EFFECT OF SEASON AND CLIMATIC FACTORS ON MORTALITY AND REMEDIAL MEASURES ON SURVIVAL OF RURAL POULTRY FLOCKS

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KEYWORDS: Season, Climate, Poultry, Mortality, Medication

ABSTRACT

The four rural poultry flocks were reared up-to age of 10-12th weeks during the year 2017 in district Attock (Pakistan). Mortality pattern in relation/comparison to the temperature and percent humidity was recorded. The vitamin supplements, immune boosters, preventive vaccination and prophylactic medications were given with respect to age of flock. The highest mortality was observed in the flock B at 11th week of age, followed by flock A at 1st week of age, followed by flock C at 8th week of age. The increased mortality during month of June was due to heat stress, the mortality during months of January was due to cold stress, while mortality during the month of August was due to excessive heat and high humid environment. The cold environment caused chilling of the chicks and required extra care while brooding during winter season. The hot and humid environment predisposed the chicks towards coccidiosis and the required stirring of litter and medication against coccidiosis. It was observed that the rural poultry birds being very hardy and resilient to harsh environmental settings may not sustain extremes of seasonal & climatic factors and require extra care and management during peak/extreme seasons.

INTRODUCTION

The strength of rural poultry in Pakistan is 87.16 million. Rural poultry provides 4239 million eggs and 119.89 thousand tons of meat annually. The rural poultry corresponds to 7.2 percent of total poultry birds, provides 23.5 % of the total egg product, and shares 8.61% of total meat from poultry source (Government of Pakistan, 2017-18). The demand of rural poultry has increased over years due to increasing demand of organic meat and eggs. Moreover, some extra consciousness about quality and composition of commercial feed supplied to layer and broiler flocks has raised questions in the minds of consumers regarding use of steroids in feed, use of pig fat in feed, hormonal composition of the feed, edible or non-edible sources of commercial feed. The resultant focus on the rearing of backyard poultry is gaining interest in eyes of consumers. It is reported that consumers have predilection towards backyard poultry due to belief about nutritive value of the desi eggs (Sankhyan, Katoch, Thakur, Patial & Bhardwaj, 2013). The rural poultry provides cheap, readily available, protein enriched, digestible meat and eggs (Miao, Glatz, & Ru, 2005).

The rural chickens have some unique features like are good foragers, scavengers, more active, vigilant, efficient mothers, suitable under free range conditions, require less care for the growth under field conditions and play role in the socio-economic conditions of developing countries (Alders, 2004). Rural poultry provides quality protein to landless and marginal farmers livelihood of rural families (Alders, Spradbrow & Young, 2009). Rural poultry is adopted to harsh environmental stresses in most rural areas (Faranisi, 1995). Climate change affects socio-economic sectors including animal husbandry and has substantial impact on both the living and the non-living creatures (Osaguona, Fajobi,

Meduna, Irokanulo, Ayeni & Ogunjobi, 2009). The present study was therefore planned to observe the effect of the seasonal and climatic factors on the mortality and concurrent medication on the survival of the rural poultry flocks raised in Attock city, district Attock (Pakistan).

MATERIAL AND METHODS

The study was conducted at Government Poultry Farm Attock, during the months from last week of December 2016 to first week of January 2018. Attock lies between 33°38' and 34°0' N. and 72°7' and 72°50' E. The average temperature is 22.2 °C, and average rainfall is 539 mm throughout year. Attock has both hot and cold climate. Geographically the district has hills, plateaus and dissected plains. The rain water is the main source of irrigation/agricultural use. The four crops/flocks of rural poultry breed i.e. pure/crosses of Fayoumi, Rhode Island Red (RIR), Black Australorp, Naked Neck, Desi and Silky were reared up-to the age of 10^{th} – 12^{th} week. The day old chicks (DOC) of these flocks were procured from the hatcheries of Poultry Research Institute (PRI), Rawalpindi.

