Research on Humanities and Social Sciences
ISSN (Paper)2224-5766 ISSN (Online)2225-0484 (Online)
Vol.6, No.10, 2016

Effects of Climate Variability on the Outbreak and Spread of Newcastle Disease in Suneka Division of Kisii County

Norah M.Nyaiyo[1*] and Dr.Eric Nyankanga Maangi[2]
1. Doctoral student and part-time Lecturer, Kisii University, Kenya
2. Lecturer, Department of Psychology and Foundations University of Kabianga, Kenya
*corresponding author

ABSTRACT
Newcastle Disease (ND) is a common occurrence in Suneka Division. ND is caused by Avian Paramyxovirus Type 1, is one of the most significant diseases for poultry producers around the world. This poultry disease is influenced directly or indirectly by weather as it affects the timing and the intensity of an outbreak. This article examined the influence rainfall and temperature on the outbreak and the spread of Newcastle disease in Suneka Division of Kisii County. The study used a descriptive design with both qualitative and quantitative approaches. The sample size was 200 households and respondents were poultry farmers. Veterinary officers were key informants. Primary data was collected using questionnaires and interview schedules. Secondary data on rainfall and temperature was collected from the Kisii meteorological station for 2007 and 2011. Data was analysed using measures of central tendency such as means and mode. They were presented using frequency tables. Karl Pearson coefficient of correlation was used to test the null hypothesis that there was no relationship between temperature and rainfall, and the occurrence of ND at 5% level of significance. The study revealed that ND occurs during the months of July-August and December-January. It was generally found out that this disease occurs after the long March, April and May (MAM) and short rains October November and December (OND). It was also found out that there was a positive Pearson Correlation between rainfall and ND in the months of August ($r = 0.286$) and December ($r = 0.275$). However, there was a negative relationship in the months July ($r = -0.549$) and January ($r = -0.144$). Concerning temperature, there was a positive Pearson Correlation between temperature and ND in August ($r = 0.772$), July ($r = 0.683$) and January ($r = 0.159$). But, in the month of December there was a negative Pearson Correlation ($r = -0.546$). To curb the ND menace and increase productivity of free range indigenous chicken, the research recommended that there was need for farmers to monitor weather changes by obtaining data from the meteorological weather stations. Educate small-scale farmers on how to adopt hygienic and bio-safe poultry rearing methods to minimize loss of chicken through diseases, pests and predation.
Keywords: Free range, Indigenous chicken, Newcastle Disease

Introduction

Poultry plays a key role in the lives of the poor rural population in developing countries. This is especially so in Sub-Saharan Africa (SSA) where they provide income, capital assets, and fertilizers (Millar *et al.*, 2008). In Kenya both hybrid and indigenous poultry are reared. Indigenous poultry production presents a significant portion of the economy and a source of income to small scale farmers (Kaingu *et al.*, 2010). Most farmers in rural areas rear chicken because they are raised with relatively low capital, space and readily available household labour. They are also hardy, adapt well to the rural environments, survive on low inputs and adapt to fluctuations in the available feed resources (Gichoni and Maina, 1992). FRIC play a vital role in the improvement of the nutritional status and income of many poor rural households. They are also a global asset for many millions who live below the poverty line (Alders and Spradbrow, 2001).

Despite their importance, FRIC are faced by many challenges. These include: predation by snakes and birds of prey, poor housing, poor nutrition, climate variability, attack by pests and diseases and lack of adequate assistance from extension services (Moreki, 2006).

Newcastle disease (ND), caused by Avian Paramyxovirus Type 1(APMV-1), is one of the most significant diseases for poultry producers around the world (Okwor and Eze, 2011). This poultry disease is influenced directly or indirectly by weather and climate. These may be spatial with climate affecting distribution or temporal with weather affecting timing of an outbreak and both relate to the intensity of an outbreak. Outbreaks are often associated with alternating heavy rainfall, drought and high temperatures (Perry *et al.*, 2002).

