

This edition of Nutrition Research Update highlights research from the Experimental Biology (EB) conference which took place this week in Boston. As always, it was fascinating to see the variety of nutrition research discussed at EB. In this issue, we have highlighted a few of the studies presented which examine the association between intake of eggs or egg nutrients and various indices of health and disease. We hope that you will find these topics interesting and applicable to your practice.

If you have any questions about the studies or concepts presented, do not hesitate to contact us at info@eggnutrition.org.

Regards,



Mitchell Kanter, PhD
Executive Director, The Egg Nutrition Center

SPECIAL FEATURE

Effects of egg intake on HDL composition and function in metabolic syndrome.

By: Catherine Andersen, PhD Candidate & Graduate Research Asst. University of Connecticut, Department of Nutritional Sciences

Metabolic syndrome (MetS) is a growing health concern that increases an individual's risk of cardiovascular disease and type II diabetes by 2- and 5-fold, respectively. Research studies have consistently demonstrated that carbohydrate-restricted diets effectively ameliorate atherogenic dyslipidemia, insulin resistance, and inflammation in MetS...[read full article](#).

BREAKING RESEARCH FROM EXPERIMENTAL BIOLOGY

Eggs Consumption in Older Adults has No Adverse Effect on Serum Lipids

A study involving 45 adults diagnosed with early age-related macular degeneration (AMD) investigated the effects of consuming 12 eggs per week (intervention group) for one year on blood lipids, lipoprotein cholesterol, apolipoprotein A-1 and B, lipoprotein a, and C-reactive protein¹. The control group did not consume eggs for one year. The investigators...[read full article](#).

Eggs as part of Nutrition Education for Low-Income Women

Investigators examined egg intake patterns among females in federally-funded nutrition education programs and determined amount, source and cost of eggs¹. Whole eggs alone, egg white alone, visible egg (where eggs were visible as part of a larger food item like an egg sandwich), and hidden egg sources...[read full article](#).

Focusing on Dietary Patterns Versus Specific Foods

Using the NHANES 2001-2008 database, researchers examined foods typically consumed with eggs and developed eight egg consumption patterns¹. The researchers then studied the differing effects of those egg consumption patterns on nutrient intake, diet quality, BMI, waist circumference...[read full article](#).



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Effects of egg intake on HDL composition and function in metabolic syndrome.

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Metabolic syndrome (MetS) is a growing health concern that increases an individual's risk of cardiovascular disease and type II diabetes by 2- and 5-fold, respectively. Research studies have consistently demonstrated that carbohydrate-restricted diets effectively ameliorate atherogenic dyslipidemia, insulin resistance, and inflammation in MetS. Recent studies from the laboratory of Dr. Maria Luz Fernandez at the University of Connecticut have further demonstrated that the addition of daily whole egg consumption improves markers of HDL metabolism in this population, including increases in plasma HDL-cholesterol, HDL particle size, HDL enrichment of antioxidant carotenoids, and reductions in the HDL-associated inflammatory protein serum amyloid A (SAA)^{1, 2}.

In a recent study published in *Lipids*³, we aimed to further assess whether the beneficial changes in HDL from daily egg intake corresponded with changes in HDL lipid composition and a greater cholesterol-accepting capacity of serum from MetS subjects. The cholesterol-accepting capacity of subject serum may be indicative of a greater potential for HDL to retrieve lipids from arteries to reduce cardiovascular disease risk⁴.

Men and women classified with MetS participated in a 12-week moderate carbohydrate-restricted diet (25-30% of energy from carbohydrates) in addition to consuming either 3 eggs per day or the equivalent amount of yolk-free egg substitute. Compared to baseline, HDL became more enriched in cholesteryl esters relative to triglycerides in both whole egg and egg substitute groups. Cholesteryl ester-rich HDL are associated with a reduced risk of cardiovascular disease⁵, whereas triglyceride-rich HDL undergo impaired metabolism^{6, 7}.