Management of Flocks

The birds were reared in open poultry housing system under standard conditions. The proper management according to season was provided to flocks. The birds were reared in houses having cemented floor and roof with windows of wire guaze across the sheds. The rice husk was used as bedding material. The depth of 1-2 inches of the rice husk was provided during summer seasons, while 4-5inches' deep rice husk was provided during winter season. On day-1 the chicks were provided the corn maize. The commercial chick starter ration was mixed gradually in corn maize from day-2. The chicks were completely shifted to commercial chick starter ration on day-4 of age.

Table 1 Proximate Feed Analysis and Afla-toxin of Feed at GPF Attock

Dry Matter (%)	89.9
Moisture (%)	10.2
Crude Protein (%)	18.38
Crude Fat (%)	3.2
Crude Fiber (%)	2.5
Total Ash (%)	5
Aflatoxin B1 (ppb)	4
Calcium (Ca)	1
Phosphorous (P)	0.4
Metabolizable Energy (ME) (Kcal)	2898

The proximate analysis of feed was carried out from Feed and Water Testing Laboratory (FTL), PRI, Rawalpindi. The analysis is mentioned in Table 1. The feeding was done in feeding trays upto age of 5^{th} week, then after in round feeders till keeping of flocks.

Table 2 Analysis of Water Quality Given to Flocks at GPF Attock

pH	6.8
TDS	420
Na (ppm)	46
K (ppm)	05
Ca (ppm)	22
Chloride (ppm)	68
Sulphates (ppm)	<200
Nitrates (ppm)	25
Total Hardness	>375

The watering was done in manual drinker up-to age of 5th week, then after automatic drinkers were used. The water quality is mentioned in table 2. The analysis of quality of drinking water was carried out from FTL, PRI, Rawalpindi.

Table 3 Vaccination Schedule of Flocks Reared at GPF Attock

Age (day)	Vaccine	Route
1	Marek's Disease	S/C
1	IB	E/D
5	ND + H_9	S/C
5	ND La Sota	E/D
9	IBD Intermediate	D/W
12	IB	-do-
16	IBD Intermediate Plus	D/W
20	ND (La Sota)	-do-
30	Fowl pox	W/W
55	ND+H9 (Killed / Oil Based)	S/C
55	ND (La Sota)	D/W

[IB = Infectious Bronchitis; ND = Newcastle Disease; H_9 = Avian Influenza H_9 strain; IBD = Infectious Bursal Disease; S/C = Sub Cutaneous; E/D = Eye Drop; D/W = Drinking water; W/W = Wing Web]

The birds were vaccinated according to the schedule mentioned in table 3. The Mareks' vaccine was administered by the vaccinators at the hatchery, while other vaccines against important / prevalent viral diseases of poultry like ND, IB, IBD and Avian Influenza (H_9) were administered by the experts/technical staff at GPF Attock. Two shots were given to provide maximum protective immunity to birds. Fowl pox vaccine was administered.

Table 4 Schedule of Daily Feed Allowance

Age (Week)	1	2	3	4	5	6	7	8	9	10	11	12
Daily Feed Allowance (gm)	12	15	22	28	33	41	44	48	52	54	55	57

The feed was offered to birds according to schedule mentioned in the table 4. The daily and weekly mortality of the flocks was noted and percentage was recorded. The effect of season and environment on the mortality was noted. The correlation/effect of season/ environmental factors including temperature, humidity and atmospheric pressure on the disease and mortality pattern were analyzed. The proper diagnosis of disease was carried out from postmortem laboratory of the Disease Section, PRI, Rawalpindi and prescribed medication was given accordingly. The locally available medicines were used in the study for the treatment of birds. The results were compared/analyzed accordingly.

RESULTS OF STUDY

Flock A: The flock A was reared from 4th week of December 2016 to 3rd week of March 2017. The winter season prevailed during the months of January and February 2017, while spring season prevailed during March 2017 in Attock city.

