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To Explore the Risk Factors associated with Coccidiosis in commercial Poultry Farms in the Central Districts of Khyber Pakhtunkhwa Province, Pakistan

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Abstract

The commercial poultry are susceptible to various diseases responsible for high mortality. Coccidiosis is a protozoan disease of economic importance in the majority of the developing countries including Pakistan. Mortality, loss in production and extensive veterinary costs demands an appropriate management strategy along with its adequate treatment. A study was carried out from January to April 2017; to investigate the possible risk factors associated with its transmission in 120 randomly selected commercial poultry farms at Peshawar, Nowshera, Mardan and Charsadda Districts of Khyber Pakhtunkhwa province. Data of the poultry flocks having birds with positive test results of the faecal examination of the coccidiosis at 95% confidence interval and having clinical findings indicative of this disease like enteritis, diarrhoea, bloody faeces, ruffled feathers, anaemia and somnolence were collected directly by interviewing the farmers. That data was analysed by the Risk Matrix of the Subjective Risk Assessment software and logistic regression in the Epi info 7 Software. The results indicated that the coccidiosis was significantly associated with the risk factors like the consumption of poor quality feed, farm workers and veterinarians taking care of different poultry flocks on the same day, unhygienic wet litter, distance between farms and contaminated supply vehicles with mean risk scores 17.00, 13.75, 10.50, 8.00 and 6.75 respectively. Similarly the Odds ratio was 4.61, 3.23, 2.89, 1.04 and 1.02 and p-value for these risk factors was 0.006, 0.012, 0.027, 0.034 and 0.049 respectively. Control measures must be enhanced to prevent these risk factors will results in the eradication of this disease.

Key words: Risk factors analysis, Coccidiosis, Poultry parasite, Odds ratio

Introduction

Poultry birds are one of the important sources of essential amino acids contributing to human food through chicken meat and eggs (Amin et al., 2014). However the marvellous development of this source is badly influenced by many diseases. Amongst these diseases coccidiosis is one of the most important dilemmas faced by the poultry farmer despite of expensive interference carried out to avoid it by better administration, proper nourishment of birds and adequate treatment (Amin et al., 2014). There are 82.08 million indigenous poultry birds reared in homes and around 722.39 million broilers and 39.86 million layers are produced in Pakistan (Livestock Statistics, 2014). Poultry diseases, including the coccidiosis causes huge monetary losses to the poultry business (Bera et al., 2010). These organisms are in the phylum Apicomplexa and family Eimeriidae. In poultry birds the coccidiosis is caused by the species of the genus Eimeria. Intestine is the favourable place of their living, feeding and reproduction. Its incubation period is four to seven days. These Eimeria organisms reproduce in the intestinal cells with a major injury to its mucosa. These organisms are firmly host specific, and various species occupy specific intestinal portions. The coccidiosis control needs improvement in the management practices, suitable treatment and efficient work. Substantial loss is due to mortality, reduced productivity and low weight birds. Majority of the birds are exposed to this disease, thus its prevention and eradication are the main challenges for the poultry farmers. The coccidiosis is classified into caecal coccidiosis mainly caused by E. Tenella and intestinal coccidiosis usually produced by E. acervulina, E. maxima, E. brunetti, E. mivati, E. nagani, E. mitis and E. necatrix (Aiello, 1998).

Infection of this disease is caused by eating of contaminated feed or drinking water. Unhygienic wet litter, dead birds and faeces of the sick bird are a source of infection for the poultry farm. Visiting

veterinarians, farm employees and farm labour were an important source of the coccidiosis, vehicles visiting farm to farm and poultry markets. Faecal transmission of coccidian protozoa and contact with contaminated materials from infected and dead birds widely occurs in the contaminated poultry farms (Anjum, 1997).

Risk assessment matrix for prioritizing the high risk factors is a better tool for taking appropriate decision for proper intervention in controlling the coccidiosis. After identification of necessary pathways of the disease, it would be useful to evaluate the worth of control measures. Eradication of the risks of the disease is not always possible, but these risk factors can be minimized. The aim of this research was to explore possible risk factors responsible for transmission of the coccidiosis in the study area and identify potential preventive measures to control its transmission (EU, 2000).

