Effect of vaccination on daily milk yield in Ongole (*Bos indicus*) cows

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Abstract

The present study was conducted to assess the impact of vaccination for Foot and Mouth Disease (FMD), Lumpy Skin Disease (LSD) and Hemorrhagic Septicemia (HS) on daily milk yield in Ongole (*Bos indicus*) cows using milk yield and vaccination records available at Livestock Research Station, Lam, Guntur of Sri Venkateswara Veterinary University, Tirupati, India. Daily milk yield observations for 12 days (from one day before vaccination 'denoted as -1' until ten days after vaccination 'denoted as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10' and '0 day' is the day of vaccination) were collected based on the available dates of vaccinations. The day-to-day absolute change (kg/animal/day) and percent change (%) in milk production were calculated to quantify the effect of vaccinations on milk production. The present study revealed that there was no significant variation among daily milk yields during the period of 12 days concerning all three types of vaccinations. FMD vaccine caused a slight drop in milk production on 1st, 4th and 6th day after vaccination, the LSD vaccine caused the same on 0th, 1st, 2nd, 5th and 9th days and the HS vaccine led to a slight decline in milk yield on 0th, 1st, 2nd, 7th, 8th, 9th and 10th days. There was a non-significant drop in milk yield (0.01 to 0.07 kg per animal per day) on the first day after vaccination in the case of all three vaccines. In terms of percent, change in milk yield ranged from -3.10 to -6.20%. It may be concluded that vaccination caused only a non-significant reduction in milk yield, ranging from 0.01 to 0.07 kg per animal per day, corresponding to a percent decline of 3.10% to 6.20% within 10 days post-vaccination.

Keywords: Ongole cows, vaccination, milk yield, foot and mouth disease (FMD), lumpy skin disease (LSD) and hemorrhagic septicemia (HS).

Introduction

Livestock vaccination is an important biosecurity measure done all around the world. Aside from protecting cattle from infectious diseases, vaccinations indirectly help minimize antibiotic use and contribute to animal welfare by preventing unnecessary disease-related suffering. Vaccination also reduces the likelihood of transmission to other susceptible animals. It also avoids the massive financial loss incurred by farmers because of treatment costs and production loss due to disease outbreak. The major infectious diseases such as Foot and Mouth Disease (FMD), Lumpy Skin Disease (LSD) and Hemorrhagic Septicemia (HS) were reported to cause loss of Rs. 922.66 (Dadawala *et al.*, 2023), 6693.33 (Chouhan *et al*., 2022) and 2355.78 (Singh *et al.*, 2014) per animal, respectively. In some cases, the vaccines are also used to cure viral diseases (Zhang *et al.*, 2026).

The herd immunity threshold, *i.e.,* vaccination coverage needed to control infection for HS, FMD and LSD was 60.20, 41.50 (Krishnamoorthy *et al.*, 2020), and 80.00% (Tuppurainen *et al.*, 2021), respectively. However, the vaccination coverage in some regions of India is 48.00% or even lower (Sharma and Khadse, 2023; Rathod *et al.,* 2016). The reasons for the poor coverage may include short-term side effects of vaccination, such as decreased milk production (5.5-16%), stress, fever and immunosuppression (Rajput *et al.*, 2024; Kim *et al.*, 2021). There is a need to create awareness among farmers on the benefits of vaccination and to develop vaccines with minimal side effects on animals. Recombinant and nucleic acid vaccines were reported to cause lower side effects than the live attenuated and inactivated vaccines (Jorge and Dellagostin, 2017).

The purpose of the present study is to investigate the immediate effects of vaccination on daily milk yield which is critical and it can help in proving that the short-term loss in milk yield is far outweighed by the long-term insurance against disease outbreaks and in distinguishing benign post-vaccinal drop in milk yield from active pathological conditions in which a sudden decline in milk production is observed. The present study was designed to assess the impact of vaccination for Foot and Mouth Disease (FMD), Lumpy Skin Disease (LSD), and Hemorrhagic Septicemia (HS) on milk production in the Ongole cows.