Table 5 Seasonal and Climatic Factors During the Months of January, February and March

Month	Temperature (°C)			Rainfall (mm)	Atmospheric Pressure (mb)	Humidity (%)
	Max.	Avg.	Min.			
January	17	14	9	69.6	1020.8	47
February	23	19	13	27.3	1018.2	41
March	27	24	18	17	1013.9	35

The range of temperature, rain fall, atmospheric pressure and relative humidity are depicted in table 5.

Table 6 Weekly Mortality Pattern of Flock A

Age (Week)	Avg. No. of birds	Mortality	Cumulative mortality	Mortality (%)	Cumulative Mortality (%)
1	15174	723	723	4.66	4.66
2	14694	145	868	0.97	5.63
3	14592	75	943	0.51	6.14
4	14515	80	1023	1.77	7.91
5	14448	60	1083	0.41	8.32
6	14377	75	1158	0.52	8.84
7	13242	49	1207	0.36	9.20
8	12224	44	1251	0.37	9.57
9	11366	82	1333	0.72	10.30
10	11282	94	1427	0.66	10.50
11	10110	101	1528	1.04	10.95
12	3630	47	1575	1.27	12.22
Total	--	1575	1575	13.27	13.27

The weekly mortality, cumulative weekly mortality, percentage mortality and cumulative percentage mortality of flock A is described in table 6. The high mortality during first week was due to cold stress, weakness and emaciation. The chicks exhibited symptoms of typhoid / salmonella during second week and were treated with CNF & ADEK. Birds exhibited loose droppings in 8th & 9th week and were treated with Zeo-feed, CNF and Pro-SB plus. In 10th & 11th week birds exhibited CRD & Congestion and were treated with ADEK, Pro SB Plus and Respire. In 11th& 12th week mortality was due to weakness, emaciation and birds were treated with ADEK and Pro SB Plus.

Flock B: The flock B was reared from the 1stweek of April 2017 to 4thweek of June, 2017. The spring season prevailed during the month of April 2017 while summer season prevailed during months of May and June 2017 in Attock city.

Table 7 Weekly Mortality Pattern of Flock B

Age (Week)	Avg. No. of birds	Mortality	Cumulative Mortality	Mortality (%)	Cumulative Mortality (%)
1	16125	194	194	1.2	1.2
2	15953	208	402	1.30	2.5
3	15766	68	470	0.60	3.10
4	15707	65	535	0.41	3.51
5	14606	78	613	0.55	4.06
6	12785	92	705	0.72	4.78
7	12676	17	722	0.13	4.91
8	12656	22	744	0.17	5.08
9	12631	36	780	0.28	5.36
10	6688	47	827	0.89	6.25
11	538	24	851	5.49	11.74
Total	-	851	851	11.74	11.74

The weekly mortality, cumulative weekly mortality, percentage mortality and cumulative percentage mortality of flock B is described in table 7. The high mortality during 1st week was due to weakness, emaciation. The mortality during 2nd week was due to cannibalism / picking in birds. Cannibalism again started in 5th week. ADEK was supplemented. In

9th week bird died due to weakness and treated with ADEK. Heat stress & congestion mid of 9th to mid of 10th week. Treatment with Nicofrin and Salic-C was done. Deaths due to weakness and emaciation were recorded from mid of 10th week to 11th week.

Table 8 Seasonal and Climatic Factors During Months of April, May and June

Month	Temperature (ºC)			Rainfall (mm)	Atmospheric Pressure (mb)	Humidity (%)
	Max.	Avg.	Min.			
April	35	32	27	75.4	1008.1	20
May	40	37	33	9.3	1004.8	22
June	42	40	35	22.4	999.9	25

The range of temperature, rain fall, atmospheric pressure and relative humidity are depicted in table 8.

Flock C: The flock B was reared from the 1stweek of July 2017 to 4thweek of September, 2017. The warm and humid season prevailed during the months of July and August2017 while warm to moderate season prevailed during month of September 2017 in Attock city.

