The concept of designer eggs is interesting and even encouraging. However, the technology of manipulating nutrients in poultry feed, fortification of egg with micronutrients, vitamin, antidiabetic factors and specific modified immunoglobins warrants a mass awareness campaign among veterinarians, extension agencies, feed manufacturers, pharmaceutical industry, poultry owners and consumers.

Ever since the dawn of civilization, consumption of animal origin food, especially eggs, has been a preferred choice over vegetarian food as it provides proteins and other essential nutrients and micronutrients (protein, vitamin A, D, B12, folate, selenium, phosphorus etc) in a balanced ratio for growth, development and reproduction. One large egg contributes 70 Kcal in the form of fat (4.5 g), fatty acids (4 g), Cholesterol (0.2 g), Carbohydrate (1 g), Protein (6 g), Sodium (0.06 g), Potassium (0.06 g) besides, 13 important vitamins, minerals, and antioxidants.

Eggs are the least expensive animal protein source of the highest quality. Eggs contain Lutein and Zeaxanthin that prevent spots on the retina and have prophylactic activity against atherosclerosis. Sufficient quantities of these nutrients in the diet are thought to reduce the risk of age-related macular degeneration in the elderly. In addition to possibly reducing the risk of macular degeneration, lutein has been associated with a protective effect for early atherosclerosis. Increased amounts of dietary lutein from green leafy vegetables and egg yolks could be protective against atherosclerotic lesions in humans and animals.

Choline is a nutrient naturally found in eggs that contributes to fetal memory and brain development. It is found in the form of phosphatidylcholine and sphingomyelin, which are types of phospholipids. Choline’s chief function in the body is as an important part of cellular compounds such as the neurotransmitter acetylcholine and lecithin, a naturally occurring emulsifier present in cell membranes and bile. One large egg contains approximately 300 milligrams of choline. Eggs are good sources of choline since the recommended daily intakes range from 425 to 550 milligrams for adults, including pregnant and lactating women, according to the National Academy of Sciences.

But now, the nutrient content of eggs can be modified to provide nutrients above and beyond what is normally found in generic shell eggs—designer eggs for you! Many consumers desire somewhat distinct products with respect to safety, healthfulness, freshness, taste, colour, etc. To tap into this market, companies have developed several designer and specialty eggs that have started appearing on store shelves. The nomenclature of such eggs may be confusing, and often misleading.

**Designer Eggs**

In an effort to meet the growing demands of health conscious consumers, the egg industry is developing new designer eggs. One of the ways to market a new product is to change the old product. The contents of the chicken egg can be changed in such ways as to be more healthful and appealing to a segment of our consumers who are willing to pay for those changes in the egg. “Designer eggs” are those in which the content has been modified from the standard egg. Altering the content of the feed of the laying hen produces eggs with enhanced nutrient content.

Designer eggs currently available include vegetarian eggs and eggs with modified fat content. Hens fed an all grain diet, free of animal fat and byproducts lay eggs marketed as vegetarian eggs. Vegetarian eggs may differ slightly in nutrient content from generic shell eggs depending on the nutrient content and quality of the vegetarian feed. These designer eggs appeal to individuals who are lacto-ovo-vegetarians.

**Vitamin content:** Designer eggs have been produced that contain higher concentrations of several vitamins. Two vitamins, A and E, are receiving the most interest as components of designer eggs. The vitamin content of the egg is variable.
and is somewhat dependent on the dietary concentration of any specific vitamin. In addition, the hen does not transfer different vitamins into the egg with equal efficiency.

Designer eggs have 26 times more vitamin E, 16 times higher carotenoid content, over 7 times greater selenium content, and 6 times higher DHA content than generic eggs. Eggs with higher vitamin E content are currently available in stores.

**Lowered cholesterol:** A large egg contains approximately 200-220 mg of cholesterol. Genetic selection of hens for lowered cholesterol has not been successful in lowering the egg cholesterol content. Lowering egg cholesterol has centered mostly on diet and pharmacological intervention.

Drugs have been successful in lowering egg cholesterol by as much as 50%. Drugs lower cholesterol in the egg by either inhibiting the synthesis of cholesterol in the hen or by inhibiting the transfer of cholesterol from the blood to the developing yolk on the ovary. This new egg is said to have 40% less cholesterol and 29% less saturated fat. Chromium supplementation to laying hen diets at concentrations of less than 1 ppm have been shown to lower egg cholesterol and also improve egg interior quality.

The most effective way to lower egg cholesterol content is to lower the energy consumption of the hen. Eggs can be produced by feeding a special all-vegetarian diet that is higher in protein and fiber, and enriched in vitamin E.

**Fat content:** Eggs with modified fat content have become very popular and are available in many parts of the country. Modified fat content eggs are marketed as containing less cholesterol, less saturated fat, higher amounts of omega-3 fatty acids, higher vitamin E content, and high amounts of iodine when compared to generic shell eggs.

