An epidemiological study of recent outbreaks of Gumboro disease in Ghana

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ABSTRACT

A study to assess the epidemiological factors responsible for the recent outbreaks of infectious bursal disease (IBD) in Accra and Kumasi, between October and December 2002 and January to April 2003, was conducted. Case report records at Veterinary Diagnostic Laboratories were examined for IBD cases. Farm investigations were carried out using a combination of questionnaire and interviews to obtain information on the disease situation on farms, where the outbreaks had occurred. The highest occurrence of the disease was recorded between March and April 2003, with Accra showing the highest number of cases in March, coinciding with the Easter season. Day-old chicks imported into the country succumbed more easily to the disease than those produced locally. There was an association between IBD and the chicken type that was significant ($P < 0.05$) in cockerels and layers. Chickens vaccinated twice were more likely to be protected from the disease than those not vaccinated or vaccinated only once. The prevalence of the disease was also influenced by the age of the chickens with a rise in susceptibility with age from 3 weeks to 6 weeks old. The results of the study indicate that the factors studied, namely source of day old chicks, bird type, vaccination history, and age of chicks at the time of outbreak influenced outbreaks of IBD and are likely to contribute to the endemicity of infectious bursal disease in the poultry producing areas of Ghana. It is recommended that stringent biosecurity measures be observed on poultry farms to control the disease in the country.

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Introduction

Infectious bursal disease (IBD), commonly known as Gumboro disease, is an acute highly contagious viral disease of young chicken between the ages of 3-6 weeks. It is characterized by a haemorrhagic syndrome and damage to the Bursa of Fabricius (Hitchner, 1978). However, more recently, it has been reported in chicken older than 16 weeks (Okoye & Uzuokwu, 1981). The effects of IBD are on chick morbidity, mortality, increased susceptibility to other infectious diseases and retardation of growth (Hitchner, 1978). The disease has an important economic impact both through direct losses that are incurred due to specific mortality, and indirect losses as a consequence of immunosuppression (Mcleroy *et al*., 1989, 1992).

The disease was first diagnosed in Ghana in 1977 (Gyening & Corkish, 1977). IBD, when first introduced into the country, was manifested in its mild form, accounting for only 2-5 per cent of poultry mortality. Currently, it is considered as the most important cause of mortality in commercial poultry, responsible for about 60 and 25 per cent mortality in layers and broilers, respectively (Veterinary Services Directorate, 2001). Seasonal outbreaks occur regularly in the country from October to December and January to April, which coincide with the peak production periods for Christmas and Easter celebrations (Koney, 1993) mostly in vaccinated birds (Gyening & Awumbila, 1977; Abdu, 1988).

Previous reports on investigating epidemiological factors which contribute to IBD outbreaks have been scanty. These studies are necessary for designing effective control strategies for IBD in commercial poultry. The paper describes some epidemiology factors associated with IBD outbreaks that occurred in the major poultry production areas of Ghana in 2002 and 2003.

Materials and methods

The study was undertaken between May and June 2003.

Examination of records

Necropsy records of poultry diseases at the Central Veterinary Diagnostic Laboratories of the Ministry of Food and Agriculture in Accra and Kumasi were examined for reported cases of IBD in these areas.

Diagnosis

Veterinarians in charge of the diagnostic laboratories made a definitive diagnosis of IBD, if gross lesions such as muscular hemorrhages in the breast and thigh muscles, enlargement of Bursa of Fabricius, petechial hemorrhages in the junction of the proventriculus and the gizzard that are pathognomonic signs of IBD were observed. A case of IBD was defined as a poultry farm that reported the outbreak of the disease irrespective of the number of birds that actually died or were affected.

Farm investigations

A questionnaire was used to interview owners or assistants of farms in which the outbreak had occurred during the period. The questionnaire captured such information as location of farm, type of birds, flock size, source of day-old chicks, number affected, number that died during the outbreak, and vaccination history. Oral interviews were applied to confirm information collected from the laboratory. Data was transformed into tables, with respect to cases of IBD, morbidity, and mortality according to source of day-old chicks, type, age, month and IBD vaccination history of birds. Specific morbidity and mortality rates of the disease were determined for each factor.

Specific morbidity rate was calculated as the number of birds affected by IBD due to a specified factor divided by the total number of chickens affected by IBD during the specified period of time multiplied by 100. The specific mortality rate was calculated as the number of chicken dying as a result of IBD due to a specified factor divided by the total number of chickens affected by IBD during the specified period of time multiplied by 100. The odds ratio (OR) was also calculated to

determine whether or not an association existed, and the strength of association between a factor and the disease (OR was calculated as the ratio of the odds of being affected or not in a case of IBD due to a specified factor) (Westergren *et al*., 2001). Chi-square analysis was used to determine the significance of the association or relationship between the factors and IBD.