Materials and methods

The present study was conducted at Livestock Research Station, Lam, Gunturto know the transient effects of Foot and Mouth Disease (FMD), Lumpy Skin Disease (LSD) and Hemorrhagic Septicemia (HS) vaccines on milk production in the Ongole (*Bos indicus*) cows. The milk production and vaccination records from 2020 to 2025 were used for the present study. A total of 3,276 daily milk yield observations for 12 days (from one day before vaccination 'denoted as -1' until ten days after vaccination 'denoted as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10', and '0 day' is the day of vaccination) from 273 animals were collected to meet the objectives of the present study. Weaning of calves was not practiced in the farm and the amount of milk consumed by calves during suckling was not considered while presenting results related to milk production. The animals were fed on a daily ration of 3-5 kg high-protein concentrate (20% DCP, 70% TDN), 20-30 kg chopped green fodder and 6-7 kg paddy straw.

Raksha-OVAC Trivalent Inactivated Foot and Mouth Disease (FMD) vaccine (IIL, Hyderabad) was administered @ 2ml per animal *via* the deep intramuscular route. Live, freeze-dried Raksha-Goat Pox vaccine (IIL, Hyderabad) was administered, as a prophylactic measure against Lumpy Skin Disease (LSD) (Haegeman *et al.*, 2025), subcutaneously @ 1ml per animal. Inactivated Hemorrhagic Septicemia (HS) vaccine (VBRI, Hyderabad) was administered @ 2ml per animal *via* the subcutaneous route.

The day-to-day absolute change (kg/animal/day) and percent change (%) in milk production were calculated to quantify the effect of vaccinations on milk production. The absolute change in milk production on a day was calculated by subtracting the milk yield of an animal on its preceding day from the milk yield of the animal on that day. The percent change in milk yield was calculated by the formula given below (Brauen *et al.*, 2020).

$$Percent\ change\ in\ milk\ yield\ in\ a\ day(\%) = \frac{(Milk\ yield\ of an\ animal\ on\ that\ day - Milk\ yield\ of the\ animal\ on\ preceding\ day)}{Milk\ yield\ of\ the\ animal\ on\ preceding\ day} \times 100$$

The SPSS software was employed to analyze the data using conventional statistical methods, including mean, standard error, one-way ANOVA, absolute change and percent change. The results pertaining to the percent change in milk output and the means of milk yield on various vaccination days were visualized using the R Studio software.

Results and Discussion

Vaccination is the process of introducing a safe antigen called 'vaccine' into a host to induce immunity against an infection. Live attenuated, inactivated (killed), toxoid, peptide, recombinant and nucleic acid vaccines are popular and effective types of vaccines. Vaccines help in protection against diseases, lowering morbidity and mortality, however, indirect benefits include ensuring food safety, protection of human population from zoonotic diseases, enhancing herd immunity, improving net profits, increased wellbeing of farmers (Scutt *et al.*, 2022; Railey *et al.*, 2019). However, short-term negative effects of vaccination such as stress, immunosuppression, fever, drop in milk production were also reported (Rajput *et al.*, 2024; Kim *et al.*, 2021).

The short-term effects of FMD, LSD, and HS vaccination on milk production were investigated in the present study. The results of average milk yields (kg per animal per day) during different vaccinations are given in Table 1 and the trend of average milk yield over different days is depicted in Figure 1 through line graphs. The results of absolute and percent change in milk yield for different vaccinations are presented in Table 2. The trend of average percent change in milk yield over different days is shown in Figure 2. The average milk yield per animal per day during a period of 12 days of lactation was found to be 2.40 ± 0.02 kg in the Ongole cows. The finding was in agreement with Reddy *et al.* (2023), who reported that the mean milk yield per animal per session was 1.30 ± 0.03 kg in the Ongole cattle.

