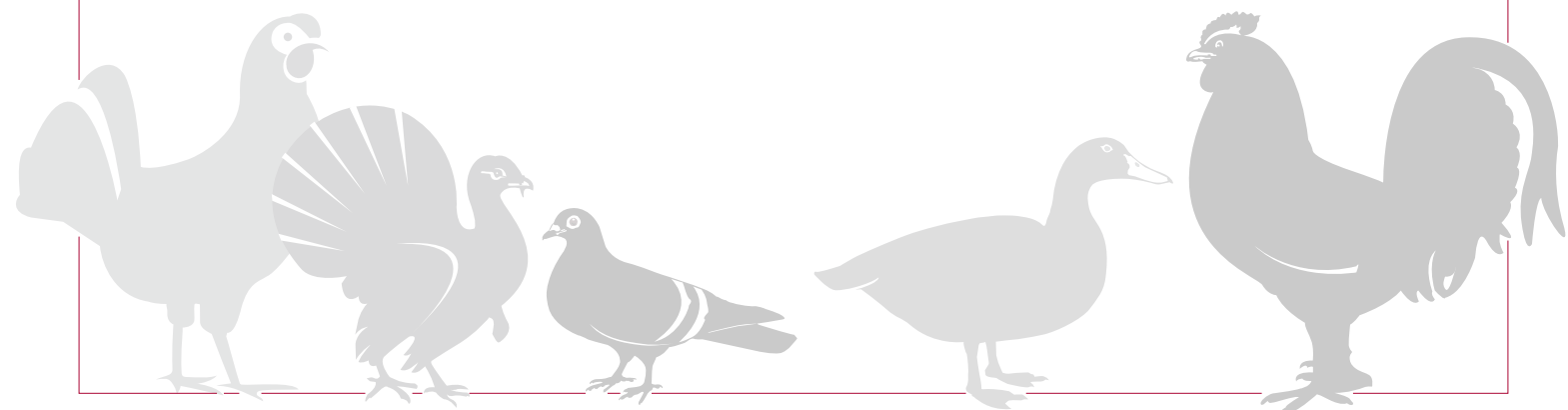


The role of poultry in human nutrition



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Chicken meat and eggs are the best source of quality protein, and are badly needed by the many millions of people who live in poverty. In sub-Saharan Africa (SSA) and South Asia malnutrition (poor nutrition) and undernutrition (inadequate nutrition) are closely associated with poverty. These conditions affect the immune system. The HIV/AIDS epidemic sweeping through countries in SSA stems partly from extreme poverty and, with it, poor nutrition.

WIDE VARIATION IN CONSUMPTION OF POULTRY MEAT AND EGGS

A recent survey of several countries found that 34 percent of the people surveyed in South Asia and 59 percent in SSA were suffering from severe energy deficiency (Smith and Wiseman, 2007). Both groups obtained 67 percent of their energy from staple foods (cereal grains, grain legumes, starchy roots and tubers) containing small quantities of only low-quality protein. Their average per capita egg consumption was only 42 per year, compared with a global average of 153. Stunting and wasting in children under five years of age, and slow mental development were seen mainly in rural areas of SSA. Eight out of ten of those affected were among the poor. Diseases such as kwashiorkor and marasmus, both seen in underweight children, are associated with inadequate dietary energy and protein. Pregnant and lactating women and young children are particularly vulnerable.

In SSA, only 8 percent of dietary energy comes from animal protein, compared with an average of 17 percent in all developing countries, and 28 percent in China.

CHICKEN MEAT AND EGGS: A VALUABLE SOURCE OF PROTEIN AND ALMOST ALL OF THE ESSENTIAL NUTRIENTS

Chicken meat and eggs provide not only high-quality protein, but also important vitamins and minerals. Worldwide, 2 billion people depend on rice as their staple food. Most eat polished white rice stripped of many essential fats, the B complex vitamins and several minerals. Other cereal grains are usually deficient in critical nutrients. For example, maize (corn) is a staple food in some regions, but the niacin it contains is unavailable. Maize consumption without supplements causes pellagra. Invariably the protein content of grains is low and of poor quality. Net protein utilization (NPU) is an index of protein quality, calculated by multiplying protein digestibility by biological value. NPU of grains is generally less than 40. Rice is the exception, with NPU of about 60, but it is low in protein (7.5 percent). NPU of chicken eggs is 87. Generally, cereals lack the most important amino acids for humans – lysine, threonine, the sulphur-bearing amino acids (methionine and cysteine) and occasionally tryptophan. Eggs and chicken meat are rich in these essential amino acids.

