DAY OLD CHICKS (DOC) HEALTH STATUS AND EARLY MORTALITIES: CONSEQUENCES OF MYCOTOXIN ON BREEDER FARMS AND HATCHERY MANAGMENT IN WEST AFRICA: CASE STUDIES FROM NIGERIA

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INTRODUCTION

Agric Trade business in Day Old Chicks (DOC) and value chain products is still poorly developed in the West Africa sub region. This must be strengthened in order to contribute and impact on the intra regional agricultural business and trade movement in other to increase poultry food security in the region in line with the presidents Global Food security Response (GFSR).

The paper traces a vertical relationship of mycotoxins transfer and its immuno-pathological implications on the health status of the upstream (Breeders) and the down stream (DOC) segment of the Industry by providing comprehensive case studies from poultry health management operations in Nigeria.

Mycotoxins negative impacts on efficient chemotherapy and on immune response integrity for upstream and downstream poultry segment in the region may negate the CCDP and AU NEPAD target achievement of a 6% agricultural growth for the region. Private initiative advocacy and contributions from observations derivable from field studies analysis will contribute in reductions of sanitary risks and diseases transmission in the region in other to boost food security for over 240 million consumers of the region that needed safe poultry and hygienic value added products products.

The health status of a chick or a flock is a function of many factors such as the gene quality, climatic elements (of temperature, relative humidity, rainfall etc) and the environment (particularly the housing parameters), diet and management. These altogether can influence the performance of birds as they grow to become egg layers or meat producer.

The level of diseases exposure and susceptibility of chicks could be determined by the degree at which the above factors interfere with the immune status of the flock.

We can represent the influence of these factors on the chicks performance by a simple equation represented as:

Perfomance =fG+fD+fH+fE+fMgt or

Performance=f(G+D+H+E+Mgt)

G = gene

D = diet

H = housing

E = environment

Mgt = management

MYCOTOXIN: THE CORE PROBLEM

Mycotoxin high occurrences in West Africa contaminate mainly maize crops and the oil seeds such as Soya and Groundnuts prior to the crop harvest, because of high temperature and interrupted rainfall pattern.

The concentration of mycotoxins increases when the raw materials and the finished feed are not properly stored.

Presently more than 200 mycotoxins have been identified on the field with five commonly identified on maize and feed samples include the following with acceptable ppb level.

Aflatoxin	>10PPB
DON	>50PPB
T2tox	
ZEA	>70PPB
FUMONISM	>1PPM

(Whitlow et al 1998)

IMMUNOPATHOLOGY

Mycotoxins such as Aflatoxin and DON (Vomitoxin) depress the secretions of protective Immunoglobulin like IgM and IgG and this may have a long- lasting implications on the immune system of the Breeder Stock and passive immunity of DOC .

On the cellular immunity, Mycotoxins and especially Aflatoxin may reduce lymphocyte stimulation.

After exposure of Breeders to AFB1(Aflatoxin B1) it was reported by Silvoti et al (1997) that progeny from such parents suffered from reduced lymphocyte proliferation which was related to a direct reduction in the synthesis of Cytokines and the integrity of the Cell Mediated Immune System (CMI).

This observation may account for numerous reports of Mareks diseases vaccination failures in the region, due to the damage of toxins on the B and T cells and the epithelial monolayers the IgG and the IgM respectively with the direct implications of early chicks mortalities of commercial stocks.

Mycotoxins effect on immune system is responsible for most resistances to infections that were recorded on the field in West Africa,

Recent studies have proved that Mycotoxins such as Ochratoxin (OTA) and Fuminosin B1 (FB1) when ingested at sub- clinical level by chicks may increase their susceptibility to natural field infections attack such Salmonellas and E coli infections respectively. (Oswald et al 2003)

Figure 1 below showed the clinico-immunological implications of mycotoxins on the immune system of chicken.

CLINICO IMMUNOLOGICAL EFFECT OF MYCOTOXIN

Symptoms	AFB1	DON	T2tox	FB1	OTA	ZEA	
Anorexia	1	3	3	1	1	0	**9**
Growth	3	3	2	1	1	0	**10**
Liver Damage	3	0	0	2	1	0	**6**
Kidney damage	0	0	0	1	3	0	**4**
Abortion	0	0	0	1	0	2	**3**
Infertility	0	0	0	0	0	3	**3**
Vulvovaginitis	0	0	0	0	0	3	**3**
Pulmonary edemas	0	0	0	3	0	3	**3**
Immunomodulation	3	2	2	3	1	1	**12**
	10	**8**	**7**	**12**	**7**	**9**	

