



BIOACTIVE MOLECULES IN EGG POWDER CONTRIBUTE TO PIGLET'S HEALTH

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"Egg powder, a nutrient with bioactive molecules, helps piglet's growth, performance and increases immunity in piglets during the first two weeks after weaning."

Egg powder is a source of essential nutrients and bioactive molecules that has a significant potential to improve piglet's health. These bioactive molecules present in egg powder include immunoglobulins, antimicrobial proteins, vitamins, omega-3 fatty acids and antioxidants. The synergistic effects of these bioactive molecules contribute to improved growth, immunity and health of young piglets.

PASSIVE IMMUNITY

The consumption of egg powder rich in IgY supplies passive immunity and offers immediate protection against a wide range of pathogens like viruses and bacteria. Immunoglobulin Y (IgY) is mostly found in the yolk part of the egg and has a structure with two heavy chains (H), each one with a molecular weight of 67 to 70 kDa, and two light chains (L), with 25 kDa. IgY significantly reduces the risk of infections, supplying better health and immunity to piglets during the first and the second week post weaning.

IgY against the antigen K88 is able to significantly inhibit the growth of *E. coli* K88, block the binding of *E. coli* to small intestinal mucus, and protect piglets from *E. coli*-induced diarrhea. *Escherichia coli* (ETEC) are bacteria that colonize the small intestine and cause severe diarrhea in neonatal and weaned piglets. The pathogenesis of *E. coli* is due to

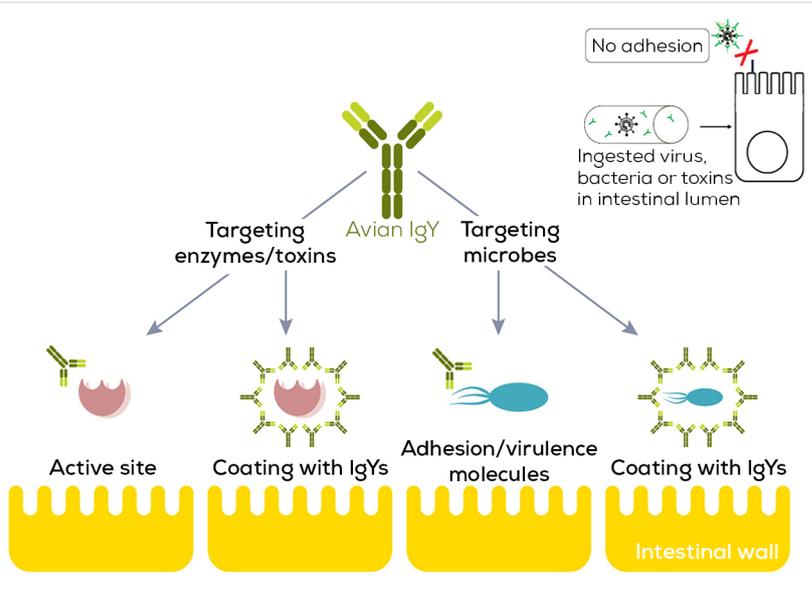
the adhesion of bacteria to the mucus of the small intestine using surface proteins like fimbriae.

Fimbriae are long filamentous polymeric protein structures found at the surface of bacterial cells. They enable the bacteria to bind to specific receptor structures and thereby colonize specific surfaces. IgY is highly effective against a wide variety of intestinal pathogenic microorganisms which cause diarrhea in animals, such as *Salmonella* spp., *Eimeria* spp., as well as porcine epidemic diarrhea virus.

Also, Ig Y significantly prevents *E. coli* K88 adhering to the jejunal and ileal mucosa of piglets with *E. coli* infection and significantly decreased *E. coli* and enterotoxin expression in colonic contents (Zhao-bin Wang-Veterinary research).

ANTIMICROBIAL PROTEINS

The most common antimicrobial proteins are Lysozyme, Ovomucin and Ovotransferrin. Lysozyme is a multifunctional enzyme that serves as nonspecific innate immunity molecule responsible for the antibacterial defense. If piglets consume egg powder having lysozyme, then the health microbiota increases, and the proliferation of damage bacteria reduces. This balance is essential for an optimal digestion, good nutrient absorption and gut health in piglets.



Plenty of studies prove that Lysozyme improves gut performance and protects against enterotoxigenic *Escherichia coli* infection in neonatal piglets (Guanping Huang-Veterinary research-2018). Ovomucin is a heterogeneous mixture of glycoproteins responsible for the gel-like structure of egg white and it increases the number of macrophages.

Ovomucin and its derivatives have good anti-inflammatory, antioxidant and immunity-regulating properties. These activities keep the physical-junctions barrier, and immune associated with good intestinal health (Aobai Tu-2020). Ovotransferrin has an antibacterial effect by binding iron and preventing that it can be used by bacteria. Ovotransferrin has an antifungal, antiviral, antioxidative, antihypertensive, and immunomodulatory properties (Alexandra Acero-Lopez-2012-International food research).

VITAMINS

Vitamin D, prominently present in egg yolks, plays a significant role in the bone health and calcium metabolism. This nutrient ensures the proper development of strong skeletal structures in piglets. The vitamin D receptor can be found in the intestinal enterocyte, the osteoblast, and the renal cells, but also in the intestine, pancreas, heart, eye, brain, thyroid, parathyroid, and muscle. Deficits of Vit D can produce weak and fragile bones, at the end also paralysis in the piglets.

Vitamin A is vital in sustaining a healthy skin, supporting the immune function, keeping good vision, and promoting general reproductive health. Deficiency of vitamin A can make pathologies of the eyes and the epithelial tissues but also in the respiratory, reproductive, nervous, urinary, and digestive systems.