Eggs are also high in lutein which lowers the risk of cataracts and macular degeneration, particularly among people living in developing countries.

In the least developed countries, the projected increase in egg consumption between 2005 and 2015 is 26 percent, compared with only 2.4 percent in the most developed countries (Windhurst, 2008). Corresponding annual projections for poultry meat are 2.9 percent and 1.6 percent, respectively (FAOSTATS).

ADVANTAGES OF CHICKEN MEAT AND EGGS COMPARED TO OTHER ANIMAL PROTEINS

In developing countries, the diet of people living in cities usually contains more animal protein than that of rural people, mainly because urban people are more prosperous, but also because they generally have access to a wider variety of foods at local markets. In low-income countries, commercially produced chicken meat is well placed to satisfy the demands of a rapidly increasing affluent, middle class who can afford to pay for broiler chickens. Facilities and infrastructure for producing broiler chickens can be established quickly and soon start generating. Not only is chicken meat seen as a healthy meat, but it is also the cheapest of all livestock meats.

A major advantage of eggs and poultry meat as human food is that there are no major taboos on their consumption. In addition, a chicken provides a meal for the average family without the need for a refrigerator to store left-overs. Meat from other livestock such as pigs and cattle is kept mainly for special festive occasions and celebrations, partly because of a lack of storage facilities (no refrigerator or electricity supply). Eggs can be purchased relatively



Most eggs that are consumed in developing countries are produced by commercial layer breeds



Consumption of duck eggs is popular in Southeast Asian countries

cheaply and in small numbers. One egg is almost a meal in itself and when hard-boiled will last for several weeks. It can be taken to school safely by children for lunch.

SCAVENGING CHICKENS PROVIDE CHEAP EGGS AND MEAT

Scavenging family poultry provide much-needed protein and income, and contribute to food security for many families living in poor rural regions of developing countries. The eggs and meat produced by their own or neighbours' small poultry flocks are the only eggs and poultry meat that the majority of these families are

ever likely to eat. This makes family poultry increasingly important as the world's population pushes towards 7 billion people. Furthermore, it is not difficult to improve the nutritional value of the egg, to become a functional food.

CONCLUSIONS

Poultry has a major role to play in developing countries. Produce is relatively inexpensive and widely available. The commercial poultry industry provides employment and is growing rapidly. To produce 1 kg of meat from a commercial broiler chicken only about 1.7 kg of feed is needed. Poultry production has a less detrimental impact on the environment than other livestock, and uses less water. Semi-scavenging backyard indigenous poultry are extremely important in providing income and high-quality protein in the diets of rural people whose traditional foods are typically rich in carbohydrate but low in protein. The vexed question of the cholesterol content of eggs and human health seems to have been exaggerated.

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The nutritional benefits of chicken meat compared with other meats

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Chicken meat is a white meat, distinguished from other meats such as beef and lamb by its lower iron content (0.7 mg compared with 2 mg/100 g).

CHICKEN MEAT HAS SEVERAL ADVANTAGES OVER OTHER MEATS

The fat content of cooked chicken varies depending on whether it is cooked with the skin on or off, the portion of the bird, and the bird's diet and breed. Breast meat contains less than 3 g fat/100 g. An average value for dark meat (skin off) is 5 to 7 g/100 g. About half of the fat from chicken meat is made up of the desirable monounsaturated fats, and only one-third of the less healthy saturated fats. There are much higher proportions of saturated fats in most cuts of red meat, which also vary considerably in total fat. Chicken meat is therefore seen as a healthy meat.