AFB1 -Aflatoxin B1 (Calcinogenic)

DON - De-oxynivalenol (Vomitoxin)

T2tox -Tricothecelex

FB1 -Fulminoxin

OTA -Ochratoxin

ZEA -Zearalenone

MYCOTOXINS IN VACCINATION FAILURES AND BACTERIA RESISTANCE

Mycotoxins as contaminants in the feed or in the environment are metabolites from raw materials that are contaminated with moulds or fungi from the field and storage operations. When such contaminated feed are consumed by chicks or adult birds, they pose serious threat to the functional integrity of the immune system, leading to resistance development and persistent vaccination failures, despite Good Veterinary Practice(GVP) of correct vaccination procedures at hatchery and farm level.

What is vaccination failure?

Vaccination failure in poultry occurs when chicken do not develop adequate and lasting immune response after the administration of vaccines or when they become susceptible to field challenges during the protective period of such vaccinations.

What is Bacteria resistance?

Bacteria resistances on the other hand, develop when a known efficacious antibiotic can no more inhibit, kill or prevent the growth of a pathogenic bacteria in a host.

These two scenarios have been identified as major contributory factors that are currently limiting heath status and sustainability of poultry development in tropical West Africa where escalating mortalities from resistances and vaccination failures result in economic losses to poultry farmers in the region.

MYCOTOXINS MAY AFFECT SUSTAINABILITY

HUMAN POPULATION				LAYER POPULATION AND BROILER CONSUMPTION (COMMERCIAL)			
Region	Yr 2000 (,000,000)	Yr 2010 (,000m)	Rate of Growth	Projected egg consumption/caput/annum 2010	Projected Br meat consumed caput/annum	Projected layer Pop 1,000,000 birds	Projected boiler consumption (,000 tons.)
Africa	856,156	1,116,253	2.7	3.9kg	4kg	268	4,480
W. Africa 6 countries including Nig		240,058	2.3	2.9kg	4kg	80.4	1,344
Nigeria	129	168	2.7	3.9kg	4kg	40.2	672

Source: S.O. Adejoro: African Poultry industry to focus on Sustainability; World Poultry Vol 19 No 11, 2003, www.AgriWorld.nl

Table 2: Estimated Grand parent and Breeder stock population(Nigeria)

Grandparent stock	Population	Expected Output
Heavy breeds	46,000	1,308,125 Ps/year
Light birds	33,000	1,543,750 Ps/year
Total	79,000	2,951,875 Ps/year

Source: Adene, D.F. and Oguntade A.E. - commercial and village based poultry industry in Nigeria (FAO Rome study, 2006)

Table 3: Estimated parent stock population

Parent stock population	Broiler Ps population	Black layers Ps population	Brown layers Ps population
Configured fig	885,500	311,500	287,000
Unconfigured fig	88,500	31,150	28,700
Total	974,050	324,650	315,700

MYCOTOXIN IN BREEDER FLOCK: LATEST STUDIES

Mycotoxins are metabolites produced by moulds and fungi that contaminate feed raw materials and the environment and may impact negatively on the integrity and function of the breeder's immune system if they are fed with feed from such materials.

The physiological role of the immune system in producing active and maternal antibodies against microbes of viral, bacteria and protozoan origins can therefore be compromised.

Several researches have been conducted on breeder strain resistances to some mycotoxins. Washburn proved that Aflatoxin resistances do exist in different strains of chicken while Manning et al developed a line differences in resistance of chicken to acute and chronic dietary aflatoxin.

Study showed that Breeder hen fed with contaminated aflatoxin B1 over a period of 25 days at 3,300mg/kg produced contaminated eggs which may hatch aflatoxin contaminated DOC.

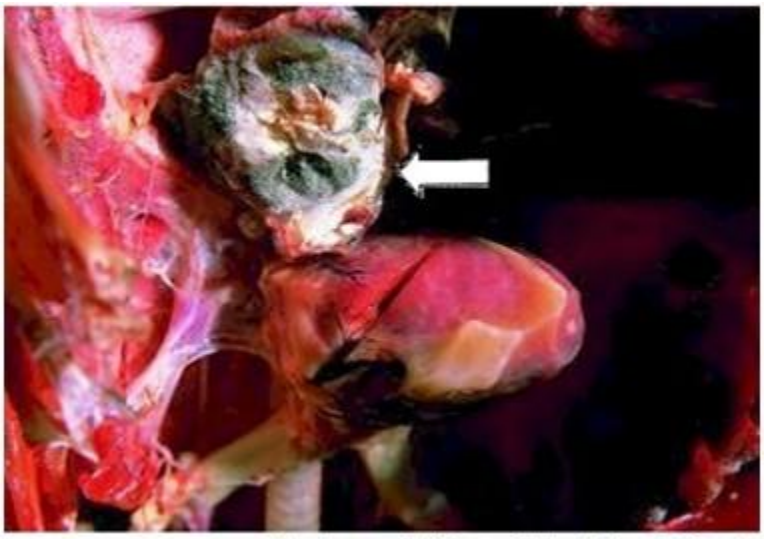
These categories of chicks often show poor response to vaccination performed at the hatchery as well as developing high resistances to antibiotics commonly used for treatment.