The age of birds was considered in weeks but those between 0 and 1 week were considered under one age group, and those above 9 weeks grouped as 10-12 or above 12 weeks age groups. The bird types encountered were broiler, layer and cockerel. The sources of day old chicks were considered as locally produced (eggs produced and hatched locally) or imported into the country.

Results

A total of 161 cases of farms with IBD, confirmed by laboratory diagnosis, were documented in the outbreaks of the disease during the period under study. The monthly occurrence of IBD cases seen in both Accra and Kumasi increased from October to November and decreased in January and February but rose again in March and April. Accra recorded the greatest increase in March 2003 (Fig. 1). IBD cases never exceeded 13 per cent between October and February in Kumasi and Accra. Thereafter, the incidence of the disease in both cities more than doubled (Fig. 1).

It was observed that chicks imported into the country were more likely to come down with Gumboro than locally produced chicks. The specific morbidity rate was higher (79.5.0%) in imported birds than the locally hatched ones (20.5%) (Table1). Generally, layers (OR 2.4) were more likely to come down with the disease, followed by cockerels (OR 2.3). These associations were all significant ($P < 0.05$). Broilers were less likely to succumb to IBD (Table 2). Table 3 shows that chickens that were vaccinated once were about seven times more likely to come down with the disease compared to those not vaccinated, while those receiving two vaccinations are about two times less likely to come down with the disease. These associations were all significant ($P < 0.05$).

IBD cases were most prevalent during 4-6 weeks of age and declined thereafter (Table 4). Specific morbidity and mortality rates peaked

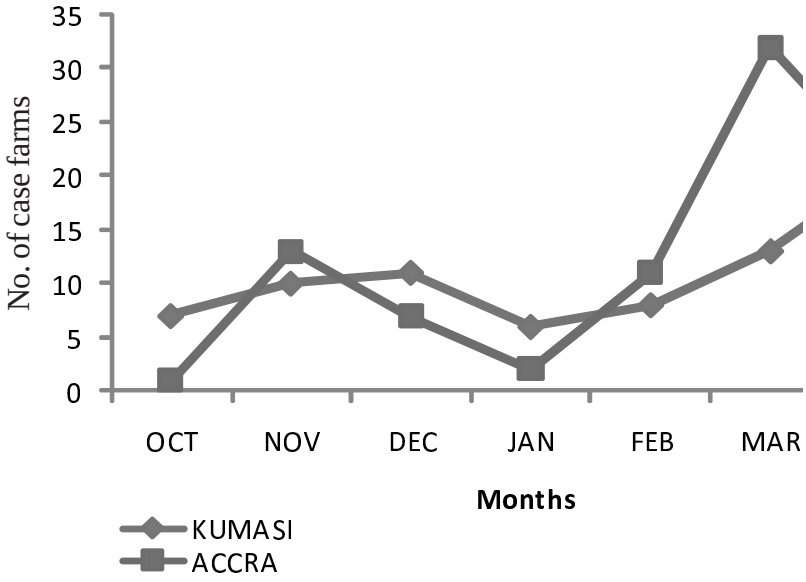

Fig 1. Monthly distribution of IBD cases seen in Accra and Kumasi during the period of Oct 2002-April 2003.

TABLE 1

Distribution by Source of Day-old Chicks of IBD (Gumboro Disease) Cases Seen in the Recent Outbreaks in Ghana

Source of chicks	*Case farms*	*Specific morbidity rate (%)*	*Specific mortality rate (%)*	*Odds ratio (OR)*
Imported	117	79.5	87.0	4.7*
Local	44	20.5	13.0	0.2
Total	161			

* Significant at $P < 0.05$; OR = Odds ratio.

TABLE 2

Distribution by Type of Chicks of IBD Cases Seen in the Recent Outbreak in Ghana

Type of chicks	*Case farms*	*Specific morbidity rate (%)*	*Specific mortality rate (%)*	*Odds ratio (OR)*
Broilers	70	27.3	30.0	0.4
Layers	82	69.5	66.3	2.4*
Cockerels	9	3.2	3.7	2.3*

* Significant at $P < 0.05$; OR = Odds ratio.

TABLE 3

Distribution of IBD Cases Seen in the Recent Outbreak in Ghana According to IBD Vaccination History

No. of IBD vaccinations	*Case farms*	*Specific morbidity rate (%)*	*Specific mortality rate (%)*	*Odds ratio (OR)*
None	15	5.6	4.8	1.1*
Once	47	32.1	30.2	7.3*
Twice	99	62.3	65.2	0.2

* Significant at $P < 0.05$; OR = Odds ratio.

between 3 and 6 weeks of age from 12.2 and 3.7 to 10.6 and 13.9 per cent respectively, in affected birds but declined thereafter to 1.7 and 1.3 per cent, respectively, beyond 12 weeks of age.

