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ORIGINAL RESEARCH

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Prevalence of symptoms (respiratory and non-respiratory) among poultry farm workers in India

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ABSTRACT

Background: Poultry confinement workers often develop adverse health effects as a result of exposure to poultry dust arising from work activity. Exposure to high levels of airborne dust and endotoxins is known to cause many respiratory diseases and deterioration of lung function.

Aim: To record the symptoms and to evaluate the association between the symptoms and pulmonary test result in poultry farm workers.

Methods: This cross-sectional study was carried out on 66 poultry farm workers and 66 healthy controls of Ludhiana city of Punjab (India). Data were analyzed using student's *t*-test and chi-square test.

Results: Overall 43.93% of poultry farm workers reported symptoms, which include shortness of breath (20.68%), cough (34.48%), sneezing (20.68%), nasal discharge (17.24%), phlegm (24.13%), sore throat (6.89%), itching eyes (27.58%), itching skin (6.89%), pain abdomen (6.89%), headache (10.34%), and fever (3.44%). Overall respiratory morbidity was 53.03%. The association between the number of symptoms and pulmonary functions was statistically non-significant ($p = 0.2400$).

Conclusion: Poultry farm workers are more prone to work-related symptoms of both respiratory and non-respiratory. So, there is a need for an intervention program to protect poultry workers health.

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KEYWORDS

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Introduction

India, being a developing country, is facing current nutritional problems of low birth weight, protein-energy malnutrition (marasmus and kwashiorkor) in children and micronutrient deficiencies such as Vitamins A and B complex deficiency, iodine deficiency disorder, iron deficiency anemia, and chronic energy malnutrition in adults. Poultry farming is a very versatile agro-business. The total poultry production in India has increased over the last few decades. It is a source of high-quality human food, especially egg and meat. Egg protein is considered as the best among food proteins as it has the majority of the essential amino acids required for the human body. Except for Vitamin C, all vitamins of both fat-soluble and water-soluble are available in the egg. Important minerals such as calcium, phosphorus, iron, and zinc are also present in the egg [1]. Poultry meat is supplied by chicken, duck, turkeys, geese, pigeons, and many other species of poultry. Poultry meat is highly palatable, easily digestible, and rich in proteins, fats, and minerals [2]. Eggs and chicken meat are, perhaps, the cheapest sources of protein to fight protein-energy malnutrition [3]. A large number of people are associated with poultry production; thus, making this industry as important for the national economy.

Poultry environment to which the workers are exposed contains fungi which are originated from the soil, poultry feed, and poultry litter. The fungi exist in the poultry confinement work environment as a single cell or chain of spores, a bunch of cells, or may be stuck to other dust components. The various species of fungi are Cladosporium, Aspergillus including Asp. fumigates and Eurotium, Penicillium, Fusarium sp., Mucor, and Colletotrichum sp. which

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are found suspended in dust and are recognized allergen. Long-term continuous exposure to this poultry dust containing airborne fungal spores leads to the lowering of pulmonary functions, asthma, farmer's lung, and allergic alveolitis [4,5].

Mite infestation is a significant means of airborne allergens in the poultry dust. Both house dust (*Dermatophagoides pteronyssinus*) and storage mites (*Acarus siro*, *Acarus immobilis*, *Lepidoglyphus destructor*, and *Aleuroglyphus ovatus*) are found in contaminated litter and feed. Stored feed also contains mites. Northern fowl mite (*Ornithonyssus sylviarum*) is a well-known causative agent for causing occupational allergy in poultry farm workers. Mite sensitivity is closely related to asthma [6]. Poultry feathers, dander, serum, and fecal material contain several allergenic components and are known to cause occupational allergy by inhalation, ingestion, and eye contamination in poultry workers. Chicken droppings contain excreted serum protein antigens [7]. Mycotoxins, beta-glucans, and many other ingredients of fungal pathogens induce an inflammatory and immunostimulatory effect on the respiratory system of the poultry workers [8].