The present study revealed that there was no significant variation among daily milk yields during the period of 12 days (1 day before vaccination, on the day of vaccination and 10 days post vaccination) concerning all three 3 vaccines studied. These findings indicate that the effect of FMD, LSD and HS vaccinations on milk production is negligible. The FMD vaccine caused a slight non-significant drop in milk production on 1st, 4thand 6th day after vaccination, the LSD vaccine caused the same on the day of vaccination and on 1st, 2nd, 5th and 9thdays after vaccination and the HS vaccine led to a slight non-significant drop in milk yield on the day of vaccination and on the 1st, 2nd, 7th, 8th, 9th and 10thdays after vaccination. There was a slight, non-significant drop in milk yield (0.01-0.07 kg per animal per day) on the first day after vaccination in the case of all three vaccines. The present findings regarding the FMD vaccine were in line with that of Raina *et al.* (2023) and Krishnaswamy *et al.* (2021) who reported a non-significant drop in milk yield. However, Pramod *et al.* (2021) reported a significant drop in milk production after the first day of FMD vaccination in crossbred cows. The reason for this disagreement might be differences in terms of breeds. The result regarding the LSD vaccine was supported by Kumar *et al.* (2023) and Morgenstern and Klement (2020). Contrary to the findings of the present study, Abutarbush *et al.* (2016) stated that there was a prolonged drop in milk production post LSD vaccination.

Table 1: Average milk yields

Day	Average milk yield (kg per animal per day)*		
	FMD (N = 106)	LSD (N = 80)	HS (N = 87)
-1	2.40 ± 0.11	2.52 ± 0.14	2.35 ± 0.13
0 (Day of vaccination)	2.39 ± 0.11	2.47 ± 0.13	2.32 ± 0.12
1	2.38 ± 0.12	2.41 ± 0.13	2.30 ± 0.12
2	2.42 ± 0.11	2.39 ± 0.11	2.15 ± 0.12
3	2.48 ± 0.12	2.44 ± 0.12	2.21 ± 0.12
4	2.37 ± 0.12	2.49 ± 0.13	2.22 ± 0.11
5	2.50 ± 0.12	2.47 ± 0.13	2.31 ± 0.12
6	2.38 ± 0.12	2.50 ± 0.12	2.33 ± 0.12
7	2.46 ± 0.12	2.55 ± 0.14	2.32 ± 0.12
8	2.53 ± 0.12	2.59 ± 0.12	2.28 ± 0.12
9	2.55 ± 0.11	2.46 ± 0.14	2.24 ± 0.13
10	2.58 ± 0.12	2.51 ± 0.13	2.18 ± 0.12
P value	0.957^{NS}	0.998^{NS}	0.989^{NS}

N: Sample Size, NS: Not Significant, *: The amount of milk consumed by calf during suckling was not taken into account

