PREVALENCE OF POULTRY DISEASES AND THEIR INTERACTION WITH MYCOTOXICOSIS IN DISTRICT CHAKWAL: 1. EFFECTS OF AGE AND FLOCK SIZE

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ABSTRACT

Relationship of age and flock size with disease incidence in layer and broiler flocks, and interaction of diseases with mycotoxicosis was investigated. These investigations are based on postmortem examination of birds submitted to the Poultry Production Institute, Chakwal, during 2003-04. In broilers, incidence of coccidiosis, ascites, and infectious bursal disease (IBD) decreased with increase in flock size, while respiratory diseases seemed not to be affected by flock size. In layers, ascites and IBD followed the same trends as these were in broilers. However, incidence of coccidiosis in layers increased with increase in flock size. Effect of flock size on incidence of respiratory diseases was pronounced with negative correlation (-0.65). In broilers, coccidiosis was the most prevalent disease during 2nd and 3rd week of their life. After 4th week, ND and HPS were the most frequently encountered diseases. Incidence of respiratory diseases increased linearly with increase in age of the broilers (1.6, 12.8, 16.2, 25.7, and 43.7% in 1st, 2nd, 3rd, 4th, and 5th-8th weeks, respectively). Similarly, incidence of ND, and mycotoxicosis increased linearly with age. In layers, share of coccidiosis started increasing tremendously from 3rd week making it the most often encountered disease from 3rd week up to 3 month age. IBD and HPS were seen only during 1 to 2 and 2 to 3 month age, respectively. At 5 months of age 10.6 per cent ND outbreaks were observed whereas it was as18.1 per cent (maximum incidence) at 6 months of age. In various age groups, mycotoxicosis was found to have high correlation with ascites (r^2, 0.7) in broilers, and ND (r^2, 0.9) in both broilers and layers. The inverse relationship of management related diseases i.e., coccidiosis with flock size in broilers indicated lack of modern management practices on small farms. Similarly, the high positive correlation of mycotoxicosis with ND outbreaks is an indicative of one of the major contributing factors in vaccine failure in the study area. This necessitates more inputs from both feed millers and veterinarians in terms of farmer education and awareness on this issue.

Key words: Prevalence, mortality, hemagglutination mycotoxicosis, coccidiosis.

INTRODUCTION

Poultry sector of Pakistan is characterized by farm sizes ranging from less than 1000 to a multiple of 10000 (Naveed *et al*, 1999 and Farooq *et al*, 2000). Thus, variation in management practices and housing conditions is evident from this spread of farm size. Generally, the average flock is approximately 2000 to 3000 for both broilers and layers: one can call this as rural subsistence farming. These farms are characterized by household labor and usually lack modern facilities. The small flock size makes it unfeasible for the owners to erect and use modern husbandry facilities and practices. On the other hand, this smallness may be an advantage as far as close and personal supervision, on the part of farm owner, is concerned.

In some previous studies, prevalence of poultry diseases alone (Khan and Ajmal, 1982; Ahmad *et al*., 1986; Siddique *et al*., 1987) or simply causes of mortality (Ahmad and Irfan, 1981) have been reported sporadically whereas Anjum (1990) has discussed incidence of disease and tried to elicit its relationship with weather. In the study present an effort has been made to work out relationship / interaction of flock size and age of birds with various factors causing mortality. Effect of this interaction has not been studied / reported before from Chakwal area. It is an attempt to deal the problem with holistic approach in which management linked issues (age & flock size). have been discussed.

MATERIALS AND METHODS

Present study investigates important causes of mortality in broiler and layer flocks and their interaction with mycotoxicosis as influenced by age and flock size. The data of upon at a total of 2151 postmortem examination cases of the birds submitted to the Department of Poultry Production, Chakwal to probe mortality causes during the period from November 2003 to October 2004. Commercial broilers, layers, and crossbred Fayoumi (non-descript local x Fayoumi) constituted 79.5, 17.9, and 2.6% cases respectively. Diagnosis was mostly based on history, clinical signs, and postmortem examination. Hemagglutination

inhibition titer was evaluated for confirmation of complicated cases of Newcastle disease in layers. For a valid comparison between broiler and layers, first month age was divided into weeks. Thereafter, monthly age was taken as a standard until 6 months age, beyond which, further grouping was done on the basis of 7 to 12 months and greater than 12 months age.

