

# Investigation on mortality and interactions of selected diseases in free-range chickens

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## Background

Within the last 10 years free-range and organic farming has expanded in Denmark due to consumer demands for improved animal welfare. Especially organic egg production has increased from almost nothing in 1996 to approximately 14 % of the marketed eggs in 2000. In total, approximately 100 commercial farms operate as organic table egg producers. However, high mortality represents a major problem in organic farming systems. According to the annual report from The Danish Poultry Council (2001), 5.9% and 9.6% mortality was observed in cage and deep litter systems respectively, while 15.9% died in the organic system. So far, no systematic studies on the causes of mortality have been carried out. However, the free range egg/organic egg production system in which the hen is offered access to outdoor facilities appear to result in a range of diseases among which several are not seen in indoor systems (cage or deep litter). Overall, the increased number of disease outbreaks in free-range/organic systems appear to be responsible for the increased mortality observed. Reports have indicated a broad range of diseases in free-range/organic systems, i.e., *Pasteurella multocida*, egg drop syndrome (*Adenovirus*), *E. coli* and *Histomonas meleagridis* (Black-head). Fowl cholera, caused by *P. multocida*, is seen in most species of birds and transmission from wild birds to domestic poultry has been demonstrated. Recent investigations showed that about 80% of the diagnosed cases of pasteurellosis in Danish poultry appeared in flocks that had access to outdoor areas. Furthermore, due to the outdoor conditions and the large flock size (up to 3.000 animals in organic layer flocks) parasitic diseases are very common. Several studies have shown that all animals are parasitized at a stage in their life and that especially *Ascaridia galli*, *Heterakis gallinarum*, *Capillaria obsignata* and *Eimeria spp.* are common infections. A recent study in Denmark has shown that the flock prevalence of parasites is 100% in free range/organic systems, compared to 25% in confined indoor deep litter production systems. Recent studies have also shown that the interaction between for instance *Ascaridia galli* and *Pasteurella multocida* may result in an increased number of Pasteurella carrier animals enhancing the transmission of Pasteurella. Many of these infections and aspects are not common in conventional indoor systems due to the high level of management and biosecurity. The high level of morbidity/mortality in organic egg production represents an ethical problem and does not harmonize with the idea of high welfare, which is often connected with organic production. Due to ethical problems and poor performance there is a high demand for further investigation of the occurrence of diseases and their significance in organic table egg production systems and to elucidate the possible relationship between disease prevalence and production systems. In addition, we do not know how the synergistic or antagonistic effects of concurrent parasitic and bacterial diseases affect the immune system. This information can only be obtained through controlled experimental investigations including studies on the impact on the immune system.

## Objective

The aims of this project are: (i) to improve welfare of poultry under free-range conditions by investigating the occurrence of diseases, their interaction and significance in free-range table egg production systems and to elucidate the possible relationship between disease prevalence and production systems and on this basis develop strategies to improve the disease prophylaxis in free-range poultry production systems; (ii) to investigate the host response using interaction studies between parasitic and bacterial infections which are of crucial importance for improving the health of free-range poultry.

The project will include the following steps:

### *1. Farm studies:*

Longitudinal studies will be carried out in randomly selected flocks starting at the beginning of egg production until slaughter. Post mortems will be carried out on all dead animals and causes of diseases will be determined. Faeces and blood samples are regularly collected and examined for the presence of parasitic eggs and selected poultry diseases, respectively. Parameters related to biosecurity will be recorded for all the flocks.

### *2. Interaction studies:*

To investigate avian immune response using interaction studies between parasitic and bacterial infections. The purposes of these experimental studies are to describe how the synergistic or antagonistic effects of concurrent parasitic and bacterial diseases affect the immune system.

## Progress - 2004

### *Farm studies*

Farm studies at 14 farms with layers have been finished. In total, ten farms with organic production and four farms with deep litter production are included in the study. At the moment the last data are being collected from the farms and data are in the process of being analysed. High mortality has been observed in several flocks due to Blackhead, *Erysipelothrix rhusiopathiae*, *Pasteurella multocida* and *E. coli* infections. Molecular characterization of bacterial isolates is in the process of being carried out in order to obtain epidemiologic information. Molecular characterizations of isolates have demonstrated the establishment and spread of one successful clone of *P. multocida* spp. *multocida* and *E. rhusiopathiae*, respectively. Serum samples have been collected from all farms and serological profiles for selected diseases are in the process of being determined.

### Ph.D. courses

- SOAR, Summerschool 2004: Is Organic Farming the Key to Sustainability?, 2004, 4 ECTS
- NOVA, Nordic postgraduate course in Veterinary Epidemiology Part 2, 2004, 4 ECTS

### Writing

- Three papers are in the process of being written.

### Teaching

- Poultry diseases lectures and practicals to veterinary students.

## Plans – 2005

### *Experimental study*

- One interaction study will be designed and carried out. So far the intention is to study either *Pasteurella multocida*, *Erysipelotrix rhusiopathiae* or Blackhead infections.

### *Farm studies*

- Data obtained from the farm studies will be analysed and molecular characterization will be finished.
- The last serological profiles will be processed for selected diseases and the results compiled.

### *Writing*

- Articles
- Ph.D.–thesis.
- An examination paper must be handed in to pass the final part of the course Poultry Diseases (practical part and theoretical finished) at The Royal Veterinary and Agricultural University, 11 ECTS

### *Teaching*

- Poultry diseases lectures and practicals to veterinary students.

## **Ph.D.-courses:**

- SOAR, Summerschool 2004: Is Organic Farming the Key to Sustainability?, 4 ECTS
- NOVA, Nordic postgraduate course in Veterinary Epidemiology Part 2, 4 ECTS NOVA, Nordic postgraduate course in Veterinary Epidemiology Part 1, 5 ECTS
- The Royal Veterinary and Agricultural University, Statistics for Veterinarians, 9 ECTS
- The Royal Veterinary and Agricultural University, Immunologi, 24 ECTS
- The Royal Veterinary and Agricultural University, Veterinary Immununo-diagnostic Methods, 6 ECTS

## **Publication**

- Permin, A. and Ambrosen, T. and Maag Eigaard, N. and Folden Fensburg, M. and Bojesen, M. and Christensen, J.P. and Bisgaard, M. (2002) [Sygdomme og velfærd](#). *Dansk Veterinær tidsskrift*, No 6, page 12-16.

## **Conference participation**

- Maag Eigaard, N. and Permin, A. and Christensen, J.P. and Bisgaard, M. (2003) [Mortality in organic free-range chickens and molecular characterization of the involved pathogens](#). Poster presented at XIII Congress of the World Veterinary Poultry Association, Denver, Colorado, July 19-23, 2003.

## **Oral presentations**

- Mortality in Organic Free-Range Chickens and Molecular Characterization of the Involved Pathogens.

November 2002: The Nordic Advisory- and Veterinary Seminar. Denmark.

- Sygdomsproblemer hos økologiske høner. April 2002: WPSA – Seminar 2003. Denmark.