# Bacteriophages: new preventive approach for bacterial infection

Antibiotic-resistant bacteria are rapidly emerging worldwide compromising the efficiency of antimicrobials on transforming medicine and even saving millions of affected lives.

The catastrophe caused by antimicrobial resistance (AMR) has been associated to misuse and overuse of these medical treatments.

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The Centers for Disease Control and Prevention (CDC) quantified and classified bacteria based on its serious effects and concerning threats which are responsible for health and financial risks. Subsequently, managing the crisis through government regulations and research efforts are immensely needed.

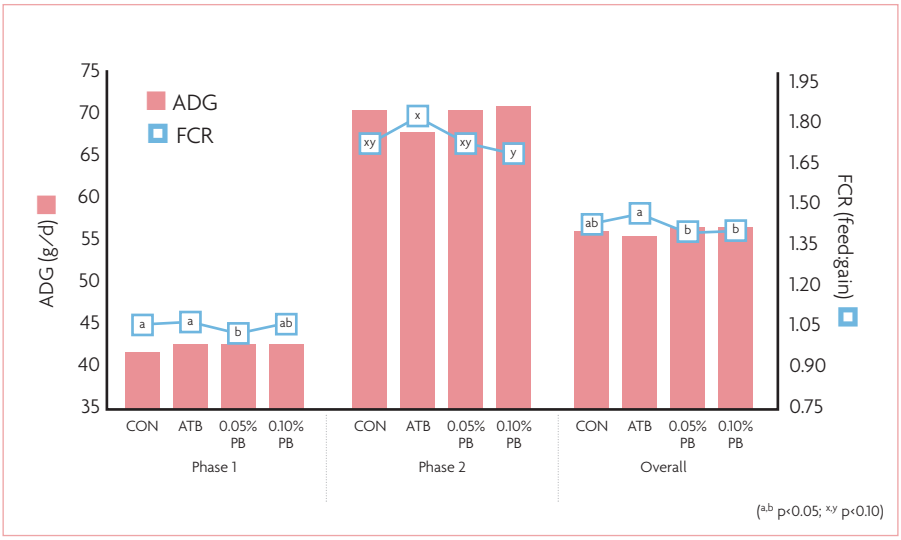


**Fig. 1. Effect of ProBe-Bac PE supplementation on growth performance of broilers.**

## Antibiotics are not a sustainable solution

The poultry industry has been threatened due to various pathogenic bacterial, viral, and fungal infections, or other parasitic origin.

A severe global challenge the poultry industry currently faces is salmonellosis, a well-recognised serious disease caused by Salmonella.

Markedly, S. Gallinarum and S. Pullorum are the most pathogenic serotypes affecting avian species that eventually lead to systemic infection.

This causes huge economic losses in the poultry industry.

The Global Antibiotic Research and Development Partnership (GARDP) stated that antibiotic discovery has transformed the world by treating previously incurable illnesses.

However, our time with these drugs is endangered. Antibiotics have been extensively used which lessens the individual's ability to fight against pathogenic bacteria.

Approximately 1.2 million deaths per year are accounted to antibiotic-resistant superbugs. This number is anticipated to increase exponentially if urgent action is not taken.

Meanwhile, the World Health Organization (WHO) reported that substandard or untrustworthy medicines are antibiotics due to their drug resistance effect against bacterial pathogens.

## AMR: significant financial and health risk

Endeavouring to resolve problems caused by AMR, usage of antibiotics in treating diseases in livestock is prohibited in many countries worldwide. The WHO emphasised that antibiotic administration to farmed livestock animals is one of the major causes of AMR. It is currently considered the biggest threat to global health and food security.

The US reported that AMR cases currently give rise to 2.8 million infections and 35,000 deaths each year that costs between $US50-70 billion.

Subsequently, according to the General Assembly of United Nations (UNGA), AMR kills 700,000 people each year and by 2050, it is expected to increase to 10 million which will lead to a global financial and health crisis.