Newcastle Disease was first recognized in Indonesia in 1926 and has persisted as the major disease affecting poultry. Although little systematic research has been conducted on the epidemiology of ND in Indonesia, it is reputed to affect both indigenous and imported species of poultry throughout the country on what would appear to be a seasonal basis. Highest mortalities have been reported towards the end of the dry season for the months between July-September, the period which farmers refer to as *'musim penyakit'* or the 'disease season' (Kingston and Creswell, 1982).

A study conducted by Njagi *et al., (*2010) revealed that Newcastle Disease Virus (NDV) was significantly higher (17.8 percent) in the dry hot zones compared to the cool wet zone at 9 percent showing climate as a risk factor in the occurrence of NDV in FRIC. Also Sonaiya (1999a) reported that the major outbreak of Newcastle disease regularly occur at the peak of the rain (June/July) and the dry season (January/February) during which mortality reaches 70 – 100% in Nigeria. Reports from Kenya (Anonymous 1996) and Ethiopia (Sonaiya 1999b) indicated that severity of this disease reached the peak in wet season but in dry season in West Africa (Mukiibi–Muka 1992; Gueye 1998). Unfortunately the period of high demand in dry season coincided with high incidence of Newcastle disease thus increasing its spread (Kuzonga *et al*., 2008). This high demand for FRIC in December/January for Christmas and New Year Celebrations is a major factor for its spread in Nigeria. Also a study done by Olabode *et al.,* (2012) in Ilorin Kwara state in Nigeria revealed seasonal distribution of the disease indicated a higher occurrence in the dry season (October-March). Therefore pathogens or parasites that are sensitive to moist or dry conditions may be affected by changes in precipitation, soil moisture and frequent floods.

In relation to temperature, the virus can survive for more than 8 weeks in hot dry areas at temperatures of 40oC (Warner, 1989), for about 3 months at 20^{o}C to 30^{o}C and even longer at cooler temperatures (Lancaster, 1966). At 23oC -29oC, the virus (APMV-I) is reported to survive in contaminated litter for 10 to 14 days and 20oC in soil for 22 days (Institute of International Co-operation in Animal Biologics IICAB, 2005). When temperatures are just above freezing point (1-2oC) the virus is reported to survive on chicken skin up to 160 days and in bone marrow for nearly 200 days. APMV-1 can be inactivated by heat of 560 c for three hours or 600c for 30 minutes (IICAB, 2005).

METHODOLOGY

The study adopted a descriptive research design. The variables were ND, temperature and rainfall. Temperature is indicative of thermal stress while rainfall affects both the quality and quantity of feeds consumed. The research used simple random and purposive sampling methods. The sample size was 200 households. Both primary and secondary data were collected. Primary data was collected from poultry farmers using questionnaires. Data collected included, season of ND occurrence over 2007-2011, mortality of FRIC, socio-economic impacts of ND to poultry farmers and mitigation and adaptive measures put in place to manage ND. Data from the farmers was collected from September to December 2012.Interview schedules were used for veterinary officers. Secondary data on climatic variables (temperature, humidity and rainfall) on monthly basis was collected from Kisii Meteorological Department for 2007-2011.

Descriptive data was analysed by objectives and hypothesis. Climatic variables were analysed using the arithmetic mean for the five years. Hypothesis testing was done using the Karl Pearson Coefficient of Correlation. The Statistical Package for Social Sciences (SPSS) was used in testing of hypotheses and in the analysis of empirical data.

RESULTS AND DISCUSSIONS

Relationship between temperature and the occurrence of Newcastle Disease in FRIC in Suneka Division

Climate variability can affect poultry both directly and indirectly. Direct effects are from air temperature which influence poultry performance, growth and egg production. Indirect effects include climatic influences on severity and distribution of poultry diseases and parasites. In relation to ND, changes in temperature influenced the outbreak and severity of the disease in FRIC. When respondents were asked if changes in temperature had influence on the outbreak and spread of ND, 98.5 percent agreed that it had while 1.5 percent had no knowledge about it. This is in agreement with Dontwi *et al.,* (2011) who found out that wet season or dry season predisposes the FRIC to diseases. Further, when respondents were asked the months in which ND occurred, 74 percent reported that it occurred in July-August, 24 percent December- January and only 2 percent were not sure. Relating these months to temperature, rainfall and humidity, it was found out that temperature for July was the lowest for the five years. The temperatures recorded in the month of August were higher than July for the five years.

