



A newsletter by Dairy Management, Inc.[™] to provide the dairy industry with current research on nutrition and dairy foods

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NDC Research Update

THE ASSOCIATION BETWEEN CALCIUM INTAKE, NUTRIENT INTAKE AND BODY COMPOSITION IN OVERWEIGHT OR OBESE AFRICAN AMERICAN YOUTH

African American adolescents are almost twice as likely to be obese compared to Caucasians, and consume less than half of the recommended amount of dairy products and calcium on a daily basis, say the authors of this study. Researchers at the University of Tennessee in Memphis examined the role of calcium intake on body composition (fat mass, lean body mass, bone mass, and body mass index (BMI)), in 186 African-American males and females (11-18 years) who were classified as overweight or obese (BMI \geq 85th percentile). Secondarily, the study evaluated the association between calcium intake and the presence of components of the metabolic syndrome (i.e., lipid and glucose abnormalities, hypertension, severity of overweight) and how levels of calcium intake affect the intake of other nutrients in the diet.

Result highlights:

- Less than 10% of the youth studied met the Dietary Reference Intake recommendation for each of the following nutrients: calcium, magnesium, phosphorus, potassium, folate, fiber, and vitamins D, A, and K.
- Children and adolescents in the lowest calcium intake group had the lowest energy-adjusted intakes of fiber, riboflavin, folate, vitamin A, vitamin D, magnesium, phosphorus, potassium, iron and zinc.
- “Compared to those with a low calcium intake (<365 mg/day), those with the highest calcium intake of >701 mg/day had higher intake of thiamin, folate, cobalamin [vitamin B₁₂], vitamin D, phosphorus, iron, and zinc.”
- Females in the lowest calcium-intake group (<314 mg/day) had a higher percent fat mass than those in the middle and highest calcium-intake group (\geq 634 mg/day) when age and energy-intake were controlled. Interestingly, there was no association between the lowest and highest tertile of calcium intake and any body composition measures in males.
- There was no association between calcium intake and dyslipidemia, impaired glucose metabolism, hypertension, severity of overweight or combined risk of having one of these.

The results of this study showed that African American girls with the lowest intakes of calcium had increased body fat and lower vitamin and mineral intakes as compared to those girls with the highest intakes of calcium. This study highlights the importance of adequate dairy food consumption in susceptible populations since dairy/calcium intakes were beneficially associated with nutrient intake and body composition (in girls). [Tylavsky FA, et al., *Nutrients*, 2: 950-964, 2010]

CHANGES IN TOTAL SUGAR AND ADDED SUGAR INTAKE AS A CONTRIBUTION TO TOTAL ENERGY INTAKE IN THE U.S.

This study used data from the National Health and Examination Survey (NHANES) I (1971-1975) and NHANES III, 1988-1994, to document changes in total sugar intake and intake of added sugars in the U.S., in the context of total energy intake and intake of nutrient categories – and identifies food sources contributing to those changes. For example, results showed that compared to NHANES I, the dietary intake of average total sugar and average added sugars reported in NHANES III increased in those 1-18 years by 0% and +5%, respectively, whereas the averages in those 19+ years increased by +14% and +18%, respectively. Average total energy intake increased by 144 kcal/day between NHANES I and NHANES III. Major food sources contributing to the changes in total energy, total sugar, added sugar, and total carbohydrate also changed over time. For example, in adult participants (age 19+ yr), “Major contributing food items for total energy intake changed from meat/breads/fluid milk (in descending order of importance) to mixtures of mainly grain/breads/mixed meat dishes.”

Although fluid milk remains among the major contributors to total sugar intake over the years among 1-18 yr olds, it dropped from first place in the 1970s to second place in the 1990s, while carbonated soft drinks moved from second to first place. The authors are careful to distinguish between sugars that are intrinsic to the food, such as lactose in milk and fructose in fruit, and added sugars, contributed mainly by carbonated soft drinks. In fact they identified soft drinks “as the most significant source of added sugars, contributing 27 g of sugar intakes daily in NHANES III.” They say, “The percentage of total sugar intake from soft drinks significantly increased by 49% and 39% for ages 1-18 and 19+, respectively, from NHANES I to NHANES III. In contrast, total sugar intake from milk and milk products dropped by 44% in 1-18 y subjects and 46% in 19+ subjects, respectively, during the same time period.” The authors conclude, “Overall, the effect of increased intake of added sugars, as it has replaced intake of intrinsic sugars such as lactose and fructose, has been to compromise the intake of more nutritious foods and impeded compliance with current dietary guidelines.”