Poultry feeds are provided as grain, pellets, pulses, or fully-fledged meal. In addition, it contains pollens originating from cereal grain, protein and wheat allergens, and microbial enzymes like phytase which is added to the feed. These are vulnerable to the multiplication of fungi causing its growth and production of mycotoxin. Inhaling grain dust can cause a large number of health ailments like asthma, acute and chronic bronchitis, and grain fever. Sensitization may be caused to the exposed dust in susceptible individuals and any further continuous subsequent exposure, just at meager quantity, may lead to mucous membrane inflammation involving nose or eye or initiate an episode of asthma [9,10].

A study in poultry farm workers found that the exposure to poultry dust resulted in a higher prevalence of asthmatic and nasal symptoms. These respiratory ailments were due to the much greater quantity of particulate matter (PM) both PM5 and PM10 found in the poultry farm dust [11]. Occupational asthma most often occurs in poultry workers who already exhibit allergic symptoms. Symptoms of sinusitis include continual or frequent cold, difficulty in breathing, headache, and blockage of ears. There occurs inflammation which is mainly toxic in nature and mucous membranes swelling of the various sinus cavities and the nasopharyngeal tubes connecting to the middle ear. This often coexists with rhinitis and pharyngitis [8]. In a study, it was found that the sinus symptoms and sinus irritation were higher in workers working in swine houses [12,13].

The higher exposure to organic dust leads to a delayed hypersensitivity response known as organic dust toxic syndrome (ODTS). The affected worker complains of fever, malaise, muscle and joint pain, fatigue, cough, dyspnea, and airway irritation [8]. Headache, dizziness, nausea, and breathlessness develop within a few hours of exposure. Repeated episodes of ODTS lead to permanent pulmonary damage and fibrosis [14].

Hypersensitivity pneumonitis (HP) is one of the respiratory symptoms encountered in animal agriculture almost specific in poultry farm workers. It is caused by the sensitization to and repeated inhalation of organic antigens: poultry feathers and fecal material. Host immune response and cytokine release are the most important underlying mechanisms for its pathogenesis. Lung changes are a result of cellular infiltration into the alveoli and small airways followed by granuloma formation. In acute HP, symptoms develop approximately 4–6 hours after the exposure and consist of a combination of dyspnea, cough, chills, fever, headache, and malaise. On regular exposure, long-term disease develops, resulting in changes consistent with other interstitial lung disease. The only treatment is the avoidance of the antigen and the lung damage is usually irreversible. Individuals diagnosed with farmer's lung are more prone to developing airway hyperreactivity [8,15,16].

In addition, hazardous gases in poultry houses such as ammonia, hydrogen sulphide, carbon dioxide, and carbon monoxide are readily inhaled and reached deep into the lung causing toxic effects. Ammonia, a by-product of the bacterial process in the manure is a well-recognized human toxin. Ammonia which is water soluble in nature is easily absorbed in the upper respiratory airways and damages the epithelia. These inflammatory responses lead to persistent airway hyperresponsiveness. This chronic exposure results in chronic bronchitis, bronchial reactivity, bronchiolitis obliterans, as well as generalized mucous membrane irritation [7,17].

Thus, the air quality in the poultry houses has an influence on the health status of the poultry workers. The study was undertaken to assess the occupational risks in Indian poultry farm workers. So, the aim was to record the symptoms and to evaluate the association between symptoms and pulmonary tests results in poultry farm workers.

Materials and Methods

This cross-sectional study was done from 2013 to 2015. It was carried out in the Department of Physiology, Dayanand Medical College & Hospital, Ludhiana (Punjab). The approval was obtained by the institutional ethical committee for medical research in Dayanand Medical College & Hospital, Ludhiana (Punjab).

A pro forma was filled which included name, age, gender, duration of work in hours per day, number of years of exposure, description of the protection equipment used during work, and symptoms and their frequency—sore throat, cough, phlegm, shortness of breath, sneezing, nasal discharge, itching eyes, itching skin, sore legs, headache, fever, and pain in abdomen. History of smoking and any other addiction was taken. Present, past, and family history were obtained. A general physical examination and systemic examination of all the subjects were done. All the willing participants were required to fill an informed consent form. Lung function variables were calculated by RMS Helios Spirometer.

