EFFECTS OF WEATHER ON THE INCIDENCES OF CHICKEN DISEASES IN ILORIN, NIGERIA

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Abstract
This paper explores the role which climate plays on the severity of diseases and seasonal mortality rate of chicken in the guinea savanna ecological zone of Kwara State, Nigeria. Data on climate and mortality rate of chicken collected over a period of 23 years (1991-2013) were partitioned according to characteristic weather types. Correlation and simple regression methods were used to analyze the data. The results of the analyses showed that weather types of each season affect outbreak of various diseases and mortality rate differently. In the dry season weather types, outbreak of Newcastle and Gumboro diseases prevailed most during harmattan. In this weather type, mortality rate of chicken exhibited a strong positive relationship of 0.711 with rainfall and a strong negative relationship of 0.604 with maximum temperature. The last two months of dry season (Mar-Apr) witnessed the reverse of the above but with Newcastle disease and heat stress plaguing chicken production. The most prevalent chicken disease of rainy season in the study area is ***Coccidiosis****. During the first weather type of wet season (two months before August break) mortality rate of chicken exhibits a strong positive relationship of 0.861 and 0.845 before August break, 0.775 and 0.894 during August break with both rain fall and relative humidity. However mortality rate of chicken shows a negative relationship with both maximum and minimum temperatures. Suggestions are made on how to manage both major weather types and poultry operation for efficient poultry farm development in the topics.*
Key words: Climate, Weather types, Chicken, Diseases, Guinea savanna.

Introduction

The human body requires both plant and animal proteins to function efficiently. Protein which has been described by Olusanya, et.al (1990) as a conglomerate of amino acids that can be grouped into two classes based on the composition of amino acids. For instance, proteins that are rich in essential amino acid that the body cannot produce are referred to as first class proteins. They are often of animal origin. However, second class proteins majority of which are obtained from plants lack one or more essential amino acid (Olusanya, et.al 1990). The importance of proteins in diets is revealed by various roles they perform. Proteins promote growth and repair the worn out body tissues, responsible for the transmission of hereditary characters from parents to offspring, and assist the body in fighting against diseases and infections among others.

As important as this class of food is in diet, its supply is very low in the tropical countries. For instance, Kenneth (1999) reported a low production of meat and milk in Africa. Starr (1986) has also noted a tremendous potential for more animal production in the tropics than in the

temperate areas. But great disparity exists when the two regions are compared with the animals of the tropics being subjected more to various diseases. In fact, tropical environment has been described as a nuisance to livestock production (Loosli and Henry 1999). Poultry constitutes one of the livestock productions that contribute significantly to human source of food (Demeke, 2004).

Poor performance of livestock production in the tropics is also evident in Nigeria. According to Mohammed (1983), the cost of protein is beyond the reach of many in Nigeria because it is in short supply. Less than 2kg of beef and 4kg of egg are available to an average Nigerian per year (FAO, 2006). This shortage had led to importation of poultry products by Federal Government of Nigeria for so many years. However the Federal Government of Nigeria recently decided against importation of some lists of goods in which poultry products is one (Kazeem, 2003). The step was taken not because Nigeria is self sufficient in poultry products but rather to safeguard Nigeria's hard currencies. The scarcity of poultry products may be sustained and even worsened if nothing is done to redeem the situation.

In order to solve the problem of protein shortage in diets, the root cause of scarcity of poultry products must be tackled. Disease and climate problems have been described by Oppong (1999) as the main limitations to modern animal husbandry in the tropical areas. Smith, (2001) associated high relative humidity in chicken's pen with mortality of young poultry birds. Demeke, (2008) identified hot weather as the common problem of poultry in the tropics. Ajiboye, (2014) linked decline in dairy cow milk production in Shonga farm, Kwara State to climatic variables of which high temperature was most critical. To alleviate these problems Starr (1986), Ajibade and Ogunbodede (1999) emphasized the need to know the role played by climate and weather in animal health so that prediction of animal production will be accurate and effective. Thus, this work is aimed at exploring the role played by climate on the severity and spread of the major poultry diseases and on the seasonal mortality rate of chicken in Ilorin and its environs.

