information (LayWel Report (2006) www.laywel.eu).

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**Summary**

Council Directive 1999/74/EC (1999) defines three major categories of housing system: alternative (non-cage), un-enriched (conventional) and enriched (furnished) cage. Conventional cages are to be phased out by 1st January 2012, leaving only two categories of housing system. Both categories however comprise a wide variety of different designs and models, making it hard to draw conclusions on bird welfare in these systems. Thus, it is deemed important to gather information on the comparative welfare of hens in various egg production systems. The objective of this study is to provide information about the comparative welfare of laying hens housed in a variety of egg production systems, using evaluation criteria based on the Swedish poultry welfare monitoring system. The study involves assessments on flocks in conventional and furnished cages, single and multi-tier aviaries (barns) with and without verandas as well as fixed and mobile house free-range systems. Production assessments are measured throughout the laying period. Physical condition assessments are carried out on hens at about 35 and 60 weeks of age looking at feather cover on the back and wing area, feather hygiene, comb wounds, rear and back wounds, keel bone deformity, bumblefoot and broken claws. Environmental assessments are taken at about 35 and 60 weeks of age. The basics of the evaluation programme are results obtained on production, mortality and physical condition in relation to stipulated minimum requirements given as percentages of defect birds. Each physical condition assessment parameter is scored from 1 to 4, where 1 means a serious defect and 4 means very good condition. For the physical condition assessments, only scores of 1 and 2 are included in the minimum requirements. Only those hens are counted in the total percentage of defect hens.

Early indications show that feed usage of hens in cage systems (both conventional and furnished) is lower than in non-cage systems, even though the bodyweight and egg production of hens is higher in cage systems than in non-cage systems. Interim results suggest that mortality is probably low or very low in conventional and furnished cages, moderate in barns/aviaries and highest in the free-range system. This may be one indication of poorer welfare in free-range systems, and taken together with the apparent lower production, it may be an important one that warrants further investigation. To date, all systems studied have met the Swedish welfare standards for rear and back wounds, feather hygiene and broken claws. The most favourable housing systems for laying hens in terms of comb wounds, keel bone deformity and bumblefoot are conventional and furnished cages.

**Key words**

Laying hens, housing systems, welfare, egg production, mortality, physical condition

**Zusammenfassung**

Vergleichende europäische Studie zum Wohlbefinden von Legehennen in Käfig- und Nicht-Käfig-Systemen


Stichworte

Legehenne, Haltungssystem, Wohlbefinden, Legeleistung, Mortalität, physische Kondition

References


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