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Economic Impact of Recurrent Outbreaks of Gumboro Disease in a Commercial Poultry Farm in Kano, Nigeria

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ABSTRACT

The economic significance of infectious bursal disease is well known to worldwide poultry farmers. Reported cases of concern in chickens by researchers have primarily been targeted at direct mortality, secondary bacterial infections, immuno-suppression with major impacts on production efficiency and decrease responses to vaccination. This study evaluates economic losses of 3 successive recurrent outbreaks of IBD in a commercial poultry farm in Kano, Nigeria and also projected 3 year (2009-2011) economic losses. Contrary to many research findings, increased age dependence and high mortality rates were observed during the study. Spreadsheet method of disease analysis (2003) was used to project economic loss of over three billion naira during these years under study. Due to high prevalence of IBD in Nigeria, it has become necessary to attempt to quantify the economic impact of IBD so that its economic losses could be appreciated, quick decisions are made on how best to prevent, control and design research priorities. The negative impacts of IBDV can be strategically minimised by good planning, effective vaccination and sound biosecurity principles.

Key words: Gumboro, economic impact, recurrent outbreaks, poultry, Kano, Nigeria

INTRODUCTION

There remains no doubt that poultry industry in Nigeria has greatly expanded over the years holding the greatest promise in affordable animal protein supply, food security and poverty alleviation in both rural and urban populace. In fact paper analysis would always indicate poultry business first on the list of currency doublers among other financial transactions. Unfortunately, constraints especially of diseases and in particular Gumboro disease have rendered this investment fearful and unrealistic to both organizations and individuals (Okoye, 1983; Abdu, 1986; Lukert and Saif, 1997; Shane, 1997; Sainsbury, 2000; Islam and Samad, 2004; Musa *et al*., 2010). The common local slogan of "your money in the refuse dump" is common amongst inexperienced poultry farmers to indicate how mortality of commercial chickens ruins the poultry business in an attempt to caution beginners of poultry enterprise.

Infectious Bursal Disease (IBD) or Gumboro is caused by a highly contagious birnavirus affecting predominantly young chickens and often associated with great economic losses in the poultry enterprises (Lukert and Saif, 1997; OIE, 2008). Avibirnaviruses to which IBD virus belongs are long recognized as being immunosuppressive predisposing chickens to intercurrent infections and lack of adequate responses to vaccinations against other diseases responsible for greatest economic losses in the affected flocks (Shane, 1997).

IBD is a major setback to productivity and profitability in the poultry industries of both developing and industrialized nations (Shane, 1997; Sainsbury, 2000). Gumboro disease is worldwide distributed with two recognized serotypes (1 and 2) (OIE, 2008). Serotype 1 is responsible for clinical cases of Gumboro to which commercial vaccines against Gumboro disease were mainly produced (OIE, 2008). Of the 4 pathotypes of serotype 1 that exist in the field, the hyper or very virulent IBD virus is capable of infecting chickens in the presence of maternally derived or higher levels of vaccinal antibodies causing very high mortalities and bursal damage with severe economic losses (Lukert and Saif 1997; Shane, 1997; Sainsbury, 2000; Islam and Samad, 2004; Musa *et al.*, 2010). The time when chickens are most susceptible to IBD is between 3 and 6 weeks, when the bursa of fabricius is at its maximum rate of development and the bursa follicles are filled up with immature lymphocytes (Lukert and Saif, 1997; Baxendale, 1981). This is because the IBD virus replicates in and cytolytically affects the actively dividing B lymphocytes in the bursa of fabricius (Lukert and Saif, 1997; Baxendale, 1981). However, cases of IBD have also been reported in chickens 14-20 weeks in Nigeria over the years (Okoye and Ozoukwu, 1981; Owoade and Durojaiye, 1995; Igbokwe *et al.*, 1996; Dashe *et al.*, 2009; Musa *et al.*, 2010), necessitating a rethink in IBD control strategies.

In Nigeria, the first report of IBD was by Ojo in 1973 (Okoye and Uzoukwu, 2001). Pullets, cockerels and indigenous chickens were shown to be more susceptible than broilers and males had higher mortality rates than females following outbreaks (Okoye, 1983; Sainsbury, 2000). It has become almost practically impossible to control IBD in Nigeria due to poor biosecurity practices in most Nigerian households and poultry farms (Musa, 2009; Musa *et al.*, 2010). Therefore, prevention of IBD is mainly dependant on vaccination with a single prototype indigenous and various types of foreign IBD vaccines (Okoye and Uzoukwu, 2001). Unfortunately, severe outbreaks still occur with high mortality rates in vaccinated and unvaccinated flocks (Okoye, 1983; Abdu, 1986; Sainsbury, 2000; Musa *et al.*, 2010).

