RECENT ADVANCEMENTS IN DESIGNER EGG PRODUCTION

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Abstract: The health conscious consumers are demanding quality poultry products and ready to pay premium price. This leads to development in designer foods. The Designer foods are also termed as functional, fortified, enriched or nutraceutical value added foods. Designer foods have better potential effects on health besides providing the basic nutritional benefits. The designer eggs produced by nutritional manipulation of poultry diets i.e. addition of different health promoting components like antioxidants, minerals, omega fatty acids, vitamins, and various nonnutrient additives. By alteration or enrichment in eggs we can obtain the designer eggs like low cholesterol eggs,omega-3 enriched eggs, vitamin enriched eggs, mineral enriched eggs, pigment enriched eggs, herbal enriched eggs, antioxidant enriched eggs, Pharmaceutical designer eggs and many more type of enriched eggs.

Keywords: Designer eggs, herbal enriched eggs, minerals, Omega-3 fatty acids, vitamins.

Introduction: In present scenario consumers are very much conscious about their health as a result demands of designer foods increasing worldwide day by day. Meeting consumer demands is a constant challenge for the animal food industry. So that the food industry has responded to the demand for foods of superior health benefits by modifying the nutritional profile of popular foods like eggs and meat. Eggs as an integral part of the diet packed with thirteen important vitamins and minerals. Eggs are also considered the highest quality protein, yet compared to other animal protein sources but consumer awareness on the relationship between dietary lipid and the incidence of Coronary Heart Disease (CHD) and salmonella problem changed their attitude towards egg consumption. The per capita consumption of egg and meat has not increased in required number and quantity, respectively, through the years because of the fear that egg yolk contains high cholesterol. In order to improve consumers perception the egg is nutritionally modified it is referred as designer or functional food (American Dietetic Association, 1995).

Designer eggs: "Designer eggs" are those in which the content has been modified from the standard egg. Designer eggs don't just have to alterations in nutrient content. Several other distinguishing factors may include appearance, being pathogen free and a number of alternative production methods (feed, housing and even fertility). Designer eggs may be categorized as 1) nutritionally enhanced, 2) value added, and 3) added processing.History of Designer Eggs

Cruickshank (1934) was one of the frist researchers document the ability to change the nutrient profile of the egg.In the late 80s, Sim, Jiang and their associates in the university of Alberta, Canada, blended these idea together and developed a designer egg, rich in n-3 fatty acids and antioxidants. They patented this egg as **Professor Sims Designer Egg.** They incorporated the n-3 PUFA in the egg yolk at the expense of saturated fatty acids, by feeding hens with diets having flax seeds.In India, Narahari (2004) developed Herbal Enriched Designer Eggs, which were not only rich in n-3 PUFA, vitamin E, selenium, carotenoids, B complex vitamins and trace minerals; but also rich in herbal active principles like Allicin, Betaine, Euginol, lumiflavin, Lutein, sulforaphane, Taurine and many more active principles, depending on the herbs fed to the hens.

Production of Designer egg: Poultry researchers have been dedicating a considerable amount of their efforts in recent decades to studies with hens in an attempt to lower egg yolk cholesterol to satisfy concerns of health conscious consumer.

Shell colour: Regional consumer preferences determine the shell color f. Kuhl estimated that half of the designer eggs on the market are brown shelled. A brown-shelled egg is a designer egg because it differentiates that egg from the conventional market. In some countries, there is even a market for blue-shelled eggs.

Yolk colour: Yolk color can vary from virtually white to orange depending on the deposition of xanthophylls from the feed. Some xanthophylls are yellow, while others are red. Sources of supplemental xanthophylls include corn gluten meal, alfalfa, marigold, peppers and spirulina . Consumers may have a preference for a specific yolk color. Part of this preference may represent a perception that darker yolks have health benefits or originate from healthier chickens. Xanthophylls have been shown to the health conscious consumers are demanding quality poultry products and ready to pay premium price.

