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Research Reports

Safety and Potential Test Profile of Inactivated Coryza Vaccine in SPF Chickens

Profil Uji Keamanan dan Potensi Vaksin Coryza Inaktif pada Ayam SPF

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ABSTRACT

Background: Infectious coryza, caused by *Avibacterium paragallinarum*, is an acute and highly contagious respiratory disease in chickens that results in high morbidity, growth retardation, and decreased egg production, leading to economic losses in poultry industries. Vaccination is considered the most effective preventive measure, and inactivated vaccines are widely used due to their safety and ability to stimulate protective immunity. **Purpose:** This study aimed to evaluate the safety and potency of a commercially produced inactivated coryza vaccine using Specific Pathogen-Free (SPF) chickens at the National Quality Testing and Certification Center for Veterinary Drugs (BPMSPH), Indonesia. **Method:** A descriptive observational approach was used to assess safety and potency in vaccinated SPF chickens. A total of 40 SPF chickens four weeks old were used and divided into a vaccinated group and a control group. The vaccinated group received the inactivated coryza vaccine according to standard test procedures, while the control group remained unvaccinated. Clinical observations and local reaction assessments were conducted to evaluate safety, and antibody titers against coryza serotype A were measured to determine potency. **Results:** Observations showed that 100% of both control and vaccinated chickens exhibited no abnormal clinical signs or coryza reactions. In addition, the vaccine potency test showed that 100% of vaccinated chickens had coryza serotype A antibody titers ≥10. **Conclusion:** This test confirms that the registered inactivated coryza vaccine formulation meets safety test criteria: 100% of control and vaccinated chickens remained clinically normal, and no abnormal local reactions were observed at the inoculation site. Potency testing demonstrated that all vaccinated chickens developed serotype A antibodies, which are expected to provide protection against coryza infection in the field and improve poultry survival.

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ABSTRAK

Latar Belakang: Infeksi coryza, yang disebabkan oleh *Avibacterium paragallinarum* merupakan penyakit pernapasan akut dan sangat menular pada ayam yang menyebabkan angka kesakitan tinggi, pertumbuhan terhambat, serta penurunan produksi telur, sehingga menimbulkan kerugian ekonomi pada industri perunggasan. Vaksinasi dianggap sebagai langkah pencegahan paling efektif, dan vaksin inaktif banyak digunakan karena keamanannya serta kemampuannya menstimulasi kekebalan protektif. **Tujuan:** Untuk mengevaluasi keamanan dan potensi vaksin coryza inaktif yang diproduksi secara komersial menggunakan ayam *Specific Pathogen-Free* (SPF) di Balai Pengujian Mutu dan Sertifikasi Produk Hewan (BPMSPH), Indonesia. **Metode:** Metode yang digunakan adalah pendekatan deskriptif dengan uji keamanan dan potensi secara observasional terhadap ayam SPF yang divaksinasi. Sebanyak 40 ekor ayam SPF dengan usia 4 minggu digunakan dalam penelitian ini serta dibagi menjadi kelompok yang divaksin dan yang tidak di vaksin. **Hasil:** Hasil pengamatan menunjukkan bahwa 100% ayam kontrol dan ayam yang divaksinasi tidak menunjukkan gejala abnormal atau reaksi coryza. Selain itu, uji potensi vaksin menunjukkan bahwa 100% ayam pada kelompok vaksinasi memiliki titer antibodi coryza serotype A ≥ 10. **Kesimpulan:** Hasil pengujian ini menegaskan bahwa formulasi vaksin coryza inaktif yang terdaftar memenuhi kriteria uji keamanan, di mana seluruh ayam kontrol dan vaksinasi tetap menunjukkan kondisi klinis normal serta tidak ditemukan reaksi lokal abnormal pada lokasi penyuntikan. Uji potensi menunjukkan bahwa seluruh ayam yang divaksinasi membentuk antibodi terhadap serotipe A, yang diharapkan dapat memberikan perlindungan terhadap infeksi coryza di lapangan dan meningkatkan kelangsungan hidup unggas.