Chicken meat does not contain the trans fats that contribute to coronary heart disease, and can be found in high amounts in beef and lamb. In Canada, values of 2 to 5 percent have been reported for beef and as high as 8 percent for lamb. The World Cancer Research Fund and others (Bingham, 2006) have suggested that the consumption of large amounts (more than 500 g/week) of red meat, particularly processed meat, but not chicken meat, may be unhealthy.

POULTRY MEAT IS RICH IN THE OMEGA-3 FATS

Poultry meat is an important provider of the essential polyunsaturated fatty acids (PUFAs), especially the omega (n)-3 fatty acids. Scavenging chickens are a particularly good source because of their varied diet. The amounts of these important fatty acids can be increased more easily in chicken meat than in other livestock meats; so too can some trace minerals and vitamins. The recommended dietary intakes (RDIs) of niacin can be met with 100 g of chicken meat per day for adults and 50 g for infants.

By feeding broiler chickens only small amounts of a supplement rich in alpha linoleic acid (an n-3 PUFA), such as flax seed, the n-3 PUFA in thigh meat can be increased from 86 mg to 283 mg/100 g, and that in the minced carcass from 93 to 400 mg/100 g. To a large extent, the fat contents of the different portions determine the content and enrichment of PUFAs, so dark chicken meat always contains more PUFAs than white breast meat.

POULTRY MEAT CAN BE ENRICHED WITH SEVERAL OF THE IMPORTANT DIETARY NUTRIENTS

Unlike most other meats, chicken meat can also easily be enriched with several other important nutrients. A recent study (Yu *et al.*, 2008) showed that by adding 0.24 mg of selenium (as organic selenium) per kilogram of feed, the selenium content of

breast meat was increased from 8.6 µg to 41 µg/100g, which is more than 65 percent of the RDI. The same amount of selenium in the form of inorganic sodium selenite also increased selenium in the breast meat, but only to 16 µg/100g. Selenium deficiency is becoming more widespread in humans because soils are becoming depleted and the foods grown on them are therefore lower in selenium. The RDI of selenium is 55 µg per day. Selenium is a powerful antioxidant and plays a role in the prevention of some forms of cancer. A deficiency of selenium can cause Keshan's disease, a heart ailment in the young, which is common in parts of China, and cognitive decline in adults. Enriched poultry meat could help alleviate this condition.

CONCLUSIONS

Chicken meat can make many positive contributions to the diet of those on low incomes. Although not all meat is seen as healthy, chicken meat is, and is frequently more affordable than other meats. It is of a consistently high quality, is low in saturated fats, can be enriched with some essential nutrients and is sought after worldwide.

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The importance of poultry meat and eggs, especially for children and women

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WHY POULTRY MEAT AND EGGS ARE SO IMPORTANT

To illustrate just how important poultry can be in the developing world, this information note examines a typical diet of a three-year-old girl living in Papua New Guinea, weighing about 10 kg and with an energy intake of 4 000 kJ/day. Her diet might consist of a small amount of rice (50 g/day) but mainly sweet potato, taro, yams and cassava. Her family of five keeps a small flock of nine hens and a cockerel. These should produce approximately 12 eggs and one chicken, yielding 780 g of edible meat, each week. This will give each member of the family 22 g of meat a day, and the child receives five of the 12 eggs each week, or 36 g of edible egg per day.

Table 1 shows the daily contribution that the eggs and meat make to the girl's recommended dietary intake (RDI) of some essential nutrients. These are mostly for a child of three to four years of age, but RDIs have not been determined for people living in developing countries and are likely to be generous (by perhaps 20 percent), especially if "the law of diminishing returns" applies to nutrient utilization, so that a low nutrient intake is used with greater efficiency, particularly from animal products.

The eggs and meat will provide the girl with all the critical amino acids and vitamin K she needs, 30 percent of the RDI for folate, 66 percent for vitamin B12, 30 percent for biotin and 29 percent for iodine.

Iron is especially important and often deficient, particularly in the diet of women in developing countries. It is known that the iron in meat and, to a lesser extent eggs, is highly available, unlike the iron in vegetables; the iron in the chicken meat and eggs in Table 1 is likely to meet more than 14 percent of the girl's daily requirement.