Flock size was taken as an indicator of the management conditions. In rural subsistence farming, according to our observation, farmers prefer to manage their flocks with family labor until flock size is around 2000 birds. At this much strength, birds are usually kept in open sheds without much attention to modern management practices. Hired labor and modernization in infrastructure become important factors as the flock size increases beyond 3000 heads. With, flock sizes over 5 to 6 thousand birds, hiring of trained veterinarian for flock monitoring and modernized infrastructure results in better management of birds and their protection from harsh environment, thereby improving productivity. Therefore, to see the effect of flock size on incidence of various diseases, flock size grouping was done on 1000 heads up to the flock size of 5000 heads, beyond which the other group comprised of flock sizes of greater than 5000 heads.

Data were analyzed in SPSS 13 for windows. Data regarding disease and flock size interaction has been presented as percent (%) of disease incidence within flock size. However, data regarding disease and age interaction have been tabulated as percent of disease incidence within various age groups, while where necessary, these have been discussed also as percent of disease within a particular disease group.

RESULTS AND DISCUSSION

Prevalence of diseases: Data regarding prevalence of different diseases are presented in Table 1. On overall basis, incidence of coccidiosis was the highest, which was followed by coryza, E. coli, CRD, ND, and IBD, in order of occurrence. In case of broilers, coccidiosis was followed by coryza, E. coli, CRD, IBD, HPS, and ND. In layers, coccidiosis was followed by ND, and coryza, whereas in crossbred Fayoumi, coccidiosis was followed by ND, IBD, and coryza, in order of occurrence.

Coccidiosis was the most frequently occurring disease in all type of birds. However, its incidence was significantly lower in broilers (19.6%) as compared to layers (27.0%). Incidence of respiratory diseases (coryza, CRD, IB, and pneumonia) was 29.9% in broilers, which is significantly ($P<0.01$) higher than in layers (20.1%) and crossbred Fayoumi (14.3%). However, IB was an exception, as this was the only respiratory disease with higher incidence (2 times) in case of layers as compared to broilers. Similarly incidence of *E. coli* infections was 3 times higher in broilers than in the layers and 6 times higher than in the crossbred Fayoumi.

Though ND, on overall basis, was the 4th highest occurring disease, it was the 7th highest in case of broilers (6.2%) while in case of layers it was 2nd highest disease (24.4%). Newcastle disease has been reported to be the highest occurring disease in some of the previous surveys (Anjum, 1990). Lower incidence noted in this study may be due to the difference in location or may also be due to use of improved vaccines.

Effect of flock size on prevalence of different diseases: Average flock size in broilers, layers, and crossbred Fayoumi was 3187.6±1993.1, 4278.2±3367.6, and 1665.8±1776.4, respectively (± standard deviation). In case of broilers, 5.6, 30.9, 30.9, 14.6, 9.0, 9.0% cases were from flocks of <1, 1 to 2, 2 to 3, 3 to 4, 4 to 5, and 5 thousand heads. In case of layers, 9.6, 19.7, 18.2, 17.9, 10.9, and 23.7%, cases were from flocks of <1, 1 to 2, 2 to 3, 3 to 4, 4 to 5, and 5 thousand heads. For crossbred Fayoumi layers, 50, 28.6, 8.9, 0, 7.1, and 5.4% cases were from flock sizes of <1, 1 to 2, 2 to 3, 3 to 4, 4 to 5, and 5 thousand heads, respectively. This means that 64% of the total cases were from flocks of 1 to 3000 heads. In case of broilers, 61.8% cases were from flocks of 1 to 3000 heads. In layers 55.8% cases were from flock size between 1 to 4000 heads. However, in case of crossbred Fayoumi, 78.6% cases were from flock sizes of less than 2000 heads. The number of cases for crossbred Fayoumi layers was too low (only 56) to draw any conclusion regarding interaction of various diseases with age, flock size, and mycotoxicosis. Therefore, the data regarding these birds were not considered for calculation of interactions.