Materials and Methods

The present study was conducted from January to April 2017, in the heavily poultry populated four adjacent central districts out of Twenty five districts (Peshawar, Nowshera, Mardan and Charsadda) of Khyber Pakhtunkhwa Province in Pakistan. Thirty commercial poultry farms in each district with a total of one hundred and twenty poultry farms were randomly selected for the study. Farms in the mentioned districts having sick birds with clinical findings of the coccidiosis were enrolled in the study. Faecal material were sampled and examined for the coccidiosis by using direct smear method and the faecal sample having at least ten eggs per field was taken as positive for coccidiosis (Zajac and Conboy, 2006). All the poultry farms having sick birds diagnosed by the veterinarians as coccidiosis, having positive test results in the faecal examination conducted and showing clinical findings like enteritis, diarrhoea, bloody faeces, ruffled feathers and anaemia was defined as coccidial disease cases.

Data and samples collection

All the selected poultry farms were visited for faecal sampling and data collection. The data was collected directly by interviewing the farmers or owner of the farms. The data incorporated all the risk factors and comprehensive history of the flock including kind, age and number of poultry birds, management structure, size of the farm, condition of the litter, feed quality and its utilization procedures, distance between farms, details of workers engaged with the flocks especially if they were working in one or more farms, medicine used, mortality rate, morbidity rate, particulars of the consulting veterinarian, equipments conditions and their routine disinfection techniques, previous history of coccidiosis in the farm, social background and financial position of the farmer. Sick birds were checked clinically and post mortem of sick and dead birds were carried out for disease diagnosis and visible pathological lesions in the small intestine and caeca.

Samples gathered to probe the coccidiosis in the selected poultry farms of the studied districts was worked out by using the power of 80% and having 95% confidence interval with the prevalence of the coccidiosis of 5% (Martin and Meek, 1986).

Data analysis

In this study the risk assessment of the coccidiosis was calculated by using the Risk Matrix of the Subjective Risk Assessment. The possible risk factors essential for the exposure of the coccidiosis were analysed in this risk assessment and those risk factors were including poor quality feed, workers and veterinarians working in a lot of poultry farms, distance separating the poultry farms in the area, dirty wet litter and supply vehicles. This analysis represented the results of each level of risk for the risk factors of the coccidiosis in terms of qualitative descriptors in words, while for the presentation of the likelihood of the risk factors of the coccidiosis the qualitative descriptors were denoted as, highest, high, moderate, unlikely and rare, consequently the highest level of the risk factors of the coccidiosis was indicated by high and the lowest level by rare, while for the consequences of the risk factors of this disease, the descriptors specified were catastrophic, major, moderate, minor and insignificant, hence the highest risk of coccidiosis was termed as catastrophic and the most controlled or minimum situation was called insignificant. For elimination of the bias in this study, the qualitative descriptors in words used were converted into numerical numbers 5, 4, 3, 2 and 1 respectively, similarly the words used for the consequences of the Coccidiosis disease were changed into 5, 4, 3, 2 and 1 respectively (Subjective Risk Assessment Software Ver3, 2005).

Similarly the quantitative data was analysed. The relationships of the independent variables in the data and the dependent variable were calculated. The faecal examination results were considered as the dependent variable in the analysis. The independent variables were taken into consideration to prove their significance as risk factors for the coccidiosis against the dependent variable of faecal examination results. The data were analysed by the statistical method, logistic regression in the epi info 7 software (Epi Info 7 Software, 2014).

Results and Discussion

Independent variable having the odds ratio equal or greater than one had a significant effect and

similarly the p value equal or less than 0.05 would have significant effect. The poor quality feed was identified as the major risk factor of coccidiosis in this study and had got maximum risk score of 17, odds ratio of 4.61, and lowest p-value of 0.006, the findings of this study was supported by earlier research by Yunus *et al*. (2009) who described that contaminated feed was the main source of different pathogens and played a vital role in happening of different diseases. There are many commercial feed brands sold in Pakistan but their roles in causing of different ailments were usually ignored. Feed is usually acquired on credit and then stored for a couple of weeks in open sheds. Storage of feed for such a longer period could result in growth of fungus and other microorganisms at the farm (Yunus et al., 2009). Ayaz et al 2003 stated that the procurement of poultry feed from a few feed suppliers, who supplied untreated feed along with is causing a lot of problems at the poultry farm (Ayaz et al., 2003). Similarly Anjum et al 2012 found that the poultry production undergoes huge economic loss due to vulnerability to poor quality feed. Cereals grains and plant protein resources utilized in feed are usually polluted by the contaminants formed by moulds during the harvest and storage. These contaminants created by moulds spoil poultry feed and has harmful effect on the health of birds as they produce noxious metabolites resulting in the damage of vital production functions in birds like, feed intake, feed conversion competence, weight gain, production of various diseases of the gastro-intestinal tract including coccidiosis (Anjum et al., 2012).

