

Nutrition Close-Up

Egg Nutrition Center



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SPECIAL FEATURE

Is Diet Quality Inversely Related to Health Outcomes?

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The use of diet quality indices has become widespread and often used to determine valid dietary guidance. Indices allow evaluation of the total diet in relationship to select nutrient intake, compliance with dietary recommendations, and chronic disease risk¹. An initial review of indices of overall diet quality and the variability in selected indices of overall diet quality was followed 11 years later by a critical review that focused on diet quality measures with particular attention paid to their actual compositions, the differences (and similarities) between various indices, and the components used to determine the score. Most importantly, this critical review also looked at diet quality indices and their relation to health outcomes². In summary, 20 different indices were reviewed, differing in several respects, such as the items included, the cut-off values used, and the exact method of scoring, indicating that many arbitrary choices were made. Development or assessment of these indices has focused on food or nutrient intake, or nutrient adequacy, biomarkers, chronic disease risk, mortality, or obesity. Very few studies looked at individual cardiovascular risk factors (CVRF) and diet quality^{3,4}.

Measures of overall diet quality have been associated with biomarkers of chronic disease risk and health outcomes^{3,4}. However, large cohort studies have often shown conflicting results with diet quality scores and chronic disease. One study⁵ with female nurses 30-55 years found that diet quality was a strong predictor of chronic disease risk, namely coronary heart disease, diabetes, stroke, and cancer. In a study of French adults, higher diet quality scores were weakly associated with lower Body Mass Index (BMI) and lower blood pressure for men only but were not associated with plasma lipid profiles³. Diet quality scores were weakly associated with lowered risk of cardiovascular disease in men⁶ but were not associated with a reduced chronic disease risk in women⁷.

Previous research in the United States has shown inverse relationships between diet quality and BMI, total cholesterol, C-reactive protein (CRP), homocysteine, glucose, and glycated hemoglobin. Several studies have looked at whether diet quality was related to obesity in adults and children or to abdominal obesity in adults. One study found weak positive associations between diet quality scores and weight and adiposity in children⁸. Alternatively, in children and adults, a low diet quality score was associated with overweight and obesity with a decreased risk of becoming obese with increased diet quality. A systematic literature review of 30 observational studies found that the significant association between a diet index score and BMI and obesity were consistently negative⁹. However, some studies have failed to find similar relationships between diet quality and weight measures^{10,11}. After careful review, no current studies using more recent national data and the most current measure of diet quality associated with individual CVRF and metabolic syndrome were found.

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Interpreting Nutrition Research Findings

By Mitchell Kanter, Ph.D.

Executive Director, Egg Nutrition Center



With issues like politics or advertising, we may accept information that exhibits clear bias. But should this be the case with published scientific research? Absolutely not. Research published in scientific journals generally goes through a peer-review process designed to weed out studies that use faulty methodologies or scream of researcher bias; however, the system is not pristine, and studies are occasionally published with errors and/or bias.

A case-in-point: the journal *Atherosclerosis* recently published an article that suggested that eggs may not only increase the risk of heart disease but that the association between egg usage and heart disease may be as great as that of cigarette smoking. The headlines generated in the lay press from this study were swift and sensational: “Eggs as Bad for You as Cigarettes” became a banner headline in newspapers throughout the world. Needless to say, the American Egg Board was flooded with calls from concerned consumers and scientists seeking a response.

Not wanting to disseminate misinformation, we reviewed and sent copies of the manuscript to seven leading researchers (three of whom are highly respected, well-published epidemiologists) for feedback. Their comments were unanimous: all felt that the study contained a number of fatal flaws, ranging from lack of dietary control, to the use of an already sick population of older subjects that might possibly have created a reporting bias, to the use of a variable (“egg-years”) that purportedly controlled for age but, in fact, did not do so. A number of the researchers we queried went as far as to ask how a study of this nature was accepted for publication.

