

Avian Antibodies (IgY)-A New Weapon against Antibiotic Resistance

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Abstract

Alternatives to antibiotics for the treatment and prevention of infections are badly needed. Passive immune therapy with avian antibodies (immune globulin, IgY) from eggs of hens, that have been vaccinated with a specific microbe, is a real alternative.

Keywords: Avian antibodies; Superdrug; Antibiotic resistance

Antibiotic Resistance

The tremendous use and overuse of antibiotics both to humans and to animals [1] (often as a “growth promoting factor”) is a real menace for both mankind, animals and environment. The most alarming threat is the increase of antibiotic-resistant bacteria, viruses and fungi all over the world-examples are among others: *Mycobacterium tuberculosis*, MRSA, VRE and *Pseudomonas aeruginosa*. The antibiotic resistance is a deadly threat, especially for patients with Cystic Fibrosis (CF), who have one of the highest rates of resistant bacteria-mainly *Pseudomonas aeruginosa*-in the world. Immune suppressed patients and patients with AIDS have high resistance against antimycotic drugs. Common viruses-such as influenza and common colds-are today very resistant to antiviral agents.

Needed a Superdrug

What we need is a Super-drug that is a) Effective against microbes, b) Does not induce bacterial resistance, c) Does not disturb the normal flora, d) Is atoxic and does not give any adverse events, e) Is inexpensive, and can be produced in big amounts.

Avian Antibodies (Immunoglobulin, IgY)

Avian antibodies have been shown to have all the above requisites and has the potential to be a valuable replacement for antibiotics and other antimicrobials to decrease the development of antibiotic and antimicrobial resistance. The term IgY antibodies was first introduced around 1965. Since then there have been more than 300 new articles mentioned in PubMed [2]. Many of them discuss treatments for humans and for animals with good results. For those who are interested I will recommend them to pick out some of these references to realize the good effect of them. We must take advantage of this good weapon “avian antibodies IgY” from the nature-go back to. Rousseau’s device: “Returning a la nature”.

Effectivity

The best defence against infection for humans, mammals and birds has always been the immune system. Eggs have been used as a source for production of polyclonal antibodies specific to a variety of different infectious agents such as bacteria, viruses [3] and parasites. Orally

given IgY retains its neutralization activity in the gastrointestinal tract [4,5].

Gastrointestinal infections: Some few examples indicate that IgY is the best prophylaxis and treatment for a variety of gastro-intestinal infections [6]. Oral administration of IgY is proven to give successful treatment for enterotoxic *Escherichia coli* (ETEC), *Salmonella* spp, *Helicobacter pylori*, bovine and human rotaviruses, etc. Oral anti-*Streptococcus mutans* IgY reduces caries in mice and humans [7].

The weaning diarrhea is a deadly threat for neonatal calves and piglets all over the world. Oral administration of anti-ETEC IgY cures ETEC induced diarrhea in piglets and calves [8,9]. Increased survival in mice and calves with experimental salmonellosis, has been shown by Yokoyama 1998. *In vitro* IgY inhibits the adhesion of *Salmonella enteritidis* to human intestinal cells [10]. Oral administration of IgY from hens immunized with three serotypes of rotavirus prevents diarrhoea in mice infected with murine rotavirus

Lung infections: Anti-pseudomonas IgY prevents colonization of *Pseudomonas aeruginosa* in the lungs and reduces the number of antibiotic treatment in patients with CF [11]. A phase III study supported by EU has just been concluded. A report will be revealed early in 2018. Anti-Pseud-IgY is approved on license by the Swedish MPA for the prevention of *P. aeruginosa* infections in CF patients and has got an Orphan drug designation by EMEA.

Does not induce antibacterial or antimicrobial resistance

The immune system and the microorganisms have coexisted for millions of years and microorganisms have not yet become resistant towards polyclonal antibodies. Since avian antibodies (IgY) was discovered, antigen-specific avian antibodies have been used for numerous applications in medical and research fields. One of the most valuable and promising areas of IgY is its potential to be used for passive immunization to treat and prevent human and animal infections. As expected: No resistance against IgY antibodies has been reported. See PubMed reference list: IgY.

Does not disturb the normal flora

A study on mice given anti-pseudomonas IgY was done by dr Bizanova, Lithuania (unpublished): After oral administration of the mice with anti-PA IgY, there was no disturbance of the normal microflora. The pathogenic bacteria of faecal flora: *Staphylococcus*

aureus, *Listeria monocytogenes*, *Shigella* spp., *Campylobacter* spp., *Salmonella* spp., *Pseudomonas aeruginosa* were not found. Whereas the normal of faecal bacteria flora: *Enterococcus* spp., *Escherichia coli*, *Enterobacteriaceae*, *Clostridium perfringens* were detected and found normal. The immunofluorescence analysis based on the direct specific reaction between the tissue antigen of the gastrointestinal epithelial tissue samples of control and treated mice was performed. The gastrointestinal epithelial cells of the treated animals did not respond to the immunomarker.

Conclusions: The oral administration of Anti-*Pseudomonas* IgY had no effect on the normal and pathogenic bacterial micro flora. The immunohistochemical analysis of gastrointestinal epithelial tissue of the experimental mice groups, treated with anti-*Pseudomonas* IgY did not respond to the immunomarker.

Atoxic-No adverse events

Egg is normally included in the diet. IgY has several advantages for preoral immune therapy. There is practically no risk for toxic side effects. Yolk antibodies recognize other epitopes than mammalian antibodies due to their evolutionary distance from mammals. IgY will not cause immune complex mediated effects in the human gastrointestinal tract such as cell activation or inflammation and humans do not normally produce anti-IgY antibodies. EgCel™ is a dietary supplement and no medical claims have been made. EgCel™ is a dried egg powder containing antibodies to more than 24 different enteric bacteria. United States Code of Federal Regulations has granted egg powder including IgY as “GRAS generally recognized as safe” for use as food or food ingredients. We have used more than 250000 doses of anti-pseudomonas IgY in our phase I, II and III studies on protection for pseudomonas infection in the lungs of CF patients. We have not got any advert events during the studies (to be reported in 2018). However, it is important to consider egg allergy for consumption of IgY.

Inexpensive, and can be produced in big amounts

The total procedure: to have bacteria in culture for vaccination, to have a hens farm, to vaccinate the hens, to collect the eggs and thereafter collect the egg yolk and have IgY separated and to have the egg yolk prepared for tablets or solution will cost less than 10 dollars per dose, or 3500 dollars/year. The products can easily be increased to produce several million dosages. The costs for treatment with

antibodies will certainly be much lower than those for antibiotic treatment.

Conclusions

Avian immunoglobulin is a super-drug that immediately has to be considered in the world’s fight against antibiotic resistance.

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