Data presented in table 2 show effect of flock size on incidence of different diseases in broilers. Incidence of coccidiosis, ascites, and IBD decreased with increase in flock size. However, this effect was most pronounced on the occurrence of coccidiosis. This is in line with our hypothesis that management conditions at small farms may not be adequate, as coccidiosis is generally regarded as a management-related disease (Hafez, 2008). Contrary to coccidiosis, incidences of mycotoxicosis and fowl typhoid appeared to increase with increase in flock size. Higher incidence of mycotoxicosis may be due to longer feed storage at small farms which was a general observation during the study.

Except in flock sizes of more than 5000 heads, early chick mortality (due to omphalitis, vent pasting, brooder pneumonia, aspergillosis) had an increasing trend with increase in flock size being 3.1, 4.2, 4, 4.8, 6.6 and 4.0 % with increasing flock size (figure 1; r^2 0.32). However, respiratory diseases being 32.3, 30.7, 26.7, 29.9, 30.8, and 29.7% seemed not to be affected by flock size

Table 1. Prevalence of diseases in different type of birds[1]

Disease	Total		Broiler		Layer		Fayoumi (Crossbred)*	
	Freq	%	Freq	%	Freq	%	Freq	%
Coccidiosis	454	21.1	334	19.6	104	27.0	16	28.6
Coryza	345	16.1	287	16.8	53	13.8	5	8.9
E. coli infections	229	10.7	214	12.5	14	3.6	1	1.8
ND	214	10.0	105	6.2	94	24.4	15	26.8
CRD/CCRD	210	9.8	195	11.5	13	3.4	2	3.6
IBD	199	9.3	182	10.7	9	2.3	8	14.3
HPS/hepatitis	115	5.4	110	6.5	4	1.0	1	1.8
Mycotoxicosis	82	3.8	61	3.6	21	5.4	-	-
Omphalitis	73	3.4	65	3.7	7	1.8	1	1.8
Ascites	63	2.9	58	3.4	2	0.5	3	5.4
Enteritis	48	2.2	35	2.1	13	3.4	-	-
IB	36	1.7	24	1.4	11	2.9	1	1.8
Fowl typhoid	27	1.3	14	0.8	13	3.4	-	-
Heat stress	13	0.6	9	0.5	4	1.0	-	-
Parasites	9	0.4	-	-	8	2.1	1	1.8
Vent pasting	7	0.3	4	0.2	3	0.8	-	-
Prolapse	5	0.2	-	-	5	1.3	-	-
Pasteurella	4	0.2	3	0.2	1	0.3	-	-
Lameness	4	0.2	-	-	4	1.0	-	-
Brooder pneumonia	3	0.1	3	0.2	-	-	-	-
Leukosis	3	0.1	-	-	1	0.3	2	3.6
Aspergillosis	1	-	1	0.1	-	-	-	-
Marex	1	-	-	-	1	0.3	-	-
Total [2]	2146	100	1705	100	385	100	56	100

Freq. number of flocks; [1]% within type of birds; [2] total missing values 5; * non-descript local x Fayoumi

Table 2. Effect of flock size on occurrence of disease in broilers [1]