But the publication of this paper raises larger questions about the scientific process, the rationale for how studies of this nature are published, and how they should be interpreted. First and foremost, it must be remembered that this was an observational study and as such, was not designed to measure cause-and-effect. So, while we can’t discount the fact that studies like this can add to the body of knowledge and can help guide the development of future research questions, they cannot tell you if X (egg consumption in this instance) causes Y (heart disease) or if Z (cigarette smoking) is as potent a variable as X. To answer these questions, of course, you’ve got to design a more rigorous experimental trial that involves the randomized selection of subjects, and the double-blind, placebo controlled dissemination of the independent variable(s) (eggs and cigarette smoking in the aforementioned study). Studies of this nature tend to be very expensive, very time consuming, and very difficult to control. Hence, particularly in a field like nutrition science, the use of observational data is often used which, allows us to observe the responses of large numbers of subjects but limits the

conclusions we can, or should, arrive at.

Herein lies a flaw with much of the data in the nutrition science literature: because of financial constraints that limit our ability to do large, well-controlled experimental studies, we are often left to rely on observational trials to answer questions that they are not designed to answer, and we rely too heavily on the results of these studies to guide our thinking about nutrition. Many excellent scientists are guided by “statistical power” to accept that an observational study with 500 subjects is better than an experimental trial with 40 subjects at answering questions that they were never intended to answer. And so well-controlled, smaller experimental trials are often marginalized, while the results of larger epidemiological trials are often given more credence than they deserve.

There are no easy solutions to these issues as they relate to the nutrition literature. Experimental research is expensive; diet and lifestyle are difficult variables to control in free-living subjects, and genetic predispositions can cause difficult-to-explain variability among subjects. So observational studies often become the “fallback of choice.” At some point in the future, this may change as our understanding of genomics increases to the point where we can recruit subjects with more uniform genetic patterns, and/or more funding for nutritional research is made available. Until that time, understanding the limitations of observational studies and knowing the scientific consensus on a topic will give context to the results of a given study. Also, having knowledge of the track record of a research team itself can help to keep the results of a given study in perspective.

In the case of the *Atherosclerosis* study, the researchers “reached” with their results, suggesting a cause-and-effect relationship based on descriptive data. They were also proposing a theory (eggs are as bad for you as cigarettes) that had never been posited before. Finally, based on prior publication record, this research group had published a number of studies clearly extolling the benefits of an animal protein-free diet and had made a number of statements that were disparaging of eggs and other animal protein sources in the past. Red flags must be factored into an analysis of a study of this nature.



MESSAGES

- Observational studies are not designed to show cause and effect, but only to find associations.
- Small well controlled experimental research, which is more expensive and involves fewer subjects, is often not given the respect it deserves.
- Research should be viewed within the context of scientific consensus and the track record of the research team.

Continue from page 1.

Is Diet Quality Inversely Related to Health Outcomes?

A study was conducted to determine if there was an association between diet quality and CVRF in adults¹². National Health and Nutrition Examination Survey (NHANES) 2001-2008 data was used to compare diet quality, as determined using 2005 Healthy Eating Index (HEI-2005) scores, and CVRF in adults less than 19 years (n=18,988; 51% males; 50% white; 21% African American; 25% Hispanic American; 4% other). HEI-2005 scores were calculated using one 24-hour dietary recall collected on the adults. Weight and adiposity, blood pressure, and CVRF were measured. Regression analyses were conducted to assess linear relationship of CVRF and HEI-2005 scores using appropriate covariates. All analyses were weighted using sample weights to produce national estimates and adjust for the complex sample design of NHANES. Odds ratios were calculated for HEI quartiles and CVRF. BMI ($p<0.0001$); waist circumference (<0.0001); diastolic blood pressure ($p=0.0002$); CRP ($p=0.0016$); total cholesterol ($p=0.0006$); low-density lipoprotein cholesterol ($p=0.0039$) and metabolic syndrome ($p=0.0035$) were inversely associated with HEI-2005.

“Results of this analysis of data found high-density lipoprotein cholesterol (HDL-C) significantly increased across the Healthy Eating Index-2005 quartiles.”

