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Response of Local Breeds of Chicken to Challenge with Newcastle Disease Virus (Kudu 113 Strain)

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Abstract: Three breeds of local chickens, Dwarf (DW), Frizzled Chicken (FZ) and Long Legged (LL) were purchased from the chicken market at Sabon Gari, Zaria and environs. Ten birds of each breed were bought making a total of 30 chickens. The birds were housed in the same pen to simulate local husbandry method. At three days after purchase the birds were bled to determine their Newcastle disease antibodies and then subsequently the birds were challenged with a local strain of Newcastle virus (Kudu 113). The birds were monitored for clinical signs and mortality. The mortality rates were: 60, 80 and 90% for DW, FZ and LL, respectively. The morbidity rate was 100% in all the breeds. The mean HI antibody titres before challenge were : 0.2, 1.4 and 2.0 for LL, DW and FZ, respectively. At 5 weeks post challenge the mean HI antibody titres were : 1024 for both DW and FZ and it was 32 for LL. The clinical signs seen in all the breeds were similar to those seen in the velogenic viscerotropic form of Newcastle Disease (ND). The post mortem lesions seen in all the breeds were similar to those seen in the velogenic viscerotropic form of ND. The study showed that all the breeds were equally susceptible to ND. Unlike the belief of the Hausas that the FZ is resistant to ND. It was concluded that there is no breed difference among the local chicken in susceptibility to ND and that there is the need for further studies on the claim that the local chicken is resistant to ND viral infection.

Key words: Newcastle disease, kudu 113 strain, virus, local chickens

INTRODUCTION

The poultry population of Nigeria from resource inventory and management[1] consists of 150 million chickens of which 102.8 million are indigenous.The distribution of the chicken population in the country revealed that 84.5% of the local chickens are found in the Northern States of Nigeria. On the other hand, the majority of exotic chickens (83%) are found in the Southern States[2].

Local chickens are reared by majority of rural house holds[3]. Flocks usually consist of cocks, hens and chicks. In some house holds, other poultry species are also kept in the same compound. Neighbouring flocks are allowed to mix freely and a cock may service several flocks. In a survey[4] reported that a typical family in Plateau State owned an average of 19.6 chickens. The study also showed that the local chicken is the most predominant poultry species kept by most rural households. The Nigerian local chickens are characterized by survival traits like small body size, slow growth, late maturity and poor production ability[5].

The rural dwellers are able to recognize different breeds and strains of local chickens based on phenotypical characteristic[6]. They associate certain qualities with the different breeds and strains. For example the Hausas of Northern Nigeria associate resistance to ND with the FZ and good production to DW[6].

Despite the good knowledge of the rural dwellers on the qualities of the local chickens, they are allowed to fend for themselves and in most cases shelter is not provided and losses continue to occur due to diseases and predation[4, 7-12].

Among the diseases, ND is rated as the major disease of local chickens[13] and the high mortality and morbidity associated with the disease are major hinderance to the development of the poultry industry in developing countries[7,8]. In most countries the disease is seasonal[8, 14-16]. In Nigeria the disease is more common in the dry harmattan period and the cold harmattan wind is known to worsen the outcome of the disease[14]. This study attempts to compare the susceptibility of three different breeds of local chickens to challenge with Kudu 113 strain of ND Virus.

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MATERIALS AND METHODS

Local chickens: The different breeds of local chickens DW, FZ and LL. were purchased from chicken markets at Sabon Gari, Zaria and environs. A total of ten chickens per breed were bought. A brief description of the strains is as follows: The feathers of the FZ chicken are usually erect and coiled outward. This chicken has far less feathers than all other breeds of chickens and during hot months of the year, the feathers are lost completely. DW: these are usually short chickens, the legs usually measuring between 3-4 cm.. LL: these chickens are usually taller than the dwarf, the leg measure between 5-7 cm, the feathers are usually smooth and this is the predominant breed of chicken in Northern Nigeria.

The birds were dewormed with levamisole orally once and treated with Terramycin long acting intramuscularly once 0.3 mL (60 mg) per bird. The birds were fed on commercial grower mash(16.0% CP) throughout the experimental period. Three days after arrival the birds were bled and subsequently challenged with ND virus (Kudu 113 strain).

Challenge virus: The Kudu 113 strain of the ND virus with titre $10^{9.5}$ EID_{50} per mL was obtained from National Veterinary Research Institute, Vom, Nigeria.

Chicken Red Blood Cells (RBC): Five milliliter of chicken RBC was collected in to 5 ml of Alsever's anticoagulant solution and gently mixed. The RBC was washed 3 times with Phosphate Buffered Saline (PBS) PH 7.4 by centrifugation at 1400 g for 5 min. A. 0.25% suspension of RBC was prepared by mixing 0.05 mL of RBC in 20 mL of PBS for use in haemagglutination (HA) and Haemagglutination inhibition (HI) tests[17].

