



AN INTRODUCTION TO INOVO TECHNOLOGY

R. P. Limsay

Dept. of Pharmacology & Toxicology

Nagpur Veterinary College, Seminary Hills, Nagpur, India

Abstract

***In ovo* (In Latin- in egg) supplementation of nutrients or the vaccine is a unique technique which is basically aimed to supply the nutrients or the vaccine at early stages of embryonic development of the chick. The technique is intended to assure better growth rate, better feed conversion efficiency, higher bird weights and relatively superior immunity in poultry. Sharma and Burmester first used *in ovo* technique where they vaccinated the chicks with Marek's vaccine during early embryonic stages and observed significant increase in immune protection against the disease. Now the technology is commercialized.**

The five basic compartments in an incubating egg i.e. Air cell, Allantoic sac, Amniotic sac, the Embryo itself and the Yolk sac used as a site for injection in *in ovo* technique and the most preferred period to use it is during 17th to 19th day of incubation.

The *in ovo* technology is now utilized for supplementation of nutrients to the chicks before hatch to enhance growth as well as immunity where different nutrients like carbohydrates, amino acids, minerals and vitamins are under investigation singly or in combination.

The major advantages of technology are precise delivery of vaccines, reduced labour cost, improvement in final body weights and immunity. In conclusion, lots of development is expected in *in ovo* technology in coming future as it has potential to save economical losses in poultry due to diseases as well as increased productivity and sustainability.

Indian economy and poultry-

As per the annual Report 2016-17 of Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare,

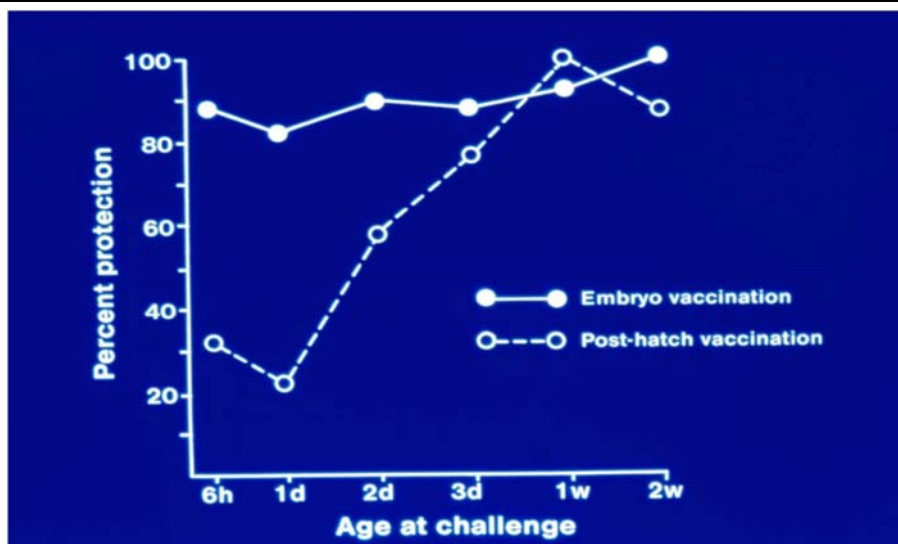
Govt. of India, India ranked third worldwide in egg production with 82.93 billion eggs production and fifth in broiler meat production with around 4.4 metric tons. It is significant to note that the Poultry Industry is contributing about 70,000 crores in Indian rupees to the national GDP. As the economy of the country is growing, the per capita income is also elevating, which will definitely further boost the demand for poultry products in coming days. While the fact remains is that, it is providing good income source to marginal farmers particularly women and employed youths.

***In ovo* Technique-**

In ovo (In Latin- in egg) supplementation of nutrients or the vaccine is a unique technique which is basically aimed to supply the nutrients or the vaccine at early stages of embryonic development of the chick. The first administration of *in ovo* delivery of exogenous material was reported in the 1980s for vaccination against Marek's disease by Sharma and Burmester. Later on, a wide research was carried out worldwide to inject smaller quantities of vaccines, drugs and nutrients *in ovo* to validate its effect in later stages of life. The basic aim of using *in ovo* technique in poultry is to assure better growth rate, better feed conversion efficiency, higher bird weights and relatively superior immunity.

Conceptualization of *in ovo* technique-

In the decade of 80s it was observed that, there is mortality in birds due to Marek's disease in poultry in spite of vaccination, as adequate time period was not available to develop protective immunity post vaccination. To overcome the issue, Sharma and Burmester first used *in ovo* technique where they vaccinated the chicks with Marek's vaccine during early embryonic stages and observed significant increase in immune protection against the disease (Fig. 1).



The technology was patented and later made available commercially which significantly decreased mortality due to disease and ultimately enhanced the production performance of the poultry. Now, the *in ovo* commercial vaccines are also available against Infectious bursal disease virus (IBDV) and Pox virus in chicken.

