

Nutrition Close-Up

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Egg Nutrition Center
ENC

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EDITORIAL

Is It Time To Be More Objective About Dietary Cholesterol?

By
Mitch Kanter, Ph.D.
Executive Director,
Egg Nutrition Center



A recent LA Times editorial questioned the accuracy of some of the present dietary guidelines citing, for example, the long-stated recommendation that we drastically reduce egg consumption in an effort to limit cholesterol intake. The editorial goes on to quote a Journal of Nutrition article that looked at worldwide studies of egg consumption and concluded that the current restrictions on eating eggs “are not supported by scientific data.”

Similarly, in a recent review Fernandez (Curr Athero Rep, Aug 2010) discussed the perceived association between dietary cholesterol and the risk for coronary heart disease (CHD), stating that “dietary (cholesterol) recommendations proposed in the 1960s had little scientific evidence other than the known association between saturated fat and cholesterol, and animal studies where cholesterol was fed in amounts far exceeding normal intakes.” Further, the author cites recent epidemiological data demonstrating that increasing concentrations of dietary cholesterol are not correlated with increased risk in CHD.

Why this apparent about-face among some researchers with respect to dietary cholesterol? There are no easy answers. To a large extent, it probably has something to do with the unpredictable nature of nutrition research itself. While most scientists attempt to control as many variables as possible when designing a study, and appropriately power their studies by using adequate sample sizes, the fact remains that different people respond to nutrients and diets differently (J Lipid Res. 1984, 25:1442-1449). What might raise serum cholesterol in one individual may have no impact on a second individual. Hence, the “up-and-down” nature of nutrition research. One month vitamin E is the cure for heart disease; the next month it causes cancer in laboratory mice. Results like these confuse the public, confound researchers, and make it difficult for folks to break from established dogma.

“Over time, the hope is that emerging technologies such as nutrigenomics and epigenetics will allow researchers to more effectively recruit and classify subjects.”

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Recent USDA ARS Research Confirms Egg Cholesterol Lower Than Previously Reported.

By
 Marcia Greenblum, MS, RD
 Senior Director,
 Nutrition Education,
 Egg Nutrition Center



In the latest edition of the USDA National Nutrient Database for Standard Reference (SR #23) published this fall, the updated nutrient analysis data for raw, fresh, whole, eggs shows that a single large egg contains 186mg of dietary cholesterol. This is a 12% reduction from the 213mg found in a large egg approximately 10 years ago when the last USDA nutrient analysis was performed. The potential impact of this new data is huge—because now everyone, including people with heart disease risk factors, can enjoy an egg every day and still comply with dietary guidance set forth by the Dietary Guidelines Advisory Committee.

Interestingly, the new analysis indicates very little difference in other macro-nutrients contained in a large egg. An egg remains an excellent source of protein, has nearly no carbohydrates and is still quite low in saturated and total fat (1.6g and 5g resp.) Furthermore, the egg remains a nutrient dense source of 13 vitamins and minerals and a good natural source of vitamin D, choline, selenium, riboflavin and phosphorus. The variance in USDA published cholesterol values of an egg has been suspected for some time. In the book *Egg Science and Technology 4th ed* (1995) authors Stadelman and Cotterill make the point, *“Recent studies on the cholesterol content of eggs indicate that the amount is lower than the previously published values. Although the cholesterol content is now set at 213mg per egg, some health authorities believe that the level is still high.”* They go on to say, *“Although the egg has been targeted as a rich source of cholesterol, the egg provides an essential source of linoleic acid and the proportions of saturated: monounsaturated: polyunsaturated are balanced relative to the ratios suggested by the American Heart Association.”*

The reasons for the difference in cholesterol content since the last USDA analysis in 2000 are yet to be determined. Many authorities have offered theories to explain why only the cholesterol content and not the content of other nutrients varies significantly. Theories include selective breeding in which today’s hens don’t deposit as much cholesterol in their eggs, improved feed composition or the possibility of a more accurate methodology of cholesterol measurement. Further, Hargis