The mean temperature for the five years was in January was 21.8^{0}C while for December was 21^{0}C, July was 19.7^{0}C while in August 20.3^{0}C.Generally July recorded the lowest temperatures while January was among the second highest after February. The mean annual temperatures are higher for the four months. This agrees with Njagi *et al* (2010) who found out that NDV was significantly higher in drier zones.

There was a positive Pearson Correlation ($r = 0.683$) between temperature and ND in the month of July,($r= 0.772$) in the month of august and in the month of January ($r= 0.159$). However in the month of December there was a negative pearson ($r= -0.546$) between temperature and ND.

Table 1: Total monthly rainfall in mm for the years 2007-2011 from Kisii Meteorological Department

Year/ Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2007	188.6	179.5	**151.1**	**172.3**	**246.7**	**191.4**	**139.3**	**70.7**	**158.9**	**125.4**	**97.5**	**96.6**
2008	**30.8**	**59.5**	**304.1**	**291.1**	**118.5**	**136.0**	**220.6**	**191.7**	**168.9**	**241.0**	**154.3**	**82.1**
2009	**120.8**	**54.7**	**252.2**	**242.0**	**311.1**	**183.1**	**70.0**	**213.0**	**145.3**	**94.1**	**133.4**	**310.0**
2010	**108.6**	**106.5**	**217.7**	**244.6**	**375.7**	**252.3**	**80.3**	**178.1**	**256.7**	**256.9**	**109.3**	**170.3**
2011	**101.0**	**44.7**	**141.9**	**228.4**	**235.1**	**94.4**	**99.1**	**226.4**	**226.0**	**209.2**	**312.6**	**220.2**
Mean	**110**	**89**	**213.4**	**235.7**	**257.4**	**171.4**	**121.9**	**176**	**191.2**	**185.3**	**161.4**	**175.8**

The mean annual rainfall for five years in January was 110 mm; July was 121mm, August 176mm and December 175.8 mm. This shows that ND occurs after the long rains MAM and short rains OND. There is a negative Pearson Correlation (r = -0.549 and r = -0.144) between rainfall and ND in the month of July and January, a positive Pearson Correlation (r = 0.286 and 0.275) in the month of august, and December respectively.

Conclusion

The research found that Newcastle Disease outbreaks were experienced in the months of July to August and December to January. The mean annual temperature for the five years in January was 21.8 0C while for December was 210C, July was 19.7 0C while in August 20.3 0C. Generally July recorded the lowest temperatures while January was the second highest after February. There was a positive Pearson Correlation (r =0.772) between temperature and ND in August, a negative correlation (r = -0.546) in December, a positive correlation (r = 0.683) in July and a positive correlation (r = 0.159) between temperature and ND in January.
The mean annual rainfall for five years in January was 110 mm, July was 121mm, August 176mm and December 175.8 mm. This shows that ND occurs after the long rains MAM and short rains OND. There was a negative Pearson Correlation (r = -0.549) between rainfall and ND in the month of July. There was a positive correlation (r = 0.286) in August, a positive correlation (r = 0.275) in December and a negative correlation (r = -0.144) between rainfall and ND in January.

Recommendations

On the basis of the findings of this study, the following are the recommendations that would improve the production in free range indigenous chicken, prediction and control of Newcastle disease.
i) Decentralize weather stations to location levels to enable monitoring of changes in temperature, rainfall and humidity so as to predict the occurrence of this disease and take early precautionary measures.
ii) The government should employ more extension officers and decentralize veterinary offices to the sub-location levels so as to bring services to the farmer. This will enable farmers to get technical assistance without travelling long distances.
iii) Establish quarantine system to curb the spread of the disease and also establish a slaughter house to allow inspection. This will ensure that only healthy chicken are sold to consumers.
iv) Government to provide free drugs for vaccination and reduce the cost of feeds in order to reduce the cost of production for the poultry farmers

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