Disease	Flock size						Average	Freq [2]
	<1	1-2	>2-3	>3-4	>4-5	>5		
Coccidiosis	19.8	20.9	21.6	18.1	12.4	10	19.6	334
Coryza	18.7	17.9	14.2	15.7	17.7	17.8	16.8	287
E. coli infections	9.4	12.4	13.1	13.3	13.7	22.4	12.5	212
CRD/CCRD	11.5	11.8	10.4	13.8	11.1	9.9	11.5	195
IBD	16.7	9.9	10.1	12.5	9.8	10.5	10.7	182
HPS/hepatitis	6.3	5.7	7.2	6.9	5.2	9.9	6.5	110
ND	1.0	6.3	6.5	5.2	8.5	7.2	6.2	105
Mycotoxicosis	-	3.6	4.2	2.8	5.9	7.2	3.6	61
Ascites	7.3	3.2	3.4	2.4	3.9	2.6	3.4	58
Omphalitis	3.1	3.6	3.6	4.4	5.9	2.6	3.7	64
Enteritis	3.1	1.7	2.1	1.6	3.3	2.0	2.1	35
IB	2.1	0.8	2.1	0.4	1.3	2.0	1.4	24
Fowl typhoid	-	0.9	0.6	1.2	-	2.6	0.8	14
Heat stress	1.0	0.4	0.6	0.8	-	2.0	0.5	9
Vent pasting	-	0.4	0.2	0.4	-	0.7	0.2	4
Pasteurella	-	0.2	-	0.4	0.7	-	0.2	3
Brooder pneumonia	-	0.2	-	-	0.7	-	0.2	3
Aspergillosis	-	-	0.2	-	-	0.7	0.1	1
Freq [2]	96	525	527	248	153	152		1701

Freq. number of flocks; [1] % within flock size; [2] total missing values 8

Table 3. Effect of flock size on occurrence of disease in layers [1]

Disease	Flock size						Average	Freq [2]
	<1	1-2	>2-3	>3-4	>4-5	>5		
Coccidiosis	18.9	26.3	18.8	33.3	35.7	27.5	26.8	103
ND	21.6	25.0	23.2	15.9	23.8	33.0	24.5	94
Coryza	13.5	18.4	17.4	15.9	11.9	6.6	13.8	53
Mycotoxicosis	8.1	6.6	7.2	5.8	2.4	3.3	5.5	21
E. coli infections	-	-	8.7	5.8	2.4	3.3	3.6	14
CRD/CCRD	5.4	3.9	4.3	-	2.4	4.4	3.4	13
Enteritis	10.8	2.6	1.4	2.9	2.4	3.3	3.4	13
Fowl typhoid	5.4	1.3	7.3	2.9	2.4	2.2	3.4	13
IB	2.7	3.9	4.3	2.9	2.4	1.1	2.9	11
IBD	2.7	3.9	1.5	1.5	-	3.3	2.3	9
Parasites	-	2.6	1.5	4.3	2.4	1.1	2.1	8
Omphalitis	-	2.6	-	1.5	-	4.4	1.8	7
Prolapse	5.4	1.3	-	1.4	2.4	-	1.3	5
HPS	-	-	-	1.5	-	3.3	1.0	4
Lameness	-	-	1.5	1.5	2.4	1.1	1.0	4
Heat stroke	-	1.3	1.5	1.5	2.4	-	1.0	4
Vent pasting	-	-	-	1.5	2.4	1.1	0.8	3
Ascites	2.7	-	1.4	-	-	-	0.5	2
Pasteurella	-	-	-	-	-	1.1	0.3	1
Leukosis	2.7	-	-	-	-	-	0.3	1
Marex	-	-	-	-	2.4	-	0.3	1
Freq [2]	37	76	69	69	42	91		384

Freq. number of flocks; [1] % within flock size; [2] total missing values 2

Table 3 shows effects of flock size on incidence of various diseases in layers. As with broilers, early chick mortality (due to omphalitis, and vent pasting) increased with increase in flock size (figure 2; r^2 0.59). Similarly, ascites and IBD followed the trends as were in broilers. Contrary to broilers, incidence of coccidiosis in layers,

Table 4. Incidence of diseases at various age groups of broilers [1]