Materials and Method Of Study

The Study Area

Ilorin, the state capital of Kwara State lies on latitude 08 30'North of the equatot and longitude 04 35'East of the Greenwich Meridian. Its climate is controlled by the two major winds of West Africa i.e. the South West wind during rainy season and the dry North East continental during the dry season. The rainy season starts in April and lasts till November with an August break. However, Olanrewaju (2010) found out that in dry years rain usually starts very late (late April or early May) and ends early around October. Mean annual rainfall of Ilorin according to Adeyemi (1983) is 1,318mm. However, Olaniran (1986) observed a drop from this value to about 1,200mm. Temperature is high throughout the year, the dry season is exceptionally hot, except during the harmattan which begins late November and lasts until February. The weather is cold and dry during this period coupled with a hazy atmosphere with dust particles floating around. Such climatic conditions favour the development and spread of crop/animal pathogens in the tropics.

According to Hopkin (1979), physiognomic classification, the vegetation of the study area can best be described as tree savanna with floristic composition of mainly grasses of different specie whose height varies between 1.5 and 5 meters. Such area, according to Hill (1999) is characterized by an extensive type of husbandry and houses large concentration of livestock.

Sources of Data

Meteorological data and chicken mortality rate were used in this study. The meteorological data (rainfall amount, relative humidity, minimum and maximum temperature) were collected from Nigeria Meteorological agency Ilorin Airport while monthly chicken mortality rate data was obtained from Nigerian Veterinary Research as reported by poultry farmers in Ilorin for twenty three years period that spanned between 1991 and 2013. Also collected was the list of diseases to which chickens were susceptible for the same period. The diseases were Newcastle, Coccidiosis, Gumboro, Heat stress, Colibacilliosis and Fowl typhoid.

Data Processing

The raw climatic data were first partitioned into two seasons of wet (May-October) and dry (November-April) season. Each season was further partitioned into its own characteristics weather types. Based on this, wet season was further groupedinto months before August break (May-June), during August break (July-August) and months after August break (September-October). Similarly, dry season was further partitioned into months of harmattan (November-February) and months after harmattan (March-April). Also, monthly mortality rates with the associated diseases were partitioned based on different weather types as described above. Meteorological, chicken mortality and outbreak of various diseases data that covered the period of 1991-2013 were summarized quantitatively. Correlation and simple regression analyses were then used to study strength of relationship between various climatic variables and chicken mortality rate.

Results and Discussion

The average monthly climatic pattern and monthly mortality rate between year 1991 and 2013 is presented in table 1 below.

Table 1: Average Climatic Pattern and Mortality Rate of Chicken at Ilorin (1991-2013)

Months	Mortality (%)	Rainfall (mm)	R.H (%)	Maximum Temp ($_o$C)	Minimum Temp ($_o$C)
Jan	11.3	5.3	51.1	32.6	20.0
Feb	10.1	4.6	53.9	35.7	21.8
Mar	21.5	41.4	66.4	35.4	23.2
Apr	21.4	98.7	72.6	34.0	23.2
May	16.8	173.9	78.5	32.2	22.1
Jun	20.4	183.2	82.0	30.5	22.0
Jul	12.9	160.9	84.0	29.1	21.3
Aug	18.8	164.5	93.0	26.0	20.8
Sep	27.5	257.9	84.9	29.7	21.0
Oct	28.7	151.1	77.5	31.1	21.3
Nov	13.8	12.8	66.2	29.8	20.0
Dec	18.7	4.8	60.2	33.8	20.1

Source: National Veterinary Research Institute, Ilorin.