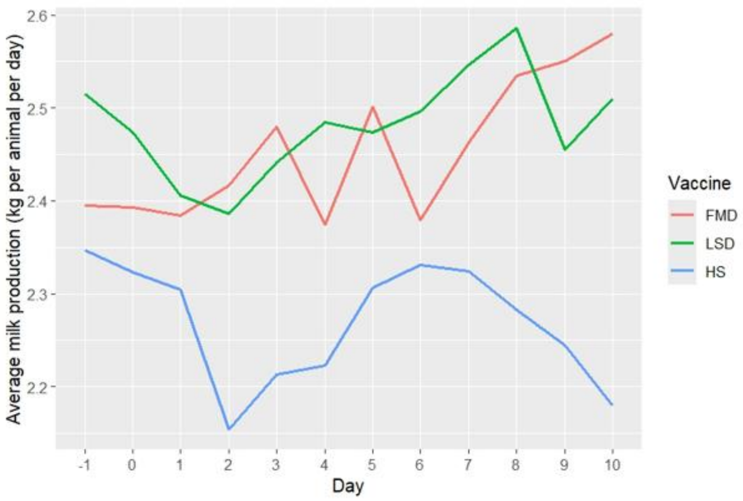

Fig. 1: Trend of average milk yield over different days of vaccination

Table 2: Absolute and percent change in milk yield per animal

Day	Average absolute change in milk yield (kg/ animal/ day)			Average percent change in milk yield (%)		
	FMD (N = 106)	LSD (N = 80)	HS (N = 87)	FMD (N = 106)	LSD (N = 80)	HS (N = 87)
0	0.00 ± 0.05	-0.04 ± 0.08	-0.02 ± 0.06	1.87 ± 2.36	3.45 ± 3.82	3.01 ± 2.95
1	-0.01 ± 0.06	-0.07 ± 0.07	-0.02 ± 0.05	1.04 ± 2.74	0.22 ± 3.05	1.76 ± 2.71
2	0.03 ± 0.06	-0.02 ± 0.07	-0.15 ± 0.04	6.43 ± 3.15	4.20 ± 3.01	-6.20 ± 2.09
3	0.06 ± 0.05	0.06 ± 0.05	0.06 ± 0.04	6.58 ± 2.51	5.07 ± 2.71	5.84 ± 2.39
4	-0.10 ± 0.05	0.04 ± 0.05	0.01 ± 0.04	-3.10 ± 2.50	2.50 ± 2.24	3.56 ± 1.91
5	0.13 ± 0.05	-0.01 ± 0.06	0.08 ± 0.05	12.97 ± 3.96	1.66 ± 2.64	4.60 ± 2.47
6	-0.12 ± 0.05	0.02 ± 0.06	0.02 ± 0.05	-3.67 ± 2.22	5.31 ± 3.18	4.91 ± 3.79
7	0.08 ± 0.06	0.05 ± 0.09	-0.01 ± 0.05	8.79 ± 2.97	5.30 ± 4.20	3.03 ± 2.97
8	0.07 ± 0.07	0.04 ± 0.08	-0.04 ± 0.05	10.08 ± 4.47	12.03 ± 4.79	1.04 ± 3.45
9	0.02 ± 0.05	-0.13 ± 0.09	-0.04 ± 0.05	5.81 ± 2.38	-4.05 ± 3.46	0.40 ± 2.89
10	0.03 ± 0.06	0.06 ± 0.08	-0.07 ± 0.05	7.92 ± 7.27	11.08 ± 4.27	1.36 ± 2.53

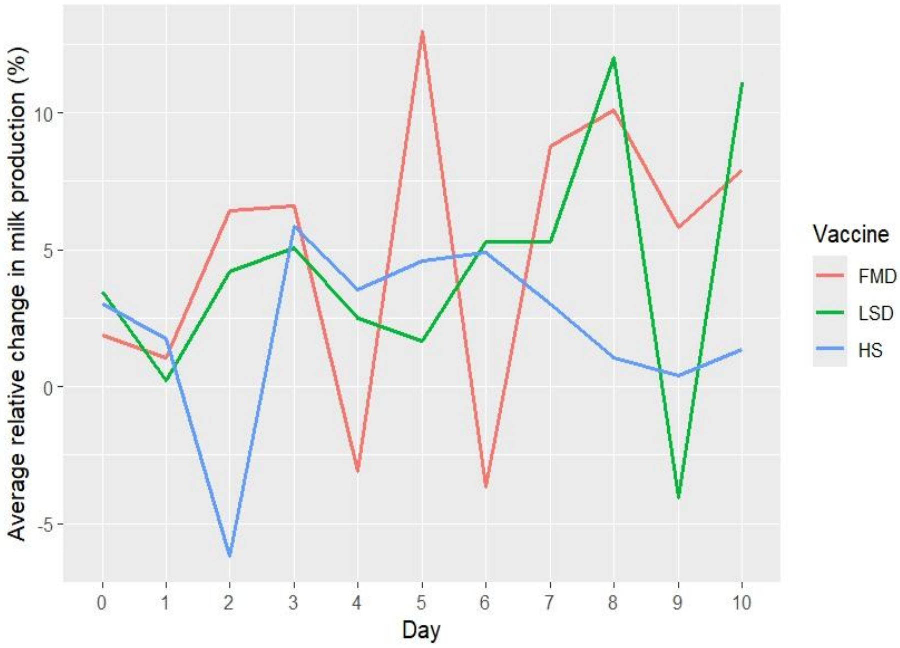

Fig. 2: Trend of average percent change in milk yield over different days of vaccination

Analysis of table 2 and figure 2 revealed that the day-to-day percent change in milk production was found to be negative on 4th (-3.10 ± 2.50%) and 6th (-3.67 ± 2.22%) days after vaccination in case of the FMD vaccine and it was negative on 9th (-4.05 ± 3.46%) and 2nd (-6.20 ± 2.09%) day after vaccination in LSD and HS vaccinations, respectively. On an overall basis, the change in milk yield ranged from -3.10 to -6.20%. Similar values for a drop in milk production upon vaccination were reported by Rajput *et al.* (2024) and Abutarbush *et al.* (2016).