Altering the total fat content in the diet of the hen has little effect on the total fat content of the egg yolk. However, the fatty acid profile of egg yolk lipid can easily be changed, simply by changing the type of fat used in the diet. Diets high in omega-3 fatty acids can reduce heart disease risk. Hens fed diets high in omega-3 fatty acids produce eggs with high omega-3 fatty acid content in the yolks. The type of omega-3 fatty acid in the feed can be linolenic acid from flaxseed or docosahexanoic acid (DHA) or eicosapentaenoic acid (EPA) from marine algae or fish oil. Individuals who do not eat or do not have access to fish products can consume an adequate amount of omega-3 fatty acids by incorporating omega-3 eggs into their diet.

Consumption of polyunsaturated fatty acids reduces the risk of atherosclerosis and stroke. Consumption of these fatty acids promotes infant growth. Different feeds, such as flaxseed (linseed), safflower oil, marine algae, fish, fish oil, and vegetable oil have been added to chicken feeds to increase the omega-3 fatty acid content in the egg yolk. Omega-3 fatty acid-rich eggs may provide an alternative food source for enhancing consumer intake of these ‘healthy’ fatty acids. Evaluation of the eggs during storage indicated that the shelf life of the enriched eggs was comparable to that of typical eggs.

There are also designer eggs on the market that contain a lowered saturated to unsaturated fatty acid ratio. Canola oil is commonly used to alter the ratio of saturated to unsaturated fatty acids.
Mineral content: The shell contains the majority of the minerals in an egg. There is approximately 2,200 mg of calcium and 20 mg of phosphorus in the shell. There has been very little success in changing the calcium and phosphorus content of the albumen and yolk. It is possible, however, to increase the content of selenium, iodine and chromium. This has been done through dietary supplementation of the hen. Selenium helps in combating old age, cancer and infertility. By feeding natural selenium to (selenium yeast) to layers, the selenium content of eggs can be increased significantly. These three minerals are important in human health. There has been some interest, therefore, in promoting these eggs as designer eggs.

Pigment content: The colour of the yolk is a reflection of its pigment content. In addition, the type of pigment in the egg and its concentration are directly influenced by the dietary concentration of any particular pigment. Consumer preferences vary greatly according to yolk colour.

Yolk colours can be achieved by using only natural pigments obtained from natural raw materials. Natural sources can be from plants such as marigold, chili, or corn. The high protein blue-green algae known as Spirulina has also been shown to be a very efficient pigment source for poultry skin and egg yolk. The most effective carotenoids are lutein and zeaxanthin, which are commonly found in dark-green leafy vegetables such as spinach and collard greens.

Most of the carotenoids in egg yolk are hydrox compounds called xanthophylls. Lutein and zeaxanthin are two of the most common xanthophylls found in egg yolk. They are high in pigmented feed ingredients such as yellow corn, alfalfa meal, corn gluten meal, dried algae meal, and marigold-petal meal. Fortunately, both lutein and zeaxanthin are efficiently transferred to the yolk when these various feed ingredients are fed to laying hens. The egg processing industry has routinely produced highly pigmented yolks for use in bakery products, pasta and mayonnaise.

Pharmaceuticals: New biotechnology is being used to develop genetically modified chickens that produce compounds that can be harvested from the eggs. These compounds include insulin for the 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.

Immunologists are taking advantage of the fact that 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 who develops antibodies against them. As new biotechnology knowledge is gained in this area, designer eggs in the future may be produced that result in a range of antibodies from treatment against snake venoms to the countering of microorganisms that cause tooth decay.

Specialty Eggs

Eggs with a special attribute that makes them attractive to a niche market are known as “specialty” eggs. A number of these eggs are available in stores. The packaging used, however, can often be misleading.

Organic: Until recently there was no set standard for the production of organic poultry products. To be certified organic, the eggs must be produced from hens that have been fed certified-organic feed produced without synthetic pesticides or herbicides, antibiotics, or genetically-modified crops. In addition, no synthetic pesticides can be used to control external and internal parasites. Typically, organic eggs are also produced from hens in cage-free systems.

Fertile Eggs: Almost all eggs produced commercially are infertile. Roosters do not have to be present for hens to lay eggs and roosters are, therefore, not kept with laying flocks. When there is an excess of hatchling eggs in the poultry meat industry, eggs from broiler breeder flocks can be sold for human consumption. A large percentage of these eggs will be fertile. Fertilized eggs are safe to eat. There is no nutritional difference between fertilized and unfertilized eggs. The embryo does not develop in fertilized eggs that are refrigerated soon after laying.

Added Processing: New technologies continue to be introduced in food processing. The latest one commercialized for eggs is pasteurization of shell eggs. Pasteurization has been used for years for liquid egg products; however, the technology to pasteurize a whole shell egg is relatively new. The process involves heating eggs to specific temperatures in water baths designed to heat the egg enough to destroy pathogenic bacteria but not enough to coagulate the proteins. The eggs are held in the water baths for long periods of time at carefully controlled temperatures. The eggs are then cooled and packaged.

Other new technologies in the development process are set to improve the safety of shell eggs. One such technology is irradiation. The FDA approved irradiation for treatment of shell eggs in 2000. To date, irradiated eggs have not yet been produced for the consumer market.

Designer eggs offer options for consumers who want eggs with different nutritional payback or property than generic eggs. A generic shell egg provides a nutrient dense, high quality, inexpensive source of protein as well as a variety of essential vitamins and minerals, with other functional components. By feeding hens special diets, eggs can offer functions above and beyond the excellent nutrition that they already provide.

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