

Original Research Article

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## An Economical Impact of Newcastle Disease Outbreaks in Various Commercial Broiler Chicken Farms During 2020-21 in Gujarat, India

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### ABSTRACT

#### Keywords

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Among the disease challenge, the Newcastle disease (ND) is the second most deadly viral infection and considered a very serious problem for poultry production in many countries. Outbreaks of the ND have a tremendous impact on the backyard as well as intensively reared commercial poultry farming and are considered as an unending agony of poultry farmers. During the study was observed that currently circulating NDV is viscerotropicvelogenic in nature and responsible for the outbreaks recorded in most of the vaccinated sampled commercial broiler farms which ultimately resulted in a huge economical impact on poultry farmers.

### Introduction

The Indian poultry industry is one of the fastest-growing segments of the agricultural sector in India with around 8% growth rate per annum. The constant efforts in development in poultry production have contributed to spectacular growth rates in egg (4-6% per annum) and broiler production (8-10% per annum) in India during the last 40 years (Chatterjee and Rajkumar, 2015). A striking

feature of NDV strains and isolates is their ability to cause quite distinct signs and severity of the disease, even in the same host species. Depending upon the pathotype and susceptibility of the bird mortality rate varies from 0% to 100% (Nanthakumar *et al.*, 2000). Outbreaks of ND may be devastating, with flock mortality approaching 100% in fully susceptible chickens. Newcastle disease is considered economically influential disease-causing huge production loss to the farmers of

developing countries that export poultry or poultry products.

Losses resulting from trade restraints and high mortality is a major threat to the poultry industry (Narayanan *et al.*, 2010).

During recent years, outbreaks of Newcastle disease were observed inspite of stringent and intensive vaccination policy against ND in many of the commercial broiler farms in Gujarat state, India. Few attempt has been made to estimate the economic losses due to ND among the commercial broiler chickens in the India.

Therefore, in this publication, we have calculated economic losses due to Newcastle disease outbreak occurred during 2019-21 in twenty-five commercial broiler farms located in three different geographical area of Gujarat state in India.

## **Materials and Methods**

The information regarding the name and location of the farm, Farm ID No., Flock size, Flock mortality and Period of ND outbreaks was obtained directly from the farm owner at the time of necropsy examination or by making personal visits to the commercial broiler farms located at three different geographical areas of Gujarat where mortality was reported due to ND with or without regular vaccination program (Table-1).

The economical impact of ND in affected commercial broiler farms was calculated by using data recorded for epidemiological study as well as other information like overhead cost per bird per day (included labour, electricity and managerial expenses), current rate of day-old chicks, rate of per kg feed and selling rate of live bird/kg body weight, cost of ND vaccination, cost of routine medicine, biosecurity measures, and other vaccination

for prevention of other diseases, cost of medicine during the course of ND etc. A newly modified economic model was developed and used to calculate the estimated economical impact of ND in all the twenty-five commercial broiler poultry farms included in the present study based on an earlier model of Williams (1999) and Khorajiyi *et al.*, (2018).

In viewing to better understanding and easiness of calculation, losses due to mortality (expenses on dead birds), expenses on live birds and income from selling of live birds were calculated separately and presented in respective tables.

Finally, the economical impact of ND in individual farms either in form of profit or losses was calculated by subtracting the total expenses on live birds and losses due to mortality (expenses on dead birds) from the income of selling live birds.

All kinds of costs or expenses and final profit or losses have been expressed in Indian currency rupees (₹) for a better realization in Indian perspectives.