The vulnerability of chicken to climate pattern varies during the period of study. However, it appears that increase in monthly rainfall brings about corresponding increase in chicken mortality rate for most of the months considered except for the months of May, October and December when higher rainfall attracts lower chicken mortality rate (Figure 1). For instance, in January when rainfall amount received was 5.3mm, mortality rate was 11.3%. In February, a drop in rainfall amount to 4.6m brought a corresponding drop (10.1%) in mortality rate. A sharp departure from the above pattern was observed in May when high rainfall of 173.9mm attracted mortality rate of 16.8% compared to 21.4% reported in April. However between June and September, former trend in which mortality rate rises with increase rainfall amount was re-established but the reverse sets again in October and December (see Fig.1 below).

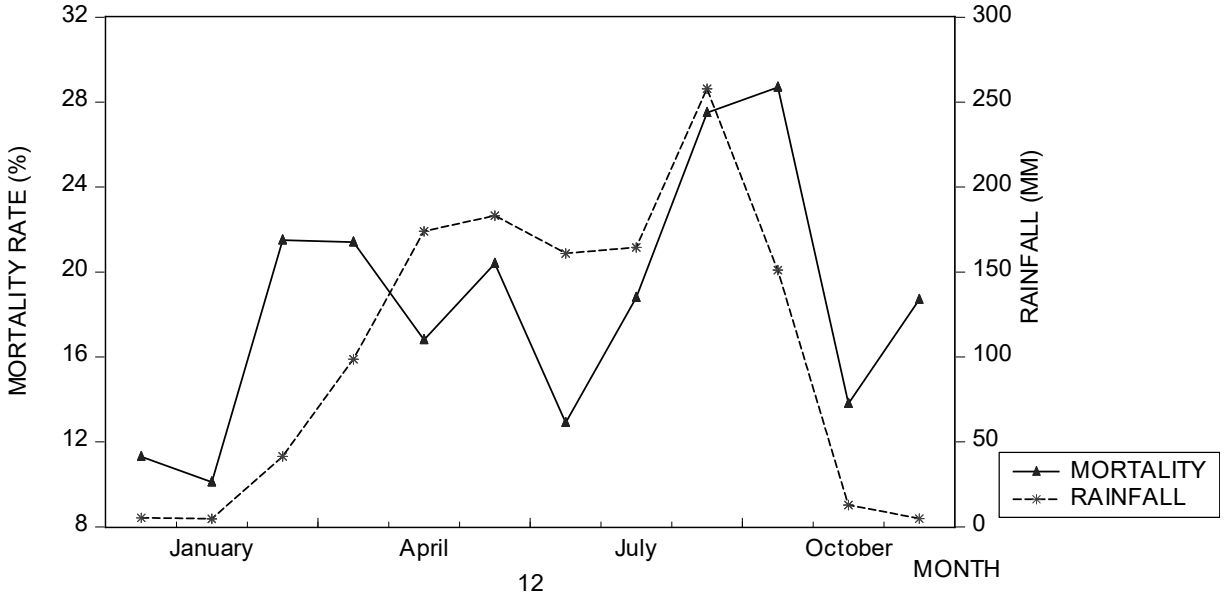

Figure 1: Mortality Rate and Rainfall (mm) 1991- 2013. **Source:** Author's Field Survey 2013

Compared with mortality rate of chicken, relative humidity though important may not be as crucial as rainfall. For instance, the month of highest mortality rate does not coincide with the month of highest relative humidity (Figure 2). In fact, highest mortality rate was reported in October when relative humidity was 77.5%. Highest relative humidity of 93.0% was reported in August and mortality rate stood at 18.8%.