Table 9 Seasonal and Climatic Factors During Months of July, August and September

Month	Temperature (ºC)			Rainfall (mm)	Atmospheric Pressure (mb)	Humidity (%)
	Max.	Avg.	Min.			
July	41	38	35	78.6	998.6	39
August	40	37	33	71.7	1000.8	42
September	36	33	28	23.8	1006.2	37

The range of temperature, rain fall, atmospheric pressure and the relative humidity are depicted in table 9.

Table 10 Weekly Mortality Pattern of Flock C

Age (Week)	Avg. No. of birds	Mortality	Cumulative Mortality	Mortality (%)	Cumulative Mortality (%)
1	12937	255	255	1.96	1.96
2	12778	106	361	0.83	2.79
3	12689	67	428	0.53	3.32
4	12589	104	532	0.82	4.14
5	12541	18	550	0.14	4.28
6	11972	48	598	0.41	4.69
7	10606	54	652	0.51	5.2
8	9966	397	1049	3.98	9.18
9	9526	83	1132	0.87	10.05
10	9398	47	1179	0.49	10.54
11	9355	40	1219	0.43	10.97
12	6743	17	1236	0.23	11.2
Total		1236	1236	11.2	11.2

The weekly mortality, cumulative weekly mortality, percentage mortalityand cumulative percentage mortality of flock C is described in table 10. The high mortality in the 1st week was due to weakness + emaciation. Treatment with Bio-Enro-Colis and Nicofrin was done in the 1st week. The mortality in the 2nd week was due to weakness and emaciation and treatment was done with nicofrin. Cannibalism started in 4th week. The touching of beaks with electric debeaker along with treatment with ADEK was done. Heat stress was observed in 8th week. In the mid of 8th week to mid of 9th week, heat stress, Coccidiosis

and Staphylococcus infection was observed. Treatment was done with CAP-600, Salic-C and Aminox. In the 10th week birds were treated with ADEK, A. Sorb, Pro-SB Plus, Intramin Copper, and Potenmic. In 11th week the birds were treated with ADEK, A-Srob and ADEK.The A-Srob was continuously used from 8th to 12th week. ADEK was also given in 12th week.

Flock D: The flock C was reared from 2nd week of October, 2017 to 4th week of December, 2017. The warm and humid season prevailed during the months of July and August 2017, while warm to moderate season prevailed during month of September 2017 in Attock city.

Table 11 Seasonal and Climatic Factors During Months of October, November & December

Month	Temperature (°C)			Rainfall (mm)	Atmospheric Pressure (mb)	Humidity (%)
	Max.	Avg.	Min.			
October	33	30	24	0	1011.1	23
November	25	21	16	17.6	1016.5	26
December	20	16	11	14.8	1019.4	29

The range of temperature, rain fall, atmospheric pressure and the relative humidity are depicted in table 11.

Table 12 Weekly Mortality Pattern of Flock D

Age (Week)	Avg. No. of birds	Mortality	Cumulative Mortality	Mortality (%)	Cumulative Mortality (%)
1	18132	293	293	1.61	1.61
2	17923	149	442	0.83	2.44
3	17742	146	588	0.82	3.26
4	17657	46	634	0.26	3.52
5	17606	80	714	0.45	3.97
6	16172	87	801	0.51	4.48
7	13141	69	870	0.52	5
8	15558	118	988	0.76	5.76
9	14785	191	1179	1.31	7.07
10	12732	147	1326	1.15	8.22
11	8895	66	1392	0.72	8.94
12	1879	13	1405	1.13	10.07
Total =	--	1405	1405	10.07	10.07