Mycotoxins impact negatively on the innate, humoral and cellular immune system if mycotoxins contaminated feed are ingested by poultry, they affect the innate immune system by altering the integrity of the epithelial monolayer and affecting the phagocyte activity (Bouhet and Oswald 2005).

MYCOTOXIN IN HATCHERY OPERATIONS

A generalized rise in temperatures and humidity in the hatchery may provide a good medium for fungal and bacteria growth that may predispose chicks to post- hatching microbial contamination and Aspergillus infection with aflatoxin complication. High temperature will encourage more evaporation to the air and thus encourage the build- up of microbes. Acute aspergillus infection may result in a devastating loss of birds in hatcheries.

Usually the sources of infection are quite often from contaminated litter from the Breeder farm when farm or if fumigation of eggs are delayed in farms sited at a long distance from the hatchery.



Photograph / Copyright - Milton Friend.

Similarly, incidences of dirty eggs not properly cleaned and disinfected may result in contamination prior to hatching, which may provide ideal growth medium for the fungus and subsequent production of massive numbers of spores for infection of newly how soon becoming occluded by cellular material and hyphae branches.

Monitored hatchery production in tropical West Africa showed that weather fluctuations manifesting as high temperature, interrupted rainfall and high humidity have impact on chicks hatchability and chick quality.

Some documented results (not published) from the region showed a reduction in hatchability in the range of 3%-5% over short period of monitoring in the last 2 years, with chick output showing evidences of roughed feathers and high rate of unhealed navel.

UPDATE FROM NIGERIA

Farmers in Nigeria are recording persistent vaccination failures to Newcastle Diseases (ND) Infectious Bursa Diseases (IBD) and Mareks Diseases (MD) even when Breeder and Hatchery operators recognized and implemented IBD and Mareks vaccination in their operations respectively.

Resistances and vaccination failures in poultry can be linked to the role of underlining mycotoxins as a major hazardous factor interfering with immune response synergy to the effectiveness of chemotherapy and vaccinations in Breeder and commercial operations.

Documented case studies of vaccination failures to Infectious Bursa Diseases (Gumboro Disease) Newcastle Diseases (ND) and Mareks Diseases MD have been severally reported world wide. This paper describes cases of such events in Nigeria that were escalated by the ongoing climate change.

Mycotoxin effect on breeders can permeate through the hatchery to manifest on the health and performance status of the emerging offsprings even when they are adequately vaccinated at the hatchery or subsequently at the commercial farm level.