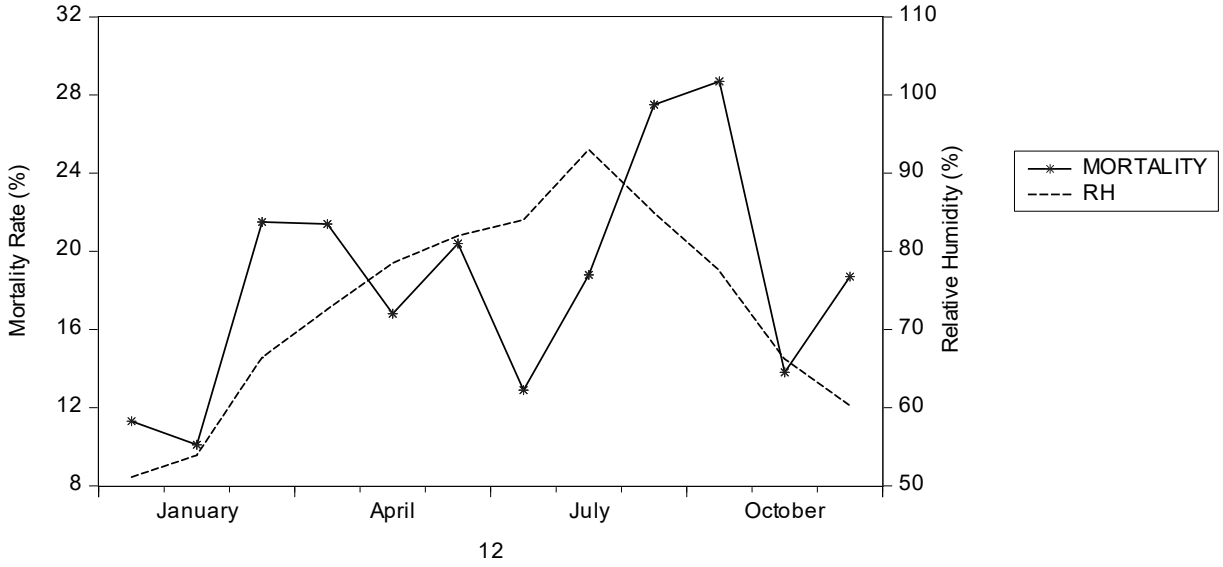

Figure 2: Mortality Rate and Relative Humidity (%) 1991-2013.
Source: Author's Field Survey 2013

Temperature was high throughout the period of study with some slight variations. The highest maximum temperature of 35.7°C was recorded in February while the lowest of (26.0°C) was recorded in August. For minimum temperature the highest of 23.2°C was recorded in March and April but the lowest of 20.0°C was observed in January and November. The interactions between mortality rate in chicken and temperature did not follow any regular pattern (Figure 3).