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Kata kunci: *Avibacterium paragallinarum*; Keamanan Vaksin; Potensi Vaksin; *Specific Pathogen Free;*

INTRODUCTION

Coryza infection occurs almost worldwide, especially in tropical countries. In Indonesia, Coryza infection occurs worldwide, especially in tropical countries. In Indonesia, coryza infection was first identified in 1975 by the Indonesian Veterinary Research Institute (BALITVET), which successfully isolated *Avibacterium paragallinarum* from samples taken from three sick chickens on small-scale farms near Bogor (Kusumaningsih and Poernomo, 2002). Coryza infection, also known as "snot," affects the respiratory tract of poultry, with severity ranging from acute to chronic (Wahyuni *et al.,* 2018). The causative agent is *Avibacterium paragallinarum*, a Gram-negative, short rod-shaped (coccobacillus) bacterium that is non-motile, anaerobic, and non-spore-forming (Milo *et al.,* 2020).

Coryza infection results in high morbidity but low mortality. "Morbidity" here refers to how often the disease occurs and how quickly it spreads among the chicken farm population (Wahyuni *et al.,* 2019). The spread of coryza can occur through direct contact with affected birds, contaminated feed or water, aerosols, and feces; the incubation period ranges from 1–3 days, and susceptible birds in a flock typically show symptoms within 7–10 days (Vegad and Katiyar, 2001). Coryza infection leads to decreased body weight and reduced egg production by up to 40%, which has a significant economic impact in the poultry industry due to reduced production and increased medical costs (Putra *et al.,* 2023). Factors that increase the risk of coryza include unsanitary housing conditions, cold weather or extreme climate changes, and contact with previously infected birds (Agustiani *et al.,* 2019). Patil *et al.,* (2017) characterized serotypes A, B, and C; serotypes A and C are considered virulent, whereas serotype B may contribute to infection despite often producing milder clinical signs. One way to prevent coryza is vaccination with inactivated vaccines administered to parent stock and layers during the grower phase and before production. Proper husbandry and strict biosecurity also help prevent spread.

The purpose of this test is to determine the safety and potency of the Coryza X inactivated vaccine in Specific Pathogen Free (SPF) chickens, and to evaluate the quality-test requirements for inactivated coryza vaccines in these chickens through safety and potency testing. The novelty of this research lies in testing the inactivated Coryza X vaccine sample at the National Veterinary Drug Quality Testing and Certification Center (BPMSPH), the official authority responsible for determining vaccine suitability prior to market release. This study evaluates vaccine safety and potency in SPF chickens and assesses compliance with national quality-testing procedures. Another novel aspect is that the testing addresses the serotypes of coryza circulating in Indonesia, increasing the relevance of the results to local vaccine needs. Thus, this research contributes scientifically and practically to ensuring the marketability of the Coryza X vaccine and to supporting poultry-industry self-reliance by providing high-quality vaccines that meet national and international standards.

MATERIAL and METHOD

Methodology

This study used a descriptive approach, utilizing data from safety and efficacy tests of the inactivated coryza vaccine on Specific Pathogen Free (SPF) chickens conducted by BBPMSOH, using test animals in numbers specified by the Farmakope Obat Hewan Indonesia (FOHI) standards. The testing was observational in nature, based on direct observation; therefore, this study did not perform independent testing but referred to results previously obtained by BPMSPH.

Location and Time

This study was conducted at the Center for Quality Testing and Certification of Veterinary Drugs (BPMSPH), over a period of five months (February–June 2024). Center for Quality Testing and Certification of Veterinary Drugs (BPMSPH) is a technical implementation unit under the Directorate General of Animal Husbandry and Animal Health, responsible for providing quality testing and certification services for veterinary drugs to the livestock and veterinary community.

Sample

The safety and potency of an inactivated Coryza vaccine produced by Company X were evaluated using Specific Pathogen-Free (SPF) chickens. The use of SPF chickens ensured a controlled health status and the absence of confounding infections, thereby maintaining the accuracy of the safety and potency assessments. Forty chickens aged four weeks were used in this study and were randomly allocated into vaccinated and control groups.

Safety Test Procedure

Safety testing of the inactivated coryza vaccine, 10 chickens were vaccinated with 2 doses of 1 ml/head via the subcutaneous route, and the remaining 10 chickens were left unvaccinated as a control group. The safety of the vaccine was closely monitored by clinical symptom assessment, which was done within 21 days of immunization. Assessment was done by analyzing behavior changes, appetite changes, as well as the occurrence of localized effects such as inflammation or swelling at the injection site. The absence of any note of all the observed symptoms and assessing them. Daily observations were made in order to provide precise data concerning the health status of the control and vaccinated group chickens.