Results of this analysis of data found high-density lipoprotein cholesterol (HDL-C) significantly ($p=0.0048$) increased across the HEI-2005 quartiles. Compared to the lowest HEI-2005 quartile, individuals with the highest diet quality in quartile⁴ were less likely to be overweight and obese (34%) and to have: elevated waist circumference (35%); elevated blood pressure (26%); metabolic syndrome (35%); and decreased HDL-C level (21%).

In conclusion, the data suggest that diet quality is inversely associated with several CVRF in adults in the US. However, the overall effectiveness of these guidelines in disease prevention needs to be investigated further in prospective studies and among different subpopulations. ✨

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MESSAGES

- Very few studies have looked at diet quality and its association with individual cardiovascular risk factors (CVRF)
- NHANES 2001-2008 data was used to compare diet quality and CVRF.
- Diet quality appears to be inversely associated with CVRF in adults

Protein Content Of The Diabetes Diet: Are We Ready To Change?

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In the first half of the twentieth century, Elliot P. Joslin and others used a daily calorie breakdown of 40% from carbohydrates, 40% from fat and 20% from protein to treat people with diabetes. This diabetic diet was widely accepted until the late 1970s. Although effective in controlling diabetes, this diet's fat content was considered high and was blamed for the increased incidence of coronary artery disease among diabetic patients. As a result, the medical community decided to reduce dietary fat intake by approximately 10% and added these calories to carbohydrates instead of increasing protein content, for the fear harming kidney function. Although seemingly unwise to recommend a higher intake of carbohydrates to treat a disease principally characterized by carbohydrate intolerance, medical experts considered this the safest alternative at the time. These changes led to the current dietary recommendation of 50-60% of calories from carbohydrates, 30-35% from fat and 15-20% from protein.

Now, the questions that we should ask: Did this diet help our diabetic patients? Did this diet save their kidney function or prevent coronary artery disease? What about postprandial hyperglycemia, postprandial hypertriglyceridemia, weight gain and overall diabetes control?

“ In a 1-year randomized clinical trial, a high-protein weight-reduction diet was found to have a more favorable cardiovascular risk profile than a low-protein diet with similar weight reduction in people with type 2 diabetes. ”

Recently, several clinical trials showed that increasing protein intake is a better alternative to increasing carbohydrate for patients with diabetes and could be considered a good option toward optimal diabetes dietary composition. The current U.S. Dietary Guidelines recommend a protein intake of less than 20%. This amount is reduced in the early stages of chronic kidney disease (CKD) to 0.8-1 gm/kg/day and in the later stages of CKD to < 0.8 gm/kg/day.

Using a percentage to calculate protein intake is an obvious mistake when a calorically restricted diet is recommended for weight reduction because the absolute amount of protein intake becomes significantly low. This consequently leads

to a speedy loss of the lean muscle mass and subsequently causes further reduction in the basal energy expenditure and a rebound weight gain.

Although many randomized clinical trials in type 1 diabetic patients have shown that reducing protein intake to 0.8 gm/kg/day in patients with overt nephropathy decreases proteinuria and reduces the rate of decline in the glomerular filtration rate (GFR), no data are available to support this recommendation for patients with type 2 diabetes. Moreover, there is no evidence to show that increasing protein intake for diabetic patients with normal kidney function will induce microalbuminuria or cause a decline in the GFR.

It had been suggested that the benefit of low-protein diets on the progression of kidney disease may be related to other factors than the restriction of protein per se; namely salt intake and saturated fat. On the other hand, high-protein intake was not associated with any remarkable change in the estimated GFR in women with normal renal function (defined as an estimated GFR \geq 80 mL/min per 1.73 m²). Change in estimated GFR during the 11-year follow up in the Nurses' Health Study was only 0.25 mL/min per 10-g increase in protein intake. On the other hand, Möllsten et al, in a nested case control study of 1,150 diabetic patients with duration >5 years, reported that a high intake of fish protein and fish fat was associated with a reduction in the risk for microalbuminuria as compared to individuals consuming less fish protein.