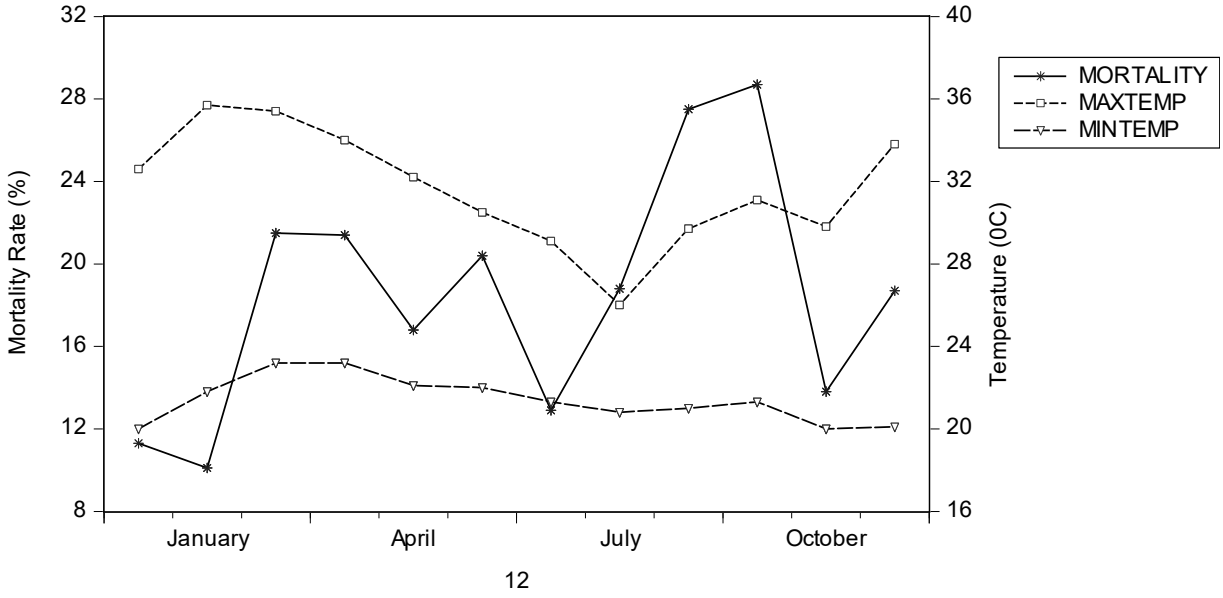

Figure 3: Mortality Rate and Temperature (^{O}C) 1991-2013. **Source:** Author's field Survey 2013
From the foregoing, rainfall appears to be more crucial for chicken mortality rate in Ilorin because the regular pattern observed in the relationship between chicken mortality rate and

rainfall is absent when temperature was considered. However, to be more précised the data is further subjected to correlation analysis and the result is discussed below.

Table 2: Result of Correlation between Climatic Parameters and Mortality rate during Harmattan (Nov-Apr) 1991-2013

Dry Season Months (Nov-Apr)	Rainfall (mm)	Relative Humidity (%)	Maximum Temp (°C)	Minimum Temp (°C)
During harmattan	0.711	0.249	-0.604	-0.449
After harmattan (Mar-Apr)	-0.818	-0.842	0.936	0.879

Source: Author's Computation, 2013

Table 2 describes relationship between climatic parameters and mortality rate of chicken at various weather types of dry season. During harmattan period, strong positive relationship exists between chicken mortality rate and rainfall (0.71) while negative correlation of -0.60 and -0.45 was established with both maximum and minimum temperature respectively. The reverse was the case for the period after harmattan (Mar-Apr). While a very strong negative relationship exists between rainfall (-0.82), relative humidity (-0.84) and mortality rate, a very strong positive relationship was established between temperature (maximum (0.94) or minimum (0.88)) and mortality rate of chicken (Table 2).

The implication of this is that occurrence of rainfall couples with a drop in temperature during harmattan will result in high chicken mortality rate. However, high temperature is more crucial after harmattan. For efficient poultry development Scott (1999) emphasized that the temperature of a chicken pen must not go beyond 35°C for any prolong of time. Rainfall during harmattan makes poultry farming vulnerable but serves as a relief after harmattan period.

The frequency of outbreak of some poultry diseases of different weather types of the dry season is presented in table 3 below.

Table 3: Frequency of Outbreak of some Poultry Diseases of different Weather types during the Dry Season in Ilorin and its Environ (1991-2013)

	Months	Newcastle diseases	Coccidious	Gunboro	Heat Stress	Colibacillosis	Marek	Respiratory Infection	Fowl typhoid	Lymphid lencosis	Mortality rate
HARMATTAN PERIODS (Nov-Feb)	Nov.	7	3	1	1	0	0	0	0	0	12.5
	Dec.	11	5	5	3	0	2	2	2	0	9.0
	Jan.	10	4	6	0	0	0	4	1	0	12.1
	Feb.	8	3	7	2	4	5	2	1	0	10.1
	Total	36	15	19	6	4	7	8	5	0	43.7
	$\bar{x}$	9.0	3.7	4.7	1.5	1.0	1.7	2	1.2	0	10.9
After harmattan	Mar.	12	5	3	13	4	3	0	3	0	20.1
	Apr.	9	4	1	6	2	0	1	1	0	21.2
	Total	21	9	4	19	6	3	1	4	0	41.3
	$\bar{x}$	10.5	4.5	2.0	9.5	3.0	1.5	0.5	1	0	20.6

Source: Author's Computation from Data Obtained at National Veterinary Research Institute, Ilorin

The increased vulnerability of chicken during dry season may be attributed to physiological imbalance created by various weather types. For instance, it is not impossible that harmattan chill makes chicken more susceptible to diseases. However after harmattan, many chickens die of heat stress and Newcastle disease (Table 3). For efficient poultry development, Scott 1990 emphasised that the temperature of a chicken pen must not go beyond 35^0C for any prolonged time. This opinion is supported by strong positive relationships of 0.94 and 0.89 established between chicken mortality rate and both maximum and minimum temperature after harmattan period (Mar-Apr).