CASE STUDIES FROM NIGERIA ROLE OF MYCOTOXINS

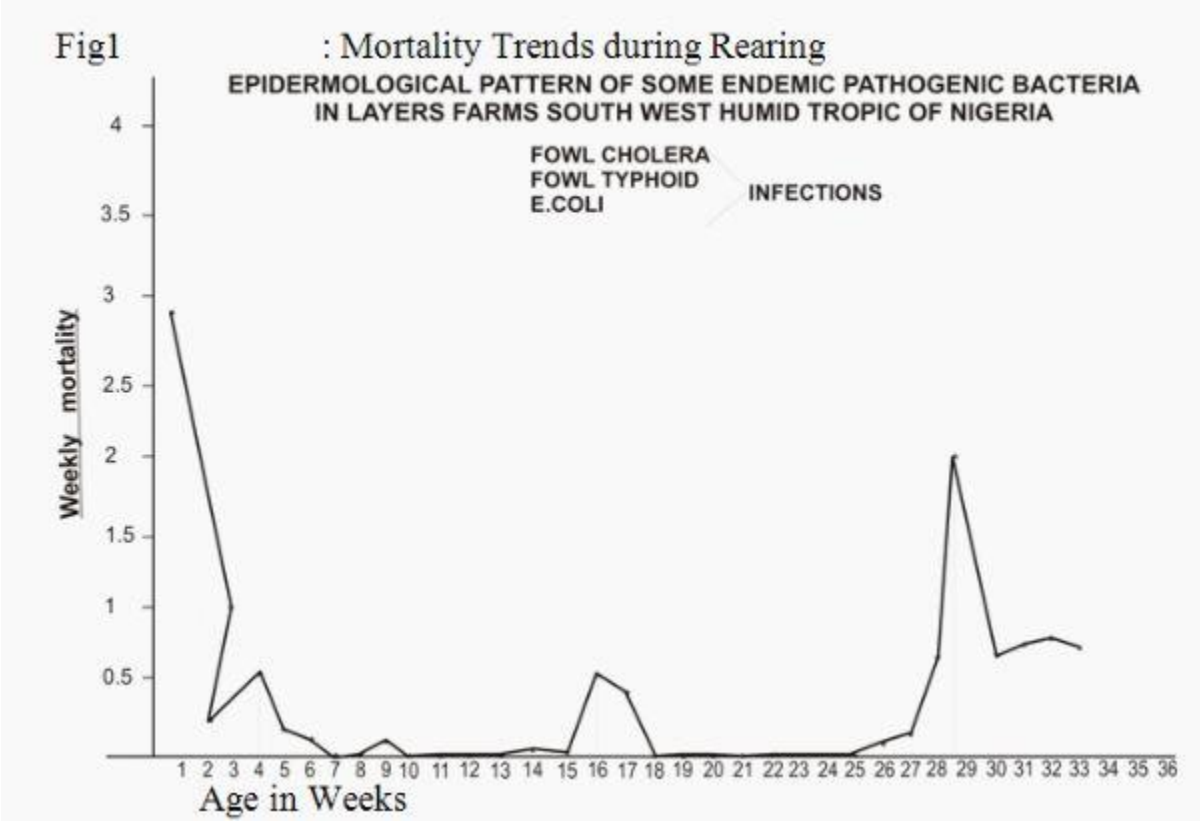
1) PREVALENCE OF BACTERIA RESISTANCES

Case study on the effect of mycotoxins level on therapy and resistance development in Nigeria poultry production are presented below;

Table 2: Incidence and Level of Resistance problem to commonly diagnosed Antibiotics of Poultry in South Western Nigeria

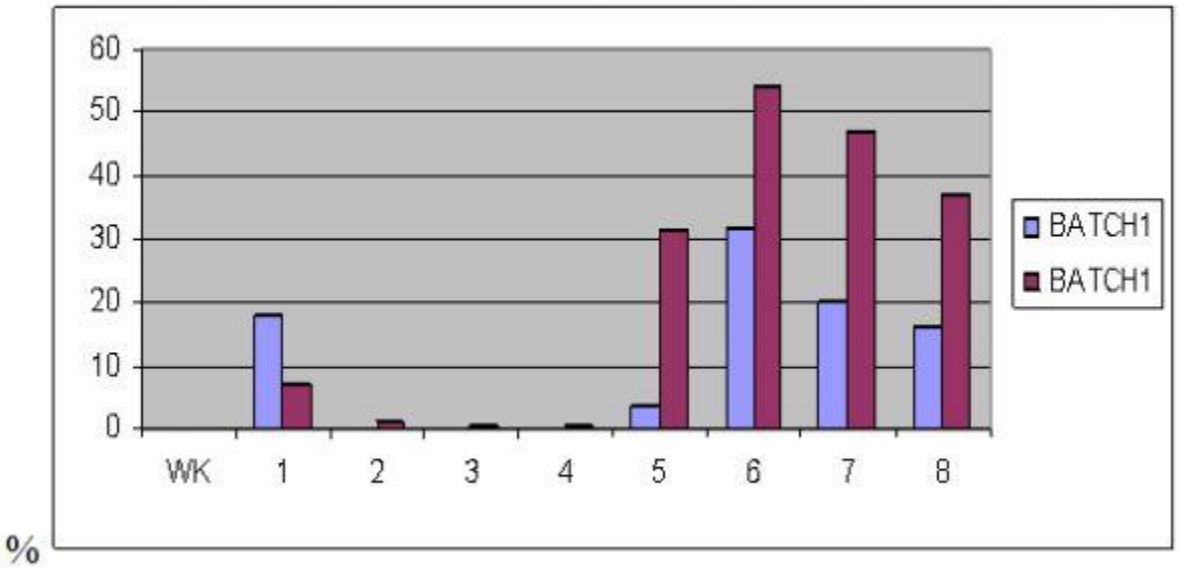
Bacterial Diseases	% Quarterly Incidence	% Resistance to 20 marketed antibiotics in Nigeria
E Coli/Collibacillosis	73.4	55.3
Salmonellosis	8.6	56.3
Pseudomonas	5.3	73.8
Bacillus	3.6	30
Fowl Cholera	9.1	-