Subjects of age between 18 and 60 years of both males and females were considered for the study. Subjects who have a history of smoking, suffering from cardiopulmonary disease, and spine and chest deformities, who had undergone recent surgical procedures (abdominal, thoracic surgery) were not considered for the study.

The pulmonary function parameters were recorded in 66 poultry farm workers and 66 healthy controls. The controls were matched for age and sex. Nearly, 29 poultry workers were taken from poultry farm 1, 6 were taken from poultry farm 2, and 31 were from poultry farm 3, all located in Ludhiana city of Punjab (India). All were male poultry farm workers.

Pulmonary function parameters, namely forced vital capacity (FVC) which is the total volume of air that can be exhaled during a maximal forceful effort, forced expiratory volume in half, one, and three second ($FEV_{0.5}$, FEV_1, and FEV_3) which is the volume of air exhaled in specified period under force after a maximal inhalation, forced expiratory flow rate between 25%–75% and 200–1,200 ml of expired FVC ($FEF_{25\%–75\%}$ and $FEF_{0.2–1.2}$, respectively), peak expiratory flow rate (PEFR) were recorded with the help of a computerized portable autospirometer (Helios 701: Chandigarh). This spirometer is automated and has an inbuilt printer which gives print-outs containing the subject's information and calculates values of all the parameters. The handset is designed in such a way that it is easy to be used by persons of all ages. The tests were carried as per American Thoracic Society/European Respiratory Society (ATS/ERS) task force guidelines [18,19]. The pulmonary functions were recorded in the standing position after adequate demonstration of how to perform the maneuver.

Statistical analysis was done by student's *t*-test by IBM SPSS Statistics Version 20. To find out the association between a number of symptoms and lung function tests, the chi-square test was used. *p*-value less than 0.05 was taken as statistically significant.

Results

Poultry farm workers spent an average of 9 hours in the poultry farm buildings. Table 1 and Figure 1 show the prevalence of various types of symptoms in poultry farm workers.

Table 2 shows the association of one or more symptoms (sore throat, cough, phlegm, shortness of breath, sneezing, nasal discharge, itching eyes, itching skin, sore legs, headache, fever, and pain in abdomen) and the results of pulmonary tests.

Table 3 and Figure 2 show the presence of symptoms with respect to the duration of exposure to poultry dust.

Discussion

The main findings in our study were (a) overall 43.93% of total poultry farm workers reported symptoms, out of which 34.48% complained of a cough, 20.68% shortness of breath and sneezing, 17.24% nasal discharge, 24.13% phlegm, 6.89% sore throat, 27.58% itching eyes, 6.89% itching skin, 6.89% pain in abdomen, 10.34% headache, and 3.44% fever. In the study, the overall respiratory morbidity reported was 53.03% (Table 1

Table 1. Prevalence of various types of symptoms in poultry farm workers.

Type of symptoms	Number of workers	Percentage (%)
Shortness of breath	6	20.68
Cough	10	34.48
Sneezing	6	20.68
Nasal discharge	5	17.24
Phlegm	7	24.13
Sore throat	2	6.89
Itching eyes	8	27.58
Itching skin	2	6.89
Pain in abdomen	2	6.89
Headache	3	10.34
Fever	1	3.44