Additionally, egg intake altered HDL phospholipid composition by promoting phosphatidylethanolamine (PE) enrichment. Studies have suggested that enrichment of HDL with PE may confer greater anti-thrombotic activity of HDL⁸. Eggs are a good source of dietary PE, as PE is the second most prevalent class of phospholipids in whole eggs⁹. After 12 weeks of egg feeding, HDL similarly became more enriched in the specific sphingomyelin species present in the whole eggs, suggesting that the egg-derived phospholipids may become directly incorporated into HDL.

As a measure of the lipid-accepting capabilities of HDL, we further assessed whether egg intake impacted on the capacity of subject serum to accept radiolabeled cholesterol from macrophage foam cells. Interestingly, we found that egg intake significantly increased the cholesterol-accepting capacity of subject serum (+2.4%), whereas egg substitute intake had no effect. Evidence from another study suggests that this shift in cholesterol efflux is indicative of a clinically relevant improvement in cardiovascular health⁴.

In summary, we found that daily consumption of 3 whole eggs per day during carbohydrate restriction promotes favorable changes in HDL lipid composition and function in metabolic syndrome. Taken together with previously established benefits of egg intake on HDL profiles, these findings further support the notion that eggs serve as a functional food to reduce cardiovascular disease risk in a MetS population.

Sources:

¹Blesso CN, Andersen CJ, Barona J, Volek JS, Fernandez ML. Whole egg consumption improves lipoprotein profiles and insulin sensitivity to a greater extent than yolk-free egg substitute in individuals with metabolic syndrome. *Metabolism: Clinical and Experimental* 2013; 62:400-414

²Blesso CN, Andersen CJ, Bolling BW, Fernandez ML. Egg intake improves carotenoid status by increasing plasma HDL cholesterol in adults with metabolic syndrome. *Food & Function* 2013; 4:213-221.

³Andersen CJ, Blesso CN, Lee J, Barona J, Shah D, et al. Egg Consumption Modulates HDL Lipid Composition and Increases the Cholesterol-Accepting Capacity of Serum in Metabolic Syndrome. *Lipids* 2013; DOI 10.1007/s11745-013-3780-8

⁴Khera AV, Cuchel M, de la Llera-Moya M, et al. Cholesterol efflux capacity, high-density lipoprotein function, and atherosclerosis. *The New England Journal of Medicine* 2011; 364:127-35

⁵Arsenault BJ, Lemieux I, et al. HDL particle size and the risk of coronary heart disease in apparently healthy men and women: the EPIC-Norfolk prospective population study. *Atherosclerosis* 2009; 206:276-81

⁶Lamarche B, Uffelman KD, et al. Triglyceride enrichment of HDL enhances in vivo metabolic clearance of HDL apo A-I in healthy men. *The Journal of Clinical Investigation* 1999; 103:1191-9

⁷Skeggs JW, Morton RE. LDL and HDL enriched in triglyceride promote abnormal cholesterol transport. *Journal of Lipid Research* 2002; 43:1264-74

⁸Kontush A, Chapman MJ. Functionally defective high-density lipoprotein: a new therapeutic target at the crossroads of dyslipidemia, inflammation, and atherosclerosis. *Pharmacological Reviews* 2006; 58:342-74

⁹Weihrauch JL, Son Y-S. The Phospholipid Content of Foods. *Journal of the American Oil Chemists' Society* 1983; 60:1971-8

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Sources:

¹Wilson TA, Aljohi H, Kotyla E, Nelson MD. Consuming 12 eggs per week for 1 year does not alter serum lipids, lipoprotein cholesterol, or C-reactive protein in older adults. *Experimental Biology* 2013. Boston, MA. April 20, 2013.

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Sources:

¹Wei C, Lohse B. Profiles from assessment of amount, source, and cost of egg consumption by low-income women inform nutrition education intervention planning. *Experimental Biology* 2013. Boston, MA. April 20, 2013.

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Sources:

¹Nicklas TA, O'Neil CE, Fulgoni VL. Relationship between egg consumption patterns and nutrient intake, diet quality, weight measures, and cardiovascular risk factors (CVRF): 2001-2008 NHANES. *Experimental Biology* 2013. Boston, MA. April 20, 2013.



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