Сучасне птахівництво

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Research of Poultry Dust and Other its Components on Workers in Poultry Farming

The influence of working environment dust was described on the health of poultry farms workers. The highest levels of dust, bacteria, fungi and endotoxins were investigated during the major works on a poultry farm. Measures were presented to prevent occupational diseases of workers who perform work for the care and rearing of poultry.

Poultry dust, poultry farm workers, work-related symptoms, total inhalable dust, grain dust, bacteria, mite allergens, fungi, endotoxins

Respiratory disease is a major occupational health risk for those working in agriculture. Research suggests that working in poultry housings is associated with higher exposures to organic dusts than for cow or swine housing and prevalence of symptoms among poultry workers is also higher. Poultry dust can be a complex mixture of organic and inorganic materials derived from soil, bedding, feed and feed components, chemical and therapeutic additives, faeces, feathers etc, as well as microbiological contaminants. Poultry dust contains a number of recognised asthmagens, including softwood dust and grain and storage mites.

The work activities that give rise to the dust include: laying down of litter; populating poultry houses; handling and inspection of birds; vaccinating birds; the routine upkeep and cleaning of houses during the growing or production period; catching or depleting of birds; removing litter and /or manure; and cleaning houses at the end of the production period, and other related or similar activities. Poultry dust may vary in composition from pure wood dust to a complex mixture of organic and inorganic particles, faecal material, feathers, dander (skin material), mites, bacteria, fungi and fungal spores and endotoxins depending on the type of birds, the work activity and the point in the growing or production cycle.

Poultry dust contains particles of varying size in the range 0,5-50 microns [1]. The presence of particles in the respirable range (<5-7 microns) means that poultry dust particles can penetrate into the gas exchange region of the lung. Larger particles can also cause disease by impacting in the upper and larger airways below the vocal cords. Bacteria, fungi and their components are likely to be components of the dust. They may be present as single cells or spores, clumps of cells or chains of spores, or may be attached to other dust components and therefore be present in a range of particle sizes. There will be a combination of live and dead organisms, but both may trigger allergic response. In addition to particulates, gases may build up as a result of the decomposition of biological material and these include ammonia and hydrogen sulphide. These substances have acute effects on the respiratory system and may compound the effects of the dust.

The dust, as other agricultural dusts, contains a number of allergens that can cause respiratory illness. Acute and chronic work-related symptoms are very common in poultry workers: including cough, phlegm, eye irritation, dyspnea, chest tightness, fatigue nasal congestion, wheezing, sneezing, nasal discharge, headache, throat irritation and fever. These symptoms are generally non-specific and may improve during periods away from work.

This range of symptoms suggests that poultry dust may cause harm by many mechanisms, including direct irritancy effects and those associated with allergy. Some poultry farm jobs appear to be associated with a higher risk of exposure. Chicken catchers, turkey workers, broiler and layer workers have all been shown to exhibit significant decreases in lung function over a work shift. In egg producers, the frequency of symptoms correlates with the hours per week inside laying facilities.

The length of time a worker has been exposed is correlated with the risk of respiratory disease. Chronic respiratory symptoms have been reported in chicken catchers with five years or more of occupational exposure. Significantly higher prevalences of symptoms and decreased lung function are seen among poultry workers exposed for more than ten years when compared with those with fewer years of exposure. Workers who spend more than four hours in confinement at a time are at risk from rhinitis or eczema.

The use of wood shavings for bedding, dry feeds, disinfectants and non-slatted floors increase the risk of organic toxic dust syndrome. The type of production system, ie floor or cage housed, has an effect on the respiratory health of workers. Workers from cage-housed operations report more cough and wheeze and have decreased lung function when compared with workers from floor-housed facilities. Other reported risk factors for bronchial responsiveness in poultry workers include gender, age, a positive family history of asthma and smoking.

Wood dust. The bedding used in hen rearing and broiler operations often comprises softwood shavings or shreds. Softwoods are mainly from coniferous trees such as pine. The following health problems are among the effects associated with exposure to softwood dust; skin disorders, rhinitis and occupational asthma. Softwood dust has a WEL 5mg/m^3.