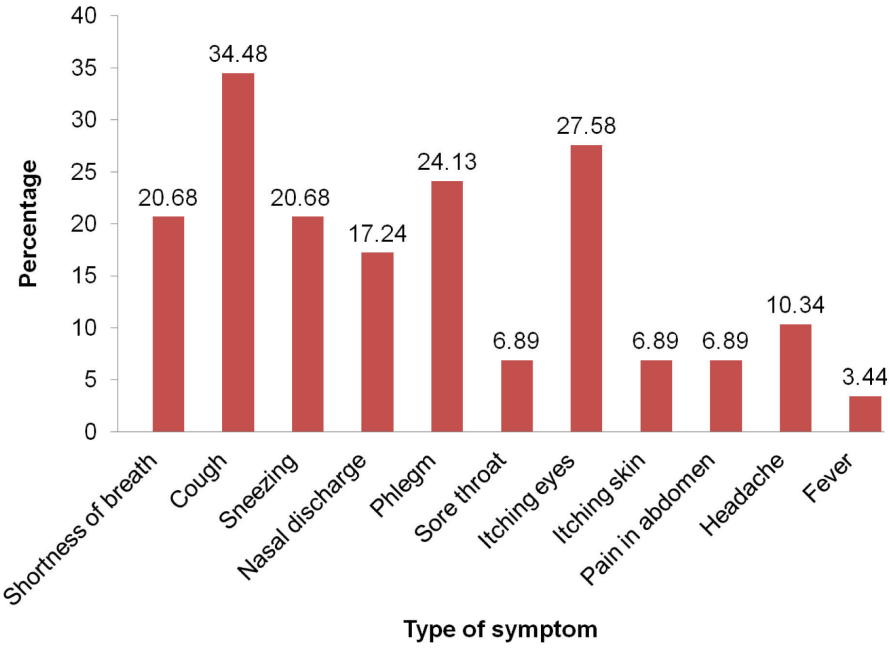

Figure 1. Prevalence of various symptoms in poultry farm workers.

and Fig. 1). (b) However, the association between the number of symptoms and lung function result was observed to be statistically non-significant (p = 0.2400; Table 2). (c) According to the duration of exposure, 43.93% of poultry workers showed the presence of symptoms (Table 3 and Fig. 2). (d) The association of duration of work (hours per day) and the presence of symptoms was found to be non-significant (p = 0.072; Table 4). (e) Nearly, 32.25% and 54.28% poultry workers who worked for greater than 8 hours per day and less than 8 hours, respectively, showed the presence of symptoms (Fig. 3).

Table 2. Association between the number of symptoms and lung function test result.

Number of symptoms	Lung function test		
	Altered	Normal	Total workers
One or more (yes)	24	5	29
None (no)	26	11	37
Total workers	50	16	66

Chi-square = 1.381, DF = 1, p-value = 0.2400.

Similar results were observed in poultry farm employees of Saskatchewan and Alberta in Canada. The study reported a higher prevalence of phlegm (19%), wheeze (16%), and cough (13%) in poultry farm workers [20]. Upper respiratory tract conditions like sinusitis and rhinitis are frequently reported in this group of workers [8]. Higher prevalence of symptoms was also observed by Donham et al. [21] and Kearney et al. [22] in studies on poultry workers.

The symptomatic effects may be because of high amounts of poultry dust and ammonia causing general respiratory irritation. Poultry dust having particles of both organic and inorganic origin, endotoxins, feces, appendages, dander, microorganisms like bacteria and fungi, pure wood dust, and dry feeds may be responsible for the development of various symptoms and causing occupational asthma [10,11,23–25]. Alencar et al. reported that the task inside poultry buildings initiates lung allergy in poultry workers

Table 3. Total duration of exposure to poultry dust and symptoms.

S. no.	Total duration (years)	Symptoms present	Presence of one symptom	More than one symptoms	Symptoms absent	Total
1	Upto 5	9 (27.27%)	4	5	24 (72.72%)	33 (100%)
2	>5–10	7 (53.84%)	1	6	5 (38.46%)	13 (100%)
3	>10–15	3 (42.85%)	1	2	4 (57.14%)	7 (100%)
4	>15–20	3 (60.00%)	3	0	2 (40.00%)	5 (100%)
5	>20	6 (75.00%)	3	3	2 (25.00%)	8 (100%)
	Total	29 (43.93%)			37 (56.06%)	66 (100%)

Df = 4, p = 0.061, Chi square = 9.016.