Workers and veterinarians working on many farms was found as important risk factor in this study with the risk score of 13.75, odds ratio of 3.23 and p-value of 0.012, the findings of this study was in line with the previous work by Racicot et al 2012 who worked out that the poultry flocks were infected due to lack bio-security measure by workers and visiting veterinarians. Sometimes those people could not be excluded from the farm and were possible sources of coccidiosis disease. As nearly all bio-security plans included doing all achievable actions to sanitize the external people entering the poultry farm but they fall short to judge that contamination that pass through on the inside of a worker are ahead of bio-security protocols and therefore, could not be excluded (Racicot et al., 2012). Likewise Henken et al 1992 stated that the introduction of the detrimental pathogens in the poultry farms were vastly linked to the frequency of visits of sloppy veterinarians and work force in the farm that brought infection with them were decidedly related to the transmission of diseases (Henken, 1992). Also Graat, *et al.* (1998) investigated that the reasons of this ailment were, staff engaged on numerous farms, careless veterinarians were not following the hygienic protocols and standard bio-security measures, and the poultry farm having a kind of farmyard which was hard to be disinfected. The comparative significance of the stated risk factors were measured and were extremely valuable to set up priorities for poultry farm consultation and interference plans for the entry of pathogen in the farm, followed by prevention and ultimately its eradication (Graat *et al.*, 1998).

Unhygienic wet litter had a risk score of 10.50, odds ratio of 2.89 and p-value of 0.027, the findings of this study was held up by previous study of Jamal *et al*. (2014) who stated that clinically diseased and recovered poultry drop oocysts in their excreta, which infect litter. As poultry litter is composed of bedding material combined with droppings, feathers, leaked water, and waste feed gathered in the growth phase. Because of its elevated nutrient level, it is an excellent medium for the growth of Eimeria organisms. This dirty litter unable to absorb water stimulating the growth of these harmful pathogens and became the possible source of coccidiosis. These Oocytes are then spread by farm utensils, clothes, bugs, personnel to other birds. Sometimes the heating and ventilation equipments in a poultry farm were not constantly watched to keep the moisture content of the litter controlled so that the litter remains damp (Jamal et al., 2014). Similarly Stephen and Collett (2014) reported that many illnesses cause the birds to excrete wet droppings. The pathogens directly injure the digestive system causing diarrhea. The poultry birds had usually anorexia but drinks water, producing an elevated moisture content of the excreta. Coccidiosis results in the damage to the alimentary canal and will cause wet droppings and wet litter (Stephen and Collett, 2012). Also Sultana et al 2009 found that the reasonably elevated rate of the coccidiosis was also due to unhygienic wet litter consumed at the farms, but the major risk factor of the coccidiosis was unhygienic wet litter in summer when the moisture content of the air is very clear. The huge number of the poultry birds excreting faeces which causes unhygienic wet litter. These risk factors might present in the farm due to incomplete understanding required for appropriate poultry farm management, little observation of the poultry litter (Sultana et al., 2009).

Distance between farms had a risk score of 8, odds ratio of 1.04 and p-value 0.034, the findings of this study was held up by the previous findings of Noordhuizen et al 1996 who stated that in disease out breaks importance is given to outlining better risk control plans. In such plans, the risk of spread and

production of microorganisms within and between poultry farms should be thoroughly worked out. Primarily these tools were designed to control zoonotic diseases; but they are also helpful for the prevention of every disease including the coccidiosis. The short distance between poultry farms were the potential risks factors for the introduction of the coccidiosis (Noordhuizen and Welpelo, 1996).

Farm supply vehicles had a risk score of 6.75, odds ratio of 1.02 and p-value of 0.049, the findings of this study was supported by earlier research of Akcay et al (2011) who investigated that the risk factors associated with the coccidiosis were, dirty farm feed supply trucks, infected floor of the vehicles, insufficient time and disinfectants utilized for cleaning the vehicles, physical state and storage capacity of the farm vehicles, number of visits of the same vehicles into different poultry farms throughout the production period, workers involved in loading and unloading of feed and birds, schooling and awareness about this disease of the driver, contamination of vehicles due to diarrhoea, blood in the faeces and vehicles supplying to many farms. Additionally the stress of winter season during transport of birds and unclean vehicles departing to various farms may be its risk factors (Akcay et al., 2011).

