



Estimated Incremental Benefits of Complete Vaccination Against Newcastle Disease in Layers

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Abstract

Regular vaccination along with better management practises and biosecurity plays a vital role in the sustenance and growth of the poultry sector. However, despite of vaccinating all the birds on the farm, the poultry industry reported Newcastle Disease cases year after year. To understand the benefits of vaccination in monetary terms, a retrospective study was conducted with the purpose to estimate the benefits of regular/complete vaccination over incomplete vaccination against Newcastle Disease. The data was obtained directly from farmers with a total sample size of 90-layer farms for the period April 2021- March 2022. The partial budget analysis technique was employed, and the overall incremental benefit of complete vaccination was estimated to be ~22 INR per bird. Hence the study suggests poultry farmers to follow complete vaccination on their farms as a standard management practice.

Keywords: Vaccination; Benefits of Vaccination; Newcastle Disease; Complete Vaccination; Layers

Abbreviations

~: Approximate; INR: Indian Rupee; ND: Newcastle Disease

Introduction

One of the major challenges faced by the poultry industry other than a continuous increase in poultry feed costs has been vulnerability to poultry diseases [3]. Amongst the poultry diseases, various studies reported Newcastle disease (ND) as one of the major diseases affecting rural as well as commercial poultry which directly and indirectly causes immense economic loss to the poultry industry [5,6]. The studies conducted by Javed, et al. and Bessell, et al. suggested that vaccination acts as one of the key preventive strategies against losses due to ND. Regular vaccination along with better management practises and biosecurity plays a vital role in the sustenance and growth of the poultry sector [1,4]. Although, ND vaccination has been a common practice in all commercial poultry farms in India, and despite it, erratic ND outbreaks have been continuously reported during the past five years, proving the endemicity of the disease in the country [2].

The efficacy of vaccination can be jeopardised by several factors such as those linked to the vaccine itself, those related to vaccine delivery, and those endogenous to the bird. Factors linked to the vaccine itself include the antigen's serotype and level of protec-

tion provided by the vaccine, whereas factors endogenous to birds include maternal immunity, immunosuppression, infection status, and genetic factors. The factors associated with vaccine delivery include the route of vaccine administration, vaccine doses and protocol of vaccination. Amongst the aforementioned factors, a routine follow-up of vaccination protocol or complete vaccination can be considered an important factor which entirely depends on poultry farmers for the success or failure of vaccination. To understand the importance of complete vaccination and its benefits in commercial layer farms, a study was conducted to estimate the benefits of vaccination against ND, quantified in monetary terms.

Material and Methods

A retrospective study was conducted with a total sample size of 90 commercial layer farms in the Panchkula region of Haryana. The data pertaining to vaccination status and ND outbreak in layer farms was obtained directly from poultry farmers via Multistage purposive random sampling for the period April 2021- March 2022. Based on the vaccination status, the farms were categorised as non-vaccinated, ill-vaccinated and completely vaccinated farms. The completely vaccinated layer farms were those in which vaccination against ND was done strictly as per the predesigned vaccination schedule duly validated by poultry experts. The farms which either defaulted on or deviated from the schedule were categorised

as ill-vaccinated farms, whereas the farms with no vaccination history against ND were categorised as non-vaccinated. Based on the occurrence of ND, farms with a history of ND outbreaks were classified as ND-infected farms, otherwise ND-free farms. The partial budget analysis technique was employed to observe the benefits of vaccination as the difference in net returns in layer farms with complete vaccination over incomplete vaccination.

Results and Discussion

Among 90-layer farms, 57 farms (63.3%) were found to be completely vaccinated and the rest of the farms (36.7%) were ill-vaccinated against ND (Table 1.1). None of the layer farms was classified under the non-vaccinated farm category which portrayed the 100 per cent vaccination status of farms against ND. The ND outbreaks were reported on 42 farms out of 57 completely vaccinated ones (73.7%) whereas, among 33 ill-vaccinated farms, 32 farms reported ND outbreaks (97%). Overall, it was observed that ND outbreaks reported on ill-vaccinated farms were higher compared to completely vaccinated farms. There was a significant association observed between the ND vaccination status and the occurrence of ND on the farm ($\chi^2 = 7.73, p = 0.005$). These observations were in accordance with the findings of the study conducted to estimate the economic ramification of ND in Pakistan [8] *i.e.*, adherence to a complete vaccination schedule resulted in a significant reduction in morbidity in poultry. Also, the observations made in the study conducted at an avian clinic in Nigeria [7], were similar in effect in that birds with a history of incomplete vaccination had higher ND prevalence (13.1%) compared to those having complete vaccination history (2.8%).

ND vaccination status	Farm type		Total
	ND-free	ND-infected	
Complete (63.3)	15 (26.32)	42 (73.68)	57 (100.0)
Ill-vaccinated (36.7)	1 (3.03)	32 (96.97)	33 (100.0)
Total (100)	16 (17.78)	74 (82.22)	90 (100.0)

Table 1.1: Vaccination against ND vis-à-vis ND incidence.

Note: Figures in parentheses indicate the percentage.

