

IGY TECHNOLOGY IN VETERINARY MICROBIOLOGY

Department of Microbiology

INTRODUCTION TO IGY TECHNOLOGY

What is IgY?

- **IgY** is the **main antibody** found in **egg yolks** of birds, especially **chickens**.
- Functions similarly to mammalian IgG, but with unique advantages.
- Extracted **non-invasively** from eggs — ethical and practical.

IMMUNOLOGICAL BASIS OF IGY

How IgY Works in Birds?

- Hens transfer antibodies to yolk to protect embryos.
- IgY accumulates in large quantities in eggs.
- Acts as the primary immune defense for chicks after hatching.

This natural maternal immunity system can be used to produce **specific antibodies for veterinary use.**

ADVANTAGES OF USING IGY IN VETERINARY MEDICINE

Why should we prefer IgY?

- **Non-invasive production**
- No interference with mammalian Fc receptors
- No complement activation in mammals
- **High specificity to pathogens**
- **Cost-effective and scalable**

These features make IgY particularly valuable in both diagnostics and as a therapeutic alternative to antibiotics.

IgY vs IgG – Structural and Functional Differences

- **Source:** Birds (IgY) vs Mammals (IgG)
- **Structure:** IgY has larger constant region
- **Reactivity:** IgY doesn't bind mammalian Fc receptors
- **Stability:** IgY is more stable at different pH levels

These differences help **avoid false positives** in **mammalian diagnostic assays** and reduce immune reactions.

Production of IgY Antibodies

How is IgY Produced?

1. Immunize hen with specific antigen
 2. Collect eggs over several weeks
 3. Separate yolk from white
 4. Purify IgY using precipitation or filtration methods
 5. Formulate for use
- A single hen can produce hundreds of doses - making this method efficient for **large-scale use**.

Applications in Veterinary Microbiology

Where is IgY Used in Practice?

- **Diagnostics:** ELISA kits, lateral flow tests
- **Therapy:** Oral IgY for GI infections
- **Prevention:** Prophylactic use in feed or water
- **Research:** Studying immune responses to pathogens

IGY IN DIAGNOSTICS

Diagnostic Tools with IgY

- Used in kits for detecting pathogens like:
 - *Salmonella*
 - *E. coli*
 - *Campylobacter*
- Less cross-reactivity = more accurate results
- Common in poultry and food safety testing
- Because IgY doesn't bind to Fc receptors, it reduces background noise in assays.

IGY IN DISEASE PREVENTION AND THERAPY

- Oral IgY binds pathogens in the gut
- Prevents colonization and reduces symptoms
- Used against:
 - *E. coli* in calves and piglets
 - *Rotavirus* in poultry
 - *Clostridium* and others
- No resistance risk like with antibiotics - a major advantage for long-term use.

CASE STUDY: IGY AGAINST SALMONELLA

Case Study: Poultry Protection

- Hens immunized with *Salmonella* antigen
- Eggs collected, IgY extracted
- Administered orally to chicks
- Result: Reduced *Salmonella* colonization, better flock health
- Field trials have shown reduced pathogen loads and better performance metrics in treated flocks.

LIMITATIONS AND CHALLENGES

What are the drawbacks of the technology?

- IgY is sensitive to **heat** and **pH**
- Oral delivery needs **protective encapsulation**
- **Regulation and approval** still evolving
- Variable response depending on bird strain and protocol
- Despite these, research and innovation are addressing most of these challenges.

FUTURE PERSPECTIVES

What's Next for IgY?

- **Microencapsulation for oral delivery**
- **Recombinant IgY production**
- Wider use in **aquaculture** and **companion animals**
- Integration into **One Health strategies**
- IgY could play a big role in reducing antibiotic use and managing zoonotic disease risks.

SUMMARY AND KEY TAKEAWAYS

Key Takeaway Punchlines

- IgY is a powerful, ethical alternative to mammalian antibodies
- Effective in diagnosing and preventing infections in animals
- Challenges remain, but the future is promising!

Passive protection of dogs against clinical disease due to Canine parvovirus-2 by specific antibody from chicken egg yolk.

Van Nguyen S¹, Umeda K, Yokoyama H, Tohya Y, Kodama Y.

⊕ Author information

Abstract

The protective effect of immunoglobulins derived from chicken egg yolk (IgY) against infection by Canine parvovirus 2 (CPV-2) was evaluated in 10 beagle dogs orally challenged with a strain of the virus. The 2-mo-old dogs were divided into 3 groups and treated with powders containing CPV-2 IgY or normal egg yolk for 7 d after the challenge. The 4 dogs receiving normal egg yolk (control group) demonstrated mild symptoms typical of CPV-2 infection, such as vomiting, diarrhea, and weight loss. No symptoms were observed by 16 d after challenge in the 3 dogs receiving 2 g of IgY powder. Of the 3 dogs receiving 0.5 g of IgY powder, 2 had clinical CPV-2 disease; however, the manifestations were less severe than in the control group. Furthermore, the IgY-treated groups had significantly greater weight gain and shorter duration of virus shedding than the control group. These results indicate that IgY is useful in protecting dogs from CPV-2-induced clinical disease.

2g CPV-2 IgY



Group I



No signs of clinical disease!!!

0.5g CPV-2 IgY



Group II



**In 2/3 dogs milder signs of vomiting/
Diarrhea/decrease in body weight**

Normal IgY



Group III



**In all of 4 dogs vomiting/Diarrhea/
decrease in body weight**

Production, purification, and specificity serologically determination of immunoglobulin-Y (IgY) from chicken eggs against *Clostridium tetani* toxoid

Kürşat TETİK^{1,*} , Barış SAREYYÜPOĞLU² 

¹Department of Poultry Production and Feeding, Transitional Zone Agricultural Research Institute, Eskişehir, Türkiye

²Department of Microbiology, Ankara University Faculty of Veterinary Medicine, Ankara, Türkiye

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Abstract: Tetanus is a life-threatening bacterial disease in humans and many animal species caused by the neurotoxin tetanospasmin produced by *Clostridium tetani*. Antitoxins obtained from horses and humans are primarily used to treat this disease. However, there are several clinical side effects and disadvantages associated with the use of these antitoxins. Current techniques for diagnosing tetanus use monoclonal antibodies produced in mice. These antibodies have several advantages, such as their homogeneity and specificity. In contrast, a notable feature of polyclonal antibodies, especially egg yolk antibodies, i.e. immunoglobulin-Y (IgY), extracted from poultry, is that they can be generated in greater quantities than mammalian antibodies (IgG). In this study, 22-week-old chickens were immunized with *C. tetani* toxoid and adjuvant (Freund's complete and incomplete adjuvants) via injection into the chest muscle. The immunization process was completed by administering two booster injections at 4-week intervals. Total antibody titers were observed to reach their highest level in the serum of blood samples taken 14 days after the last immunization. IgY antibodies were isolated noninvasively from the eggs of immunized and nonimmunized chickens using the polyethylene glycol (6000) extraction protocol. Immunological analyses confirmed that the purified IgY antibodies were produced specifically for the *C. tetani* toxoid. The specific tetanus antibodies obtained in this study may be valuable therapeutic tools as alternatives to current treatments for tetanus in humans and domestic animals.

Key words: IgY antibody, tetanus, yolk antibodies, poultry