Disease	Weeks					Total	
	1	2	3	4	5 - 8	%	Freq [2]
Coccidiosis	10.9	35.3	28.4	16.8	13.4	19.6	332
Coryza	5.1	23.4	17.2	19.5	15.5	16.9	287
E. coli infections	22.6	26.4	14.9	8.5	6.8	12.5	213
CRD/CCRD	-	2.1	8.5	14.6	16.8	11.5	195
IBD	-	2.6	18.2	18.7	8.0	10.7	181
HPS/hepatitis	-	0.4	2.0	5.8	12.3	6.5	110
ND	-	-	2.4	5.2	11.9	6.2	105
Mycotoxicosis	1.5	1.3	2.0	3.6	5.5	3.6	61
Ascites	-	2.1	1.0	4.1	5.3	3.4	58
Omphalitis	46.0	-	-	-	-	3.7	64
Enteritis	3.7	2.6	2.4	1.6	1.5	2.0	34
IB	-	2.1	2.4	1.6	0.9	1.4	24
Fowl Typhoid	5.1	0.9	0.3	-	0.6	0.8	14
Heat Stroke	-	-	0.3	-	1.2	0.5	9
Vent Pasting	2.2	0.4	-	-	-	0.2	4
Pasteurella	-	0.4	-	-	0.3	0.2	3
Brooder pneumonia	2.2	-	-	-	-	0.2	3
Aspergillosis	0.7	-	-	-	-	0.1	1
Freq[2]	135	234	296	367	665	100	1698

Freq. number of flocks; [1] % within age; [2] total missing values 11

increased with increase in flock size. However, this effect was not significant. Effects of flock size on incidence of respiratory diseases were pronounced with negative correlation (figure 2; r^2 -0.65).

Effect of age on prevalence of different diseases: Data regarding interaction of age and disease incidence in broilers has been presented in table 4. During 1st week, 50% of the disease incidence was due to salmonellosis alone while 75% of the disease incidence was due to salmonellosis and *E. coli* infections. During 2nd and 3rd week, coccidiosis was the mostly occurring disease, after which its contribution to the total disease incidence in every week decreased in a linear fashion. *E. coli* infections continued to be second most prevalent disease during 2nd week (26.4%) after which its weekly incidence also decreased linearly. Least incidence of coryza was noted in the 3rd week (17.8% vs. 2.4, 19.2, 24.7, and 35.8% during 1st, 2nd, 4th and 5th-8th weeks). During 3rd week, IBD was the 2nd mostly prevalent disease, and from here its weekly incidence continued to increase, making it the mostly prevalent disease during 4th week. Fourth week was also characterized by a sharp increase in respiratory diseases. After 4th week, ND and HPS were the most frequently encountered diseases. Incidence of respiratory diseases increased linearly with increase in age of the broilers (1.6, 12.8, 16.2, 25.7, and 43.7% in 1st, 2nd, 3rd, 4th, and 5th-8th weeks, respectively). Similarly, incidence of ND, and mycotoxicosis increased linearly with age. Correlation of mycotoxicosis with occurrence of ND and ascites was positive and very high (r^2 0.99: figure 3 and 0.97, respectively). Similarly, Oguz *et al*., 2003 reported adverse effects of aflatoxins in lowering GMT (geometric mean titre) for ND in broilers. Of the total diseases during first week in layers, 70% were due to salmonellosis (table 5). This is quite high percentage when compared with broilers group. On the other side, share of *E. coli* infections during first week was approximately half of its share in first week of broilers. A follow up of *E. coli* infections during all stages of layers shows that this was comparatively not a major problem in layers especially during brooding. Share of coccidiosis among all the diseases during first week was however same in both broilers and layers. In layers, share of coccidiosis among all diseases started increasing tremendously from 3rd week making it the most often encountered disease from 3rd week up to 3 months age.

Table 5. Effect of age on occurrence of different diseases in layers [1]