## **Economical losses calculated by**

### **Losses due to mortality**

Losses due to mortality were calculated using the following formula.

$$LM = (NBD) \times (VDOC + CCFC + OC + CV + CMVB)$$

LM = Losses due to mortality

NBD = Nos. of bird died

VDOC = Value of day old chicks

CCFC = Cost of cumulative feed consumed per dead bird

OC = Overhead cost per dead bird

CV = Cost of ND vaccine per dead bird

CMVB = Cost of medicine, vaccine and biosecurity measures per dead bird for prevention of other diseases including medication during course of ND

### **Expenditure on live birds**

$ELB = (NBL) \times (VDOC + CCFC + OC + CV + CMVB)$

ELB = Expenditure on live birds

NBL = Nos. of birds live

VDOC = Value of day old chicks

CCFC = Cost of cumulative feed consumed per live bird

OC = Overhead cost per live bird

CV = Cost of ND vaccine per live bird

CMVB = Cost of medicine, vaccine and biosecurity measures per live bird for prevention of other diseases including medication during course of ND

### **Income from selling of live bird**

$ISLB = (NBL) \times (BWL B \times SRLB)$

ISLB = Income from selling of live bird

NBL = Nos. of bird live at the time of selling

BWL B = Bodyweight per live bird at the time of selling

SRLB = Selling rate per kg body weight of live bird at the time of selling

### **Economical impact of ND in various commercial broiler farms**

$EI = ISLB - TE$

EI = Economical impact

ISLB = Income from selling of live bird

TE = Total expenditure  $TE = LM + ELB$

LM = Losses due to mortality

ELB = Expenditure on live birds

### **Results and Discussion**

Total losses due to mortality (expenses on dead birds) caused by ND and total expenditure on live birds in all the twenty-five commercial broiler farms was ranged between ₹ 17,864 to ₹ 2,66,080 (Table-2) and ₹ 2,78,393 to ₹ 17,86,745 (Table-3) respectively. Whereas, income from the selling of live birds of individual farms was ranged between ₹ 1,60,255 to ₹ 12,46,314 (Table-4). The economical impact of ND in the individual farm in form of profit/loss in rupees as well as in percentage and also in form of profit/loss per bird in rupees is presented in Table-5. The profit/loss in percentage and profit/loss per bird in rupees was calculated from total profit/loss against total expenditure and initial flock size of individual farm respectively. As shown in Table-5, ₹ 74,290 and ₹ 94,514 profit was observed individually in only two farms.

The profit in form of percentages and ₹ / bird in these two farms was 14.23%, ₹ 27.51 and 12.62%, ₹ 23.63 respectively. The reason behind profit seen in these two farms was low mortality rate, the occurrence of disease at an early age lead to fewer expenses on dead birds, and higher body weight of birds at the time of selling and sold at market rate.