TABLE 1

Contributions of nutrients from 22 g/day of chicken meat and 36 g/day of eggs in the diet of a three-year-old girl

	Meat	Eggs	Total	% RDI*
Lysine (mg)	398	310	768	> 100
Meth + cyst (mg)	212	252	464	> 100
Tryptophan (mg)	55	76	131	> 100
Threonine (mg)	194	230	424	> 100
Niacin (mg)	2.0	0.04	2.04	20
Folic acid (µg)	11	34	45	30
B12 (µg)	0.55	0.11	0.66	66
Vitamin K (µg)	12	2	14	> 100
Iodine (µg)	12	14	26	29
Iron (mg)	0.3	0.7	1.0	14
Zinc (mg)	0.3	0.5	0.8	11

* RDI for an infant of three to four years of age, if known, otherwise RDI for an adult.

FOLIC ACID IN POULTRY MEAT AND EGGS IS ESPECIALLY IMPORTANT DURING PREGNANCY

Folic acid deficiency is of major concern in almost all developing countries and has been shown to lead to neural tube defects. These can occur very early in pregnancy, resulting in severe defects of the brain and spinal cord, stillbirths and early child mortality. A recent survey in Uttar Pradesh (India) (Cherian et al., 2005) found that neural tube defects ranged from 3.9 to 8.8 per 1 000 birth – the highest rate in the world. Green leafy vegetables and fruit are good sources of folic acid, but up to half can be lost in cooking. Assuming that she is not a vegetarian, the 45 µg in the meat and eggs shown in Table 1, will provide a pregnant woman with 23 percent of her RDI for folic acid (200 µg/day, although this figure varies widely). The folic acid concentration in eggs can be increased substantially by feeding hens a folic acid-enriched diet.

THE FAMILY ALSO BENEFITS FROM THE DIETARY ADDITION OF MEAT AND EGGS

The family of the infant girl in Table 1 will also benefit through supplementation of their diets with their shares of poultry meat and eggs. Even when only half of the meat and eggs in Table 1 are provided, they will still have a highly beneficial effect on a child by reducing many of the signs associated with a dietary protein deficiency such as low growth, kwashiorkor and poor mental function.

CONCLUSIONS

Poultry meat and eggs are widely available, relatively inexpensive and can be of central importance in helping to meet shortfalls in essential nutrients, particularly of impoverished people. The incidence of several common metabolic diseases associated with deficiencies of critical dietary minerals, vitamins and amino acids can be reduced by the contribution of poultry products rich in all essential nutrients except vitamin C.

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Increasing the nutrient content of chicken eggs to improve human health

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Over the past 20 years, there has been considerable interest in chicken eggs as carriers of critical nutrients (Miles, 1998). This has implications for improved nutritional status, particularly of low-income people in developing countries. The technology simply entails increasing the content of some nutrients in hens' diets. Several vitamins (folic acid, B12, vitamin E) can be increased in chicken eggs. Examples of two trace minerals are given in the following.

THE BENEFITS OF INCREASING THE IODINE CONTENT OF THE HEN'S EGG

About 1 billion people, mainly in developing countries, suffer from iodine deficiency, especially in India, Africa and China, often with serious consequences. Iodine has several functions, especially as a component of two hormones (T4 and T3) in the thyroid gland. As a result of iodine insufficiency, slow brain development in the foetus can result in stillbirth or mental retardation in the infant, and in goitre, mainly in adults. Villagers without access to marine food sources and in areas where soils are depleted of iodine are particularly at risk. Vegetables and grains grown on iodine-deficient soils lack iodine, and even when they have the minimum level, much can be lost in cooking. Iodized salt is one long-term solution to this problem. It has been introduced into many provinces in China since 1995, but has not yet reached all provinces.

A hen's egg normally contains about 53 µg iodine/100 g edible portion, which is about 33 percent of the recommended dietary intake (RDI), although this varies. Inexpensive supplementation of a hen's diet with 5 mg of potassium iodide per kilogram of feed does not affect the bird's performance, but increases the iodine content of a 60-g egg from 26 to 88 µg; this is more than 50 percent of an adult's RDI (Röttger *et al.*, 2008).