The exact time of vaccine administration, type of vaccine to be used, maternal derived antibody (MDA) in the chicks and the pathogenicity of IBD circulating field virus are among others important factors that determine how the efficacy of IBD vaccination will be (Shane, 1997; Sainsbury, 2000; Hair-Bejo *et al.*, 2004). Worldwide field practice involves various types of vaccine use and vaccination schedules, despite these outbreaks are still not under reasonable control (Shane, 1997; Sainsbury, 2000; Ahmed and Akhter, 2003; Musa *et al.*, 2010). This paper examined the economic impact of 3 recurrent outbreaks of IBD in a farm with respect to losses due to mortality and expected revenue if the birds had survived to complete their production cycle.

MATERIALS AND METHODS

A 3 year data (2009-2011) utilized for this study were obtained from a poultry commercial farm in Kano, Nigeria where pullets intended for commercial egg production were kept on deep litter and transferred to battery cage at 16 weeks. The pullets were vaccinated against IBD at 2 and 4 weeks of age and Newcastle disease vaccine (intra ocular and LaSota) at the first and 3rd weeks, respectively. Various forms of prophylactic antibiotics like Neoceryl plus® (Animal care) and multivitamins like Vitalyte® (Anupco) were routinely administered to the birds prior to the outbreaks. Specific antibiotics like Conflox® (Enrofloxacine) at therapeutic doses during the course of the clinical disease were also administered.

The spreadsheet model of livestock disease analysis (Benette and Ijpelaar, 2003) was used to provide basis for the economic assessment of diseases in relation to:

- The output of losses and resource wastage in livestock production due to diseases
- The treatment and preventive measures undertaken to control diseases and
- The animal welfare, zoonoses and benefits of reducing disease incidence (where applicable)

The methodology was used as follows:

- First, identifying the livestock population at risk and the production systems affected with an estimation of the annual incidence of each disease in the population
- Secondly, identification of the range and incidence of physical effects of each disease on the production systems affected as compared to when no disease is present (Fig. 1)
- The third process was valuation of the physical effects of each disease on production

Fig. 1(a-b): Clinical signs (severe depression and high mortality) of Gumboro disease from the farm

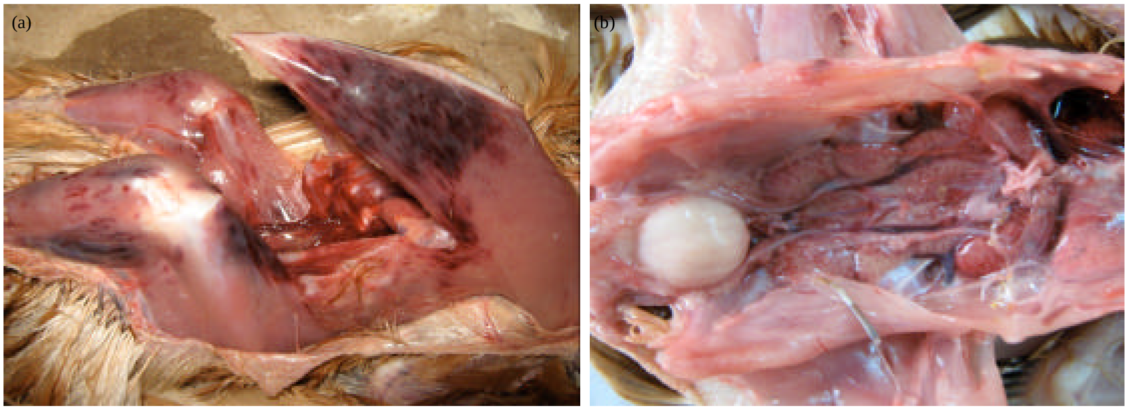

Fig. 2(a-b): Gross pathology of (haemorrhagic muscles, inflamed bursa of fabricius) in the Gumboro infected bird

- Then the estimation of the value of direct disease losses to livestock production due to disease was done
- The next step was identification of the treatment measures undertaken for each disease and estimation of treatment costs involved due to the disease (Fig. 2)
- And finally the identification of specific prophylactic measures for each disease and estimation of the costs incurred in undertaking those measures was done
- Based on the above therefore, the spreadsheet method estimates the components of 'Direct Costs' (DC) for each disease by the formula:

$$DC = (L+R)+T+P$$

Where:
L = The loss in expected output due to disease
R = The increase in expenditures on non-veterinary resources due to disease
T = The cost of inputs to treat disease
P = The cost of disease prevention measures.