Vitamin B12 (Cyanocobalamin) is essential for the energy metabolism and neurological function. Piglets with deficits of Vit B 12 can make hyperirritability, pain, and incoordination. This Vitamin B 12 is mostly present in the yolk part of the egg.

Vitamin B2, Riboflavin helps to convert the feed eaten by a piglet into the energy that they need for growth. Deficits of Vitamin B2 can reduce weight gain and these piglets usually have a poor appetite.

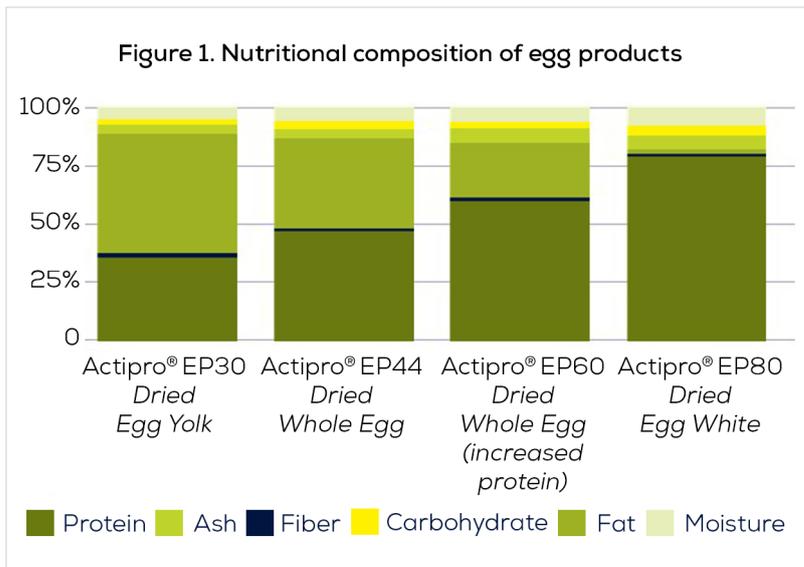
Vitamin B3, Niacin helps the functioning of the digestive system of the piglets. Deficits of Niacin can produce inflammatory lesions of the digestive tract and diarrhea and can reduce weight of the piglets.

Choline is a vital nutrient crucial for the piglet brain development and cognitive function and protects the liver functions. Choline contributes to the formation of cell membranes. It is necessary for the synthesis of the neurotransmitter acetylcholine, the synthesis of betaine and phosphatidylcholine.

Piglets' deficits of Choline can produce fatty livers and kidney damage. According to the 2012 Nutrient Requirements of Swine, choline requirements for starter/grower/finisher pigs are 400-600 mg/kg diet; and for gestation/lactation are 600-1,250 mg/kg diet.

HIGH-QUALITY PROTEIN

The high-quality protein content of egg powder supplies essential amino acids (Tryptophan, Alanine, Valine, Lysine, Methionine...) for piglet's growth and development. The ten essential amino acids for pigs are: lysine, methionine, tryptophan, threonine, valine, isoleucine, leucine, arginine, his-



decrease inflammatory processes and increase heart function. Also in sows, supplements with omega-3 during gestation and later lactation increase the number of pigs born alive (Smits et al., 2011) and reduce mortality (Rooke et al., 2001)

ANTIOXIDANTS

Egg yolks are rich in antioxidants, including lutein and zeaxanthin, which play a critical role and avoid piglet cells from oxidative stress. The fundamental role of lutein and zeaxanthin is to prevent the formation of free radicals and oxidative molecules.

tyrosine, and phenylalanine. Inside the egg we can find nine of these ten amino acids except only one, arginine. Egg white has all these amino acids, as well as non-essential amino acids, making egg powder a source of protein for piglets. The consumption of egg powder proteins supports optimal muscle development, organ function and overall body composition in piglets.

YOLKINE

Yolkine is a protein found in egg yolk and supplies a positive influence on piglet's immune system by regulating its activity. Yolkine helps in the efficient defense against infections while reducing the risk of inflammatory diseases. Yolkine's anti-inflammatory properties contribute to the immune system equilibrium and support piglet's well-being and health.

OMEGA-3 FATTY ACIDS

The omega-3 fatty acids present in egg yolk are alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These fatty acids provide anti-inflammatory properties which are integral to promote cardiovascular health. Omega-3 fatty acids support blood health,

Lutein also stimulates the production of antibodies. Guimarães Alarça et al. (2016) could show an increase of CD4+ and CD8+ T-lymphocyte subtypes. Kim et al. (2000) demonstrated the increase of lymphocytes and cells expressing CD5, CD4, CD8, and major histocompatibility complex class II (MHC II) molecules.

Zeaxanthin has several beneficial health effects thanks to its ability to catch free radicals, and antioxidant effects, as well as decrease inflammation. (Ana Gabriela Murillo 2019)

CONCLUSION

Egg powder, a nutrient with bioactive molecules, helps piglet's growth, performance and increases immunity in piglets during the first two weeks after weaning.

Egg powder offers a suitable alternative to the nutritionists to formulate with a high quality and safe functional protein source, with multiple benefits in piglets' diets.

References available upon request Jordi.yamat@veos.es

About Jordi Ysamat

Jordi Ysamat graduated from the University of Barcelona with a degree in Veterinary Medicine, specialized in nutrition. Later he completed his education with a Business Administration master's degree at the Open University of Barcelona. With more than 30 years' experience in the animal health and nutrition sector, he is now involved in business development and R&D management at the VEOS Group as Technical Sales Manager ACTIPRO, a brand dedicated to animal nutrition.