THE BENEFITS OF INCREASING THE SELENIUM CONTENT OF THE HEN'S EGG

The role of selenium, known to be a potent antioxidant, has recently received considerable attention (Surai and Dvorska, 2001). Selenium is involved in the proper functioning of the immune system and in reducing or inhibiting the progression of HIV to AIDS. This disease is less prevalent in countries where soil has a high selenium content than in countries with a low soil level (Jaques, 2006). Selenium is also required for sperm motility, and may reduce the risk of miscarriage.

The United States Department of Agriculture has allowed the statement, "selenium may reduce the risk of some forms of cancer". It is particularly important in reducing the incidence of prostate cancer. A deficiency of selenium can have an adverse effect on mood states, especially depression, and may be associated with several other health-related problems, including heart

disease (Keshan's disease). The conversion of thyroxine (T4) to the biologically active triiodothyronine (T3) also involves selenium.

One problem with selenium is that, unlike iodine, there are few specific symptoms of deficiency; consequently an obvious deficiency (with few exceptions) has not been recognized, although it may affect general well-being.

Selenium in plants depends very much on soil concentrations. Seafoods are a rich source, as are some livestock products, including eggs and chicken meat. Again, the amount reflects the selenium content of the poultry feed. Because humans' daily intake of selenium is relatively low, eggs are an ideal carrier of the trace mineral; there is a maximum amount that can be transferred from feed, but transfer is efficient at low levels of inclusion. Selenium in the inorganic form is less efficient than in the organic form. Supplementation of a layer's diet with organic selenium at 0.4 mg/kg of feed will increase the content of 100-g of edible egg from 20 µg to about 60 µg – the minimum RDI of an adult.

CONCLUSIONS

Eggs are an ideal carrier for enriching human diets with some important dietary minerals. The advantages of this approach is that it is unlikely to exceed the minerals' safe upper limits in humans because the amounts sequestered into the eggs are limited, irrespective of the levels in the hens' diet, and quickly reach a plateau.

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The omega-3 fatty acids

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TWO GROUPS OF POLYUNSATURATED FATS

There are two families of the polyunsaturated fatty acids (PUFAs) that are essential in human diets: omega (n)-3 fats and omega (n)-6 fats. Linoleic acid (LA), an n-6 fatty acid, is quite common in foods and in most seeds containing vegetable oil, and a LA deficiency is unlikely. Very few plant foods contain the n-3 fats, however, although some oilseeds (rape seed, soybean, walnuts) contain small amounts, while flax seed is rich in alpha-linolenic acid (n-3, ALA), which makes up 22 percent of the oil. Most people living in developing countries are likely to have insufficient n-3 PUFAs in their diet.

The importance of n-3 PUFAs in human health has only recently been recognized. It ranges from protection against some forms of cancer, several specific diseases and conditions (heart disease, brain development, learning ability, and inflammatory diseases such as asthma and rheumatoid arthritis) to general well-being (Anonymous, 2002).

SOME N-3 FATS ARE MORE POTENT THAN OTHERS

To be effective, ALA must first be converted into active forms (eicosapentaenoic acid, [EPA] and docosahexaenoic acid [DHA]) in the body. This is done inefficiently or not at all in the elderly and the very young. Human breastmilk contains significant but variable amounts of EPA and DHA, which can be increased by providing the mother with an n-3 fatty acid-enriched diet to the benefit of the suckling infant. Infant formula, unless supplemented with these fats (which is uncommon in developing countries), contains few or none of them.

THE RATIO OF N-6 TO N-3 IS IMPORTANT

An important feature of these essential fats is the ratio of n-6 to n-3 in the diet. Ideally, this should be less than 4:1 (as in human milk) but in practice it is usually more than 20:1 and probably much higher in developing countries, especially where there may be no access to seafoods, the major source of EPA and DHA. In the human body, this imbalance results in the rapid conversion of linoleic acid into the active form arachidonic acid (n-6), resulting in the production of pro-inflammatory compounds. High levels of linoleic acid elevate thromboxane, which stimulates platelet aggregation, leading to arterial blockage and a possible heart attack.