Feed and vaccines. Cereals form the major part of all poultry feed. A vitamin and mineral supplement is also included. Fish meal is sometimes used as a source of essential amino acids, particularly in organically reared poultry. Poultry feeds are prone to fungal growth and mycotoxin production. In addition, the constituents of feed may contain protein allergens (wheat allergens) and microbial enzymes added to the feed (eg Phytase), and pollens from cereal grain. Mite species may be present in stored feed. Vaccines are the most commonly administered veterinary medicines in poultry production. During the administration of vaccines, birds may need to be closely handled and those involved in this task may be exposed to aerosolised protein allergens derived from bird feathers, dander and serum.

Grain. The type of contaminants present will depend on the origin of the grain. The contaminants may include: bacteria; fungal spores; actinomycetes; microbial toxins such as endotoxins and mycotoxins; insects and insect parts; storage mites and their excreta; weevils and their excreta; animal hair; feathers from pigeon infestation; excreta from insects/ animals; pollens; silica; soil particles; fungicide, pesticide and fertiliser residues; and/ or plant debris other than grains. Inhaling grain dust can cause ill health, for example asthma, bronchitis and grain fever. Grain dust may contain mould spores that, if inhaled, can cause the potentially fatal disease, Farmer's Lung. Grain dust is a hazardous substance (10 mg/m^3).

Mite allergens. Mite sensitivity is closely related to asthma and mite infestation is an important source of airborne allergens. Studies have shown the Northern fowl mite (Ornithonyssus sylviarum) to be a cause of occupational allergy in poultry workers and Aleuroglyphus ovatus is a storage mite that has a worldwide distribution and has been found in stored bran, wheat, chicken meal, and dried fish products .

Poultry feathers, dander, serum and faecal material. Allergen exposure may occur from contact with chicken feather, dander, serum or droppings. Poultry workers may be exposed to aerosols of dried faecal material, particularly during the removal of accumulated waste from egg production units or when cleaning down broiler/rearing houses following depopulation. Inhalation, ingestion and eye contamination by faecal material may occur in inadequately protected personnel undertaking these tasks. There are potential exposures to live bacterial and viral pathogens contained within the faeces but

1. Highest exposure total inhalable dust, bacteria, fungi, endotoxins levels measured*

Highest exposure levels measured				
Works in which dust is formed	Total inhalable dust, mg/m^3	Bacteria, cfu** /m^3	Fungi, cfu/m^3	Endotoxins, Eu*** /m^3
Manual daily addition of whole straw by hand	84.5	1.37 x 108	2 690	38 903
Laying down wood shreds by machine	34.8	2.00 x 107	600 000	224
Populating point of lay hens into a colony system	23.8	5.13 x 107	11 000	1 441
Populating day-old chicks on a broiler farm	5.5	2.7 x 106	38 400	623
Routine cleaning using hand tools (egg production — colony system only).	4.0	1.38 x 106	6 000	249
Catching and depopulating birds by hand	10.4	1.55 x 107	39 300	16 600
Removing manure from a broiler shed	33.1	2.00 x 108	26 700	1 140
Removing manure from a free range barn (fixed poultry sheds)	107.7	9.13 x 107	80 900	1 190
Removing manure from a deep pit colony system	35.4	8.04 x 106	41 200	6 192
Cleaning a broiler shed using high pressure water jets	3.6	4.71 x 105	180 000	328

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** * Cfu = colony-forming units*
** * * EU = Endotoxin Units – a measure of biologically active endotoxin*

the actual risk to health depends on individual susceptibility and the quantity of live organisms present.

Studies have shown that highest recorded total inhalable dust levels for task-specific activities was 107,7 mg/m^3 for a worker removing manure from a free range barn (fixed poultry sheds) (Table 1).