Potency Test Procedure

The vaccine potency test was conducted to determine the ability of the vaccine to induce immune responses against Avibacterium paragallinarum. To verify the humoral potency, 10 SPF chickens were immunized with 1 dose of 0.5 ml/ head via the subcutaneous route and 10 other chickens were left unvaccinated as a control. The clinical symptoms were observed 14 days, two weeks after the first vaccination; a booster dose of 1 dose of 0.5 ml/ head via the subcutaneous route, and blood was drawn from vaccinated chickens on the 7^{th} and 28^{th} day after vaccination. Blood samples were used in determining antibody titers by the Hemagglutination Inhibi-

tion (HI) test; the blood drawn was centrifuged to separate it from the serum and then subjected to heat inactivation of the serum through a water bath maintained at 37°C for 30 minutes. The HI test is designed to identify the presence of antibodies specific to the coryza vaccine. The HI test is employed to quantify the capacity of the vaccine to induce antibody development against bacterial infections of coryza in real cases.

Data Processing

Data obtained from clinical observations and antibody titer measurements were analyzed descriptively using Microsoft Excel. The results of the safety test were compared with established safety standards by evaluating the frequency and severity of reactions observed after vaccination. The potency test results were analyzed by measuring antibody titers using the HI test method. Antibody titer data were processed by calculating the percentage of seropositive chickens in the vaccinated and control groups, in accordance with the provisions set

Instruments

The instruments used in this study included various equipment required for safety and potency testing of inactivated vaccines in SPF chickens. Vaccination protocols were followed to determine the appropriate dose, method, and schedule of administration via the subcutaneous route. For clinical observation, forms were used to record symptoms appearing after vaccination, such as changes in behavior, appetite, and swelling at the injection site. Hemagglutination (HA) equipment was used to detect antigen titers, and Hemagglutination Inhibition (HI) equipment was used to test the protective potential of the vaccine. Coryza serotype A antigens, specialized reagents, and chemicals were used in the HA and HI tests, including comparator sera, erythrocytes, and specific binding reagents, all of which were required to evaluate the safety and potency of the inactivated coryza vaccine in SPF chickens.

RESULTS

Safety Test

Vaccine safety testing is conducted before vaccines are officially approved for use in animals. The coryza vaccine safety test used two doses to ensure that the administered vaccine was safe (Table 1). This was confirmed by the absence of clinical symptoms of coryza infection and the absence of swelling or other local reactions at the injection site (FOHI Biologics, 2018). According to FOHI Biologics (2018), if SPF chickens in the control and vaccination groups do not show abnormal symptoms or local reactions, the vaccine is declared a pass. The observations in Table 2 show that 100% of the vaccinated chickens showed no abnormal symptoms or reactions to coryza infection.

Potency Test

Vaccination aims to stimulate the immune system to produce antibodies when exposed to a disease agent. The potency test of the coryza vaccine (sample X) was conducted using the Hemagglutination Inhibition (HI) method. The test involved booster doses: the first vaccination was administered to male and female SPF chickens aged four weeks, followed by a booster dose two weeks later (one dose per bird). The booster serves to strengthen the immune response previously formed and to optimize protection against reinfection (Valentina *et al.*, 2023).

The results of the coryza potency test using the HI method (Table 3) show that 100% of control group chickens did not form antibodies against coryza serotype A, whereas 100% of vaccinated chickens developed antibodies against coryza serotype A with titers ≥10. According to FOHI Biologics (2018), the quality requirements for the inactivated coryza vaccine potency test specify that not less than 70% of control group chickens must have HI titers ≤5, and not less than 70% of vaccinated group chickens must have HI titers ≥10. The

Table 1. Safety Test Observations of Inactivated Coryza Vaccine

Group	Chicken Number	Observation Day																				
		I									II								III			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Control	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vaccination	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: Control and vaccinated chickens showed no symptoms of coryza infection from day 1 to 21.

Table 2. Inactivated Coryza Vaccine Safety Test Results

Chicken Type	Local Reaction	Safety Test Results
Control Chicken (1-10)	No vaccination	100% of the control chickens showed no abnormal symptoms or coryza reactions. The chickens looked healthy, active, and had good appetites.
Vaccination Chicken (1-10)	No abnormal symptoms or no local reactions such as swelling at the vaccination site	100% of vaccinated chickens showed no abnormal symptoms or reactions to coryza. They were healthy, active, and had good appetite.