Other risk factors of this disease might be, other disease existing at the farm, entry of a vaccinator to a poultry farm, birds suffering from other diseases, social position and financial state of the farmer, disease control strategy and distance from the nearest poultry market, etc were not chosen as the probable risk factors in this research due to their less significance outcome in the data analysis.

The results of the correlation of the risk factors of the coccidiosis between the selected districts of the Peshawar, Nowshera, Mardan and Charsadda are shown in Table 1. Spearman's rank correlation coefficient was utilized to evaluate the risk factors of the coccidiosis disease. It presented values within the range of -1 to +1. The correlation between Peshawar and Nowshera districts is +0.90 which indicates that the risk factors in both the districts are highly identical and it is the highest correlation found in this study. In the previous study Graat, et al 1998, also reported high correlation (Graat et al., 1998). Another correlation between Peshawar and Mardan districts is +0.82 which also show that the similarity in the risk factors is high. A considerable relationship occurs between Peshawar and Charsadda districts, as their correlation score is +0.70. In a past study Reza and Ali, (2000) stated medium correlation in Mashhad, Khorasan, Iran (Reza and Ali, 2000). On the other hand the correlation between Nowshera, Mardan districts and Nowshera, Charsadda districts are +0.50 each, which is the lowest agreement on the risk factors in this study area. In the previous research Bettridge et al. (2014) described low correlation in the villages of Ethiopia (Bettridge et al., 2014). All the values are significantly different from zero and are positive which shows that there is an agreement between the studied districts. This similarity may be due to the fact that these districts were in the same province having alike environmental conditions, birds consuming the matching feed, comparable competence of the farmers, equal access to the market for procurement of items required in the farm, sale of their products, etc. It also indicates that there is no disagreement between the selected districts (Marta et al., 2013).

Conclusion

As poor quality feed has been revealed to be the major risk factor for the coccidiosis in the poultry farms likewise unhygienic wet litter, workers working on many poultry farms, the careless veterinarians, distance between farms and contaminated supply vehicles have also been documented as important risk factors for the coccidiosis disease transmission. The present study pointed out that awareness of the farmers, labour and poultry feed producers are ways to prevent the coccidiosis transmission through the control of the above risk factors must be given a priority. Though it may be difficult for every farmer to avoid poor quality feed in these circumstances because of affordability and availability issues of hygienic feed, other simple and inexpensive feed materials that are easily available in this region should be worked by the researchers to find an appropriate solution to this problem. In many occasions the feed supply are not available to the poultry farmer for so many reasons due to which they are compel to buy low quality feed from the local market in order to continue feeding their flock. This feed is the main cause in starting coccidiosis at their farms. Feed manufacturers have to be bound by law to treat the dead birds or other animal products used as protein source with suitable chemicals and to declare them safe and harmless, before incorporation these animal protein sources in the poultry feed. All the stakeholders handling the poultry feed have to strive hard to check its contamination.

The poultry farm owners should discourage the employees functioning on the multiple farms consecutively or keeping back yard poultry with them, so that this disease could be prevented to spread from one farm to another, similarly the veterinarians should be honest, careful and dedicated to their profession, he should avoid to visiting different farms on the same day, so that he should

control this disease instead of spreading it. In the same way appropriate distance should be kept between the poultry farms, for this purpose scientific guide lines ought to be strictly implemented by the concerned authorities. Management conditions of the farm must be enhanced to keep the litter dry. Water and drinking equipments must be clean with suitable disinfectants and bloody faeces must be taken out to prevent infection to other birds.

One of the causes producing coccidiosis in later part of the growth cycle is the contaminated supply vehicles. These vehicles coming from the infected market for collecting the birds causing a serious threat to the remaining poultry birds, because the poultry wholesaler are taking the birds in segments from the poultry farm according to the market demand and size of the birds. These frequent transportation operations took about a week time to complete, which exposes the birds to a serious threat in shape of diseases including coccidiosis.

Recommendations

Areas of risk of the coccidiosis spread from the poor quality feed, workers and veterinarians working in many farms, unhygienic wet litter, short distance between farms and unclean supply vehicles. Coccidiosis could be controlled if managed properly in time and place in the study area which present a vast prospective and boost for disease control activities by the reduction of these risk factors along with proper vaccination against major diseases and to restrict the movements of unwanted persons in the farms. Usually the veterinarians do not treat this disease properly due to poor preparation, casual approach and lack of knowledge. Importantly the data about this disease should be appropriately collected, processed and compulsorily reported to the concerned authorities.