Nutrient Content of One Large Egg

whole, raw, fresh ^{1,2}

Nutrient		SR 23 50g	DV	% DV	
Energy	calories	72	2000	3.60%	
Protein	grams	6.28	50	12.56%	
Carbohydrate	grams	0.36	300	0.12%	
Total Fat	grams	4.75	65	7.31%	
Saturated Fat	grams	1.56	20	7.80%	
Cholesterol	milligrams	186	300	62.00%	
Choline	milligrams	126	550	23.00%	
Riboflavin	milligrams	0.23	1.7	13.53%	
Vitamin B12	microgm	0.45	6	7.50%	
Folate	microgm	24	400	6.00%	
Vitamin D	IU	41	400	10.00%	
Vitamin A	IU	270	5000	5.40%	
Vitamin B6	milligrams	0.09	2	4.50%	
Thiamin	milligrams	0.02	1.5	1.33%	
Vitamin E	milligrams	0.53	30	1.77%	
Selenium	microgm	15.4	70	22.00%	
Phosph	milligrams	99	1000	9.90%	
Iron	milligrams	0.88	18	4.89%	
Zinc	milligrams	0.65	15	4.33%	
Calcium	milligrams	28	1000	2.80%	
Sodium	milligrams	71	2400	2.96%	
Potassium	milligrams	69	3500	1.97%	
Magnesium	milligrams	6	400	1.50%	
Lutein and Zeaxanthin	microgm	252			
		10 and greater = good source		20 and greater = excellent source	

1: U.S. Department of Agriculture, Agricultural Research Service, 2010. USDA National Nutrient Database for Standard Reference, Release 23. Nutrient Data Laboratory Home Page: <http://www.ars.usda.gov/nutrientdata>
 2: Discrepancies between nutrient levels in the white+yolk vs. the whole egg are due to sampling error.

suggests that *“an increased rate of egg production results in lower levels of egg yolk cholesterol which may account for the lower levels of cholesterol in today’s eggs”*. The Egg Nutrition Center is preparing a white paper to further explore why eggs have less cholesterol than the eggs we ate 10 years ago.

Whatever the reason, it’s good to know that an egg can fit into everyone’s daily diet. ✨

“An egg remains an excellent source of protein, has nearly no carbohydrates and is still quite low in saturated and total fat.”

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Dietary Cholesterol?

Change comes slowly in the scientific community. Oftentimes when a researcher takes a poke at a long-held belief, he or she is met initially with skepticism. How many folks, for example, have been quick to embrace the findings of the recent meta analysis by Siri-Tarino et al. (Am J Clin Nutr. 2010 Mar;91(3):535-46) which stated that *“there is no significant evidence for concluding that dietary saturated fat is associated with an increased risk of CHD or CVD.”* Not many, at this point. Forty years or more of published research and established recommendations won't likely be swept away by one well done meta analysis. It's going to take more well-controlled studies in the future to turn that boat around.

This will likely be the case with dietary cholesterol as well among a cadre of skeptical nutrition scientists, although data indicating the tenuous nature of the dietary cholesterol/CHD relationship has been building for some time. Despite the aforementioned paper by Fernandez and a similar review by Sutherland and Kaley (Nutrition Today, 2010, 45(4): 147-153), as well as the numerous epidemiological and experimental trials published in recent years indicating no effect of dietary cholesterol on CHD risk, a number of scientists and regulators, particularly in the U.S., remain to be convinced.

Over time, the hope is that emerging technologies such as nutrigenomics and epigenetics will allow researchers to more effectively recruit and classify subjects, and more accurately assess the impact of individual nutrients on short and long term health. When that time arrives, clinicians should be in a better position to differentiate individuals who might be best served by limiting dietary cholesterol from those who require no dietary restrictions. Until that time arrives, however, we're left to decipher an inconsistent literature through the lens of our own beliefs and biases.

One important thing that these recent reviews and meta analyses do is re-open questions whose answers have largely been accepted in the medical and lay communities for a long time. They provide new researchers with topics to investigate and, hopefully, they provoke established researchers to re-think long-held beliefs in an open minded fashion. And that, after all, is really what science is supposed to be about. ✨

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MESSAGES

- There was a 12% reduction (186mg) in cholesterol from the value found in a large egg approximately 10 years ago when the last USDA nutrient analysis was performed on the whole, raw, egg.
- The USDA analysis (SR #23) showed few differences for nutrients other than cholesterol from the prior analysis in 2000.

High Quality Proteins Can Impact Circulating Homocysteine Levels.

By
Kevin L. Schalinske, Ph.D.