For each of the disease effect:

$$L+R = p\times id\times Ie\times E\times vi$$

$$T = p\times it\times Vt$$

$$P = p\times ip\times vp$$

Where:
P = Size of livestock population at risk
id = Annual incidence of disease as a proportion of the population at risk
ie = Incidence of disease effects as a proportion of the affected population
e = Magnitude of physical disease effects (crates of eggs lost)

Table 1: Cost of production for 2009-2011

Year/Month	Batch No.	No. of birds	No. of birds stocked	Mortality (%)	Unit cost of DOCs (₦)	Total value of birds (₦)
2009/ April	1	10150	24.56	4-5	180	182700
	2	10139	12.32	3-4	187	189599
Total		20289				372299
2010/May-June	1	9126	29.65	3-4	230	209898
	2	8490	61.9	4-6	215	182535
Total		17616				392433
2011/June	1	8066	88.79	4-5	216	174225
	2	7042	87.80	5-6	216	152107
Total		15108				326332
Grand total		53013				1,091064

vi = Unit value of lost output or resource wastage (₦/crate of egg)
it = Proportion of population at risk treated
vt = Cost of treatment per bird
ip = Proportion of population at risk where prevention measures taken
vp = Cost of prevention measure per animal

From Table 1:

p = 53013 (total flock population 2009-20110
id = 7.5 (Mbuko *et al*., 2010)
ie = 0.5 (proportional incidence of affected population)
e = 2282 Crates of eggs lost (at 80% productivity and 15% allowable mortality)
vi = 700 ₦ (market price/crate)
it = 4321 (initial population less mortality)
vt = 25 ₦ (drugs and labour)
ip = 53013 (whole flock received prophylaxis)
vp = 2 ₦ (IBD vaccine; ND vaccine)

Therefore:

$$DC = (L+R)+T+P \text{ And } (L+R) = p\times id\times ie\times e\times vi = 53013\times7.2\times0.5\times2282\times700 = 3.048586783$$

$$T = p\times it\times vt = 53013\times4321\times25 = 5726729325$$

$$P = p\times ip\times vp = 53013\times53013\times2 = 5620756338$$

Therefore:

$$DC = (L+R)+T+P = 3.110, 521, 076 \text{ ₦}$$

RESULTS AND DISCUSSION

Economic losses for the years 2009, 2010 and 2011 amounting to over three billion Nigerian currency was experienced by the farmer over the period of 3 year recurrent IBD outbreaks.

From the above estimates therefore, economic losses associated with outbreaks of IBD in the studied farm appeared unimaginable to the farmer as the farmer did not relent efforts to restock his farm. IBD has been reported earlier to be an important cause of economic losses in the poultry industry (De-Wit *et al*., 2001). Many a times the farmers concern is the present monetary mortality value of the lost flock and never sees beyond if the birds were to survive. These compounded losses are often high, unimaginable and alarming if properly quantified as indicated clearly above. IBV continues to be a major disease problem of commercial and rural chickens and constitute a major threat to poultry production in Nigeria (Okoye and Uzoukwu, 2001; Musa *et al*., 2010).

Initial outbreaks of IBD on farms were observed to be of an acute nature and recurrent outbreaks in succeeding broods were usually less severe and were sometimes undetected (Lukert and Saif, 1997). In this study however, recurrent outbreaks showed higher mortality rates (25% in 2009; 61% in 2010 and 89% in 2011). It is possible that the IBD responsible for this outbreak is a variant IBV type or most likely a very virulent strain that had possibly increased pathogenicity with successive passage in the chickens during the natural course of the disease outbreaks on the farm. Or most probably IBV has re-emerged with increasing virulence in Nigeria as it did in other countries (Islam and Samad, 2004). Other likely factors that possibly could have influenced the mortality may include poor management, levels of maternally derived antibody in the chicks and other environmental stress factors. It is clear that these outbreaks occurred in the Months of April to July being heat periods in the study area and it is probable that the immunocompetence of the chicks was adversely affected.