**Table.1** Name and location, Farm ID No., Flock size, flock mortality of commercial broiler farms affected with ND.

<b>Sr. No.</b>	<b>Name and location of commercial broiler poultry farms</b>	<b>Farm ID No.</b>	<b>Flock Size (No. of birds)</b>	<b>Flock mortality (No. of birds)</b>	<b>Period of ND outbreaks</b>
1	KGN Poultry Farm, Veraval, Gir-Somnath	GUJ/NDV/1	2200	350	May - 2019
2	Afzal Poultry Farm, Mangrol, Junagadh	GUJ/NDV/2	2700	280	May - 2019
3	Azad Poultry Farm, Dungarpur, Junagadh	GUJ/NDV/3	2500	530	May-June - 2019
4	Patel Poultry Farm, Makhiyana, Junagadh	GUJ/NDV/4	4000	245	May-June - 2019
5	Atari Poultry Farm, Patan, GirSomnath	GUJ/NDV/5	3100	455	June- 2019
6	Ankur Poultry Farm, Panchasiya, Morbi	GUJ/NDV/6	7000	1208	March - 2021
7	Irfan Poultry Farm, Valasan, Morbi	GUJ/NDV/7	5000	903	March - 2021
8	Idrish Poultry Farm, Valasan, Morbi	GUJ/NDV/8	4000	960	March - 2021
9	Noori Poultry Farm, Pipaliyaraj, Morbi	GUJ/NDV/9	4000	817	March - 2021
10	Sabudin Poultry Farm, Pipaliyaraj, Morbi	GUJ/NDV/10	8000	880	March - 2021
11	Samdani Poultry Farm, Pipaliyaraj, Morbi	GUJ/NDV/11	5000	919	March - 2021
12	Sipai Poultry Farm, Kankot, Morbi	GUJ/NDV/12	6000	2130	March - 2021
13	Yusuf Poultry Farm, Kankot, Morbi	GUJ/NDV/13	3500	840	March - 2021
14	Gebi Poultry Farm, Tithva, Morbi	GUJ/NDV/14	4000	1890	March - 2021
15	Sugar Poultry Farm, Tithva, Morbi	GUJ/NDV/15	6000	1130	March - 2021
16	Sad Poultry Farm, Pratapgadh, Morbi	GUJ/NDV/16	3500	714	March - 2021
17	Faizan Poultry Farm, Jodhpar, Morbi	GUJ/NDV/17	10000	1640	March - 2021
18	Yusuf Poultry Farm, Chandrapur, Morbi	GUJ/NDV/18	4000	925	March - 2021
19	Al-Amin Poultry Farm, Chandrapur, Morbi	GUJ/NDV/19	8000	1225	March - 2021
20	Army Poultry Farm, Limbada, Morbi	GUJ/NDV/20	4000	1190	March - 2021
21	Sarkar Poultry Farm, Limbada, Morbi	GUJ/NDV/21	8500	2080	March - 2021
22	Taslim Poultry Farm, Rasikgadh, Morbi	GUJ/NDV/22	12000	1455	March - 2021
23	Abdul Poultry Farm, Mahika, Morbi	GUJ/NDV/23	3500	760	March - 2021
24	Haidar Poultry Farm, Paj, Morbi	GUJ/NDV/24	5000	535	March - 2021
25	Ali Poultry Farm, Paj, Morbi	GUJ/NDV/25	7000	1060	March - 2021

**Table.2** Total losses due to mortality in ND affected commercial broiler farms.

Sr. No.	Farm ID No.	Total mortality (No. of bird died) (NBD)	Value of day old chicks (VDOC) (₹)	Cumulative feed consumed / dead bird (Kg)	Rate of feed / kg (₹)	Cost of cum. feed consumed / dead bird (CCFC) (₹)	Overhead cost / dead bird @ 0.20 ₹/day (OC) (₹)	Cost of ND vaccine / dead bird (CV) (₹)	Cost of medicine, vaccine and biosecurity measures/dead bird (CMVB) (₹)	Total losses due to mortality LM = NBD × (VDOC + CCFC + OC + CV + CMVB) (₹)
1	GUJ/NDV/1	350	42	1.54	35	53.90	5.00	0.30	4.00	36820
2	GUJ/NDV/2	280	42	0.44	35	15.40	2.60	0.80	3.00	17864
3	GUJ/NDV/3	530	42	1.47	35	51.45	5.00	0.00	3.50	54034
4	GUJ/NDV/4	245	42	0.86	35	30.10	3.60	0.80	3.50	19600
5	GUJ/NDV/5	455	41	1.58	35	55.30	5.00	0.15	4.00	47980
6	GUJ/NDV/6	1208	29	2.46	34	83.64	6.40	0.30	4.00	148995
7	GUJ/NDV/7	903	29	2.62	34	89.08	6.40	0.30	4.00	116288
8	GUJ/NDV/8	960	29	3.41	34	115.94	7.40	0.30	4.00	150374
9	GUJ/NDV/9	817	29	2.80	34	95.20	6.80	0.80	4.00	110949
10	GUJ/NDV/10	880	29	2.70	34	91.80	6.60	0.80	4.00	116336
11	GUJ/NDV/11	919	29	2.94	34	99.96	6.80	0.30	4.00	128715
12	GUJ/NDV/12	2130	29	2.53	34	86.02	6.40	0.00	3.50	266080
13	GUJ/NDV/13	840	29	2.86	34	97.24	6.80	0.80	4.00	115786
14	GUJ/NDV/14	1890	29	2.32	34	78.88	6.20	0.00	3.50	222226
15	GUJ/NDV/15	1130	29	2.34	34	79.56	6.00	0.80	4.00	134877
16	GUJ/NDV/16	714	25	3.41	34	115.94	7.60	0.30	4.00	109128
17	GUJ/NDV/17	1640	29	2.07	34	70.38	5.80	0.30	4.00	179547
18	GUJ/NDV/18	925	32	1.98	34	67.32	5.60	0.30	4.00	101029
19	GUJ/NDV/19	1225	29	3.26	34	110.84	7.20	0.30	4.00	185392
20	GUJ/NDV/20	1190	29	3.01	34	102.34	7.00	0.80	4.00	170337
21	GUJ/NDV/21	2080	29	2.39	34	81.26	6.20	0.80	4.00	252221
22	GUJ/NDV/22	1455	29	3.47	34	117.98	7.40	0.30	4.00	230879
23	GUJ/NDV/23	760	29	2.33	34	79.22	6.00	0.30	4.00	90075
24	GUJ/NDV/24	535	29	2.63	34	89.42	6.40	0.30	4.00	69079
25	GUJ/NDV/25	1060	29	2.09	34	71.06	5.80	0.80	4.00	117300