Omega -3 (ω-3) Fatty Acids enrichment: Recently, eggs have gained attention as an alternative to fish and oilseeds as a source of Omega -3 fatty acids. Generally people tend to avoid egg yolk but yolk only contains omega 3 fatty acids. The total fat content in the egg yolk cannot be altered; but its fatty acid composition can be altered, by changing the type of

oil used in the hen's diet. Omega-3 is an essential fatty acid with a treasure trove of health benefits. Found naturally in marine micro algae (Crypthecodinium cohnii), fishes which consumes these microalgae and some plants. Omega-3 is a building block for foetal vision development and brain function. In adults, omega-3 lowers risk of heart disease and cancer of the breast, colon and prostate. Its anti-inflammatory properties help decrease episodes of asthma and pain associated with rheumatoid arthritis. One normal eggs contain only 50- 100mg of omega 3 fatty acids and which can be increased to 500mg or more with dietary modifications in the hen's diet. Flax seed (linseed), marine algae, fish oil and rape seed oil are added to chicken feed to increase the omega - 3 fatty acid content in the egg yolk (1). This n-3 PUFA in egg yolk has decreased the serum triglycerides and increased the serum HDL Cholesterol levels and also found to decrease incidence of atherosclerosis and hypertension (3).

Herbal enriched super eggs: Phytobiotics or plant-derived products containing several plant secondary metabolites can be used in poultry feed to improve the performance of hen and to produce herbal enriched super eggs. Chicken feed will be supplemented with herbs like garlic/onion leaves, spirulina, basil leaves, turmeric powder, citrus pulp, flaxseed, red pepper, fenugreek seeds etc. These super eggs will be having a lower LDL cholesterol, immunomodulator property, antioxidant, anticarcinogenic properties, higher omega-3 fatty acids etc. For example normal egg have vitamin E content of 90-100 µg /g yolk whereas herbal supplemented egg have 220 – 240 µg / g yolk which added to its increased antioxidant property. All these indicating that the overall health promotion in hens as well as possible health promotion in humans is possible by popularizing herbal enriched eggs.

Lowering Cholesterol Content: Even though the dietary cholesterol is insignificantly correlated with the serum cholesterol levels, the consumers are scared of high cholesterol foods, like eggs. A large egg contains about 200 mg of cholesterol. At present low cholesterol eggs can be achieved either by reducing the amount of cholesterol per egg, by reducing the size of the yolk or by altering the lipid profile of the yolk. Research towards lowering egg cholesterol has centered mostly on dietary and pharmacological interventions. Chromium, copper, nicotinic acid, statins, garlic, basil (tulasi), plant sterols, N-3 PUFA supplementation to chicken feed will reduce the yolk cholesterol levels significantly and many more herbs in chicken diets will reduce the yolk and body cholesterol levels by 10-25%.

Anti-Oxidants in eggs: Egg is a rich source of natural antioxidants like vitamin-E, selenium, carotenoid pigments, flavinoid compounds, lecithin and phosvitin. These compounds will protect the fat-soluble vitamins and other yolk lipids from oxidative rancidity. However, these levels are not sufficient to protect the designer eggs rich in N-3 PUFA. Hence it is essential to increase the anti-oxidant levels in the designer eggs. The designer egg not only contain high levels of the above anti-oxidants; but also contain synthetic antioxidants like Ethoxyquin and anti-oxidants of herbal origin such as Lycopene, Curcumin, Sulforaphene, Carnosine, Quercetin, depending upon the herbs used in hens diet(8). Supplementation of these antioxidants in hen's diet will increase their levels in the egg. The advantages of enrichment of the egg with anti-oxidants include prevention of fishy odour to the product, good source of antioxidants in human diet.