Table 4: Relationship Between Climate Parameters and Mortality Rate Before August Break (May-June) During August Break (July-August) and After August break (Sept-Oct) 1991-2013

	Rainfall (mm)	Relative Humidity (%)	Maximum (Temp) (°C)	Minimum Temp (°C)
Before Aug. break (May-Jun)	0.861	0.845	-0.982	-0.739
During Aug. break (Jul-Aug)	0.775	0.894	-0.935	-0.860
After Aug. break (Sep-Oct)	-0.918	0.974	0.708	0.845

Source: Author's Computation (2013)

During the first two months of wet season i.e. period before August break, mortality rate of chicken exhibits very strong positive relationship with both rainfall (0.86) and relative humidity (0.84) but very strong negative relationship with temperature (-0.98 for maximum temperature and -0.74 for minimum temperature). Such relationship was also sustained during the August break when both rainfall and relative humidity reflect a strong positive relationship of 0.78 and 0.89 with mortality rate and maximum and minimum temperatures show a strong negative relationship of –0.94 and –0.86 respectively. However, the months after August break witnessed the reverse (Table 4). During this period relative humidity, maximum and minimum temperatures exhibited positive relationships of 0.97, 0.71 and 0.85 with chicken mortality rate while rainfall shows a strong negative relationship of -0.92. Rainfall and relative humidity are most critical for poultry farming in the periods before and during August break but after the period of August break increase in rainfall is not as important as increase in relative humidity and temperature. Based on this, high relative humidity is most dreadful of all other climatic variables to poultry farming during the rainy season.

Various major poultry diseases associated with different weather types of the wet season are shown in table 5 below. Observation showed that poultry farms are more prone to certain diseases than to others during various weather types. The period before August break (May - June) and period of August break (July - August) witnessed the outbreak of poultry diseases of which coccidiosis was highest followed by gumboro, Newcastle diseases and others (Table 5). The frequency of coccidiosis, gumboro and Newcastle diseases was in order of 11, 7 and 3 during the period before August break and 5, 4 with lymphoip leucosis equalizing with Newcastle having the frequency of 3 each during the period of August break. After the period of August break, outbreak of coccidiosis alone prevails having the frequency of 12.

Table 5: Frequency in Outbreak of some Poultry Diseases of Different Weather Types During the Rainy Season in Ilorin and it's Environ (1991-2013)

	Month	Newcastle Disease	Coccidiosis	Gumboro	Heat stress	Colibaccillosis	Marek	Respiratory Infection	Fowl typhoid	Lymphoid leucosis	Mortality rate (%)
Period	May	3	6	4	0	2	0	0	0	0	22.4
before	June	0	5	3	0	0	1	0	1	1	22.0
August	Total	3	11	7	0	2	1	0	1	1	44.4
break (May-June)	Mean	1.5	5.5	3.5	0	1.0	0.5	0	0.5	0.5	22.2
Months	July	2	3	1	0	1	0	2	0	1	12.9
of August	Aug	1	2	3	0	1	0	0	0	2	18.8
Break (Jul-Aug)	Total	3	5	4	0	2	0	2	0	3	31.7
	Mean	1.5	2.5	2.0	0	1.0	0	1.0	0	1.5	15.8
Months	Sep	1	7	1	0	0	0	3	0	0	27.5
after	Oct	2	5	1	0	1	1	0	0	0	28.7
August	Total	3	12	2	0	1	1	3	0	0	56.2
Break (Sep.-Oct.)	Mean	1.5	6	1	0	0.5	0.5	1.5	0	0	28.1

Source: Author's Computation from Data Obtained at National Veterinary Research Institute, Ilorin (2013)

Poultry diseases witnessed during the period before August break (May-June) arranged in order of magnitude were coccidiosis, gumboro, Newcastle, colibacillosis, marek and lymphoid leucosis. Poultry farms were free from heat stress, respiratory infection and fowl typhoid under the weather condition of the period before August break. Average mortality rate resulted from various diseases enumerated above was 22.2%

The period of August break (July-August) experienced almost similar pattern of poultry diseases observed during the period before August break but with a milder impact. For instance, the average mortality rate stood at 15.8% compared with 22.2% as witnessed during the period before August break. The little difference observed in the pattern of diseases outbreak manifested in the mild outbreak of respiratory disease which was nil for the period before August break.