Antigen: Lasota ND vaccine obtained from the National Veterinary Research Institute Vom was used as the antigen for the HI test. The HA titre of the Lasota ND vaccine was determined as described by Allan[17,18] and diluted to contain 4 HA units. This concentration was used for the haemagglutination inhibition test.

Serum samples: The chickens were bled before challenge and thereafter at 2, 3 and 5 weeks post challenge (PC). The serum was extracted from the blood by centrifugation at 1400 g for 10 min. The sera were stored at -4°C until used.

Challenge: At day 3 after the arrival of the birds, all the chickens were challenged with 0.2 mL. of the Kudu 113 strain of ND virus intramuscularly. The chicks were observed daily for clinical signs and mortality for 5 weeks. Postmortem examination was conducted on any bird that died and the lesions observed were recorded. The morbidity and mortality, rates were calculated. The birds were also bled at 2, 3 and 5weeks post challenge.

Serological test procedure (HI Test): The HI test was used for the detection and quantification of antibodies against NDV as described by Allan and Gough[17]. Sera from all the birds were tested by this procedure. The HI titre of each bird was determined and the mean for each sp. was calculated. The HI test was performed using beta-technique (constant virus and varying serum) against 4 HA units of virus computed from the results of the HA titration. Doubling dilutions (0.05 mL) of the different sera were reacted with 0.05 mL of the 4 HA unit of the antigen per well. This is incubated for 30 min at room temperature for antigen-antibody reaction to take place. 0.05 mL of 0.25% suspension of washed chicken RBC was added to all the wells and shaken gently to mix and incubated at room temperature for 45 min. Negative control wells were also included. The titres were taken as the reciprocal of serum dilutions at which there is complete inhibition of the agglutination of the chicken RBC.

RESULTS

All the thirty chickens belonging to all the strains came down with the disease after challenge with Newcastle disease virus (Kudu 113 strain). Amongst the three strains the Frizzle Chicken (FC) and the Long leg chicken (LL) had a short incubation period (one day) whereas the Dwarf chicken (DW) had the longest incubation period (three days) Table 1. Also the duration of the disease was short in the long leg chicken (LL) (8 days), then the Frizzle Chicken (FC) (9 days) and then the Dwarf chicken (DW) (14 days) Table 1.

The clinical signs exhibited by the different breeds of local chickens are shown on Table 2. The signs manifested by the three different breeds were:- greenish yellow diarrhoea, inappetance, somnolence, dullness, dropped tail and wing feathers, ruffled feathers, facial oedema, coughing and sneezing, ocular and nasal discharges, paralysis of legs, sitting on the hock, torticollis, inco-ordination, muscular twitching, star gazing, backward movement and opisthotonus..

The average Newcastle disease HI antibody titre before challenge was higher in the Frizzle chicken 2 than in the Dwarf chicken (1.4) and lower in the Long leg chicken (0.2) (Table 1). After challenge, there was a general increase in the Newcastle disease HI antibody

Table 1: Average Newcastle disease HI antibody titre pre and post challenge (PC)

Strain	Pre challenge	No. Positive	PC		
			2 Weeks	3 Weeks	5 Weeks
Dwarf chicken (DW).	1.4	6/10	804.5	358.4	1024.0
Frizzle chicken (FC)	2.0	10/10	1024.0	384.0	1024.0
Long legged chicken (LL)	0.2	3/10	576.0	528.0	32.0

Table 2: Clinical signs of ND in breeds of local chicken after challenge with Kudu 113 ND virus strain

Clinical signs	Breeds of local chickens		
	DW	FZ	LL
Diarrhea	+	+	+
Inappetance	+	+	+
Dullness	+	+	+
Dropped wings	+	+	+
Dropped tail feathers	+	+	+
Paralysis of legs	+	+	+
Ruffled feathers	+	+	+
Sitting on the hock	+	-	+
Facial swelling	+	+	+
Cloudy eyes	+	+	+
Congested eyes	-	+	+
Coughing and sneezing	-	-	-
Torticollis	+	+	+
Moving backward	+	+	-
Incoordination	+	+	+
Muscular spasm	+	+	+
Ocular discharges	+	+	+
Nasal discharges	+	+	+
Star gazing	+	-	-

DW - Dwarf + Presence of clinical signs, FZ - Frizzle chicken - Absence of clinical signs, LL - Long legged

Table 3: Morbidity, mortality and case fatality rates post challenge with Kudu 113 strain of ND virus in breeds of local chicken

Parameters	Breeds of Local chickens		
	DW	FZ	LL
Onset of signs (days)	3	1	1
Morbidity rate (%)	100	100	100
Mortality rate (%)	60	80	90
Case fatality rate (%)	60	80	90
Duration of the disease (days)	14	9	8

titre for all the three strains. At 12 days PC, the average Newcastle HI antibody titre was higher in the Frizzle chicken (1024), followed by the Dwarf chicken (804.5) and lower in the Long leg chicken (576.0) (Table 1). At 21 days PC, there was a decrease in the average Newcastle disease HI antibody titre in all the three strains (Table1). Then at 37 days PC, the average Newcastle disease HI antibody increased again in the Dwarf and Frizzle chickens but fell to 32.0 in the Long leg chicken (Table 1).