**Table.3** Expenditures on live birds in ND affected commercial broiler farms.

Sr. No.	Farm ID No.	No. of bird live (NBL)	Value of day old chicks (VDOC) (₹)	Cumulative feed consumed / live bird (Kg)	Rate of feed / kg (₹)	Cost of cumulative feed consumed / live bird (CCFC)(₹)	Overhead cost / live bird @ 0.20 ₹/day (OC) (₹)	Cost of ND vaccine / live bird (CV) (₹)	Cost of medicine, vaccine and biosecurity measures / live bird (CMVB) (₹)	Expenditure on live bird ELB = NBL × (VDOC + CCFC + OC + CV + CMVB) (₹)
1	GUJ/NDV/1	1850	42	4.22	35	147.70	8.40	0.30	4.50	375365
2	GUJ/NDV/2	2420	42	4.36	35	152.60	8.40	0.80	4.50	504086
3	GUJ/NDV/3	1970	42	4.41	35	154.35	9.00	0.00	4.00	412420
4	GUJ/NDV/4	3755	42	3.97	35	138.95	8.00	0.80	4.50	729409
5	GUJ/NDV/5	2645	41	4.48	35	156.80	8.80	0.15	4.50	558756
6	GUJ/NDV/6	5792	29	2.99	34	101.66	7.20	0.30	4.50	826287
7	GUJ/NDV/7	4097	29	3.01	34	102.34	7.00	0.30	4.50	586445
8	GUJ/NDV/8	3040	29	3.80	34	129.20	8.00	0.30	4.50	519840
9	GUJ/NDV/9	3183	29	3.38	34	114.92	7.60	0.80	4.50	499158
10	GUJ/NDV/10	7120	29	3.18	34	108.12	7.20	0.80	4.50	1065294
11	GUJ/NDV/11	4081	29	3.35	34	113.90	7.40	0.30	4.50	632963
12	GUJ/NDV/12	3870	29	2.83	34	96.22	6.80	0.00	4.00	526397
13	GUJ/NDV/13	2660	29	3.18	34	108.12	7.20	0.80	4.50	397989
14	GUJ/NDV/14	2110	29	2.71	34	92.14	6.80	0.00	4.00	278393
15	GUJ/NDV/15	4870	29	2.60	34	88.40	6.40	0.80	4.50	628717
16	GUJ/NDV/16	2786	25	3.97	34	134.98	8.40	0.30	4.50	482479
17	GUJ/NDV/17	8360	29	2.47	34	83.98	6.40	0.30	4.50	1038145
18	GUJ/NDV/18	3075	32	2.16	34	73.44	5.80	0.30	4.50	356823
19	GUJ/NDV/19	6775	29	3.66	34	124.44	7.80	0.30	4.50	1124921
20	GUJ/NDV/20	2810	29	3.32	34	112.88	7.40	0.80	4.50	434370
21	GUJ/NDV/21	6420	29	2.85	34	96.90	7.00	0.80	4.50	887244
22	GUJ/NDV/22	10545	29	3.76	34	127.84	7.80	0.30	4.50	1786745
23	GUJ/NDV/23	2740	29	2.58	34	87.72	6.40	0.30	4.50	350501
24	GUJ/NDV/24	4465	29	3.03	34	103.02	7.00	0.30	4.50	642156
25	GUJ/NDV/25	5940	29	2.64	34	89.76	6.80	0.80	4.50	777308