Adejoro, S.O. World Poultry vol 23 No 10, 2007



Some of the project assayed in the survey period showed the under -listed pattern of mortalities highly resistant to choice antibiotics

2) MYCOTOXIN EFFECTS ON EARLY CHICKS MORTALITY IN A BREEEDER FLOCK SELECTED CASES



Aflatoxin Assay on finished Feed and Raw materials

SAMPLE	MATERIAL	PPB	JUDGEMENT
1	MAIZE	54.4	FAILED
2	SOYA	0	PASS
3	F.FAT	0	PASS
4	FEED1	45.8	FAILED
5	FISH	0	PASS
6	FEED2	40.4	FAILED
7	BONE1	0	PASS
8	BONE2	0	PASS

Adejoro et al 2007

Laboratory Research documents 2007

3) MYCOTOXIN AND MAREKS VACCINATION FAILURES IN SOUTH WEST NIGERIA

All cases reported in this study represented farms that complained directly to various hatcheries in the south western Nigeria to which this author received invitation to investigate and present a feed back report to the hatcheries for management.decision on demand for compensation by farmers

Majority of hatcheries in Nigeria are located along the south west axis and most especially within the catchments states of Ogun, Oyo, Osun, Lagos and Ondo States of Nigeria.

METHODOLOGY

INFORMATION GATHERING

- Structured questionnaire .
- Percentages of weekly/monthly mortalities
- Record farm data analysis
- An Aflatoxin assay

RESULTS

MAREKS VACCINATION FAILURES AND TRACEABILITY SOUTH WEST NIGERIA, 1986-2010

CODE	LOCATION (State)	YEAR	Was mareks validated at Hatchery		Mycotoxins identified?		Opening Stock	Age at start of Mortality (Weeks)	Age at deadline of mortality (Weeks)	Age at upsurge of mortality (Weeks)	Total cumulative % mortality
			Yes	No	Yes	No					
1	Oyo	1986		x		x	5.100	4	12	16	30
2	Osun	1986	x		x		2200	4	12	16	35
3	Oyo	1996	x		x		10.000	4	12	16	20.8
4	Oyo	2004	x			x	11.000	4	12	16	17.8
5	Oyo	2004	x		x		22.000	4	12	16	25.2
6	Oyo	2004	x			x	5.108	4	12	16	6.8
7	Ondo	2004	x			x	4.893	20	16	20	7.6
8	Ondo	2004	x		x		8.000	16	12	20	43.9
9	Ogun	2009	x		x		16.800 (Brbl)	4	12	16	36.3
10	Oyo	2009	x		x		17.630 (Brbl)	4	12	16	16.6

Brbl= (Broiler Breeder Layer)

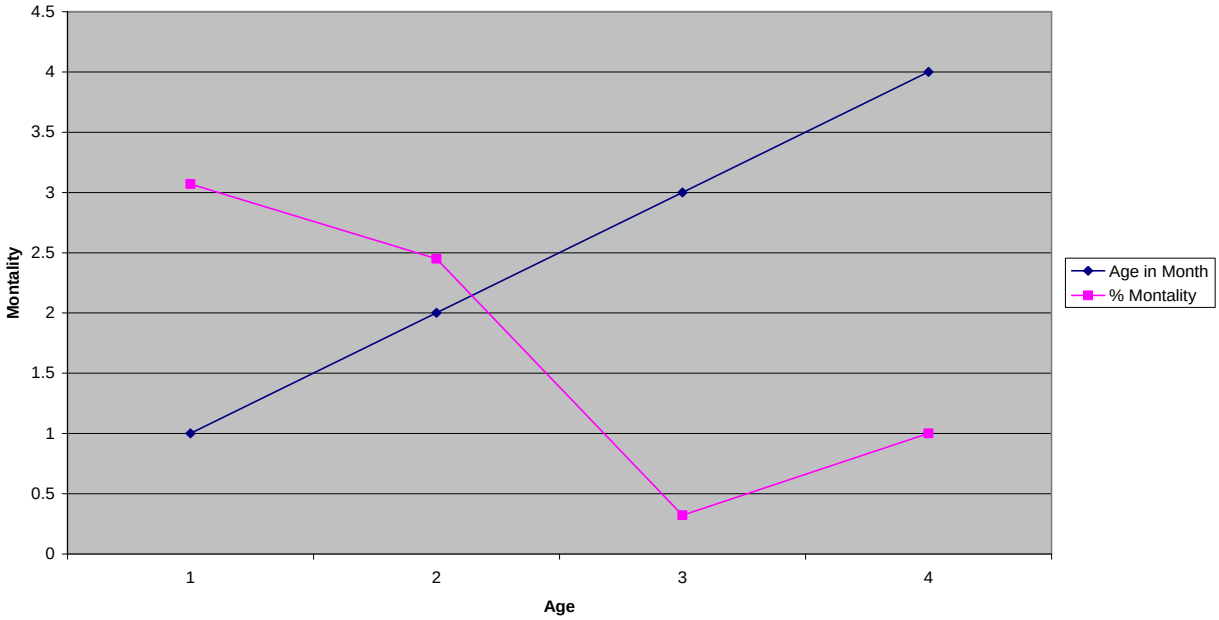
CLASSIFICATION OF MAREKS VACCCINATION FAILURES 1986-2010