Professor, Department
of Food Science and
Human Nutrition,
Iowa State University



The amino acid composition of a protein can tell you a lot about its health implications. For example a protein source high in sulfur amino acids (methionine and cysteine) can affect methionine metabolism and, ultimately, health. Cysteine is a conditionally essential amino acid, because it can be synthesized endogenously from methionine. Thus, when a dietary protein provides enough methionine beyond the need for cellular protein synthesis, the remaining surplus can be used to synthesize cysteine. Therefore, when a dietary protein has a cysteine concentration in balance with methionine, the need to utilize methionine for its synthesis is reduced. This is often referred to as the methionine-sparing effect of cysteine.

What factors play a role in abnormal metabolism of homocysteine?

As mentioned, homocysteine is an intermediate in the methionine to cysteine pathway, and its metabolism is dependent on a number of essential compounds. This includes the B-vitamins folate, B6, B12, as well as betaine, a compound derived from choline. Collectively, these compounds function to re-methylate homocysteine and convert it back to methionine, and thus supply another methyl group to SAM. Two distinct pathways, one dependent on folate/ B12 and the other on choline/ betaine, have the ability to provide a methyl group to homocysteine and regenerate methionine. Conversely, homocysteine can

“Aberrant homocysteine metabolism has also been associated with diabetes, birth defects, other vascular diseases, cancer, and numerous neurological disorders.”

Why is the metabolism of methionine to cysteine important?

Besides ensuring adequate cysteine concentrations for protein synthesis, the metabolic pathways by which methionine is converted into cysteine, termed the transmethylation and transsulfuration pathways, are also important in providing methyl groups for a vast number of methylation reactions. The methyl group from methionine, in the form of S-adenosylmethionine (SAM), is the ubiquitous methyl donor in over 100 biological methylation reactions, such as the synthesis of creatine, phosphatidylcholine, and methylation of nucleic acids, an important mechanism in the control of gene expression.

A product of all SAM-dependent transmethylation reaction, prior to the formation of cysteine, is the production of the non-protein amino acid homocysteine. Homocysteine has received a considerable amount of attention in the last 20 years owing to the reports that high circulating levels of homocysteine (i.e., hyperhomocysteinemia) represents an independent risk factor for cardiovascular disease. Aberrant homocysteine metabolism has also been associated with diabetes, birth defects, other vascular diseases, cancer, and numerous neurological disorders.

be irreversibly catabolized to cysteine, a two-step process that also depends on B6. Regardless of which route homocysteine metabolism undergoes, a blockage of homocysteine metabolism, such as B-vitamin deficiency, results in its accumulation in tissues which eventually leads to high concentrations in the circulation.

How do sulfur amino acids and eggs impact hyperhomocysteinemia?

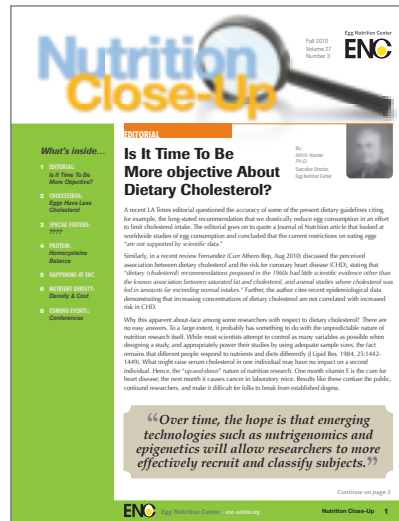
Clearly, an optimal supply of methionine and cysteine in the diet reduces the requirement for methionine to be utilized for conversion to cysteine, thereby allowing more homocysteine to be remethylated back to methionine as opposed to catabolized to cysteine. Therefore, dietary proteins that provide a greater balance and absolute amount of methionine and cysteine should optimize methyl group metabolism and aid in maintaining homocysteine balance.

Our laboratory has focused on evaluating dietary proteins based on their sulfur amino acid content and balance, in the context of their ability to prevent or attenuate hyperhomocysteinemia. As expected, dietary proteins with a high, balanced methionine and cysteine content could prevent the development of hyperhomocysteinemia and to date, egg white protein has been the most effective in this regard. Moreover, we have also begun to identify the mechanistic basis for egg white protein to prevent

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homocysteine accumulation. In addition to the methionine/ cysteine content of egg white protein, it also has the ability to increase expression of one of the enzymes that is involved in removing homocysteine by catalyzing remethylation. Thus, we speculate that the positive effect of egg white protein on modulating methyl group and homocysteine metabolism resides in (1) the optimal sulfur amino acid content, combined with (2) increased homocysteine remethylation.