## Risk associated with antibiotic overuse: reducing its efficacy

The emergence and spread of AMR cases continues to threaten the efficacy of antibiotics to treat infections. As drug-resistance spreads globally, antibiotics become progressively ineffective leading to difficulties in treating infections, and eventually causes high mortality rates.

According to WHO, the currently effective antibiotics may lose efficacy for the next 3 - 10 years because of improper use and application. The One Health approach unites multiple sectors to implement policies in preventing devastating AMR outbreaks. Meanwhile, the Organization for Economic Co-operation and Development (OECD) recommends alternatives to antimicrobials that improved animal health by reducing infection such as probiotics, prebiotics, and bacteriophages, which are safe and sustainable.

## Bacteriophages as safe and sustainable antibiotic alternative

Worldwide, multidrug resistance requires the need for alternative ways to control infections. The use of bacteriophages is

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highly recommended in reducing and eliminating pathogenic bacteria in livestock production as it serves as a biocontrol agent. With the reduced efficacy of antibiotics due to AMR, bacteriophages have attracted much attention as a potential alternative solution.

Bacteriophage is a natural antibacterial entity that has been used before antibiotics were even discovered. It is a virus that targets bacteria. Its distinctive feature compared to other harmful viruses is that bacteriophages specifically recognise and attack only pathogenic bacteria, and do not harm humans or other living organisms. Bacteriophages infect bacteria through attaching to bacterial cell membrane followed by injecting genetic material into the bacterial host.

Afterwards, bacteriophage replicates using bacterial host machinery, leading to bacterial cell rupture. Comparing to antibiotic which can be non-selective, bacteriophages have high specificity to the target hosts.

Safety of using bacteriophages has been verified by the US FDA, and also recognised as GRAS (Generally Recognised as Safe) substance. Its potential in livestock application is attracting more attention due to evident advantages.

Pathway Intermediates, along with Optipharm, its affiliate company leading in the field of animal diagnosis and biomedical research, are exerting effort for the development and commercialisation of a new bacteriophage solution called ProBe-Bac PE.

ProBe-Bac PE is a cocktail product made specifically for poultry which contains a powerful mixture of bacteriophages precisely selected against specific diseases such as typhoid, diarrhoea, and salmonellosis. Upon ingestion, bacteriophages would settle in the animal intestine which selectively kills pathogenic bacteria in a specific-manner, improves intestinal environment, and enhances feed efficiency.

## Effect of ProBe-Bac PE on growth performance of broilers

A recent study at Nong Lam University, Vietnam investigated the beneficial effect of ProBe-Bac PE on growth performance in broilers. Treatments included CON (basal diet), ATB (basal diet + 0.01% Enramycin), 0.05% PB (CON + 0.05% ProBe-Bac PE), and 0.10% PB (CON + 0.10% ProBe-Bac PE). Evaluation of treatments effect was carried out with 480 day-old chicks (Ross 308). The experimental trial was conducted for 42 days.

The feeding trial revealed significantly improved FCR ($P<0.05$) for the animal group that received different inclusion levels of ProBe-Bac PE (Fig. 1). At phase one of the investigation, 0.05% ProBe-Bac PE supplemented group had significantly lower FCR ($P<0.05$) than that of the control and antibiotic treatment group.

Overall, results showed a significantly lower FCR for both inclusion levels (0.05 and 0.10%) of ProBe-Bac PE than the other treatments. The results obtained revealed that ProBe-Bac PE supplementation improved growth performance of broilers which was even better than antibiotic treatment.

## Conclusion

The result of the investigation showed that ProBe-Bac PE supplementation improved growth performance of broilers, exhibiting even better effects than antibiotic treatment.

Collectively, these findings suggest that ProBe-Bac PE could be an effective alternative to antibiotic contributing growth promotion in broilers. ■

**References are available from the author on request**