SOUTH WEST HUMID TROPICS OF NIGERIA

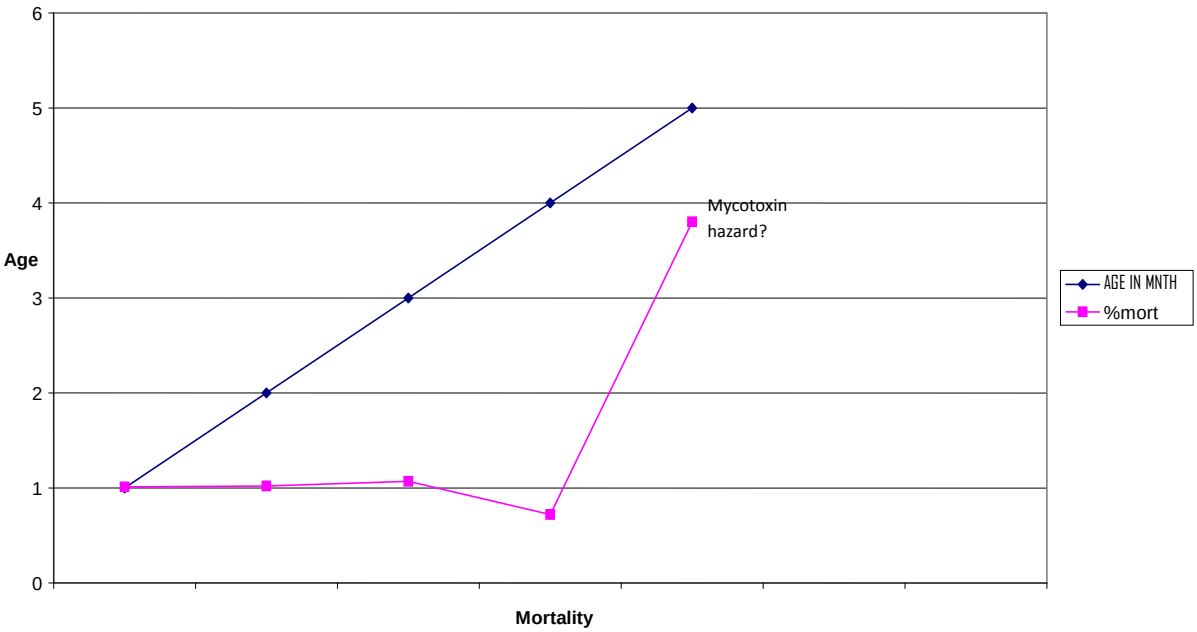
NUMBER DOCUMENTED	PERCENTAGE FROM HATCERY	AVERAGE PERCENTAGE MORTALITY	PERCENTAGE FROM FIELD	AVERAGE MORTALITY
1Q	80	23.5	20	25.6

TRACEABILITY OF MAREKS VACCINATION FAILURES

Hatcheries as origin of infection Commercial birds (Pullet)



Mycotoxin, a factor in breakdown of mareks vaccination Immunity in commercial Layers



4) MYCOTOXINS IN NEWCASTLE DISEASES VACCINATION FAILURES

This study came from a farm project in south west of Nigeria and it presented two batches of Brown and Black chicks with early mortalities that is more serious in batch 1(brown) than in batch 2 (black).

Though the two batches subsided by the third week of arrival on the farm, mortalities in both batches increased from the fourth week and their feed were found to have failed Aflatoxin test by the Neogen Veratox Software package.

Serology to ND antibody by symbiotics soft ware package failed ND test for both black and brown pullets but the farm records showed clear evidences of excessive use of antibiotics and coccidiostat in the farm

The farm regime of medication for medication activities did not apply probiotics or any mycotoxins binder for preventive measures.