Conclusion

Based on the results of the present study, it may be concluded that vaccination had no perceptible negative impact on daily milk production and there was only a non-significant reduction in milk yield, ranging from 0.01 to 0.07 kg per animal per day, corresponding to a percent decline of 3.10% to 6.20% within 10 days post-vaccination.

References

1) Abutarbush, S. M., Hananeh, W. M., Ramadan, W., Al Sheyab, O. M., Alnajjar, A. R., Al Zoubi, I. G., Knowles, N. J., Bachanek-Bankowska, K., and Tuppurainen, E. S. M. **(2016)**. Adverse reactions to field vaccination against lumpy skin disease in Jordan. Transboundary and emerging diseases. **63**(2): e213-e219. doi: 10.1111/tbed.12257

2) Brauen, S., Erpf, P. and Wasem, M. **(2020)**. On Absolute and Relative Change. SSRN Electronic Journal. 10.2139/ssrn.3739890.

3) Chouhan, C. S., Parvin, M. S., Ali, M. Y., Sadekuzzaman, M., Chowdhury, M. G. A., Ehsan, M. A., and Islam, M. T. **(2022)**. Epidemiology and economic impact of lumpy skin disease of cattle in Mymensingh and Gaibandha districts of Bangladesh. Transboundary and Emerging Diseases. **69**: 3405–3418.
4) Dadawala, A. I., Makwana, P. P., Bhati, N. B., Kapadiya, F. M., Patel, K. N. and Deshpande, S. B. **(2023)**. Economic Losses due to Important Diseases of Dairy Bovines in Sabarkantha District of Gujarat. Indian Journal of Veterinary Sciences & Biotechnology. **19**(4): 102-105.
5) Haegeman, A., Philips, W., Mostin, L., De Leeuw, I., Van Campe, W., Saegerman, C., De Clercq, K. and De Regge, N. **(2025)**. A goatpox but not sheeppox heterologous live attenuated vaccines provide complete protection against lumpy skin disease in cattle under experimental conditions. Scientific Reports. **15**(1): 26078. https://doi.org/10.1038/s41598-025-11440-w
6) Jorge, S. and Dellagostin, O. A. **(2017)**. The development of veterinary vaccines: a review of traditional methods and modern biotechnology approaches. Biotechnology Research and Innovation. **1**(1): 6-13. https://doi.org/10.1016/j.biori.2017.10.001
7) Kim, D., Moon, J., Ha, J., Kim, D., and Yi, J. **(2021)**. Effect of foot-and-mouth disease vaccination on acute-phase immune response and anovulation in Hanwoo (Bos taurus coreanae). Vaccines. **9**(5): 419. https://doi.org/10.3390/vaccines9050419
8) Krishnamoorthy, P., Suresh, K. P., Dheeraj, R., and Roy, P. **(2020)**. Basic reproduction number (R0), an epidemiological tool for prioritizing livestock diseases' An example of Karnataka. The Indian Journal of Animal Sciences. **90**(4): 510-514.
9) Krishnaswamy, N., Jeyakumar, S., Selvan, R. T., Gowane, G. R., Mahadappa, P., Vijayapillai, U., Dechamma, H. J., Patel, B.H.M., Saravanan, P., Ramesha, K. P., and Sanyal, A. **(2021)**. Short-term effect of foot-and-mouth disease (FMD) vaccination on the milk yield in the Deoni and crossbred cows. Tropical Animal Health and Production. **53**(2): 217.
10) Kumar, N., Barua, S., Kumar, R., Khandelwal, N., Kumar, A., Verma, A., ... and Tripathi, B. N. **(2023)**. Evaluation of the safety, immunogenicity, and efficacy of a new live-attenuated lumpy skin disease vaccine in India. Virulence. **14**(1): 2190647.
11) Lee, N. H., Lee, J. A., Park, S. Y., Song, C. S., Choi, I. S., and Lee, J. B**. (2012)**. A review of vaccine development and research for industry animals in Korea. Clinical and experimental vaccine research. **1**(1): 18–34. http://dx.doi.org/10.7774/cevr.2012.1.1.18
12) Morgenstern, M. and Klement, E. **(2020)**. The effect of vaccination with live attenuated neethling lumpy skin disease vaccine on milk production and mortality—An analysis of 77 dairy farms in Israel. Vaccines. **8**(2): 324.
13) Pramod, S., ThirupathyVenkatachalapathy, R., Sahib, L., and Becha, B. **(2021)**. Influence of FMD vaccination stress on milk production in crossbred dairy cattle of Kerala. Indian Journal of Dairy Science. **74**(1): 95-99.
14) Press Information Bureau. **(2024)**. Decision of vaccination of pastoral sheep and goat against FMD was extended to all such population in the country: Shri Rajiv Ranjan Singh [Press Release]. https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2046302
15) Railey, A. F., Lankester, F., Lembo, T., Reeve, R., Shirima, G., and Marsh, T. L. **(2019)**. Enhancing livestock vaccination decision-making through rapid diagnostic testing. World Development Perspectives. **16**: 100144. https://doi.org/10.1016/j.wdp.2019.100144
16) Raina, A. A., Patel, M., Somagond, A., Jeyakumar, S., Selvan, R. P. T., Gowane, G. R., Krishnaswamy, N., Joyappa, D.H., Ramesha, K., Vijayapillai, U., Bhanuprakash, V., Gaur, G.K. and Dutt, T. **(2023)**. Effect of foot-and-mouth disease vaccination on acute phase response and milk production in the Holstein-Friesian crossbred cow. Journal of Applied Animal Research. **51**(1): 495-500. https://doi.org/10.1080/09712119.2023.2229409
17) Rajput, A. S., Rajawat, D., Jisna, K. S., Panwar, A. and Patra, M. K. **(2024)**. Transient impacts of vaccination on livestock production: A holistic review. Indian Journal of Animal Health. 63: 29-40. https://doi.org/10.36062/ijah.2024.10123
18) Rathod, P., Chander, M. and Bangar, Y. **(2016)**. Livestock vaccination in India: an analysis of theory and practice among multiple stakeholders. Revue scientifique et technique-Office international des epizooties. **35**(3): 729-739.
19) Reddy, B.N., Rao, M.V.D., Rangamma, B. and Kumari, B.P. **(2023)**. Time study of milking operations in an organised dairy farm. Ruminant Science. **12**(2):191-196.
20) Scutt, G., Cross, M. and Waxman, D. **(2022)**. Theoretically quantifying the direct and indirect benefits of vaccination against SARS-CoV-2 in terms of avoided deaths. Scientific reports. **12**(1): 8833. https://doi.org/10.1038/s41598-022-12591-w