The mortality rate was observed to be age dependant with lowest in 3 week old pullets and highest in 6 week old pullets. This agrees with earlier finding that severity of IBD was related to the number of susceptible B cells present in the bursa of fabricius at the time of infection which is commonly seen between 4 and 6 weeks when the bursa of fabricius is at its maximum rate of development and the follicles are filled with immature B lymphocytes (Lukert and Saif, 1997; Rautenschelin *et al*., 2003). Most outbreaks of IBD in chickens under 3 weeks of age have been reported to be subclinical with bursal lesions and immunosuppression (Okoye and Shoyinka, 1983). However, the subclinical infections are economically important due to severe and long lasting immunosuppression; such birds do not respond to vaccinations and become susceptible to other diseases (Lukert and Saif, 1997; Baxendale, 1981).

The source of the continuous infection to subsequent batches of chicks may be due to persistence of the virus in the environment between outbreaks since IBD virus is very stable, resists many disinfectants, heat (60°C for 30 min) and persists in the poultry houses despite thorough cleaning and disinfection (Lukert and Saif, 1997). The stability of IBD virus in the environment, the economics of poultry production requiring short fallow periods between chicken batches and possible litter re-use encourage persistence IBD outbreaks that requires absolute dependence on vaccination using live and killed IBD vaccines to keep Gumboro in check because control through sanitation may not be practicable in most poultry farms (Musa *et al*., 2010). Despite these efforts unfortunately, variations exist between neutralizing antibodies of the host and field viruses, the levels of passive immunity to chicks are variable and unpredictable, vaccines available in field for protection vary in safety and efficacy, therefore, no vaccines and vaccination schedules bring rest of mind to the Veterinarian and his clients since effectively vaccinated flocks still report outbreaks (Abdu, 1986; Islam and Samad, 2004; Mbuko *et al*., 2010; Musa *et al*., 2010).

The serious economic losses associated with these recurrent outbreaks despite vaccination, one would suspect that the variant strain or the very virulent strains of the IBD virus to which vaccines currently available in Nigeria may not protect effectively are responsible for these outbreaks, though other concurrent pathogenic infections or adverse weather conditions were observed to adversely influence IBD mortality (Okoye and Shoyinka, 1983).

The use of IBD vaccines against current IBD virus in circulation in an area, effective biosecurity measures, proper decontamination and appropriate use of disinfectants and observing an adequate fallow period before restocking following outbreaks will assist in controlling further outbreaks. Meanwhile, passive protection via breeder vaccination and adequate progeny vaccination will protect birds against the menace of IBDV to a greater extent (Baxendale, 1981).

Birds that recover from natural infections remain strongly immuned while chicks with high maternal antibody if vaccinated with live vaccines may be rendered poorly immunocompetent (Baxendale, 1981). Additionally, a high degree of immune variation is been reported to exist between naturally occurring IBD and vaccine available (Baxendale, 1981). This leaves the Veterinarian and his client in a greater confusion in an attempt to effectively prevent IBD especially where laboratory facilities are inadequate. In this respect therefore, there is the need to produce bio-engineered vaccines based on the types of pathogenic IB viruses present in Nigeria.

We also recommend a continuous search for an appropriate timing of IBD vaccination in chickens to keep pace with the ever increasing demand for poultry products in Nigeria.

REFERENCES

Abdu, P.A., 1986. An outbreak of Gumboro disease in vaccinated flock in Zaria Nigeria. Zar. Vet., 1: 40-41.

Ahmed, Z. and S. Akhter, 2003. Role of maternal antibodies in protection against infectious bursal disease in commercial broilers. Int. J. Poult. Sci., 2: 251-255.

Baxendale, W., 1981. Immunity to Infectious Bursal Disease. In: Avian Immunology, Rose, M.E., L.V. Payne and B.M. Freeman (Eds.). Edinburg British Poultry Science Ltd., Harlow, Essex, UK., pp: 225-227.

Benette, B. and J. Ijpelaar, 2003. Economic assessment of livestock diseases in Great Britain. Final Report to the Department of Environmental, Food and Rural Affairs, The University of Reading, England, pp: 6-26.