Discussion

Outbreaks of infectious bursal disease over the world have been attributed to several factors (Chettle *et al.*, 1989). In this study IBD cases were seen in each month of the period, thus, confirming the suggestion of Gyening & Corkish (1977) that the disease is endemic in the country. The monthly variations in frequencies in Accra and Kumasi can be attributed to the seasonal local production of broilers for the Christmas /New Year and the Easter markets (Koney, 1993). By late December to the end of February most of these seasonal farmers would have disposed of their stock and this accounted for the reduced number of cases observed in January and February.

There are strong indications that the source of day-old chicks is a very important factor in Gumboro disease outbreaks. For most of the cases encountered in the study, the highest morbidity

TABLE 4

Distribution by Age of Chicks of Gumboro Disease Cases Seen in the Recent Outbreak in Ghana

Age (weeks)	*Case farms*	*Specific morbidity rate (%)*	*Specific mortality rate (%)*	*Odds ratio (OR)*
0 – 1	0	0	0	0
2	6	3.4	2.0	0.2
3	30	12.2	3.7	0.6
4	31	21.2	22.8	1.3*
5	41	37.1	42.6	1.1*
6	24	10.6	13.9	1.1*
7	12	2.1	2.5	0.3
8	8	3.8	4.3	0.3
9	3	4.0	3.3	3.2*
10-12	3	3.8	3.5	6.2*
> 12	3	1.7	1.3	2.1*

* Significant at $P < 0.05$; OR = Odds ratio.

and mortality were in imported chicks rather than locally-produced ones. Most of the commercially raised chickens in this country are imported since the capacity of local hatcheries is low and does not meet the demand for day old chicks (Koney, 1993). These hatcheries, therefore, produce only a small percentage of the requirements of poultry farmers. It is also well known that chicks imported to the country have higher maternal antibodies (MAs) than those produced locally because breeding hens in importing countries are vaccinated mid-lay to induce antibodies that are transferred to their progenies.

Previous studies (Nawathe & Lamorde, 1982; Abdu, 1986) have suggested that early vaccination of chicks with higher MAs could interfere with the immunity of the chicks resulting in later outbreaks. Since most of the chicks in the study were imported and over 90 per cent of them vaccinated at least once, interference with MAs due to poor timing of vaccination could be responsible for the morbidity and mortality seen in imported chicks. Broilers and layers are the most commonly raised bird types in Ghana, hence, the higher numbers of IBD cases recorded in these birds. However, broilers showed the least specific mortality rates and odds ratio because lighter breeds are more susceptible to IBD than heavy breeds like broilers (Hitchner, 1978).

Outbreaks of IBD in vaccinated chickens, although known, have not yet been adequately documented in Ghana. Elsewhere, in Nigeria for example, such outbreaks are well known and well documented (Okoye, 1984; Abdu, 1986). The observation in this study is that chickens not vaccinated at all and those vaccinated only once are most likely to succumb to the disease than those given a first and booster vaccinations.

Tong *et al.* (1992) reported a more likely vaccination failure in chickens vaccinated more than once. They attributed this to the interference with maternally derived antibodies or overwhelming of maternal antibodies with more pathogenic field strains of the virus. In contrast to the findings of Tong *et al.* (1992), observations from this study indicate that vaccination failure may be more related to the level of maternally derived antibodies at the point of vaccination, or poor handling and administration of vaccines rather than the number of vaccinations administered.

Maternal antibodies are passed to progenies

of vaccinated parent stock to protect the newly hatched chicks for the critical first 2 or 3 weeks of life (Jackwood, 2004). Consequently, chicks not vaccinated after 3 weeks are likely to succumb to the field strain infections. It is suggested that priming of flocks with live vaccines and a later booster confer complete protection for growing pullets (Kreager, 1993).

The Bursa of Fabricius described as the main target organ for the IBD virus (Hitchner, 1978) is said to develop and reaches its maximum size at 16 weeks after which it begins to atrophy until 52 weeks when it completely disappears. Since maternal antibodies wane with age (Box, 1985), consequently, a correlation was found between increasing susceptibility to IBD with increasing age after 3 weeks of age. Outbreaks of the disease in chicken older than 16 weeks are not uncommon. Such a situation is, perhaps, the case in this study and may account for the higher susceptibility in chicken older than 10 weeks of age.

Conclusion

The existence of predisposing factors of the disease may have resulted in the precipitation of outbreaks and, therefore, may also be contributing to the endemicity of the disease in the poultry producing areas of Ghana. The study shows that infectious bursal disease in Ghana depends on seasonality, age, vaccination regimes, source and type of birds. Stringent biosecurity measures are, therefore, required by all involved in the poultry industry to bring the disease under control.

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