

Egg Yolk: to Eat or not to Eat

Debabrata Biswas and Debabrata Roy*

Department of Cardiology, NH- Rabindranath Tagore International Institute of Cardiac Sciences, India

Corresponding author: Debabrata Roy, MD, DM, FACC, FSCAI, FESC, FAHA, FJCS, Senior Consultant Interventional Cardiologist, Academic Co-ordinator, Department of Cardiology, NH-RTIICS, Kolkata, India

Editorial

A healthy diet is essential for the prevention and treatment of cardiometabolic diseases, including type 2 Diabetes Mellitus (DM), obesity, hypertension, Coronary Heart Disease (CHD), and stroke [1]. Over the last decades, dietary cholesterol has been the major focus due to the relationship between elevated serum cholesterol and increased risk of CVD [2]. AHA/ACC recommends the Therapeutic Lifestyle Changes (TLC) and the Dietary Approaches to Stop Hypertension (DASH) diet to help preventing the development of CVD. The TLC and the DASH diet recommended consuming less than 200 mg and 150 mg of cholesterol per day, respectively [3,4]. Of note, the 2015-2020 Dietary Guidelines for Americans [5] have removed the recommendation of limiting cholesterol intake to no more than 300 mg/day; however, the guidelines

stated that “individuals should eat as little dietary cholesterol as possible while consuming a healthy eating pattern.” Considering egg is a rich source of dietary cholesterol (200–300 mg/100 g, about 180 mg per medium egg), individuals with increased risk for CVD are often advised against consuming eggs [6]. However, current evidence on the association between dietary cholesterol and CVD risk yields conflicting results.

Studies showing neutral/ protective role of eggs

The ATTICA study, which was a prospective, observational cohort investigation (2002–2012), examined the association of egg intake with 10-year risk of Cardiovascular Disease (CVD) and other cardiometabolic risk factors in a sample of 2020 individuals of Mediterranean origin. The participants were grouped into tertiles based on their

egg consumption from lowest (<1 serving/week) to intermediate (1–4 servings/week) and high (4–7 servings/week). Unadjusted analysis revealed lower risk of developing CVD in intermediate (1–3 eggs/week) and high (4–7 eggs/week) egg consumption group compared with the reference group (<1 egg/week). Multi-adjusted analysis revealed that in participants of low Saturated Fat intake, 1 serving/day increase in egg intake resulted in 45% lower risk of developing CVD [7]. Godos J et al. [8] performed a meta-analysis on 39 studies from MEDLINE, Embase, and Web of Science databases involving nearly 2 million individuals and 85,053 CHD, 25,103 stroke, 7536 heart failure, and 147,124 CVD cases among them. The summary analysis showed that intake of up to six eggs per week is inversely associated with CVD events, when compared to no consumption [for four eggs per week, SRR = 0.95 (95% CI: 0.90; 1.00)]. However, they concluded that there is no conclusive evidence on the role of egg in CVD risk and higher quality studies are warranted to obtain stronger evidence for a possible protective role of moderate weekly egg consumption on CVD.

Studies showing harmful effects of eggs

In a pooled analysis of data involving 29,615 Americans and following them up for a median of 17.5 years, there was a dose-dependent increase in cardiovascular risk with both dietary cholesterol and egg consumption [9]. Egg yolk has high Phosphatidylcholine content, which is converted to Trimethylamine by intestinal bacteria. This Trimethylamine is oxidized in the liver to Trimethylamine N-Oxide (TMAO), which is responsible for atherosclerosis in an animal model. Among 4007 patients referred to the Cleveland Clinic

for coronary angiograms, the 3-year risk of myocardial infarction, stroke, or vascular death was 2.5-fold higher among those having TMAO levels in the top quartile [10]. Eggs have also been implicated in increasing the risk of type 2 diabetes mellitus. An increase in the risk of type 2 diabetes mellitus with egg consumption was confirmed in several recent meta-analyses. In a prospective study involving 20,703 men from the Physicians' Health Study I (1982–2007) and 36,295 women from the Women's Health Study (1992–2007), 1,921 men and 2,112 women developed type 2 diabetes during mean follow-up of 20.0 years in men and 11.7 years in women. Data suggested that high levels of egg consumption (daily) are associated with an increased risk of type 2 diabetes in men and women [11].

Egg Consumption by Individuals at Lower Risk for CVD

Multiple groups of researchers have examined the potential lipid modulating effects of eggs in low- and high-risk individuals alike. A study conducted on college students aged 17-20, concluded that ingestion of two eggs as part of breakfast five times per week for 14 weeks resulted in similar blood lipid concentrations when compared to an egg-free, breakfast of same calorie [12]. Eggs are highly nutritious food providing good quality proteins as well as micronutrients, anti-oxidants, antimicrobials and comes with great culinary versatility, which have positive impact on overall health. In addition to protein, eggs also contain a large number of active lipid components, such as unsaturated fatty acids, phospholipids, choline, and carotenoids. Eggs are considered a valuable source of omega-3 polyunsaturated fatty acids, which have been considered to exert a number of health benefits,

including CVD protection [13]. Eggs are also a rich source of xanthophyll carotenoids, such as lutein and zeaxanthin, which are anti-oxidants and may protect against lipid oxidation [14]. Keeping these facts in mind, people with low ASCVD risk factor should not be advised against consuming egg-yolk. A consumption level of 2–4 eggs/week is the current recommendation of most health bodies and international guidelines.

Egg Consumption by Individuals at Higher Risk for CVD

Patients with significant ASCVD risk should limit their cholesterol intake to less than 200 mg/day [15]. Depending on the size, a single egg yolk contains around 215 mg to 275 mg of cholesterol. Thus, a single egg yolk daily exceeds the recommended daily intake of cholesterol for high-risk patients [16]. Consumption of egg-yolk increases cardiovascular risk attributable to its postprandial effects. There is a marked increase in the oxidation of LDL-C, endothelial dysfunction and arterial inflammation \approx 4 hours after meal; after fatty breakfast or lunch the endothelium is exposed to sugars, fats, cholesterol and free radicals from that meal, on top of the baseline. Hence, postprandial levels of lipids are at least as predictive of risk as fasting lipid levels [16]. Diabetic patients have higher propensity to be impacted by the ill effects of egg yolk. The Health Professionals Study – including physicians and nurses showed a doubling of cardiovascular disease in men who became diabetic during the course of the study. Also, it showed a significant increase in new-onset diabetes with regular egg consumption [17].

Egg yolk and meat are particularly harmful in people with impaired kidney function, including

the elderly. Egg yolk-derived toxic intestinal metabolites (after its interaction with intestinal microbiota) like TMAO, p-cresyl sulfate, p-cresyl glucuronide, and phenylacetyl-glutamine are 50-fold to 100-fold higher in people on dialysis than people with good kidney function [10]. The inconsistency of current findings on egg consumption and risk of CVD can be attributable to the variability of response to dietary cholesterol between individuals, difference in saturated fat intake and the overall dietary and lifestyle framework within populations and individuals including carbohydrate-rich diet, physical activity, smoking and so on. No single study has successfully taken care of all the confounding factors. Nevertheless, in this era when physical inactivity, obesity and diabetes are increasing globally, it is prudent to stick to the longstanding recommendations on limiting cholesterol consumption and focus on moderation of cholesterol-rich food like egg yolk, at least in patients with established ASCVD risk.

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Citation of this Article

Biswas D and Roy D. Egg Yolk: to Eat or not to Eat. Mega J Case Rep. 2024;7(10):2001-2005.

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