One of the important constraints identified in this study was the deficient training of poultry farmer on farm management and diseases control strategies. The government should maintain capacity building programs for the technical staff involved in the disease eradication measures to produce adequate numbers of qualified experts in epidemiological surveillance and outbreak investigations, data collection, data processing, record keeping and other related fields to put into practice effective health measures to prevent disease outbreaks. Similarly short duration trainings programs for new comers in poultry farming followed by awareness campaigns should be carried out to educate poultry farmers about disease control measure, vaccination, day to day farm practices and other essential techniques in poultry farm management to control the coccidiosis in the study area.

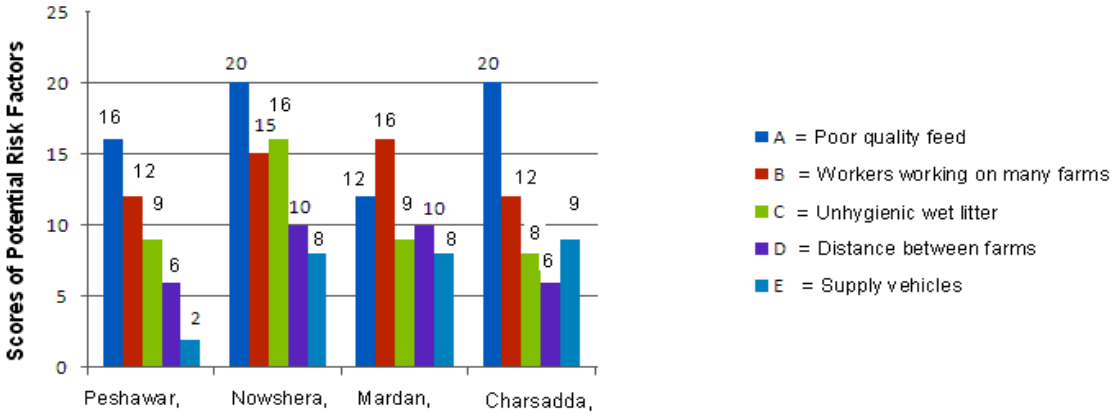

Figure 1: Graph indicating Scores of the main risk factors of coccidiosis

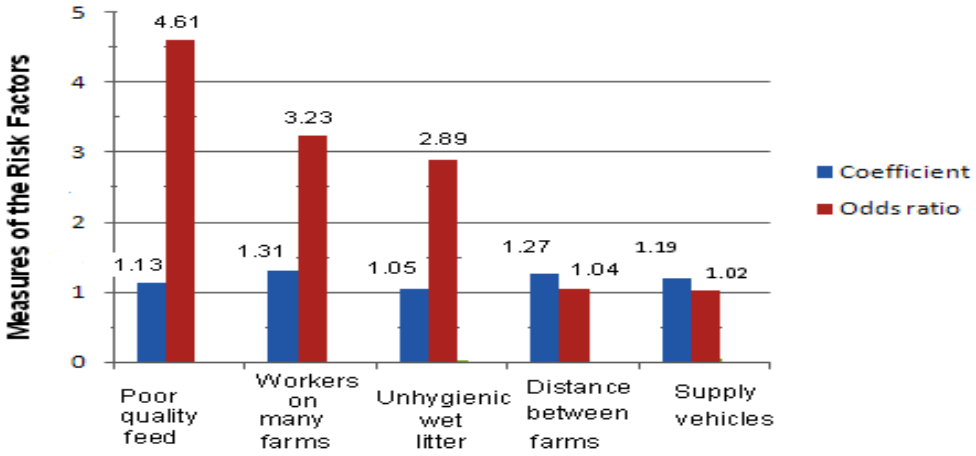

Figure 2: Graph showing relationship of the major risk factors of coccidiosis

Table 1: Correlation between the selected areas of the central districts of the Khyber Pakhtunkhwa province

	Peshawar	Nowshera	Mardan	Charsadda
Peshawar	0.00	0.90	0.80	0.70
Nowshera	0.90	0.00	0.50	0.50
Mardan	0.80	0.50	0.00	0.50
Charsadda	0.70	0.50	0.50	0.00

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