**Table.4** Income from selling of live birds of commercial broiler farms affected with ND.

Sr. No.	Farm ID No.	No. of bird live (NBL)	Body weight per live bird (BWLb) (Kg)	Selling rate per kg body weight of live bird (SRLB) (₹)	Income from selling of live bird ISLB = (NBL) × (BWLb × SRLB) (₹)
1	GUJ/NDV/1	1850	2.28	81	341658
2	GUJ/NDV/2	2420	2.54	97	596240
3	GUJ/NDV/3	1970	2.27	100	447190
4	GUJ/NDV/4	3755	2.34	96	843523
5	GUJ/NDV/5	2645	2.37	95	595522
6	GUJ/NDV/6	5792	1.76	51	519890
7	GUJ/NDV/7	4097	1.79	53	388682
8	GUJ/NDV/8	3040	2.08	51	322483
9	GUJ/NDV/9	3183	1.94	49	302576
10	GUJ/NDV/10	7120	1.90	49	662872
11	GUJ/NDV/11	4081	2.03	51	422506
12	GUJ/NDV/12	3870	1.73	42	281194
13	GUJ/NDV/13	2660	1.93	49	251556
14	GUJ/NDV/14	2110	1.55	49	160255
15	GUJ/NDV/15	4870	1.67	42	341582
16	GUJ/NDV/16	2786	2.14	42	250406
17	GUJ/NDV/17	8360	1.57	53	695636
18	GUJ/NDV/18	3075	1.48	53	241203
19	GUJ/NDV/19	6775	2.12	53	761239
20	GUJ/NDV/20	2810	2.00	53	297860
21	GUJ/NDV/21	6420	1.70	53	578442
22	GUJ/NDV/22	10545	2.23	53	1246314
23	GUJ/NDV/23	2740	1.65	53	239613
24	GUJ/NDV/24	4465	1.88	56	470075
25	GUJ/NDV/25	5940	1.61	53	506860