21) Sharma, L. and Khadse, J. **(2023)**. Adoption of improved animal husbandry practices by dairy farmers in Meerut, Raebareilly and Prayagraj district of Uttar Pradesh. International Journal of Tropical Agriculture. **41**(1-2): 89-92.
22) Singh, D., Kumar, S., Singh, B. and Bardhan, D. **(2014)**. Economic losses due to important diseases of bovines in central India. Veterinary World. **7**(8): 579-585. doi: 10.14202/vetworld.2014.579-585|
23) Tuppurainen, E., Dietze, K., Wolff, J., Bergmann, H., Beltran-Alcrudo, D., Fahrion, A., Lamien, C. E., Busch, F., Sauter-Louis, C., Conraths, F. J., De Clercq, K., Hoffmann, B. and Knauf, S. **(2021)**. Review: vaccines and vaccination against lumpy skin disease. Vaccines. **9**:1136. https://doi.org/10.3390/vaccines9101136
24) Vasantha, S.K.I., Fariya Sri, M.R., Bhavya Charitha, B.V.S., Priyanka, D., Naveen Swaroop, M., Srikanth, N.R., Chaitanya, G. 2025. Unraveling the Oxidative stress: Study on biomarkers and their gene expression in periparturient Ongole Cattle. Journal of Livestock Science 16: 307-314 doi. 10.33259/JLivestSci.2025.307-314
25) Zhang, S., Liu, G., Cao, H., Guo, A. and Chen, Y. **(2026)**. Therapeutic vaccination with a live M. bovis-BoAHV-1 combined vaccine accelerates pathogen clearance and restores mammary homeostasis in dairy cows with natural Mycoplasma bovis subclinical mastitis. BMC Microbiology. **26**:473. https://doi.org/10.1186/s12866-026-05016-5