However, the authors are reluctant to attribute the growing prevalence of obesity to an increase in added sugars intake. They say, “Data in the present study confirm the increase in intake of added sugars found in earlier studies, but while the increase in the intake of added sugars during the past three decades was 12%, its contribution to the energy intake rose less than 4%.” They say, “Other carbohydrate categories which contribute more to total energy intake [i.e., mixtures of mainly grain] may be more important in examining the growing prevalence of obesity.” They note that increased carbohydrate intake overall, “is mainly due to the increased availability and consumption of prepared, frozen and takeout meal combinations.” [Chun OK, et al., *Nutrients*, 2: 834-854, 2010]

NUTRIENT DENSITY OF BEVERAGES IN RELATION TO CLIMATE IMPACT IN SWEDEN

Discussions of how to reduce greenhouse gas (GHG) emissions related to food have either focused on modifying the food production/supply chain or on modifying food consumption patterns. This study is the first of its kind to take nutrient density into account when discussing the climate impact of food choices. Researchers in Sweden studied GHG emissions together with the nutrient density of several beverages that would typically be consumed with a meal -- milk, soft drink, orange juice, beer, wine, bottled carbonated water, soy drink, and oat drink. They estimated the composite nutrient density, expressed as a percentage of Nordic Nutrition Recommendations for 21 essential nutrients, in relation to cost in GHG emissions of production from a life cycle perspective (production, manufacturing, packaging, and transportation), expressed in grams of CO₂-equivalents – using the Nutrient Density to Climate Impact (NDCI) index. Nutrient density was calculated based on a model described by Drewnowski (*AJCN* 2005) and included protein, carbohydrates, fat, retinol equivalents, vitamin D, vitamin E, thiamin, riboflavin, ascorbic acid, niacin equivalents, vitamin B6, vitamin B12, folate, phosphorus, iron, potassium, calcium, magnesium, selenium, zinc, and iodine. “Beverages with the highest NDCI index values were those with the highest nutrient density scores in relation to the GHG emissions,” the authors explain.

Results:

- Due to a very high nutrient density, the NDCI index for vitamin D fortified milk (mandated in Sweden) was substantially higher (0.54) than for the other beverages. The NDCI index for milk not fortified with vitamin D was 0.46.
- “Due to low nutrient density, the NDCI index was 0 for carbonated water, soft drink, and beer and below 0.1 for red wine and oat drink.”
- “The NDCI index was similar for orange juice (0.28) and soy drink (0.25).”

The authors say, “It is important to use both knowledge in nutrition and climate to avoid simplistic and erroneous conclusions for food recommendations and dietary guidelines to mitigate climate change.” They conclude that “the NDCI index is a tool that facilitates inclusion of a nutritional aspect of the climate debate.” [Smedman A, et al., *Food & Nutrition Research*, 54: 5170, 2010] [Editor’s note: These results are not necessarily transferrable to other countries.]

OBESITY INCREASES FROM ADOLESCENCE TO EARLY ADULTHOOD ANALYSIS SHOWS

This longitudinal analysis used national data from the National Longitudinal Study of Adolescent Health to examine obesity incidence, persistence, and reversal in more than 15 million U.S. students (13-20 years) enrolled at public and private schools who were followed into their early 30s. Obesity was defined as a body mass index (BMI) of 30 or above, or (for individuals under 20 years) a BMI of 30 or above, or a BMI at or above the 95th percentile of the CDC/NCHS growth charts. At enrollment in 1996, 13.3% of adolescents were obese, the paper reports. “By 2008, obesity prevalence increased to 36.1%, and was highest among non-Hispanic black females (54.8%).” Ninety percent of obese adolescents remained obese into their 30s; when subdivided by gender and ethnicity, “94% of females overall, 95% of black females, and 88% of males remained obese.” The authors conclude, “We find that the upward trend in obesity continues into the adult years and is evident in both males and females and in all major

