Safe and effective vaccine against *Clostridium perfringens* in poultry

A recombinant vaccine based on toxoids of NetB and alfatox fit for vaccination of chickens against *Clostridium perfringens*.

**Target market and value**

Necrotic enteritis, caused by *Clostridium perfringens* type A, occurs in broiler chickens and emerged after the ban on the use of antimicrobial growth promoters in the European Union in 2006. *C. perfringens* infections in poultry may present as an acute clinical disease, with high mortality at 2 to 5 weeks of age, or in a subclinical form leading to reduced weight gain which costs the worldwide poultry industry 2 billion USD annually (or 0,05USD per bird). Nowadays, necrotic enteritis is typically controlled using antibiotics and anticoccidials. Owing to concerns about the spread of antibiotic-resistant bacteria and antibiotic residues in the food chain, there is a need for alternative control strategies like preventive vaccination.

Studies showed that the subclinical form of necrotic enteritis is a worldwide problem with an average of 80% of the flocks having had *Clostridium* diagnosed (90% USA, 94% Europe, 75% South America and 65% Asia). European surveys confirmed the severity and the wide spread of the problem leading to intestinal disorders. Feed intake as well as body weight gain may be decreased by 5% and feed conversion rate may be increased by 3% when broilers suffer intestinal disorders like necrotic enteritis [4]. This has a detrimental effect on the gross margins of broiler production, which can add up to €8.00 (incl. VAT) per 100 broilers [5].

Taking into account the total number of broilers produced in the top 20 broiler producing countries (FAO Stats 2010) and the prevalence per region mentioned above, a total market potential of about 26 billion broilers can be calculated. At a single dose vaccination, 2 EURO per 100 doses and 10% market share this would generate a turnover of 52 MEURO for a vaccine against *Clostridium perfringens*.

**Technology**

The vaccine consists of a combination of NetB and alpha-toxin, both detoxified. The proof of concept study has been performed with

- **NetB W262A**: NetB mutant W262A
- **CPA247-370**: the toxoid was produced in recombinant *E. coli* containing the plasmid pGEX-3X-13, which encodes the C-terminal domain of the alpha-toxin fused to GST (GST-Cpa247-370)
Technology offer

Proof of concept and development status


Experimental set up

• Non-vaccinated and vaccinated group (26-28 chickens per group)
• Subcutaneous vaccination (NetB or alphatoxoid (CPA) or NetB+CPA; QuilA adjuvant) at 3, 9 and 15 days of age
• Challenge:
  o From day 17 onwards soybean meal was replaced by fish meal (30%) as protein source
  o oral, single dose of 4x10^8 cfu of C. perfringens strain 56 [2] per bird at 17, 18, 19 and 20 days of age
  o oral inoculation of all animals with 10-fold dose Paracox-5 on day 18
• On days 21, 22 and 23 one third of the birds were euthanized and necropsied. Severity of necrotic enteritis was assessed by lesion scores (duodenum and ileum) [3]. Animals showing lesion scores of 2 or higher were classified positive.

Results

• In the control groups of untreated chickens or chickens dosed with adjuvant only the percentage positive chickens were 37% and 32%, respectively.
• Immunisation with NetB W262A and CPA247-370 reduced lesion scores completely. None of the animals vaccinated with a combination of NetB and CPA developed necrotic enteritis lesions after challenge.
• In the group immunised with NetB 18% of the chickens showed lesions and in animals immunised with CPA 12% of the chickens were positive.
Technology offer

IP-position

Two patent applications have been filed and are currently pending:

- WO2013061056 with patent family US2014302094, EP2771352 and AU2012328146
- PCT/GB2014/053748

Partnering

We are looking for partners that are interested to market the vaccine and we are open to assist during the transfer of the technology and during the development phase.

We can offer

- a challenge model for *C. perfringens* and field trials
- diagnostics for monitoring *C. perfringens* on farm and in infected animals (isolation, quantification)
- diagnostics to evaluate immune responses to vaccination/infection

References


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