ELONGATION OF N-3 FATS AND THEIR ENRICHMENT IN EGGS

Chickens have the unusual ability of rapidly converting ALA into DHA in significant quantities, and to EPA in lesser amounts. This means that eggs can be enriched with these important fats, provided that there is an adequate supply of ALA in the hens' diet.

The diet of hens usually contains some of the n-3 fats, and 100 g of edible egg typically contains 150 mg of total n-3; of this, DHA + EPA is about 20 mg. By adding 10 percent flax seed (2 percent ALA) to the diet of layers, the total n-3 will rise to more than 600 mg/100 g. About one-third of this will be DHA + EPA. Rape seed oil and rape seeds can also be used to enrich eggs with n-3 PUFAs, but result in lower concentrations. These oil and flax seeds are grown in many developing countries. When included in layer diets, fishmeal, fish waste and fish oil can also increase the n-3 PUFAs in eggs, almost exclusively as EPA and DHA, but if used in too high amounts may cause a fishy taint in the eggs.

HOW MUCH OF THE N-3 FATS DO WE NEED?

Although there is no agreed recommended dietary intake (RDI) for the n-3 fats, some suggest an intake for adults of 2 to 3 g of total n-3 fats per day, of which DHA + EPA should be 0.6 to 0.8 g. An enriched egg can therefore make a significant contribution to these requirements. Requirements for children are not known, but are likely to be considerably less than those suggested for adults. One difficulty is maintaining the critical n-6 to n-3 balance. This normally means reducing the intake of foods containing significant levels of the most commonly used vegetable oils that contain n-6 PUFAs.

CONCLUSIONS

An increasing body of information highlights the importance of the n-3 fats in human health. They are especially important during pregnancy and early infant development. Seafood, the main source of the important EPA and DHA, is becoming expensive, and its consumption is falling. There is generally a severe dietary deficiency of these n-3 fats in both developing and developed countries worldwide, causing a gross imbalance with the n-6 fats and leading to adverse health consequences. The contribution of enriched eggs will become increasingly important, especially to vegetarians, whose diet has only ALA and little or no EPA and DHA.

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How important is cholesterol in eggs?

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During the 1990s there was a drastic decline in egg consumption in the developed world. This was due to concerns about the high cholesterol content of eggs, which stemmed from the perceived effects of cholesterol on coronary heart disease (CHD). In fact blood cholesterol level ranks only about fourth or fifth in the risk factors for CHD. Smoking, excessive bodyweight, lack of exercise, hypertension and stress are other important factors, but publicity about the unproven effects of dietary cholesterol on CHD had a major impact on the sale of cholesterol-rich foods, particularly eggs, even though it has been shown that dietary factors may account for only 25 percent of all causes of elevated blood cholesterol (Narahari, 2003).

A 60-g egg contains about 200 mg of cholesterol. The standard daily recommended maximum intake of cholesterol is 300 mg.

IMPORTANT FACTS ABOUT CHOLESTEROL

There are two not widely known facts: i) cholesterol must be in the oxidized (rancid) form to cause the arterial plaques that lead to partial blockage of the blood vessels; and ii) some forms of cholesterol are beneficial. High-density lipoprotein cholesterol (HDL) protects against heart disease by mopping up circulating cholesterol. The culprit is the low-density lipoprotein cholesterol (LDL) in the oxidized form that narrows or “hardens” the arteries. One way of counteracting this process is therefore to eat foods rich in natural antioxidants.

A third important point is that the fat in eggs is in the unusual form of emulsified oil, almost half of which is made up of healthy monounsaturated fats. This combination probably minimizes the effect of eggs on blood cholesterol.

Cholesterol is not a dietary requirement although it is found in almost every cell in the body, particularly in the brain and nervous tissue. The liver produces up to 2 000 mg per day. Only about 50 percent of dietary cholesterol is absorbed, while the rest is excreted.