The weekly mortality, cumulative weekly mortality, percentage mortality and cumulative percentage mortality of flock D is described in table 12. In 1st week early chick mortality was due to weakness, emaciation. In 2nd week birds exhibited symptoms of vent pasting, typhoid fever and were treated with EN Col and Aminox. At start of 3rd week the problem of vent picking and cannibalism started. Birds were given Zeo-feed and ADEK during 4th week. Mortality from 4th to 7th week was due to the weakness and emaciation. In 7th week CAP 600 and ADEK was given as preventive to coccidiosis. In 8th week Pro-SB Plus and A-Sorb was given. The increased mortality during 9th week was due to the weakness + emaciation + coccidiosis + congestion. The treatment with Pro-SB plus, A-Srob, Anticoc super and ADEK was done. The increased mortality during 10th week was due to the weakness, emaciation, congestion and respiratory distress, and treatment with the ADEK and Respire was done. At the end of 10th week treatment with ADEK and Clariment was done. The increased mortality in 11th week was due to weakness and emaciation. In 12th week the mortality in birds was due to weakness, emaciation and leucosis which resorted to death.

DISCUSSION

The poultry birds are sensitive to both cold and warm weather. The mortality due to heat stress is an important factor for high economic losses to producers (Pereira, Vale, Zevoli & Salgado, 2010). In our study cumulative mortality upto age of 10^{th}–12^{th} week in flock A, B, C and D was recorded as 13.27%, 11.74%, 11.2% and 10.07%, respectively. Mortality in our study was recorded in different seasons and at different age of poultry flocks. In our study extreme care was given for maintain of environmental temperatures according to season and requirement of the flock but even the mortality occurred at different ages in the flocks. As the open poultry housing systems were used in our study effect of season and weather was more pronounced in our study in terms of mortality in flocks. The high mortalities are anticipated in free range poultry flocks in extreme seasons especially in young flocks. Sankhyan et al. (2013) recorded that the seasonal mortality in young flocks during summer, winter and monsoon was 16.8, 55.4 and 27.7 percent, respectively, while seasonal mortality in adult flocks during summer, winter and monsoon was 17.2, 30.9 and 51.0 percent, respectively.

The less mortality as compared to other studies in the young flock in our study was due to adopting of standard managing condition according to season and weather conditions and adopting timely medication and concurrent remedial measures. In our study, proper diagnosis of diseases was carried out and prescribed treatment was done accordingly. The previous studies have reported that 62.8% of rural poultry farmers did not adopted proper treatment of diseases (Sankhyan et al., 2013). The proper diagnosis of diseases and using prescribed treatment, results in control of disease condition, prevents spread of disease, decreases further mortality and also reduces economic losses. All the factors including management conditions, outbreaks of infectious and non-infectious diseases, accidental deaths, substandard hygienic conditions, chick quality etc contribute towards the possible cause of high mortalities (Farooq, Mian, Durrani & Syed, 2002). The season, climatic and environmental factors also contribute towards growth performance, health, disease and mortality in poultry flocks. Climate variation changes in climatic parameters (temperature, rainfall, humidity & soil moisture) are posing threat to poultry enterprise (Alade & Ademola, 2013).

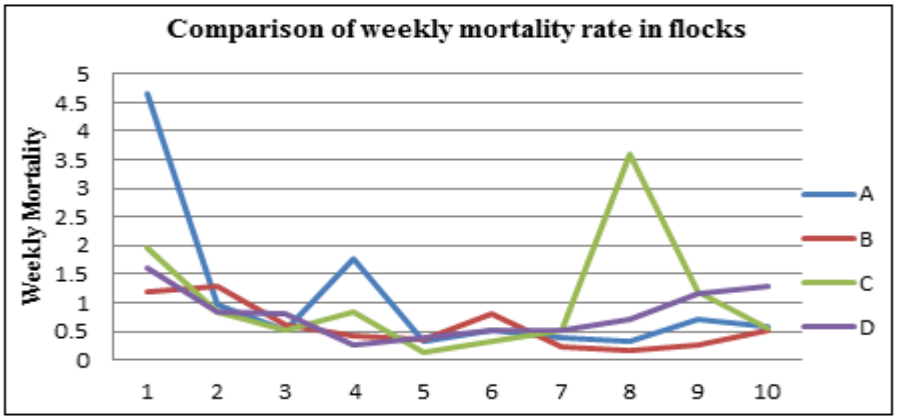
In our study maximum attempt was made to provide good and standard management for rearing of flocks. Management plays an important role in the growth of poultry farming. Suboptimal management and high mortality result in limited growth of rural poultry flocks (Sankhyan et al., 2013). Patra, Hajra, Das, Sarkar and Deka (2017) also observed that flocks reared during winter season had higher mortality during brooding season as compared to brooding during summer season. Moreover, Patra et al. (2017) found that flocks raised in summer season perform better in terms of egg production during winter season. Dana, Rathore, & Kaul (2000) recorded that in *Desi* birds very high mortality rate (52%) is found in grower chick, followed by 26% in growers and 22% in adult Desi birds in west bangal and further found that 15% of the total death losses were due to coccidiosis during the year 1995, while in the year 1996 mortality rate of 77% in starter chick, followed by 18% in growers and 5% in adult Desi birds and 14% of total death losses were due to coccidiosis during the year 1996 in different conditions and settings were recorded.