Disease	Weeks				Months						> 1 year	Total	Freq.[2]
	1	2	3	4	2	3	4	5	6	7-12			
Coccidiosis	10.0	11.1	55.6	60.0	38.9	48.3	25.0	22.9	32.6	23.2	3.2	26.8	102
ND	-	-	-	-	2.8	20.7	35.0	22.9	28.3	28.5	25.8	20.2	77
Coryza	-	22.2	22.2	20.0	19.5	10.3	20.0	37.1	19.6	9.3	16.1	18.1	69
Mycotoxicosis	-	-	-	-	-	-	-	2.9	10.8	9.3	3.2	5.5	21
E. coli infections	10.0	11.1	-	-	2.8	-	-	2.9	2.2	4.6	6.5	3.7	14
CRD/ CCRD	-	11.1	22.2	-	-	-ag	5.0	-	-	4.6	6.5	3.4	13
Enteritis	-	22.2	-	-	2.8	-	10.0	-	2.2	2.0	12.9	3.4	13
Fowl Typhoid	-	-	-	-	-	3.4	-	2.9	2.2	5.3	6.5	3.4	13
IB	-	-	-	-	-	3.4	5.0	2.9	-	3.3	9.7	2.9	11
IBD	-	-	-	20.0	19.4	-	-	-	-	-	-	2.1	8
Parasites	-	-	-	-	-	-	-	-	-	4.6	3.2	2.1	8
Omphalitis	70.0	-	-	-	-	-	-	-	-	-	-	1.8	7
Prolepse	-	-	-	-	-	-	-	-	-	2.7	3.2	1.3	5
HPS	-	-	-	-	8.3	3.4	-	-	-	-	-	1.0	4
Lameness	-	-	-	-	2.8	10.3	-	-	-	-	-	1.0	4
Heat Stroke	-	-	-	-	-	-	-	2.9	-	1.3	3.2	1.0	4
Vent Pasting	10.0	22.2	-	-	-	-	-	-	-	-	-	0.8	3
Ascites	-	-	-	-	2.8	-	-	-	-	0.7	-	0.5	2
Pasteurella	-	-	-	-	-	-	-	-		0.7	-	0.3	1
Leukosis	-	-	-	-	-	-	-	-	2.2	-	-	0.3	1
Marex	-	-	-	-	-	-	-	2.9		-	-	0.3	1
Total	100	100	100	100	100	100	100	100	100	100	100	100	381

Freq. number of flocks; [1] % within age; [2] total missing values 5

Enteritis was almost equally distributed among all age groups with 62% occurrence during the laying period. Infectious Bursal Disease, and HPS were limited only to 1-2, and 2-3 months age, respectively. Half of the total ascites cases occurred at 2 month age while other half occurred between 7 and 12 months age. Occurrence

of ND had a high correlation with mycotoxicosis (r^2 0.94: figure 4). As stated earlier, ND was among the mostly prevalent diseases in district Chakwal. Immunity breakdown against ND has been suggested to be the main cause of high frequency of ND outbreaks usually noted in areas with high farm density (Naik *et al*., 2005). The high correlation between ND and mycotoxicosis in both broilers and layers in our study suggests that fungal contamination of feed can be among main contributory factors to immunity breakdown against ND in district Chakwal. This is also in line with the previously reported effects of aflatoxins in lowering GMT for ND in broilers (Khan, 1994 and Oguz *et al*., 2003).

None of the respiratory diseases were encountered during 1st week. However, their highest share among other diseases was seen in 2nd and 3rd week (42.9 and 44.4%, respectively, table 5). After 3rd week, their overall share declined gradually to become 10% by 3rd month. In 4th and 5th months their share again increased to become 30.0 and 34.0%. After 5th month up to the age of one year their average share was 16.2%. Contrary to the general belief (Oguz *et al*., 2003), IB was not highly correlated with mycotoxicosis (r^2 0.59).

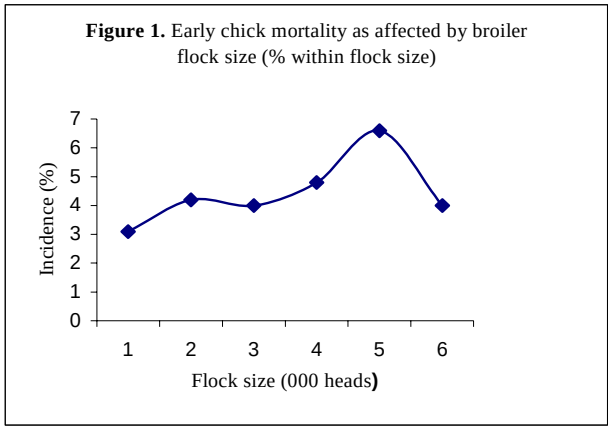

Figure 1. Early chick mortality as affected by broiler flock size (% within flock size)

