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PRODUCTION OF EDIBLE EGG YOLK ANTIBODIES AGAINST PANDEMIC DISEASE CAUSING MICROORGANISMS

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Abstract

Avian immunoglobulins transferred from the hens' blood into the egg yolk were named yolk immunoglobulins (IgY). They are an appealing alternative to mammal antibodies due to economical, ethical and animal welfare reasons. Chicken eggs present an ideal alternative antibody source to mammals, as the IgY in the chicken's blood is transported to the egg and accumulates in the egg yolk in large quantities. The yolks of eggs laid by immunized chicken have been recognized as an excellent source of polyclonal antibodies for over a decade. This simple non invasive approach presents an appealing alternative to conventional polyclonal antibody production methods. This review offers summarized information about production of edible antibodies against pandemic disease causing microorganisms.

Keywords: Immunoglobulin Y; Antibody; Chicken eggs; microorganisms

1. INTRODUCTION

During the past 20 years, the use of chickens instead of mammals for antibody production has increased. A major benefit of using birds is that the antibodies can be harvested from the egg yolk instead of serum, thus making blood sampling obsolete. In addition, the antibody productivity of an egg-laying hen is much greater than that of a similar sized mammal (Hau&Hendriksen, 2005). Purification of immunoglobulin from mammalian blood is time-consuming and expensive. Today, hens are recognized as a convenient and inexpensive source of antibodies. It has been reported that the amount of immunoglobulin that can be yielded from one egg of an immunized hen is as much as that can be obtained from 300 ml of rabbit blood.

Nowadays, most frequently chosen mammals for polyclonal and monoclonal antibody production are rabbits and mice respectively. Gottstein and Hemmeler, 1985 reported Chickens store high contents of IgY in the yolk and are considered to be efficient antibody producers. Both technologies have their advantages but also disadvantages. Major problem of monoclonal antibody production is that some antigens are weakly or not at all immunogenic for mice. In polyclonal antibody production purification of antibodies from mammalian blood has been found to be low yielding and laborious in many cases. Both technologies also involve some steps each of which causes distress to the animals involved i) the immunization itself, ii) collecting of blood samples and iii) bleeding, which are a prerequisite for antibody preparation (MojcaNarat, 2003).

2. ANTIBODIES FROM EGGS

Antibodies can be readily produced in eggs by immunising hens against specific antigens, serum antibodies of hyperimmunised hens are efficiently transferred and accumulated in the egg yolk. These Immunoglobulins can have broad applications from developing immunoassays to treating disease. Researchers have used egg antibodies in passive immunotherapy to treat a range of other diseases from bovine rotavirus in cattle to Mastitis in dairy cattle (Coleman, 1998).

3. ANTIBODY PRODUCTION

Antibody production in eggs is particularly advantageous because hens can be effectively immunised, antibodies are readily deposited in the yolk, and eggs are a convenient and inexpensive food source. Antibodies are produced by the immune system of an animal in a specific response to a challenge by an immunogen. Immunogens (antigens) are molecules which can induce a specific immune response and are usually foreign proteins or carbohydrates or sometimes lipids and nucleic acids. IgY is successfully used in medical immune testing, diagnosis, heterografts and therapy. The use of chicken IgY in a double antibody sandwich ELISA for detecting African horse sickness virus by Du-Plessis et al. Chicken egg yolk antibody (IgY) has received much attention in recent years because it can be easily prepared in high concentration and is both affordable and safe (Gassmannet al., 1990).

4. EGG YOLK ANTIBODY PURIFICATION

The antibodies present in egg yolk have been termed IgY (Hatta et al., 1990). Thus, it is possible to obtain pathogen-specific IgY antibody from eggs laid by hens immunized against antigen (Shimizu et al., 1988). Since poultry farming is carried out on a large scale globally, eggs may be a suitable source of antibody for passive immunization, which requires large amounts of antibodies. Over the past few years, we have successfully used the chicken egg yolk system to produce polyclonal antibodies to enamel proteins and other calcified tissue matrix proteins (Nanci et al., 1996). Furthermore, the amount of antibodies produced from an egg is equivalent to that from 200 to 300 ml of mammalian blood, and the costs for animal care per unit production of antibodies are much lower in chicken than in mammals. However, the practical use of IgY in research and diagnostics is limited due to complex and time-consuming purification steps associated with the further purification of IgY (Akita and Nakai, 1992). Hatta (1990) reported that the IgY remaining in this supernatant was isolated by DEAE-Sephacel column followed by salting-out with sodium sulfate resulting in almost pure IgY (98%) and the yield was 70-100 mg per egg. Water dilution method found to be superior in terms of ease of use and large scale production of IgY. This is simple rapid and efficient means of purifying IgY with high activity (Akita &Nakai, 1993).

5. EGG YOLK ANTIBODIES AGAINST PANDEMIC DISEASE CAUSING MICROORGANISMS

Powdered whole eggs or yolks have been used as an inexpensive alternative for the IgY treatment of enteric diseases in veterinary medicine. The most famous example of a successful therapeutic/prophylactic use of IgY is the treatment of calves and piglets with specific Abs against Escherichia coli, rotaviruses and corona virus Ebina, (1996). Studies using both animal models and trials in field herds have been carried out. These studies confirmed that treatment of diarrhoea in calves and piglets with specific eggyolk Abs has achieved significant prophylactic and therapeutic benefits. Sunwoo et al., 2002 were able to demonstrate in vitro amarked growth inhibiting effect of specific IgY on E. coli 0157:H7, and showed that the growth inhibitionwas actually caused by the binding of specific IgY to the bacterial surface antigens, which caused significant changes in the bacterial surface structure . Another effect of IgY binding to bacterial surface antigens is a marked impairment of bacterial attachment to the intestinal mucosa Lee et al., 2002.Thus, therapeutic IgY administration could reduce the clinical use of antibiotics, and so could lower the risk that bacteria will develop antibiotic resistance.

CONCLUSION

IgY technology more popular and to convince the scientific community of its significant advantages. Today, there is no doubt that chicken Abs can be produced and used, with minor modifications, in similar ways to the use of mammalian Abs. It is to be expected that studies on the therapeutic or prophylactic use of IgY Abs will be intensified in future. In particular, because of the increasing resistance of microorganisms to antibiotics, research on all aspects

related to the development of specific IgY against pathogenic microorganisms will have to be intensified. IgYs can be used both in veterinary medicine and in human medicine.

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