U.S. ethnic groups.” They say that these findings emphasize the need for obesity prevention in youth. [Gordon-Larsen P, The NS and Adair LS, *Obesity*, 18(9): 1801-1804]

INTAKE OF INDUSTRIAL TRANS FAT IS ASSOCIATED WITH PROSTATE CANCER RISK CANADIAN STUDY SHOWS

Researchers used data from 8 Canadian provinces in a nationwide population based, case-control study, the National Enhanced Cancer Surveillance System, to evaluate the role of nutrients including protein, fat, cholesterol, and carbohydrates on prostate cancer risk. Data on 1,797 men (20-76 years) with confirmed prostate cancer (cases) was compared to 2,547 men without the disease (controls). Results:

- The highest vs. the lowest quartile of intake of *trans* fat was associated with a significant 45% greater risk of prostate cancer. The main sources of *trans* fat in this population were fried foods (i.e., French fries, potato chips), high-fat baked goods (i.e., doughnuts, cookies), and margarines.
- The highest vs. lowest intake of sucrose and disaccharides (compound sugars) was associated with a 63% and 48% higher risk of prostate cancer, respectively.
- No association was found between intake of total protein, total fat, saturated fat, monounsaturated fat, polyunsaturated fat, total carbohydrates, monosaccharides and prostate cancer.
- Men with the highest vs. the lowest intake of cholesterol had a 24% reduced risk of prostate cancer.

Although this study did not investigate the mechanisms linking these nutrients to disease risk, they speculate that *trans* fat appears “to impact markers of systemic inflammation, and *trans* fats may adversely affect endothelial function.” They say their results suggest that “a diet low in *trans* fat and sugar might reduce the risk of prostate cancer.” [Hu J, et al., *Nutrition and Cancer*, 62(6): 710-718, 2010]

VITAMIN D INSUFFICIENCY IS ASSOCIATED WITH COGNITIVE FUNCTION PARTICULARLY IN OLDER WOMEN

This multi-center study in healthy older adults (55-87 years) in Europe assessed vitamin D status and examined its association with measures of cognitive function. Results showed that 12%, 36%, and 64% of subjects had serum vitamin D [25(OH)D] concentrations indicating marginal deficiency (<30 nmol/l), inadequacy (<50 nmol/l), and suboptimal (<80 nmol/l) vitamin D status, respectively. Among subjects sampled during the winter and early spring, 78% had suboptimal vitamin D status. A higher vitamin D status was associated with better scores on four assessments of spatial working memory. Specifically, the highest vs. lowest tertile of vitamin D status was associated with significantly fewer errors on spatial working memory tests, particularly in females; the differences were not significant in males. The authors explain that executive function (associated with the frontal area of the brain) “encompasses spatial working memory capacity as well as the ability to monitor, change and plan behavior when faced with novel tasks and situations”; it is an area of the brain affected by vitamin D. Since this study established only an association between vitamin D inadequacy and cognitive function, randomized controlled intervention studies are needed to establish causality. [Seamans KM, et al., *European Journal of Clinical Nutrition*, published online August 11, 2010]

CLINICAL TRIALS WITH LACTOFERRIN SHOW BENEFITS FOR ACNE AND VISCERAL FAT ACCUMULATION

Lactoferrin is a multifunctional glycoprotein in mammalian milk with antibacterial, anti-viral, immunostimulatory, antioxidant, and cancer prevention potential. Two recent clinical trials demonstrate its wide range of potential benefits.