Poultry farm in Ilorin were highly susceptible during the months after August break (Sept-Oct.) with coccidiosis constituting the major poultry disease. September-October weather type recorded the highest mortality rate of 28.1% of all weather types of the wet season (Table 5).

Comparing wet and dry seasons, temperature seems to be crucial for outbreak of Newcastle diseases during the dry season and in particular during the months after harmattan while relative humidity and rainfall seem to make chickens more vulnerable to diseases of which coccidiosis is most prominent during the rainy season months of May-August. These findings have modified the assertion made by Scott (1999) that high relative humidity is the most difficult factor to cope with in poultry development in the tropics. Climatic parameter that will be considered as most crucial for poultry development depends on the season and types of poultry diseases in question.

Table 6 reflects various weather types with poultry disease of economic importance in Ilorin for the period under study.

Table 6: Prevalent Poultry Diseases and Average Mortality Rate during Different Weather Types of Dry and Wet Seasons in Ilorin (1991-2013**)**

Season	Weather Type	Prevalent Diseases	Average Mortality Rate (%)
Dry Season	Period of harmattan (November-February)	Newcastle Gumboro Coccidiosis	10.9
	Period after harmattan (March – April)	Newcastle Heat Stress Coccidiosis	20.6
Total			31.5
Wet Season	Period before August break (May-June)	Coccidiosis	22.2
	Period during August break (July-August)	Coccidiosis Gumboro	15.8
	Period after August break (September-October)	Coccidiosis Gumboro	28.1
Total			66.1

Source: Author's Computation 2013

Oppong (1999) described Newcastle as the most fearsome poultry diseases of economic importance in West Africa. However, the findings as reflected in table 6 have added to the list of such dreadful diseases to include coccidiosis and gumboro. As a matter of fact coccidiosis appears to be most fearsome followed by Newcastle and gumboro for Ilorin in Kwara State.

It becomes obvious from table 6 that the wet season weather types present greater risk to poultry farming in Ilorin. For instance, the percentage total of mortality rate recorded during the dry season weather types was 31.5%. This was more than double during the wet season weather types (66.1).

Conclusion

Various poultry diseases and other stressors recognized were enumerated and classified based on weather types of wet and dry seasons. Newcastle, gumboro diseases and heat stress characterized the weather types of the dry season while coccidiosis and gumbobo diseases prevailed during the wet season.

Poultry farms are exposed to risks during wet and dry seasons however, for the period under consideration, chicken were more vulnerable to various diseases hence mortality rate was higher during wet season weather types. It can therefore be concluded that greater loss in poultry farming occur during wet season in Ilorin and it's environ.

Planning Implication

Based on the three climatic factors identified as crucial to the severity in the outbreak of chicken diseases and chicken mortality rate in Ilorin, it is important to educate poultry farmers on the use of appropriate materials in constructing their poultry pens. Awoniyi, (2003) stressed that better productivity of chicken is a function of the type of material used in roofing poultry pen. For instance, iron roofs and cement blocks encouraged rapid absorption and radiation of heat and hence widespread of poultry diseases which often result in high mortality rate. Thatched roof and mud block may discourage these because they absorb and emit heat at a very slower rate and may be able to prevent the temperature of the poultry pen from reaching extremes. Again artificial micro climates that can suppress the harshness of each weather type could be created in the pens as each weather type approaches. For instance when it is very hot means of cooling off the heat should be provided in the pens and vice-versa.

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