In a randomized crossover study among patients with untreated type 2 diabetes, Gannon et al studied the effect of substituting protein for carbohydrate in mixed meals over an extended period of time. Protein content of the diets was 15% in the control diet and 30% in the test diet. Total carbohydrate content was set at 55% in the control diet and 40% in the test diet. After 5 weeks, the study results showed that integrated 24-hour plasma glucose area was reduced by 38% and the integrated insulin area response was increased by 18% on the high protein diet. The percentage HbA1c decreased from 8.1 to 7.3%

High-protein, low-carbohydrate, energy-restricted diets have been used effectively for weight control in diabetic patients. Brinkworth et al studied the long-term (one year) weight loss and health outcomes after a 12-week intensive intervention with two diets differing in protein content; a low-protein (15% protein, 55% carbohydrate) versus high-protein diet (30% protein, 40% carbohydrate). At Week 64, weight reduction compared to baseline were -2.2 \pm -1.1 kg (low protein) and -3.7 \pm -1.0 kg (high protein), $p < 0.01$.

In another study, Parker et al compared a high-protein diet (28% protein, 42% CHO, 28% fat) with an low-protein diet (16% protein, 55% CHO, 26% fat [8% saturated fatty acids, 11% monounsaturated fatty acids, 5% polyunsaturated fatty acids]) in 54 obese men and women with type 2 diabetes during 8 weeks of energy restriction (1,600 kcal) and 4 weeks of energy balance. Women on the high-protein diet lost significantly more total (5.3 vs. 2.8 kg, $P=0.009$) and abdominal (1.3 vs. 0.7 kg, $P=0.006$) fat compared with those on the low protein diet. LDL cholesterol reduction was significantly greater on the high protein diet (5.7%) than on the low protein diet (2.7%) ($P < 0.01$).

In the Joslin's Weight Achievement and Intensive Treatment (Why WAIT) Program, a high-protein, low-carbohydrate (30% protein and 40% carbohydrates), energy-restricted diet in association with increased resistance exercise and behavioral changes, resulted in an average weight loss of 24.6±10.9 lbs (-10.3%, $p<0.001$) after 12 weeks of intervention. Waist circumference decreased significantly by 3.6±2.2 inches ($p<0.001$) and their HbA1c decreased from 7.5±1.3% to 6.6±0.99 ($p<0.001$).

In a one-year randomized clinical trial, a high-protein, weight-reduction diet was found to have a more favorable cardiovascular risk profile than a low-protein diet with similar weight reduction in people with type 2 diabetes. Many other studies have shown that high-protein, low-carbohydrate diets are associated with reduction in blood pressure, improvement in lipid profiles and other risk factors for CVD.

The potential benefits associated with protein ingestion in diabetic patients include increased satiety that facilitates a reduction in energy consumption under ad libitum dietary conditions; an increase in both thermogenesis and the thermic effect of food that also influences satiety and augments energy expenditure, and an enhanced stimulatory effect on muscle protein anabolism, favoring the retention of lean muscle mass while improving metabolic profile. The satiety associated with a higher protein diet may be partially explained by increased glucagon-like peptide-1 (GLP-1) in response to a high-protein intake.

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MESSAGES

- Current dietary recommendations of 50-60% of calories from carbohydrates, 30-35% from fat and 15-20% from protein was not based on health outcomes including diabetes.
- Recently, several clinical trials showed that increasing protein intake is a better alternative to increasing carbohydrate for patients with diabetes.
- In the Joslin's Weight Achievement and Intensive Treatment (Why WAIT) Program, a high protein-low carbohydrate (30% protein and 40% carbohydrates) energy-restricted diet in association with increased resistance exercise and behavioral changes, resulted in weight loss and reduced waist circumference.

Help Your Patients at Risk for Type 2 Diabetes: Resources from the National Diabetes Education Program

by Joanne Gallivan MS, RD
Director, National Diabetes
Education Program National
Institutes of Health



The Diabetes Prevention Program (DPP) was a major clinical trial conducted by the National Institutes of Health which hypothesized that diet and exercise as well as the oral diabetes drug metformin could prevent or delay the onset of type 2 diabetes in people with impaired glucose tolerance (IGT) or impaired fasting glucose (IFG). The DPP found that over the three years of the study, diet and exercise leading to weight loss sharply reduced the chances that a person with IGT or IFG would develop type 2 diabetes. The drug metformin also reduced disease risk, although less dramatically.