High quality proteins such as egg white protein, particularly owing to their methionine and cysteine content, represents an excellent food source with respect to management of homocysteine. Moreover, whole eggs are the primary source of choline in the American diet, and as mentioned, choline can be oxidized to betaine which in turn serves as a source of methyl groups to remethylate homocysteine and provide methyl group supply as SAM. Therefore, eggs optimize methyl group and homocysteine metabolism from multiple nutritional avenues. ✨



If you enjoy receiving Nutrition CloseUp newsletter and wish to receive it electronically please go to www.enc-online.org (in the lower left) and submit your email address. In addition, you can keep up on current issues in nutrition by letting us know that you'd like to receive the Nutrition Research Update electronically as well. ✨

Keeping Your Eggs Healthy.

In recognition of the recent salmonella outbreak that led to the recall of eggs in many parts of the country this summer, America's egg farmers issued a statement urging consumers to thoroughly cook their eggs. Eggs should be cooked until the whites and yolks are firm or, for dishes containing eggs, until an internal temperature of 160 degrees Fahrenheit is reached. Thoroughly cooked eggs are thoroughly safe eggs, according to the Center for Disease Control (CDC) and the Food and Drug Administration (FDA).

In addition to thorough cooking, other safe food-handling practices include the following simple steps:

- Thoroughly clean your hands, as well as the surfaces and utensils that come into contact with raw eggs - an important step for avoiding cross-contamination.
- Separate eggs from other foods in your grocery cart, grocery bags and in the refrigerator to prevent cross-contamination.
- Keep eggs in the main section of the refrigerator at a temperature between 33 and 40 degrees Fahrenheit, and eggs accidentally left at room temperature should be discarded after two hours, or one hour in warm weather.

For more information and recommended handling, cooking and storage guidelines, visit: www.fightbac.org or www.eggsafety.org. ✨

MESSAGES

- When a dietary protein has a cysteine concentration in balance with methionine, the need to utilize methionine for its synthesis is reduced. This is often referred to as the methionine-sparing effect of cysteine.
- High quality proteins such as egg white protein, particularly owing to their methionine and cysteine content, represents an excellent food source with respect to management of homocysteine.

Balancing Nutrient Density & Cost.

By
 Adam Drewnowski, Ph.D.
 Director, UW Center for
 Obesity Research University
 of Washington, Seattle, WA



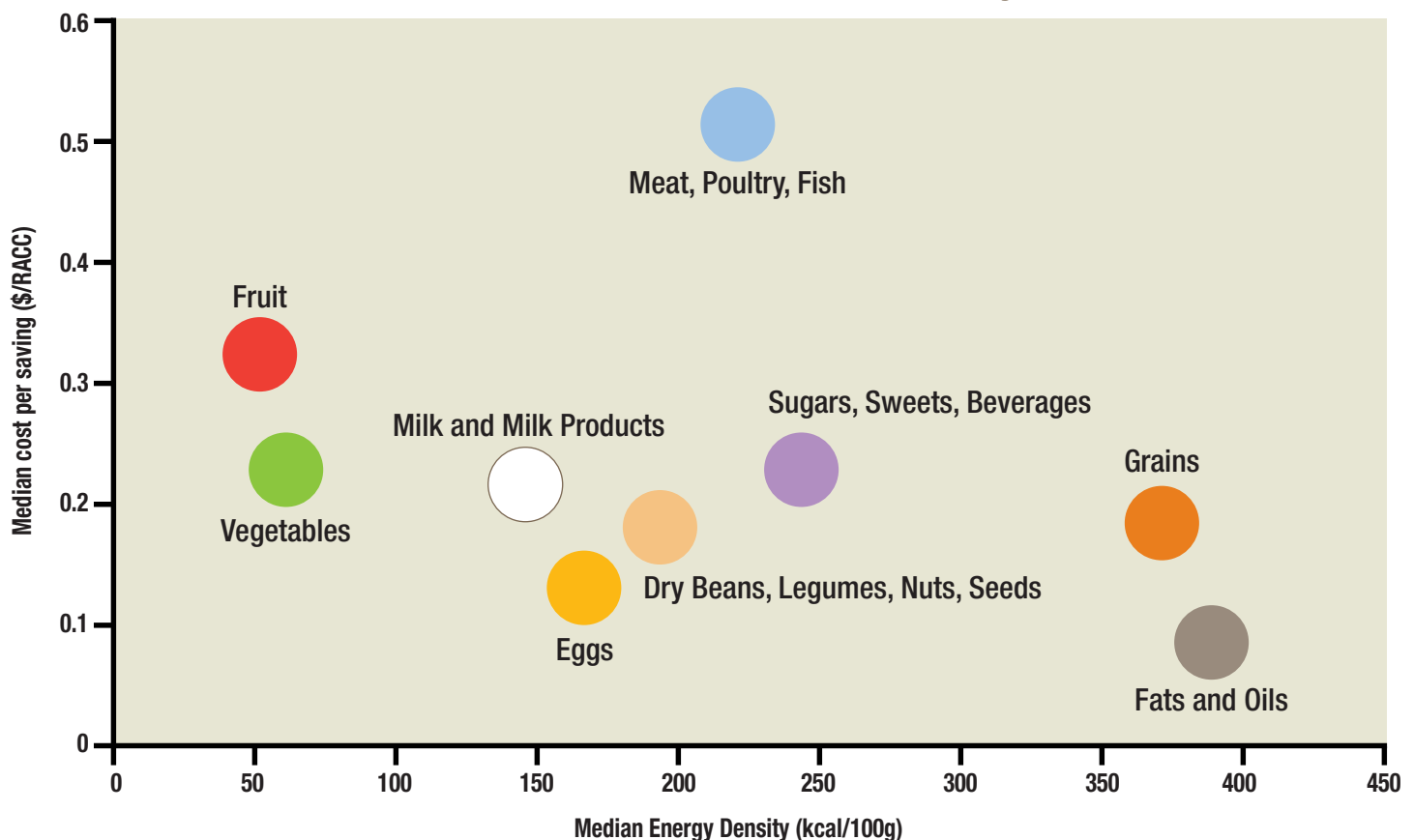
There is a yawning gap between the foods that Americans are advised to eat and the foods they do eat. To fix the problem, the 2010 Dietary Guidelines Advisory Committee (DGAC) recommended that Americans adopt a more plant-based diet, one that did not involve more corn, more soybeans, or more sugar cane. Instead, the DGAC emphasized other plant foods: vegetables, fruits, whole grains, cooked dry beans and peas, and nuts and seeds. The recommended animal products were limited to seafood; fat-free and low-fat milk and milk products, and to moderate amounts of lean meats, poultry, and eggs.