Dashe, Y.G., P. Okewale, D.L. Jwander and M.U. Alesa, 2009. Gumboro disease outbreak in a vaccinated pre-lay poultry in new pen house. Central Diagnostic Department, P.M. B. 01, NVRI, Vom, Nigeria, http://www.venerealdiseaseinfo.com/2011/09/gumboro-disease-outbreak-in-a-vaccinated-pre-lay-poultry-in-new-pen-house.html

De-Wit, J.J., E.A.M. Graat, H. Smestsres, J.F. Heijmans and H.W. Saatkamp, 2001. Epidemiology and economic aspects of infectious bursal disease in the Netherlands. Proceedings of the International Symposium on Infectious Bursal Disease and Chicken Infectious Anemia, June 16-20, 2001, Germany, pp: 278-287.

Hair-Bejo, M., M.K. Ng and H.Y. Ng, 2004. Day old vaccination against infectious bursal disease in broiler chickens. Int. J. Poult. Sci., 2: 124-128.

Igbokwe, I.O., M.A. Salako, J.S. Rabo and S.U. Hassan, 1996. Outbreak of infectious bursal disease associated with acute septicaemic colibacillosis in adult prelayer hens. Rev. Elev. Med. Pays. Trop., 49: 110-113.

Islam, M.T. and M.A. Samad, 2004. Mortality in chicks associated with economic impact and prospect of layer chick rearer package programme of the participatory livestock development project in Bangladesh. Int. J. Poult. Sci., 3: 119-123.

Lukert, P.D. and Y.M. Saif, 1997. Infectious Bursal Disease. In: Diseases of Poultry, 10th Edn., Calnek, B.W., H.J. Barnes, C.W. Beard, L.R. McDougald and Y.M. Saif (Eds.). Iowa State University Press, Ames., pp: 721-738.

Mbuko, I.J., W.I. Musa, S. Ibrahim, L. Sa'idu, P.A. Abdu, S.B. Oladele and H.M. Kazeem, 2010. A retrospective analysis of infectious bursal disease diagnosed at poultry unit of ahmadu bello university, Nigeria. Int. J. Poult. Sci., 9: 784-790.

Musa, I.W., 2009. Sero-diagnosis and survey of avian influenza and Newcastle disease in poultry in Bauchi and Gombe States. MSc. Thesis, Ahmadu Bello University, Zaria, Nigeria.

Musa, I.W., L. Saidu, J. Adamu, I.J. Mbuko, B.Y. Kaltungo and P.A. Abdu, 2010. Outbreaks of Gumboro in growers in Zaria, Nigeria. Nig. Vet. J., 31: 306-310.

OIE, 2008. Infectious bursal disease (Gumboro). Terrestial Manual, Office International des Epizootics.

Okoye, J.O.A., 1983. The effect of late infectious bursal disease on the severity of naturally occurring *Eimerria necatrix* infection in chickens. Bull. An. Health Prod. Af., 31: 263-267.

Okoye, J.O. and S.V. Shoyinka, 1983. Newcastle disease in vaccinated flock which had experienced subclinical Infectious Bursal Disease. Trop. An. Health Prod., 16: 221-224.

Okoye, J.O.A. and M. Ozoukwu, 1981. An outbreak of infectious bursal disease among chickens between 16 and 20 week old. Avian Dis., 25: 1034-1038.

Okoye, J.O.A. and M. Uzoukwu, 2001. Histopathogenesis of local Nigerian isolates of infectious bursal disease virus in broilers. Proceedings of the International Symposium on IBD and CIA, June 16-20, 2001, Germany, pp: 366-376.

Owoade, A.A. and O.A. Durojaiye, 1995. Infectious bursal disease in 14 week-old turkeys in Nigeria. Trop. Anim. Health Prod., 24: 47-49.

Rautenschelin, S., H.Y. Yeh and J.M. Sharma, 2003. Comparative immunopathogenesis of mild, intermediate and virulent strains of classic infectious bursal disease virus. Avian Dis., 47: 66-78.

Sainsbury, D., 2000. Infectious Bursal Disease: Poultry Health and Management. 4th Edn., Blackwell Publishers, Oxford, UK., pp: 125-126.

Shane, S., 1997. Infectious Bursal Disease: The Poultry Disease Handbook. American Soybean Association, USA., pp: 57-61.