Type 2 Diabetes and PreDiabetes

Nearly 25.8 million people in the United States have diabetes. Type 2 diabetes accounts for 90 to 95 percent of diagnosed diabetes in adults. Diabetes is the leading cause of kidney failure, non-traumatic lower-limb amputation, and new cases of blindness among adults in the United States. People with diabetes are also two to four times more likely than people without diabetes to develop heart disease and stroke. Prediabetes, also called IGT or IFG, is a condition in which blood glucose levels are higher than normal but not high enough for a diagnosis of diabetes. An estimated 79 million Americans aged 20 and older have prediabetes. Having prediabetes puts one at higher risk of developing type 2 diabetes, heart disease and stroke.

Other factors that make it more likely a person will develop type 2 diabetes include:

- having a family history of diabetes
- being a member of an ethnic/racial group like African Americans, Hispanic/Latinos, Asian Americans, Pacific Islanders, American Indians, and Alaska Natives
- being overweight or obese
- being age 45 or older
- having gestational diabetes or a baby weighing 9 pounds or more at birth
- having high blood pressure
- having abnormal cholesterol (lipid) levels
- not getting enough physical activity
- having polycystic ovary syndrome (PCOS)
- having blood vessel problems affecting the heart, brain or legs
- having acanthosis nigricans (dark, thick and velvety patches of skin around the neck or armpits)

“Participants in the lifestyle intervention group—those receiving intensive counseling on effective diet, exercise, and behavior modification—reduced their risk of developing diabetes by 58 percent.”

DPP Results

The DPP showed that people with prediabetes who lose a small amount of weight, approximately five to seven percent of their body weight, and increase their physical activity to 150 minutes per week, can prevent or delay type 2 diabetes. The DPP also suggests that metformin is effective in delaying the onset of diabetes in younger, heavier people. Participants in the lifestyle intervention group—those receiving intensive counseling on effective diet, exercise, and behavior modification—reduced their risk of developing diabetes by 58 percent. This finding was true across all participating ethnic groups and for both men and women. Lifestyle changes worked particularly well for participants aged 60 and older, reducing their risk by 71 percent. Participants taking metformin reduced their risk of developing diabetes by 31 percent. Metformin was effective for both men and women, but it was least effective in people aged 45 and older. Metformin was most effective in people 25 to 44 years old and in those with a body mass index of 35 or higher (at least 60 pounds overweight).

Diabetes Prevention Program Outcomes Study

The Diabetes Prevention Program Outcomes Study (DPPOS), the 10-year follow-up study to the DPP, found that the effects of the DPP have persisted for years. The incidence of diabetes in the DPPOS was reduced by 43 percent in the lifestyle group, and 18 percent in those taking metformin compared with the placebo group. For participants age 60 and older, the development of diabetes was reduced by 49 percent by intensive lifestyle when compared to placebo.

Diabetes Prevention Program Cost Effectiveness Study

The economic analysis of the DPP/DPPOS found that metformin treatment led to a small savings in health care costs over 10 years, compared with placebo. The lifestyle intervention as applied in the study was cost-effective or justified by the benefits of diabetes prevention and improved health over 10 years, compared with placebo.

ENC-Teacher Exchange: an Egg Nutrition Center program

ENC's Teacher Exchange, an online resource bank, showcases how teachers and administrators help instill healthy habits in their students during the school day that impact their everyday lives—outside the classroom. Any teacher can then repurpose these successfully tested programs in his/her classroom. Teachers are also encouraged to create new obesity-fighting teaching tools.

Spotlighted on the Teacher Exchange, the nutrition education software "Snacking on Technology" is an example of the free materials created by teachers for teachers that encourage healthy living. Visit encteacher.org to view the video.

"An egg is a nutrient-dense whole food with about 70 calories, and virtually every household can afford them," says Mitch Kanter Ph.D., ENC's Executive Director. "We're thrilled to contribute to the nationwide effort to combat obesity trends."