RESULTS

TABLE 1 BATCH 1

BROWN PULLET

PRACTICE AND RECORD ANALYSIS FARM/MORTALITY TREND

Age in Week	Mortality per wk	%	Specific medication and management practice	% Monthly Mortality	Comment
1	457	4.76			
2	28	.30	Gumboro Vac		Very high immune suppression
3	43	.47	Gumboro Vac. Transfer to grower house		Not ideal to transfer here as it will escalate mortality.
4	430	4.74	Lasota	10.27	
5	560	6.48			
6	287	3.55			
7	119	1.52			
8	129	1.68		13.23	
9	124	1.64			
10	552	7.43	Lasota		
11	1925	28.02		37.09 (3 wks record)	

Flock Profile Report - Table

Flock: **Brown** **P1** **Bleed Date:** **12/10/04** **Producer:**

DPlate: **20041211-01** **Bleed Age:** **10WKS** **Company:**

Vuce Prog: **Accession:** **Flock Comments:**

NDV

Sample	Titer
1	844
2	3929
3	2605
4	666
5	5327
6	0
7	601
8	469
9	2139
Mean	1842
GMT	642
StDev	1816
%CV	68.189

FAILED ND TEST

Neogen Veratox Software

LOG / LOGIT Details

Assay Group: Aflatoxin NS

Description: AFFA HS 101 17054 APR 26, 2005

Date: 11/22/04 9:42 18 AM

Method: Direct Competitive method

Slope: 2.3755 Com Conf: 0.9971 Units: ppb

SAMPLE	DESCRIPTION	OD	RESULT
1	0 ppb	1.120	0.0
2	1 ppb	0.980	1.0
3	2 ppb	0.838	2.2
4	4 ppb	0.705	3.8
5	8 ppb	0.490	8.1
6		0.486	30.2

TABLE 2 BATCH 2

BLACK PULLET

PRACTICE AND RECORD ANALYSIS FARM / MORTALITY TREND

Age in Week	Mortality per wk	%	Specific medication and management practice	% Monthly Mortality	Comment
1	256	2.01	Gumboro		
2	52	.41	Gumboro		Very high immune suppression
3	18	.14	Transfer		Not ideal to transfer here as it will escalate mortality.
4	29	.23	Lasota	2.79	
5	96	.77			
6	484	3.94			Gumboro Outbreak?
7	359	3.04			
8	248	2.15		9.9	
9	378	3.35	Lasota		New castle?
10	2952	27.0			
11	1703	23.1		53.45	

Flock Profile Report - Table

Flock: **BLACK P1** **Bleed Date:** **12/10/04** **Producer:**

DPlate: **20041211-01** **Bleed Age:** **11-0** **Company:**

Vuce Prog: **Accession:**

Flock Comments:

NDV

Sample	Titer
1	6698
2	5099
3	1017
4	0
5	5142
6	4047
7	2651
8	1604
9	5544
Mean	3534
GMT	1370
StDev	2310
%CV	52.091

Neogen Veratox Software

LOG / LOGIT Details

Assay Group: Fumonism

Description: FUMINISIN LOT 19107, MARCH 8, 2005

Date: 11/22/04 9:48 09 AM

Method: Direct Competitive method

Slope: -2.0374 Com Conf: 0.9994 Units: ppm

SAMPLE	DESCRIPTION	OD	RESULT
1	0 ppm	1.065	0.0
2	1 ppm	0.671	1.0
3	2 ppm	0.517	2.0
4	4 ppm	0.348	4.2
5		0.280	5.9
6		0.395	3.3

TABLES 3

PROFILE MEDICATION ACTIVITIES FOR BATCHES 1 & 2

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Vit/aminoacid	B-1	X	-	-	X	-	X	X	-	X	-	-	-	-						16.6%
	b-2	X	-	-	X	-	-	-	-	-	-	-	-	-						
Antibiotics	B1	X	X	-	X	-	-	X	-	-	X	X	X	-						30.9%
		X	-	-	X	-	-	X	-	-	-	X	X	X						
Probiotics and Toxin Binder	B1	-	-	-	-	-	-	-	-	-	-	-	-	-						0%
	B2	-	-	-	-	-	-	-	-	-	-	-	-	-						
Coccidiostarts	B1	-	X	X	X	-	-	X	X	-	-	-	-	-						21.4%
	B2	-	-	X	-	X	-	X	X	-	-	-	-	-						
IBD	B1	-	X	X	-	-	-	-	-	-	-	-	-	-						9.5%
	B2	X	X	-	-	-	-	-	-	-	-	-	-	-						
LASOTA	B1	-	-	-	X	-	-	-	-	X		-	-	-						9.5%
	B2	-	-	-	X	-	-	-	-	-	X	-	-	-						
NDUK	B1	-	-	-	-	-	-	-	-	-	-	-	-	-						0%
	B2	-	-	-	-	-	-	-	-	-	-	-	-	-						
FC / FT	B1	-	-	-	-	-	-	-	-	-	-	-	-	-						0%
	B2	-	-	-	-	-	-	-	-	-	-	-	-	-						
SUFPHAR antibiotics	B1	-	-	-	-	X	-	-	-	-	-	-	-	-						7.1%
	B2	-	-	-	-	X	X	-	-	-	-	-	-	-						
Plan water	B1										X									2.38%
	B2																			
LA injection	B1										X									2.38%
	B2																			

