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Egg Immunoglobulins (IgY): Novel Sustainable Nanotechnology Applications in One Health

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Extended Abstract

Egg immunoglobulin (IgY) Abs is a non-invasive technology obtained from egg yolks of immunized hens. IgY-technology is an innovative sustainable method, that has been widely used during the last decades, in research and developing solutions for immunodiagnosis, immunoprophylaxis, and immunotherapeutics of human and animal diseases due to its many attractive advantages over mammalian serum immunoglobulins (IgG) regarding productivity, animal welfare, and specificity. Such advantages include: 1. being more powerful (4-5 times higher binding avidity) against pathogens; 2. not reacting with the human complement system and human Fc-receptors (due to structural differences and phylogenetic distance) thereby preventing non-specific inflammation (i.e. safer); 3. large-scale production possible; 4. easy to produce specific IgY against any antigens by immunizing layer chickens; Removes only pathogenic microbes not affecting normal microflora (unlike antibiotics); 5. is effective against virus infection (unlike antibiotics); 6. has no resistance problem; 7. is safe as natural dietary egg component; and 8. is user-friendly and eco-friendly [1].

Recent advances in the sustainable development and use of IgY and nanomedicine show good properties in One Health (diagnostic, prevention and treatment etc.) program applications. Many research groups have demonstrated that IgY is active against several pathogens or conditions, a fact that may support the design of novel, safe, and effective health products. Amazing advances in IgY technology align with several sustainable development goals, notably SDG 3 (Good Health and Well-Being), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 17 (Partnerships for the Goals), creating opportunities for developing countries to effectively tackle health challenges. Therefore, the policy recommendations adopted under United Nations (un.org) to provide an outline of empirical facts as well as a prospective work related to IgY-technology and the oral administration of egg yolk antibodies as prophylaxis and therapy in a wide range of infectious and non-communicable diseases [2].

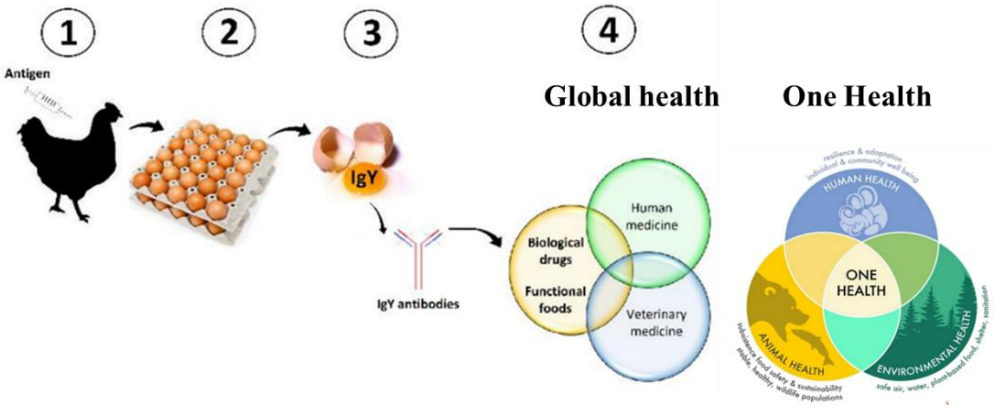

Figure 1: Overview of IgY production and its applications in health. (1) Chicken immunization, (2) Egg collection, (3) IgY purification, and (4) Formulation of IgY-based product [2, 3].

Moreover, nanotechnology has opened exciting avenues in drug delivery, particularly for biologics like IgY. The combination of IgY technology and nanotechnology offers innovative biosensors applicable in both human and veterinary medicine. Recent studies have demonstrated IgY's high sensitivity and specificity in immune diagnostics, showcasing its impressive pathogen-capturing capabilities. Additionally, the development of nanocomposites holds significant promise for the oral administration of IgY, enhancing stability, bioavailability, and targeted delivery. These advancements could lead to more effective therapeutic strategies against various pathogens. Continued research and development will be crucial in addressing existing challenges and unlocking the full potential of these innovative approaches [4].

In conclusion, the integration of sustainable development goals with nanotechnology applications of egg immunoglobulins (IgY) offers innovative solutions to pressing global health challenges. IgY, derived from the yolks of immunized hens, presents numerous advantages over traditional mammalian immunoglobulins, including higher binding avidity, non-reactivity with human complement systems, and a robust safety profile as a natural dietary component. Its ability to specifically target pathogens while preserving beneficial microflora underscores its potential as a safer alternative to antibiotics. By taking advantage of these leading-edge technologies. we can pave the way for safer, healthier communities and contribute to a more sustainable and harmonious world.

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