Table 3. Inactivated Coryza Vaccine Potency (HI) Test Results (Pre- and Post-vaccination)

Group	Chicken Number	Potency Test Results	HI Titer Pre-vaccination	HI Titer 4 Weeks Post-Vaccination
Control	1	100% of control group chickens showed no abnormal symptoms or coryza infection.	0	0
Control	2		0	0
Control	3		0	0
Control	4		0	0
Control	5		0	0
Control	6		0	0
Control	7		0	0
Control	8		0	0
Control	9		0	0
Control	10		0	0
Vaccination	1	100% of vaccinated group chickens showed no abnormal symptoms or coryza infection.	0	10
Vaccination	2		0	80
Vaccination	3		0	80
Vaccination	4		0	80
Vaccination	5		0	40
Vaccination	6		0	80
Vaccination	7		0	320
Vaccination	8		0	80
Vaccination	9		0	80
Vaccination	10		0	40

Note: 100% of control group chickens did not form antibodies against coryza serotype A and 100% of vaccinated group chickens had coryza serotype A antibody titers ≥ 10

results of the potency test confirm that the tested vaccine met the quality requirements for the inactivated coryza vaccine potency test.

DISCUSSION

Coryza infection, one of the most detrimental respiratory diseases in poultry, is caused by *A. paragallinarum*. Infected chickens may experience decreased egg production, growth retardation, and occasionally death (Serbessa *et al.,* 2023). Clinical signs include conjunctivitis, facial edema, and yellowish nasal discharge. Edema refers to the accumulation of fluid within tissues, often resulting from inflammation due to trauma or infection. Surrounding cells may also undergo hypertrophy due to fluid buildup (Deshmukh, 2015). Therefore, one of the key strategies to prevent and control coryza infection is implementing a vaccination program using high-quality inactivated vaccines. High quality vaccines must meet established quality standards through safety and potency testing in accordance with the Indonesian Veterinary Pharmacopoeia (FOHI Biologics, 2018). In the safety test, administration of vaccine doses higher than the recommended level should not cause clinical signs of infection or local reactions at the injection site. Meanwhile, potency testing determines the vaccine's ability to stimulate antibody formation after administration. According to FOHI Biologics (2018), a coryza vaccine meets safety requirements if both vaccinated and control chickens show no clinical signs of infection. This condition occurs because the control group, which is neither vaccinated nor exposed to *A. paragallinarum*, remains healthy without any disease-inducing factors.

The available research supports this, showing that 100% of control chickens exhibited no abnormal signs or coryza reactions, appearing healthy, active, and maintaining good appetite. These findings align with FOHI Biologics (2018) criteria, confirming that neither environmental nor management factors contributed to disease occurrence in the control group. In the potency test using the HI method, the control group showed no immune response because the chickens were not vaccinated and therefore received no immune stimulation against A. paragallinarum. As a result, their immune systems did not produce specific antibodies against coryza serotype A, leading to consistently low or undetectable HI titers. This outcome is expected since the control group serves as a baseline reference demonstrating that antibody responses occur only in vaccinated chickens. The findings further show that 100% of control chickens did not develop antibodies against serotype A coryza, whereas 100% of vaccinated chickens achieved HI titers ≥10. These results exceed the FOHI Biologics (2018) potency requirements, which specify that at least 70% of control chickens must have titers ≤ 5 and at least 70% of vaccinated chickens must achieve titers ≥ 10. Therefore, the findings confirm that the tested vaccine not only meets but surpasses national potency quality standards for coryza vaccines.

Serological methods provide a practical approach to detecting antibodies in the blood that form after infection and function to prevent and combat diseases caused by pathogens. The serological tests used to evaluate the effectiveness of inactivated coryza vaccines are HA and HI tests. The HA test determines the antigen titer of coryza serotype A, whereas the HI test detects and quantifies vaccine-induced antibodies against coryza. Blood serum is collected before initial vaccination to detect maternal antibodies that may affect vaccination outcomes. This aligns with Prasetyo *et al.,* (2021), who reported that chickens possess high levels of maternal antibodies. These antibodies can interfere with vaccine antigens, thereby reducing immune responses and increasing the risk of vaccination failure. Yulistya *et al.,* (2016) also noted that passively transferred maternal antibodies may inhibit immunoglobulin synthesis, thus decreasing vaccination effectiveness. When maternal antibodies are still present in the blood, vaccine effectiveness decreases due to their neutralizing activity, which ultimately lowers antibody titers. Maternal antibodies generally decline within 10–20 days after hatching. Recent studies recommend combining HI with molecular methods such as PCR or MLST to ensure serovar compatibility with vaccine strains, given the genetic variability of *A. paragallinarum*, which influences vaccine effectiveness (Zhong *et al.,* 2022; El-Gazzar *et al.,* 2024; Xu *et al.,* 2022).