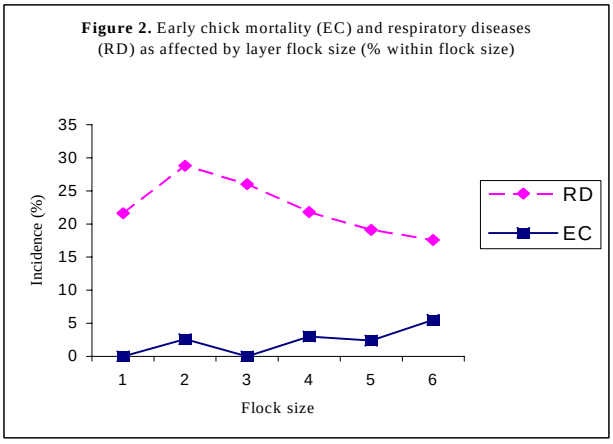

Figure 2. Early chick mortality (EC) and respiratory diseases (RD) as affected by layer flock size (% within flock size)

Approximately half (52.6%) of the respiratory disease attacks had occurred before the layers could enter in the 6th month of age. Out of the number of respiratory disease incidences occurring before 6 months age, 15% occurred in 4th month while 30.0% occurred in the 5th month. Out of total incidence of respiratory diseases, 30% occurred during 4th to 6th month.

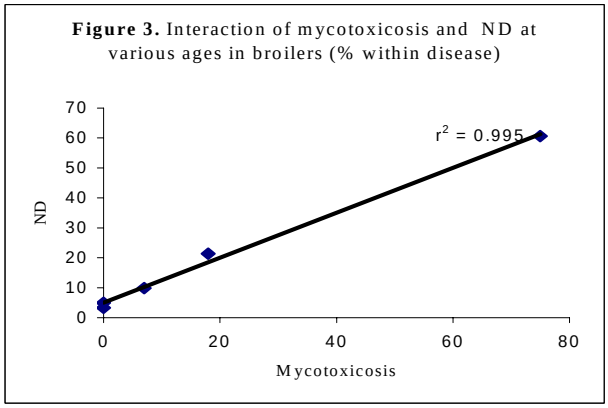

Figure 3. Interaction of mycotoxicosis and ND at various ages in broilers (% within disease)

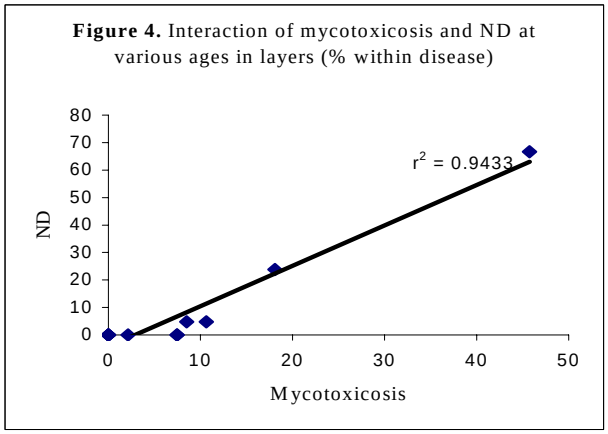

Figure 4. Interaction of mycotoxicosis and ND at various ages in layers (% within disease)

CONCLUSION: The inverse relationship of flock size (broilers) with management diseases i.e. coccidiosis and ascites shown in our data, indicates lack of modern management practices at small farms. This may in turn be due to lack of knowledge regarding poultry husbandry, less available inputs, or in some cases less supervision in a rural subsistence farm. Though surveys specifically targeted to consider various variables are needed to identify the main underlying cause, more efforts from both feed millers and veterinarians in terms of farmer education are needed. From our data, ND was identified to be highly correlated with mycotoxicosis in both broilers and layers. This indicates that mycotoxicosis can be a major contributing factor in vaccine failure in the area.

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