Sites of injection-

During the final stage of incubation, there are five basic compartments in an egg i.e. Air cell, Allantoic sac, Amniotic sac, the Embryo itself and the Yolk sac. These compartment(s) are basically used as a site for injection in *in ovo* technique. Usually the embryonic development is at its peak during the 17th to 19th day of incubation and this period provides window for *in ovo* injection. During this period the compartments change fast and each compartment is responsible for different support to embryonic development. Therefore, the site and time for *in ovo* injection is very essential to be recognized as the placement of vaccines and/or other compounds into those compartments may allow or limit their absorption by the embryo.

In ovo technology and nutrition-

The *in ovo* technology is now utilized for supplementation of nutrients to the chicks before hatch to enhance growth as well as immunity. A major intention of pre-hatch feeding is to equip the embryo with the nutrients necessary to continue intestinal development post-hatch at or close to the same rate as pre-hatch. Supplementing the embryo with exogenous nutrients would allow the gastrointestinal tract to develop the structures and functionality to properly digest and absorb nutrients immediately

when exogenous nutritional supplementation is provided after hatch. These nutrients, along with the yolk sac reserves, can contribute not only to maintaining the systems and metabolism already established but also to continuing growth, development, and proper nutritional status. The nutrients that are under investigation for *in ovo* administration are carbohydrates, amino acids, minerals and vitamins.

Some studies have shown comparatively larger digestive organs by amino acids; greater surface area of villi, higher goblet cell density on jejunal villi and higher mucin gene expression by carbohydrates administration, stimulation of intestinal development of hatching eggs; increase post-hatch growth and humoral immune response by Vit. E; beneficial effect on antibody, macrophage response, immunomodulation and cellular immunity by amino acids, vitamins and fatty acids. Due to these reasons now a day more and more studies are aimed to investigate the incorporation of various nutrients *in ovo*

Advantages-

- Precise delivery of vaccines
- Reduced labour cost
- Reduced bird handling stress
- Advanced development of intestinal mucosa
- Increased body weights at hatch and better hatchability
- Improves post hatch immune status
- Increased breast muscle size at hatch and final body weight of broilers

Future scope of *in ovo* technology-

Though there are some constraints in effective use of *in ovo* technology like economical

viability at large volume, higher maintenance cost, requirement of skilled manpower, chances of low hatchability due to any error etc., still there is lot of scope for its development as the technology has already established its usefulness till date. In future the chickens can be more benefitted through this technology by use of combinations of nutrients than alone. Even scope is there to incorporate nutrients in vaccine diluents for *in ovo* administration. Though the current machinery is costly and suitable for large scale production only, the compact, portable, low cost machine to fit the need for small scale operations can be developed for overall benefit of the poultry industry.

References-

- Gore A. B. and Qureshi M. A. (1997) Enhancement of humoral and cellular immunity by vitamin E after embryonic exposure. *Poult Sci.* 76:984–91
- Klasing KC (1998) *Comparative Avian Nutrition*. CAB International, Wallingford.
- Coles B, Croom W, Brake J, Daniel L, Christensen V, Phelps C. (1999) *In ovo* peptide YY administration improves growth and feed conversion ratios in week-old broiler chicks. *Poultry Sci.* 78:1320 – 1322.
- Sklan D and Noy Y. (2000) Hydrolysis and absorption in the intestine of newly hatched chicks. *Poult Sci.* 79:1306–10.
- Wakenell, P.S., T. Brian, J. Schaeffer, A. Avakian, C. Williams and C. Whitfill (2002) Effect of *In-ovo* vaccine delivery route on herpes virus of turkey/SB-1 efficacy and viraemia. *Avian Disease* 46(2); 274–280.
- Bhanja S. K., Mandal A. B. and Johri T.S. (2004) Standardization of injection site, needle length, embryonic age and concentration of amino acids for *in ovo* injection in broiler breeder eggs. *Indian J Poultry Sci.* 39:105–111.
- Kidd M. T. (2004) Nutritional modulation of immune function in broilers. *Poult Sci.* 83:650–7.
- Smirnov A, Tako E, Ferket P. R. and Uni Z (2006) Mucin gene expression and mucin content in the chicken intestinal goblet cells are affected by *in ovo* feeding of carbohydrates. *Poultry Sci.* 85:669 – 673.
- Bakayaraj S, Bhanja SK, Majumdar S and Dash B (2011) Modulation of posthatch growth and immunity through *in ovosupplemented* nutrients in broiler chickens. *J Sci Food Agric.* 92:313 – 320.
- Salahi A, Mozhdeh M. K. and Seyed N. M. (2011) Optimum time of *in ovo* injection in eggs of young broiler breeder flock. 18th Eur. Symp. on Poultry Nutrition, pp. 557 – 559.