RECOMMENDATION

- This study therefore recommends the need to enforce a policy on strategic and prophylactic safe incorporation of broad spectrum Toxin binder as a zoo phytosanitory requirement for DOC trade movement across the border.
- It recommended incorporation of broad spectrum Toxin binder(New generation Toxin binders) in the early 2weeks of arrival of Breeder stock and commercial DOC at the farm and strategically after each Infectious bursa Disease (IBD), Mareks disease (MD) and Newcastle diseases (ND) vaccinations for efficient development of maternal passive immunity in breeders and active immunity in DOC offspring.
- It recommends that the new generations of binders (Nano-toxin binders) will serve good purposes in this regard.
- Proper litter management is recommended to minimize contamination of hatchable eggs with mycotoxins and their penetration into eggs sent to hatchery
- Hatchable eggs from Breeder farms sited at long distances from hatchery or commercial hatcheries must fumigate eggs on farm site before transferring to hatcheries
- Ensure that clean boxes are used for transportation of such eggs and transport them in conducive vehicle that will minimize cracking and contamination by pathogen sand toxins.
- Breeder must be placed on broad spectrum Toxin Binder in feed for a period of 2 weeks following any vaccination for vertically transmitted diseases such as Avian

Encephalomyelitis (AE), Gumboro Diseases (IBD) and Newcastle diseases to ensure adequate passive and active immunity generation in breeder and off springs

- Breeders and commercial farmers must practice good veterinary practices (GVP) of monitoring and auditing of newly hatched DOC for mycotoxins and pathogen contamination in early rearing.
- More laboratories should be encouraged to spring up in the region as Diseases diagnostic support system.

All approved vertically transmitted hatchery diseases must be audited and controlled by operating hatcheries in the sub region.

All hatcheries must keep inspectable historical log book for the following audits

- Level of bacteria contamination and type per batch hatched
- Age of parents of each batch of chicks hatched
- Brief history of parents i.e. hatchability and fertility
- Average weight of batch of DOC hatched
- Types and percentages of abnormalities recorded

All chicks vaccinated at hatchery must be accompanied with duly signed certificate of vaccination with full information of vaccines used and must be clinically managed by registered veterinary surgeons.

In view of the fact that mareks vaccination given at the hatchery may fail to generate a life immunity, hatchery must recommend the need for an early booster dose within 2-3 weeks of arrival of chicks with HVT vaccines.

All batches and types of vaccines used must be properly recorded in the log book

CONCLUSION

West Africa poultry must focus on improved health status and sustainability to achieve the anticipated growth for the region. Growth must be reflected in all sectors of the industry moving vertically from the upstream sector of Breeders production through the hatchery operative system to the downstream commercial sector of the industry.

Mycotoxins contamination and influence on immunopathology of breeders and commercial DOC affected capacity to produce adequate maternal and active immunity, and this constitute a major etiology and potentiating factors for various post hatchery vaccination failures and resistances development observed the Nigeria poultry sector of the region.

With Nigeria contribution of 50% of the human population and about 50% table eggs and broiler meat output in the region, the role of mycotoxins in numerous vaccination failures and bacteria resistances to available antibiotics will pose serious threat to production of viable DOC with immunological integrity for the region.

Ignorance or none application of appropriate toxin binders prophylactic and strategically in health management system for breeder and commercial stock production may continue to account for more vertically and horizontally transmitted Aflatoxin contaminated DOC in the region.

It is therefore mandatory from this study to conclude that strategic and prophylactic application of broad spectrum Toxin binders and especially the new generations of Nanotoxin binders should be approved as zoo phytosanitory requirement mandatory for the movement of DOC across the boarders in the region in other to achieve the anticipated growth for the region and provide safe poultry and poultry food products for the region.

Livestock Industry Foundation for Africa (LIFA) technical review process

This paper has been prepared, reviewed and approved for publications by LIFA's Programmes and Publications Unit (PPU).