Bacteria. Bacteria in poultry dust bioaerosols may be derived from soil and dust generally present in any agricultural environment, from feed and bedding, and from the birds themselves (faecal or skin microflora, zoonotic agents). Their presence may constitute a risk to human health of workers either through overt infection or through an immunological or toxic challenge to the respiratory system as a result of the biological burden. The highest recorded bacterial levels for task-specific activities was 200 million cfu/m^3 for a worker removing manure from a broiler shed. Approximately 85% of these were Gram positive Bacillus species. Gram negative species recorded in poultry dust bioaerosols include E. coli, Enterobacter agglomerans, and Pseudomonas, Acinetobacter and Salmonella species. E. coli and Salmonella species are potentially capable of causing gastrointestinal infection, chiefly through hand-mouth transfer, and all Gram negative bacteria yield endotoxin. Zoonotic agents, ie animal infections capable of causing human infection, associated with poultry may include Chlamydophila psittaci [2].

Fungi. Long-term or repeated exposure to high concentrations of airborne fungal spores in a range of agricultural environments is recognised as contributing to decline in lung function and allergic disease such as asthma and allergic alveolitis. The main source of fungi in poultry houses is likely to be from feed and bedding/litter. Fungi naturally present, for example, in bedding material such as straw will multiply in the moist conditions. There may also be a progression of development of thermophilic fungi as the predominant species if conditions in, for example, deep litter become similar to those in composting organic materials. Some of these thermophilic species such as Aspergillus fumigatus are recognised respiratory allergens as well as being potential pathogens, causing lung infections in humans, albeit usually in immunocompromised individuals, and also can cause economic losses through lung disease in birds. The highest recorded fungal levels for task-specific activities was 0.6 million cfu/m^3 during laying down wood shreds by machine.

Endotoxins. Endotoxins are present in poultry dust samples collected at all stages of the production cycle. Acute respiratory symptoms associated with exposure to endotoxins include dry cough, shortness of breath, fever and shivering (organic dust toxic syndrome) as well as lung function impairment. People with pre-existing respiratory disease may be more susceptible to these effects. Epidemiological and animal studies suggest that chronic endotoxin exposure may lead to chronic bronchitis and reduced lung function. In the poultry farm study, recorded endotoxin levels for task-specific activities was 38 903 EU/m^3 during manual daily addition of whole straw by hand [3].

Conclusions

Poultry dust is a complex mixture of organic and inorganic materials derived from soil, bedding, feed and feed components, chemical and therapeutic additives, faeces, feathers etc as well as microbiological and invertebrate contaminants. Inhalation exposure to these materials in commercial poultry production could trigger allergic respiratory disease and exacerbate existing respiratory allergy. Poultry dust contains a number of asthmagens including softwood dust, grain and storage mites. It is therefore essential that health surveillance is undertaken to enquire positively about any early symptoms of ill health. As a minimum, health surveillance should include: pre-employment screening that includes a questionnaire about present or past asthma or chest illness. Each employee should be given information about the health risks associated with exposure to poultry dust, the relevant symptoms to look out for and the need to report any symptoms to the nominated responsible person. ■

Описано вплив пилу робочого середовища на здоров'я працівників птахофабрик. Наведені найвищі рівні пилу, бактерій, грибків та ендотоксинів під час виконання основних робіт на птахофабриці. Наведені заходи щодо попередження професійних захворювань працівників, які виконують роботи з догляду та вирощування птиці.

Пташиний пил, працівники птахофабрик, симптоми, пов'язані з роботою, загальна кількість інгаляційного пилу, зерновий пил, бактерії, кліщеві алергени, грибки, ендотоксини

Описано влияние пыли рабочей среды на здоровье работников птицефабрик. Приведены самые высокие уровни пыли, бактерий, грибков и эндотоксинов при проведении основных работ на птицефабрике. Приведены меры относительно предотвращения профессиональных заболеваний работников, выполняющих работы по уходу и выращиванию птицы.

Пыль птиц, работники птицеферм, симптомы, связанные с работой, общее количество вдыхаемой пыли, зерновая пыль, бактерии, клещевые аллергены, грибки, эндотоксины

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