**Table.5** Economical impact of ND in various commercial broiler farms.

Sr. No.	Farm ID No.	Flock size (No. of birds)	Total losses due to mortality (LM) (₹)	Expenditure on live bird (ELB) (₹)	Total expenditure TE = LM + ELB (₹)	Income from selling of live bird (ISLB) (₹)	Economical impact EI = ISLB - TE (₹)	Profit / loss (%)	Profit / loss per bird (₹)
1	GUJ/NDV/1	2200	36820	375365	412185	341658	-70527	-17.11	-32.06
2	GUJ/NDV/2	2700	17864	504086	521950	596240	74290	14.23	27.51
3	GUJ/NDV/3	2500	54034	412420	466454	447190	-19264	-4.13	-7.71
4	GUJ/NDV/4	4000	19600	729409	749009	843523	94514	12.62	23.63
5	GUJ/NDV/5	3100	47980	558756	606736	595522	-11214	-1.85	-3.62
6	GUJ/NDV/6	7000	148995	826287	975282	519890	-455392	-46.69	-65.06
7	GUJ/NDV/7	5000	116288	586445	702733	388682	-314051	-44.69	-62.81
8	GUJ/NDV/8	4000	150374	519840	670214	322483	-347731	-51.88	-86.93
9	GUJ/NDV/9	4000	110949	499158	610107	302576	-307531	-50.41	-76.88
10	GUJ/NDV/10	8000	116336	1065294	1181630	662872	-518758	-43.90	-64.84
11	GUJ/NDV/11	5000	128715	632963	761678	422506	-339172	-44.53	-67.83
12	GUJ/NDV/12	6000	266080	526397	792477	281194	-511283	-64.52	-85.21
13	GUJ/NDV/13	3500	115786	397989	513775	251556	-262219	-51.04	-74.92
14	GUJ/NDV/14	4000	222226	278393	500619	160255	-340364	-67.99	-85.09
15	GUJ/NDV/15	6000	134877	628717	763594	341582	-422012	-55.27	-70.34
16	GUJ/NDV/16	3500	109128	482479	591607	250406	-341201	-57.67	-97.49
17	GUJ/NDV/17	10000	179547	1038145	1217692	695636	-522056	-42.87	-52.21
18	GUJ/NDV/18	4000	101029	356823	457852	241203	-216649	-47.32	-54.16
19	GUJ/NDV/19	8000	185392	1124921	1310313	761239	-549074	-41.90	-68.63
20	GUJ/NDV/20	4000	170337	434370	604707	297860	-306847	-50.74	-76.71
21	GUJ/NDV/21	8500	252221	887244	1139465	578442	-561023	-49.24	-66.00
22	GUJ/NDV/22	12000	230879	1786745	2017624	1246314	-771310	-38.23	-64.28
23	GUJ/NDV/23	3500	90075	350501	440576	239613	-200963	-45.61	-57.42
24	GUJ/NDV/24	5000	69079	642156	711235	470075	-241160	-33.91	-48.23
25	GUJ/NDV/25	7000	117300	777308	894608	506860	-387748	-43.34	-55.39



However, losses were evident in twenty-three farms in ranged of lowest losses ₹ 11,214 to highest losses ₹ 7,71,310 and overall total losses in twenty-three farms were ₹ 80,17,549. The losses in form of percentages and ₹ / bird in individual farms were in a range between 1.85 to 67.99% and ₹ 3.62 to ₹ 97.49 respectively. Among twenty-three farms, higher percentages of losses were observed in the range of 33.91 to 67.99% (20/25). The reason behind higher percentages of losses in these twenty farms was continuous high mortality, and the occurrence of disease around four to five week of flock age leads to more expenses on dead birds. Because of continuous heavy mortality, there was a compulsion to sell the flock at a cheap rate (₹ 42 to ₹ 53) even though the current open market rate of broiler chicken was in the range of ₹ 92 to ₹ 103 per kg live body weight of broiler bird during this period. In contrast to this twenty farm, in three farms in which mortality was under control, flock reared up to marketable age and sold at market rate. Hence, in these three farm percentages of losses was in the range of 1.85% to 17.11%.

The economic losses seen in this study were concurrent to the study in India, a total of 13 flocks of 11 layer farms affected with ND and economic losses ₹ 37,19,223 was reported (Khorajiya *et al.*, 2018). Newcastle disease in India led to heavy economic losses in commercial poultry farms and our study was consistent with the study of Munir *et al.*, (2012), which stated that heavy economic losses to commercial poultry in Southeast Asia due to Newcastle disease outbreaks.

Similar results have been also observed and heavy economic losses of a total 200 million USD inspite of standard vaccination protocols and biosecurity measures among commercial poultry farms affected with Newcastle disease in Pakistan during 2011-2013 (Siddique *et al.*, 2013). Antipas *et al.*, (2012) observed 35

billion losses in the poultry industry with 55% mortality due to ND outbreaks in Chad. Mishra (1991) stated that in Nepal, Newcastle disease causes great economic loss by mortality and morbidity, estimated 75 million rupees per year.

The present study revealed that among twenty-five commercial broiler farms, twenty-three farms were highly affected due to Newcastle disease. Further, the outbreak of ND in these farms was solely responsible for ₹ 80,17,549 (₹ 8.01 million) economic losses. It gives a clear idea that once ND outbreak occurred in the farm it led to a very negative economic impact throughout the lifespan of the flock.

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