Coryza vaccines can be administered through various routes, including injection, intranasal, or oral administration via drinking water (Jahan *et al.,* 2019). For instance, Lei *et al.,* (2024) demonstrated that intranasal vaccination induced antibody titers more rapidly and effectively than injection. Saputri *et al.,* (2024) emphasized that antibody titers represent the concentration of antibodies per unit volume of serum, with higher titers reflecting a stronger immune response against the disease. According to Haryo and Enola (2019), antibody titer refers to the measurement of antibody concentration per unit volume of serum. An increase in antibody titer indicates an enhanced immune response to infection. Consistent antibody production is essential for maintaining disease protection and minimizing the impacts of bacterial, viral, parasitic, or toxin infections. This is consistent with Maulita *et al.,* (2022), who reported that low antibody titers indicate inadequate protection, whereas high titers provide effective immunity.

Recent research highlights that vaccine effectiveness depends strongly on local serovar compatibility. A 2025 study reported that varying vaccination schemes against serovar B led to significant differences in morbidity, mortality, and egg production in layer chickens (Huberman *et al.,* 2025). Moreover, vaccine innovations continue to advance, including live-attenuated candidates and the use of nanomaterial-based adjuvants (e.g., SiO_2 and Fe_3O_4), which have shown improved immune responses compared to traditional oil-based adjuvants (Guo *et al.,* 2025; Ibrahim *et al.,* 2024). Further studies are needed to determine the vaccine's effectiveness through potency and challenge tests by administering pathogenic A. paragallinarum and assessing morbidity and mortality rates in test animals. A reduction in mortality in vaccinated birds compared to controls is a key indicator of vaccine efficacy. According to Dwivedi (2018), coryza infection cases in India were more frequent in laying hens (57.89%) than in broilers (30.79%). Based on age, 23.21% of positive cases occurred in starter chickens, while 38.39% were recorded in breeder and adult chickens. For example, Deshmukh (2015) reported that vaccination reduced mortality by 60% in birds exposed to *A. paragallinarum*. Similarly, Calnek *et al.,* (1997) found that vaccinated chickens had a lower morbidity rate (20%) than unvaccinated ones (60%), and a lower mortality rate (5% vs. 15%). Egg production decreased by only 10% in vaccinated chickens, compared to 30% in unvaccinated birds. Potential coryza vaccine tests are conducted to ensure that the developed vaccine provides optimal protection against infection. Based on standard quality requirements for coryza vaccines and previous studies highlighting the importance of antibodies in disease protection, the administration of coryza vaccines that meet established quality standards is essential particularly for laying hens to protect them from coryza infection on farms.

CONCLUSION

The inactivated coryza vaccine demonstrated excellent safety, with no adverse effects observed in SPF chickens. Potency testing confirmed its ability to induce protective antibody titers against *Avibacterium paragallinarum* serotype A. These results suggest that the vaccine meets FOHI Biologics (2018) quality standards and has strong potential to protect poultry from coryza infection, thereby supporting flock health and productivity. Further challenge trials are recommended to evaluate long-term efficacy and optimize vaccination protocols.

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CONFLICT of INTEREST

The authors declare that there are no conflicts of interest with any of the parties involved in this study.

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ETHICAL APPROVAL

All experimental procedures were conducted by the National Quality Testing and Certification Center for Veterinary Drugs (BPMSPH) in accordance with protocols approved by the relevant animal ethics and regulatory authorities

AUTHORS' CONTRIBUTIONS

The processes of data curation and validation were undertaken by SGS and EA. Preparation of the original manuscript draft was a collaborative effort involving SGS, EA, MI, and DI, who also contributed to the critical review and revision of the final version of the manuscript.

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