Achieving a nutrient dense diet through nutrient dense foods was the stated goal. In general, nutrient dense foods are those that provide relatively more nutrients than calories. The new definition of nutrient density zeroed in on intact or minimally processed foods without solid fats and added sugars (SoFAS), starches, or sodium. Ideally, a diet composed of such foods should provide of a full complement of key nutrients.

“Nutrient density scores can also be used to identify foods that are both nutrient dense and affordable.”

Figure 1:

Median energy density (kcal/g) and median cost per serving (\$/RACC) where RACC = reference amount customarily consumed.



However, diets composed of seafood and fresh produce are also likely to cost more. Analyses of US Department of Agriculture's nutrient and prices data (see Figure 1) confirmed that vegetables, fruit, and fluid milk were low energy density foods. Energy density of foods (kcal/g) is largely driven by their water content, since water adds to food weight but provides no calories and no nutrients. Whereas fats, grains, and sweets were dry and energy dense, vegetables, fruit, milk, and eggs were all nutrient rich.

However, some nutrient rich foods tend to cost more. In particular, seafood, lean meats, and fresh produce cost more per calorie or per serving than do fats or sweets. The differential cost is also shown in **Figure 1**. Recognizing that not everyone could afford the recommended diets, the DGAC called for financial incentives to help more Americans purchase healthy foods, including affordable fresh produce.

Affordable nutrient dense eggs should not be overlooked. **Figure 1** shows that eggs had low energy density and much lower cost per serving than either vegetables or fruit groups. Further analyses showed that eggs provided nutrient density at low cost.

Table 1:

Median cost in dollars for 100% DV of selected nutrients by food group.

USDA food group	Milk and milk products	Meat, poultry, fish	Eggs	Dry beans, legumes, nuts, seeds	Vegetables
n =	134	196	8	62	257
Nutrients	\$	\$	\$	\$	\$
Protein	2.19	1.87	0.99	1.47	6.77
Vitamin A	4.50	51.5	1.95	68.5	10.2
Calcium	1.53	36.5	3.81	7.15	10.4
Iron	28.3	8.57	3.15	3.32	6.93
Potassium	5.70	9.62	5.48	2.64	4.09
Zinc	4.66	4.46	3.05	2.69	11.8
Vitamin B12	3.91	5.57	1.47	24.4	12.6
Riboflavin	2.52	6.35	0.92	6.00	7.28

The lowest cost food sources for each nutrient are highlighted.