The incremental benefits of vaccination were calculated by employing the partial budgeting technique/method. Notably, there were no un-vaccinated farms among the sampled layer farms. In order to estimate the incremental benefits of vaccination, the sampled farms were classified into two categories, a) completely vaccinated farms and b) ill-vaccinated farms. The incremental benefits accrued to the completely vaccinated farms were assessed in terms of the difference in gross profits with that from ill-vaccinated farms over the period of 72 weeks (Table 1.2), *i.e.*, the standard economic life of the layer birds. The results indicated that the ill-vaccinated farms reported higher ND outbreaks (~97%) and higher mortality of birds due to ND (9943/farm) compared to completely vaccinated farms (*i.e.*, ~74% and 5705/farm, respectively). The total revenue generated on completely vaccinated farms (1296.77 INR/bird) was much higher compared to ill-vaccinated farms (1221.29 INR/bird) which compensated the additional cost incurred for vaccination in completely vaccinated farms *i.e.*, 9.99 INR per bird over ill-vaccinated farms *i.e.*, 9.95 INR per bird.

Parameters	Status of ND vaccination			
	Completely vaccinated farms (n = 57)		Ill-vaccinated farms (n = 33)	
	Mean	CV%	Mean	CV%
No. of birds/farm	79474 ^a	45.52	79939 ^a	47.72
No. of birds died/farm	5705 ^a	95.31	9943 ^b	149.7
Birds' mortality due to ND	1113.51 ^a	470.25	5139.39 ^b	277.47
Vaccination cost/bird (INR)	9.99 ^a	0.04	9.95 ^b	1.16
Total cost/bird (INR)	1228.63 ^a	6.50	1194.97 ^a	10.75
Total revenue/bird (INR)	1296.77 ^a	9.60	1221.29 ^b	12.94
Gross profit/bird (INR)	68.13 ^a	144.21	26.32 ^b	283.84
ND-infected farms ^s	42/57 (73.68)		32/33 (96.96)	

Table 1.2: Estimating benefits of complete ND vaccination on poultry farms.

Note: Figures in parenthesis Indicates the percentage.

^s No. of ND-infected farms out of the total no. of farms in respective categories of vaccination.

Different superscripts in a row indicate a significant difference (a,b) in the mean of the respective variable otherwise non-significant difference (a,a).

The Welch's test was employed to observe the difference in the values of various parameters across two groups *i.e.*, completely vaccinated farms *vis-à-vis* ill vaccinated farms. Statistically, a significant difference was observed in the total mortality of birds ($t = -1.943$, $p = 0.055$), birds' mortality due to ND ($t = -1.925$, $p = 0.057$), vaccination cost incurred on the farms ($t = 2.103$, $p = 0.038$), total revenue per farm ($t = 2.507$, $p = 0.014$) and the gross profits per farm ($t = 2.272$, $p = 0.026$). The estimated average gross profit on completely vaccinated farms was ~68 INR per bird while that on ill-vaccinated farms was ~26 INR per bird. Therefore, an incremental benefit of 22 INR per bird was observed on completely vaccinated farms as compared to the ill-vaccinated farms.

Conclusion

Based on the above discussion, ill-vaccinated farms turn out to be more prone to ND outbreaks and reported higher mortality due to ND compared to the completely vaccinated layer farms. The gross profit generated on the completely vaccinated farms was much higher *i.e.*, a difference of 22 INR per bird compared to ill-vaccinated farms. Hence, poultry farmers are advised to regularly vaccinate the birds on their farms against ND strictly as per the ND vaccination protocol as a standard management practice.

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Bibliography

1. Bessell PR, *et al.* "An analysis of the impact of Newcastle disease vaccination and husbandry practice on smallholder chicken productivity in Uganda". *Preventive Veterinary Medicine* 177 (2020).
2. DAHD- Annual Reports (2016-17 to 2020-21). Department of Animal Husbandry, Dairying and Fisheries. Ministry of Fisheries, Animal Husbandry and Dairying. Government of India, 2016-2022 (2021).
3. Hafez HM and Attia YA. "Challenges to the Poultry Industry: Current Perspectives and Strategic Future After the COVID-19 Outbreak". *Frontiers in Veterinary Science* 7 (2020): 516.
4. Javed K, *et al.* "Flock size and egg production performance of backyard chicken reared by rural woman in Peshawar, Pakistan". *Livestock Research for Rural Development* 15 (2003): 80.
5. Khatun M, *et al.* "Economic impact of Newcastle disease on village chickens- A case study of Bangladesh". *Journal of Economics and Business* 1.3 (2018): 358-367.
6. Khorajiya JH, *et al.* "Economic impact of genotype-XIII Newcastle disease virus infection on commercial vaccinated layer farms in India". *International Journal of Livestock Research* 8.5 (2018).
7. Muhammed SM, *et al.* "Prevalence of Newcastle disease diagnosed at the avian clinic, Ahmadu Bello University, Zaria, Nigeria: a retrospective survey". *Savannah Veterinary Journal* 17.2 (2020): 60-64.
8. Naila CM, *et al.* "Prevalence and Economic Ramification of Newcastle Disease in Backyard Chicken in Charsadda, NWFP, Pakistan". *Journal of Biological Sciences* 1.5 (2001): 421-424.