Vitamin-E enriched designer eggs: As ω-3 fatty acid enriched eggs are more susceptible to lipid oxidation, supplementation with vitamin E is generally recommended to stabilize egg lipids against rancidity and extend the shelf life of the product by Galobart . Later Galobart *et al*. (2001a) found that supplementation of dietary vitamin E does not have a significant effect on daily feed intake, feed efficiency, egg weight and laying rate. The extra addition of vitamin-E in the diet of hens leads to the following advantages reduces free radicals in blood. Decreases risk of cancer and ageing process due to the reduction in the formation of the free radicals formation

Immunomodulation Egg Production: The eggs naturally contain certain specific compound like lysozyme (G1-globulin), G2 and G3 globulin, ovomacro globulin, antibodies etc. The globulin antibodies are natural antimicrobials and immunostimulants in the egg that can be utilized in the cure of immunosuppressed patients like AIDS patient. Chicken egg is abundant in antibodies like "IgY"; which is cheaper and better than mammalian immunoglobulin "IgG". In a 6-week period, a hen produces about 298mg of specific antibodies, compared with only 17mg from a rabbit. This "IgY" can be used to treat human rotavirus, E.coli, Streptococcus, Pseudomonas, Staphylococcus and Salmonella infections. The IgY level in the egg can be increased by dietary manipulations. The functional feed rich in omega - 3 fatty acids and anti-oxidants itself will increase the IgY level in the egg. Herbal supplementation will further boost the IgY level in the egg. Among the herbs, Basil leaves (Tulasi) at 0.3-0.5 % dietary level is having the highest ability to boost the IgY level in the egg. Other herbs like Rosemary, Turmeric, Garlic, Fenugreek, Spirulina, Aswagantha, Arogyapacha etc., are also possessing immunomodulating properties.

Pharmaceutical designer eggs: Now a day, researchers are producing genetically modified chickens through the genetic manipulation which are capable to produce certain pharmaceutical compounds and those compounds can be harvested through eggs like insulin which are used for treatment of diabetes. The hen, like all animals, produces antibodies to neutralize the antigens (viruses, bacteria, etc.) to which she is exposed to each day. These antibodies circulate throughout her body and are transferred to her egg as protection to the developing chick. The hen can develop antibodies against a large array of antigens and concentrate them in the egg. Specific antigens are now being selected and injected into the hen that develops antibodies against them.

Selenium enriched designer eggs: Today the selenium content of eggs can be easily modified by the supplementation of organic selenium rich feed to the hens. The selenium exists in the eggs mainly in the firm of selenomethionine (Sc-met). Selenium is an important constituent of a number of functional seleno-proteins which is mandatory for normal health that may come from different sources like that bread and cereals, fish, poultry and meat . Supplementation of selenium in eggs can decrease the incidence of cancer (2). Addition of selenium in the eggs may play certain vital roles such as selenium supplementation helps in reduction of arthritis, cataract, cholestasis, cystic fibrosis, diabetes, immunodeficiency, lymphoblastic anemia, macular degeneration, muscular dystrophy (10).It also helps in decreasing the risk of DNA damage that is associated with cancer (9).Selenium enriched eggs can also reduce the risk of osteoporotic hip fracture in elder subjects.

Iodine-enriched designer eggs: In developing country like India, Africa, China and in many other countries of the world, some people are suffering from iodine deficiency diseases therefore iodine enriched eggs could be a good source of iodine in human diet. A typical egg of this type includes approximately 700 µg iodine (5). Eggs enriched with iodine can also reduce plasma cholesterol in humans and laboratory animals (11). On the basis of clinical trials conducted by Garber et al. showed that ingestion of one iodine-enriched egg a day for several weeks is relatively safe and devoid any significant adverse effects in healthy individuals. However, these eggs were not effective when used in low fat and low cholesterol diet by hyperlipidemic people. There are some indications of anti-inflammatoryn (6) and anti-allergic (7) properties of such eggs. **Conclusion :** Egg is the best vehicles to incorporate various health promoting component in it. Hence these designer eggs are not only nutritious and tasty; but also promote the overall health status of consumers.

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