One way to identify affordable sources of key nutrients, including those of concern, is to calculate the estimated price for 100% Daily Value of that nutrient from every food group. Such a calculation, shown in **Table 1**, was based on USDA nutrient composition tables and USDA national food prices database. Eggs were the lowest cost source of several important nutrients, starting with high quality protein. Eggs were the lowest cost source of protein, vitamin A, vitamin B12, riboflavin and iron. Milk and dairy products were the lowest cost source of dietary calcium, whereas dry beans, legumes, nuts and seeds were the lowest cost sources of potassium and zinc. Fruit and juices were the lowest cost sources of vitamin C, whereas dry beans were the lowest cost source of fiber (not shown).

Another method of assessing a food's total nutritive value in relation to cost involves nutrient profiling. Nutrient profiling is the science of ranking or classifying foods based on their nutrient composition. The Nutrient Rich Foods (NRF) Index balances nine nutrients to encourage against three nutrients to limit in order to capture the total nutrient package. Nutrients to encourage are protein, fiber, vitamins A, C, and E, calcium, iron, potassium and magnesium, whereas nutrients to limit are saturated fat, added sugar, and sodium.

Nutrient profiling can identify the most nutrient rich foods within each food group. Nutrient density scores can also be used to identify foods that are both nutrient dense and affordable. The Affordable Nutrition Index (ANI) effectively measures nutrient density per dollar by dividing NRF scores per serving by price per serving. Among the highest scoring foods and food groups were citrus fruit and juices, eggs, milk, ready to eat cereals, potatoes, legumes, and beans.

Helping consumers identify affordable nutrient rich foods within and across food groups is the first step toward the implementation of the 2010 Dietary Guidelines. Nutrient profiles can also be used to identify those foods that are nutrient rich, affordable, appealing and best accepted by the consumer. Combining nutrient profiling, food prices, and the knowledge of people's food habits should be the basis for offering effective dietary advice to the American public. ☀

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 **MESSAGES**

- Some nutrient rich foods tend to cost more. In particular, seafood, lean meats, and fresh produce cost more per calorie or per serving than do fats or sweets.
- One way to identify affordable sources of key nutrients, including those of concern, is to calculate the estimated price for 100% Daily Value of that nutrient from every food group. Another method of assessing a food's total nutritive value in relation to cost involves nutrient profiling.

Credible Science Incredible Egg

Coming Events

American College of Nurse Practitioners National Clinical Conference

October 22 - 23, 2010
Tampa, Florida

Please visit the ENC booth #500
October 22 and 23

Breakfast Session
October 22, 2010, 7:00-8:45am

Speakers:

Mitch Kanter, Ph.D.,
Executive Director, Egg Nutrition Center

Marcia Greenblum, M.S., R.D., Senior Director,
Nutrition Education, Egg Nutrition Center

This session (free for ACNP registered attendees) will explore the latest research regarding protein intake as it relates to weight management, satiety, energy and the preservation of lean body mass. Attendees will gain an understanding of how patients can recognize these benefits by consuming a healthy diet including eggs. Research regarding the role of dietary cholesterol in heart health will also be discussed and participants will learn how to communicate the science into meaningful nutrition messages for their patients. Patient education



tools and resources will also be discussed and distributed. This session has been approved for 1.5 hours of continuing education for nurse practitioners. Attendees will also be eligible for five chances to win a year's supply of free eggs.

American Dietetic Association Food and Nutrition Conference and Exposition

November 5 - 9, 2010
Boston, Massachusetts

Please visit the ENC
booth #2849, in the Exhibit Hall
November 7, 8 and 9

The ENC staff will be distributing patient resources and discussing the latest nutrition science related to eggs with attendees. Scan your badge at the booth to donate an egg to the hungry and register to win great prizes including autographed nutrition books, a year's supply of free eggs and a donation in your name to a food assistance organization in your area.

ENC Mission Statement:

ENC is a credible source of nutrition and health science information and the acknowledged leader in research and education related to eggs.

Nutrition Close-Up is a quarterly publication that is produced by the Egg Nutrition Center.

Nutrition Close-Up presents up-to-date reviews, summaries and commentaries focused on the role of diet in health promotion and disease prevention, including the contributions of eggs to a nutritious and healthful diet.

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