INDIVIDUALS MAY RESPOND DIFFERENTLY TO DIETARY CHOLESTEROL

Not everyone responds to dietary cholesterol. There are hypo- and hyper-responders (85 and 15 percent of the population respectively). In one experiment (Elkin, 2006), men and women were given 21 eggs per person per week, amounting to about 640 mg of cholesterol per day. Plasma LDL did not change in the hypo-responders; in the hyper-responder group it increased by a small but statistically significant amount (10 to 15 mg/dL). Given the unrealistically high consumption of eggs in this study (three per day), it is surprising that the hypo-responder group did not also show an increase in LDL cholesterol.

REDUCING BLOOD CHOLESTEROL WITH DRUGS

Statins are a group of drugs that inhibit the enzyme HMG-CoA reductase from converting HMG-CoA into mevalonate – an early step in the synthesis of cholesterol. Given the very wide functions of cholesterol, this could be thought to be a retrograde step, but apparently it is not. Consequently, statins frequently account for a very large share of drug sales, as they are routinely prescribed even for people with only mildly elevated cholesterol, who then often stay on them for life.

CAN EGG CHOLESTEROL BE REDUCED?

Attempts have been made to lower the cholesterol in eggs (Elkin, 2007) by feeding different grains to layers, which may reduce egg cholesterol by about 10 percent. Feeding copper at 125 or 250 parts per million (ppm) can reduce cholesterol in eggs by up to 31 percent. Feeding garlic as a paste at up to 8 percent of the diet may reduce egg cholesterol by as much as 24 percent, but there is wide variation. Other natural products have also shown significant but inconsistent responses. Genetic selection for low and high egg cholesterol has met with little success. Although the cholesterol content of the egg is well in excess of that needed for embryo development, reducing egg cholesterol beyond a certain point can decrease hatchability and/or egg production.

CAN WE REDUCE ABSORPTION OF CHOLESTEROL IN FOOD?

Excess cholesterol is removed from the liver as HDL cholesterol, or largely converted into bile salts, then passed into the ileum, absorbed back into the blood stream and returned to the liver. Some continues to the colon and is excreted as bile acids. Compounds such as insoluble dietary fibre and saponins, found in plants (especially the yucca tree), can bind cholesterol in the small intestine, causing it to be excreted. Fibre also increases the rate of food passage, thereby reducing the opportunity to recycle cholesterol via the lower ileum.

HOW MANY EGGS SHOULD WE EAT?

Nearly half (45 percent) of the public in the United Kingdom still believe that they should be eating a maximum of three eggs a week. A recent article in the British Nutrition Foundation's *Nutrition Bulletin* (2009, 34(1): 66–70) reveals that misconceptions about eggs and cholesterol stem largely from incorrect conclusions drawn from early research.

Many heart and lung health organizations have done a complete turn-about and some have even given eggs the “heart tick” of approval. Although the recommendation of 300 mg of cho-

lesterol per day as the upper level still stands, there is general consensus that one egg a day will do no harm – not that the cholesterol content of the egg has changed in the meantime.

Many nutrition and health advisory bodies may have been influenced by several recent scientific papers, which have dispelled myths around eggs and cholesterol. Australian, Canadian and Irish heart foundations and the British Nutrition Foundation have raised their guideline limits in accordance with recent findings that there is no conclusive evidence to link egg consumption with an increased risk of heart disease.

PUBLIC PERCEPTION OF EGGS IS DIFFICULT TO CHANGE

Concern about a link between cholesterol in eggs and risk factors for heart disease is difficult to dispel. Many people living in developing countries still believe in the dangers of eating eggs, even though they would be the least at risk. Except for the few most affluent people, the staple diet in developing countries is mainly plant-based and contains only small amounts of cholesterol.

CONCLUSIONS

Consumption of one egg per day will have no effect on blood cholesterol; recent research suggests that two per day will also have no significant effect for most of the population. The conclusion is that eggs are not detrimental to human health and that for those in low-income countries, eggs are very important for good health and well-being, and their consumption should be encouraged.

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