"An egg is a nutrient-dense whole food with about 70 calories, and virtually every household can afford them."

"We knew starting with children made sense, but ENC conducted focus groups and learned that teachers need parents involved to make these programs work," he adds. "We produced video stories to illustrate school success stories in a instructive, compelling way."

Currently, spotlighted on the ENC-Teacher Exchange, Computer Sciences teacher Jeffrey Schwartz showcases *The Snack Neutralizer*, a free online program he created that teachers and students of all ages can use to calculate the time required to perform most any given exercise activity to burn calories of a wide variety of snack foods. Schwartz also created three new lesson plans for ENC to accompany the video story.

In addition to featuring health-conscious educators, ENC also awards a \$500 honorarium to a select number of teachers who submit a new nutrition education program—such as an innovative five-day lesson plan or a compelling PowerPoint presentation—provided it is published as a free downloadable teaching tool that all teachers can access on the ENC-Teacher Exchange.

All nutrition educators in grades K thru 12, notably members of *The American Association of Family & Consumer Sciences (aafcs.org)* with which ENC is affiliated, are invited to join ENC-Teacher Exchange online at no charge. And they're encouraged to submit new or existing obesity-fighting program ideas and teaching tools to ENC-Teacher Exchange for a chance to earn the \$500 honorarium by writing to info@encteacher.org. ✨

The National Diabetes Education Program (NDEP)—a joint initiative of the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), has developed a campaign "Small Steps, Big Rewards. Prevent type 2 Diabetes with tools and resources to help people at risk for diabetes take steps to prevent or delay the disease. For more information about preventing and managing diabetes, call 1-888-693-NDEP (1-888-693-6337) or visit the National Diabetes Education Program's website at www.YourDiabetesInfo.org

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MESSAGES

- The Diabetes Prevention Program (DPP) showed that people with prediabetes who lose a small amount of weight, approximately five to seven percent of their body weight, and increase their physical activity to 150 minutes per week, can prevent or delay type 2 diabetes.
- The DPP also suggests that metformin is effective in delaying the onset of diabetes in younger, heavier people while lifestyle changes worked particularly well for participants aged 60 and older.
- For more information about preventing and managing diabetes, call 1-888-693-NDEP (1-888-693-6337) or visit the National Diabetes Education Program's website at www.YourDiabetesInfo.org



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Credible Science Incredible Egg

CONGRATULATIONS

2012 Egg Nutrition Center Dissertation Fellowships and Research Grant Recipients



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Dissertation Fellowships

Jamie Baum PhD, University of Arkansas

"The effects of consuming an egg-based breakfast on energy metabolism, food intake, and glycemic response in school-aged children"

QiPing Feng PhD, Vanderbilt University

"Egg yolk components rescue skeletal muscle from statin-induced toxicity"

Arny Ferrando PhD, University of Arkansas for Medical Sciences (UAMS)

"Effect of dietary protein intake distribution on protein metabolism and skeletal muscle"

Heather J. Leidy, University of Missouri

"Effects of increased dietary protein at breakfast alone, or in combination with lunch, in adolescents"

Megan McCrory PhD, Purdue University

"Relative effects of chronic consumption of egg protein at breakfast with and without fiber on brain neural activation, appetite, glycemic and lipemic control and self-selected energy intake"

Diane L. McKay, PhD, FACN, Tufts University

"Effects of whole eggs combined with a typical cooked breakfast on postprandial markers of oxidative stress and antioxidant activity in older, overweight adults"

Kevin L. Schalinske PhD, Iowa State University

"Type 2 diabetes and vascular disease: impact of dietary egg consumption"

Tong Wang, PhD, Iowa State University

"Production of food grade egg lecithin using "green" technologies"

Research Grants

Angela Bonnema, University of Minnesota

"Satiety effects of protein and fiber: the combination of egg and whole grains on appetite and food intake"

Melanie Mott, Boston University

"Effects of egg consumption on adolescent health over ten years of follow up"

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 written and 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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