CHAPTER V

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study analyzed the transmission dynamics of bird flu in poultry farms using nonlinear mathematical models with and without vaccination. The results show that the basic reproduction number plays a key role as a threshold parameter that determines whether the disease dies out or persists. When $R_0 < 1$, the disease-free equilibrium is locally asymptotically stable, meaning the infection eventually disappears. In contrast, when $R_0 > 1$, a stable endemic equilibrium exists, allowing the disease to persist in the population. The introduction of vaccination does not change the structure of the model but reduces the effective reproduction number and shifts the stability threshold. A forward (transcritical) bifurcation at $R_v = 1$ identifies the critical level of vaccination required to control the disease. Numerical simulations and phase portraits support these analytical results, showing that the system evolves toward either a disease-free state or an endemic state depending on the parameter values. These findings highlight the importance of vaccination as an effective control strategy for reducing transmission and preventing the persistence of bird flu in poultry populations.

5.2 Recommendations

The results indicate that maintaining vaccination coverage above the critical threshold is essential for preventing the long-term persistence of bird flu in poultry farms. Farm managers should implement effective vaccination programs alongside improved biosecurity measures and reduced contact rates to ensure that $R_v < 1$, leading to disease elimination. In addition, regular monitoring and early detection strategies should be adopted to quickly identify and control outbreaks before they spread within the farm. For future research, the model can be extended by incorporating real farm data, spatial movement between farms, seasonal effects, imperfect vaccination, and stochastic factors. These extensions would improve the accuracy of the model and enhance its practical application in controlling bird flu outbreaks.