It is reported that chickens die during the bad weather, hot-wet and the hot-dry seasons (Kusina, Kusina, & Mhlanga, 2001; Maphosa, Kusina, Kusina, Makuza & Sibanda, 2004; Muchadeyi, Sibanda, Kusina, Kusina & Makuza, 2005). The high mortalities in extreme hot weathers are due to inability of bird to cope to environmental changes. The comfort zone of adult bird is between 10-20°C. Any deviation from this range of temperature may result in stress on birds. The more the deviation the increased the stress and resultant

failure of coping to environmental stress thus causing diseases, immune failures, disease outbreaks and eventually death of birds. Although in present study the mortality losses in the rural flocks were very low compared to other studies, the main factor was regular vaccination and management of flocks. Dana et al. (2000) recorded that the Ranikhet (Newcastle disease) was most important hazard in raising of poultry and also highlighted importance of vaccination and improved poultry husbandry practices to prevent losses due to the mortality and further investigated that Santal tribes of the west bangal used indigenous medicines against ND which were not effective.

The comparison of weekly mortality of flocks is depicted in graph 1. The high mortality in flock A during 1st week of brooding was due to cold stress during winter season during the months of January. The increased mortality in flock C during 7th and 8th week was due to heat stress during summer season. The months of August and September the high humidity along with the increased temperature resulted in heat stress, breakdown of immunity, and coccidiosis in flocks. Moreover, the issues related to feed toxins were also observed due to fugal growth in feed ingredients during hot and humid seasons during the months of July, August and September. It was observed that cannibalism started in flocks at age of 3rd week. The problem of cannibalism was overcome through touching of beaks with electric de-beaker. In our study it was observed that the coccidiosis was one of main issues mainly faced thru use of new litter and had seasonal effect. The problem of coccidiosis was faced during winter season and during humid environment conditions. The coccidiosis was not observed during warm and dry season.

Graph 1. Comparison of Weekly Mortality in Flocks



[x-axis = age (week); y-axis = mortality]

CONCLUSION

It was concluded that the rural poultry birds being very hardy and resilient to the harsh environmental conditions may not sustain extremes of seasonal and climatic factors and require extra care during peak seasons. Therefore, seasonal and climatic factors should be given due consideration while rearing of rural poultry flocks. The use of anti-pyretics and anti-stress medicine i.e. vitamin C, paracetamol, brufen, etc may be very helpful in combating heat stress in rural poultry flocks. The seasons of winters and high humidity should be given due consideration and the maximum efforts should be made to keep the litter dry to avoid coccidiosis and litter related disorders including ammonia emission etc. Moreover, the feed should also be placed at dry place to avoid fungal contamination in moist seasons. The stress of extreme seasons can also be reduced in the poultry flocks through regular supplementation of vitamins, feed additives, amino acids, etc. It is also concluding that use of vaccines against prevalent viral diseases can also prevent outbreak of diseases even in extreme environmental conditions.

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