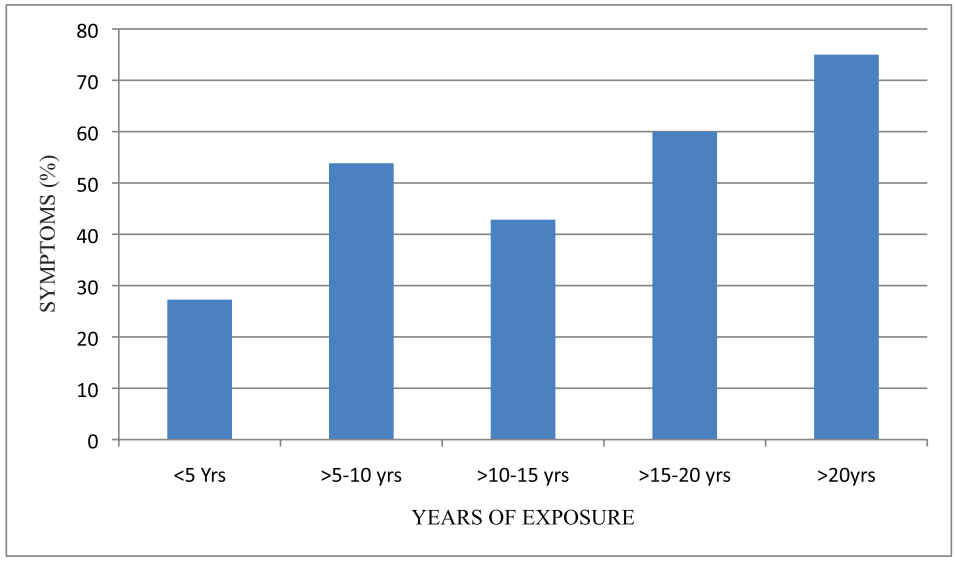

Figure 2. Total duration of exposure to poultry dust and symptoms.

Table 4. Association of the duration of work (hours per day) and the presence of symptoms.

Working hours/day	Symptoms present	Symptoms absent	Total workers
Upto 8 hours	19	16	35
>8 hours	10	21	31
Total	29	37	66

Df = 1, p = 0.072, Chi square = 3.238.

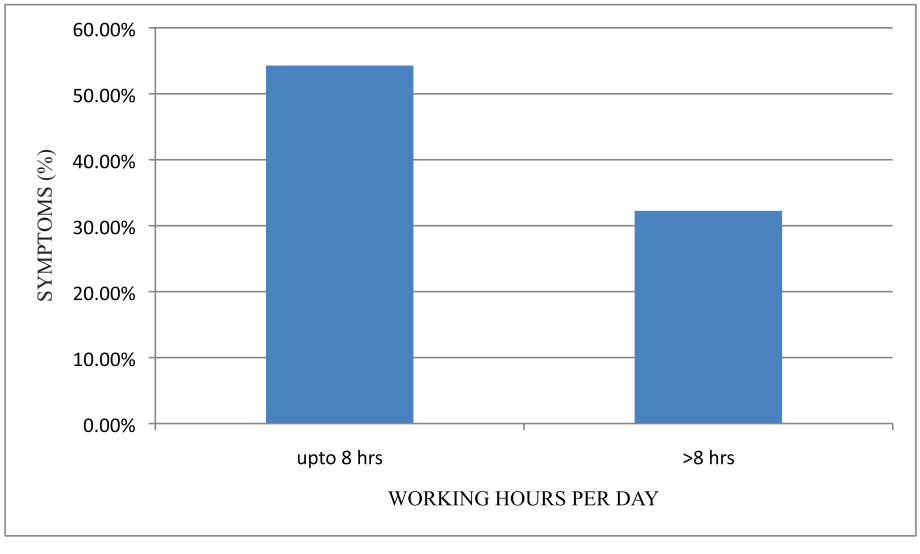

Figure 3. Percentage of symptoms present and working hours per day.

and those having greater than one symptom have more chances of the abnormal lung function test result. Comparatively, more chances of lung function deterioration (α = 0.05) were observed when the poultry workers performed tasks for greater than 5 hours per day [26]. Higher overall morbidity is due to the indoor working environment of the workers [27].

Long-term exposure to poultry dust particles suspended in the air increases the risk for hypersensitivity pneumonitis in the poultry workers [25,28,29]. The disease development incorporates cellular immunity, especially cytotoxic T lymphocytes (CTL) and formation of granulomas leading to interstitial fibrosis [30,31].

Conclusion

Poultry farm workers are more prone to the development of work-related symptoms, both respiratory and non-respiratory. Also, the use of personal protective equipment during working hours was poor. The informed evaluation of respiratory symptoms leads to a timely diagnosis of respiratory disorders. So, there is a need for an intervention program to protect the poultry worker's health.

Conflicts of interest

There are no conflicts of interest.

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Nil.

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