The geometric mean HI antibody titre pre challenge followed the same pattern to the average Newcastle disease HI antibody titre pre-challenge. Similarly, the geometric mean HI antibody titre PC was similar to the average Newcastle disease HI titre PC (Table 1).

Table 3 shows the onset of clinical signs, duration of the disease, morbidity, mortality and case fatality rates. The. The signs were noticed in the DW 3 days PC and 1 day PC in both FZ and LL. The duration of the disease

Table 4: Post mortem lesions of ND in breeds of local chickens after challenge with Kudu 113 Strain of ND virus

Post mortem lesions	Breeds of Local chickens		
	DW	FZ	LL
Enlarged and congested liver	+	+	+
Enlarged and congested kidneys	+	+	+
Congested lungs	+	+	+
Congested trachea	+	+	+
Congested thymus	+	+	+
Congested skeletal muscles	+	+	+
Haemorrhages in the trachea	+	+	+
Haemorrhages in the proventriculus	+	+	+
Haemorrhages in the duodenum	+	+	+
Haemorrhages in the jejunum	+	+	+
Haemorrhages in the ileum	+	+	+
Enlarged and Haemorrhagic cecal tonsils	+	+	+
haemorrhagic rectum	-	+	+
Necrotic foci in duodenum	-	+	+
Necrotic foci in jejunum	-	+	+
Necrotic foci in ileum	-	+	+
Necrotic foci in cecal tonsils			

+ presence of lesion, DW- Dwarf chicken - absence of lesion, FZ - Frizzle chicken, LL - Long legged

was 14 days, 9 days and 8 days for DW, FZ and LL, respectively. The morbidity rate was 100% in all the three breeds tested.. The mortality rate was 60% for DW, 80% for FZ and it was 90% for LL. The case fatality rates were 60, 80 and 90% for DW, FZ and LL, respectively.

The post mortem lesions exhibited by the birds are shown on Table 4. All the three different breeds showed the following lesions: Enlargement and congestion of liver, spleen and kidneys, congested trachea, thymus and skeletal muscles, haemorrhages in the trachea, proventriculus, duodenum, jejunum and ileum enlarged and haemorrhagic cecal tonsils, necrotic foci in the duodenum, jejunum, ileum and cecal tonsils. Hydropericardium was seen in the FZ and LL.

DISCUSSION

All the birds tested for HI antibody titre before vaccination were positive. In some breeds, the levels were protective while in others the antibody levels were below the protective level which was reported to be 3.0 Log 2.[19]. The presence of antibody before vaccination may be due to the free range system of rearing local chickens which encourages exposure to ND virus and spread of ND virus within the flock and in between flocks. Thus, ND is highly prevalent in local chickens[20-22]. The HI titre PC was high in all the challenged birds is similar to what was reported by Philip[19] that following challenge, the HI titre is usually

high as high as 11.0 log2. It is important to note that at 2 weeks PC, the antibody titre falls below the titre 1week PC, this may be due to continuous challenge by the ND virus being secreted by the birds because the disease lasted for 18 days and at 4 weeks PC, the intestinal content of all the birds that survived the infection were positive for ND antigen.

The clinical signs of ND are known to vary according to the virulence and tropism of the ND virus involved, the species of birds, the age of the host, the immune status of the birds and the environmental conditions[16]. The clinical signs seen in all the challenged local breeds were similar to those seen in velogenic viscerotropic ND outbreaks[16,20].

The post mortem lesion seen in the challenged birds are those of the velogenic viscerotropic ND[20]. But the post mortem lesions were more severe in the FZ and LL followed by the DW. This is contrary to the belief by the local folks that the FZ is more resistant to ND than all other breeds[6].

The morbidity rates recorded in all the breeds PC was high, this is in agreement with observation of earlier workers that the morbidity and mortality rates of ND outbreak in local chickens can be up to 100%[7,8,11]. Based on this finding, the FZ is equally susceptible to ND just like other breeds of local chicken unlike the belief by the Hausas that the FZ is resistant to ND[6], but it is important to note that the mortality rate is higher in the LL. This may be due to the age of the birds, because the birds used in the research are of different ages. It was concluded that all the breeds of local chickens tested were equally susceptible to ND and there is a need for further research on the claim that the local chicken is resistant to ND.

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