Researchers in Korea conducted a 12-week double-blind, placebo-controlled study among 36 young adults (18-30 years) with mild to moderate acne to evaluate whether fermented milk enriched with lactoferrin would improve this inflammatory skin condition. Subjects were randomly assigned to receive 200 mg of lactoferrin mixed in fermented milk containing probiotics (*Lactobacillus bulgaricus* and *Streptococcus thermophilus*) or fermented milk containing probiotics only (placebo group). "Acne showed improvement in the lactoferrin group by significant decreases in inflammatory lesion count by 38.6%, total lesion count by 23.1%, and acne grade by 20.3% compared with the placebo group at 12 weeks," the paper reports. In addition, the sebum (fatty matter secreted by the sebaceous glands of the skin) content of the lactoferrin group was decreased by 31.1% compared with the placebo group, as well as amounts of triacylglycerols in the skin which correlated with serum content, acne lesion counts, and acne grade. The authors conclude, "Lactoferrin-enriched fermented milk may be a potential alternative therapy or may serve as an adjunct to conventional therapies for the treatment of acne vulgaris." [Kim J, et al., *Nutrition*, 26: 902-909, 2010]

Researchers in Japan conducted a double-blind, placebo-controlled study among 26 men and women (22-60 years) with abdominal obesity to evaluate whether enteric-coated lactoferrin might improve visceral fat-type obesity, an underlying cause of the metabolic syndrome. Subjects were randomly assigned to receive bovine lactoferrin tablets (300 mg/day) or placebo tablets for 8 weeks, while maintaining their usual dietary intake and physical activity. There were no significant differences in daily energy, protein, carbohydrate and fat intakes between groups. Results showed that body weight, body mass index (BMI), and hip circumference were significantly lower in the lactoferrin group when compared to the control group. At week 8, the lactoferrin group had significantly less visceral fat area than did the control group. There were no significant differences in blood lipids between groups. The authors explain that 300 mg of lactoferrin (a substance Generally Recognized as Safe in the U.S. and approved as a food additive in Japan) is approximately the amount found in 100 g of unpasteurized cheese (lactoferrin is destroyed by heat treatment). The enteric coating on the capsule prevented degradation of the lactoferrin in the stomach (which would naturally occur with cheese consumption). The authors conclude, "This trial clarified that the ingestion of lactoferrin for an 8-week period can reduce visceral fat in men and women without the need for any lifestyle change," and that studies with a larger sample size are warranted. [Ono T, et al., *British Journal of Nutrition*, published online August 9, 2010]

In Brief...

Analysis finds cost of grains and sugars cheaper dietary energy than vegetables and fruit

This analysis used contemporary nutrient composition and food prices data from the USDA to reestablish the relationship between food cost, energy, and nutrients. It revisits the concept of food prices per calorie compared to per bushel, updating the seminal work of Atwater in 1894. "Because water contributed to food weight but supplied neither nutrients nor calories, Atwater ignored food weight and calculated instead the amounts of energy and nutrients that could be obtained from different foods for a given price," explains the author. For example, the paper

reports that “Energy cost (\$/100 kcal) was lowest for grains, fats, eggs, and milk. Energy cost of vegetables was higher than that for every other food group except for fruit.” An analysis of the contribution of individual nutrients to food prices found, “Whereas carbohydrates, fats, and sugars were associated with lower food prices per 100 g, protein, vitamins, and minerals were associated with higher food prices per 100 g, after adjustment for energy.” The author says, “The fact that healthful foods cost more than less healthy options is a formidable real-world challenge for nutrition interventions. . . A continuing appreciation of how food costs drive food choices is needed for a more effective food and nutrition policy.” [Drewnowski A, *Am J Clin Nutr*, published online August 18, 2010]

Study in rats shows whey peptides improve wound healing after caesarean section

Delivery by caesarean section increases the risk of uterine rupture in subsequent pregnancies. This study in rats evaluated whether treatment with whey peptides after caesarean section would improve healing of skin and the uterine incision. Forty-eight rats were randomly assigned to receive whey peptide or a control vehicle intragastrically each morning after the surgery, then 8 rats from the control and intervention groups were killed on day 7, 14, and 21 for testing of skin and uterine tissue strength during different phases of wound healing. Results showed that whey peptides increased tensile strength of the skin and bursting pressure of the uterus on days 7 and 14 postcaesarean section, “which may predict faster healing and a decrease in the risk of uterine rupture in the whey peptide group,” say the authors. Since the human uterus has a different anatomical structure than that of a rat, the researchers suggest further study is warranted in human subjects. [Wang J, et al., *British Journal of Nutrition*, published online August 9, 2010]

Is vitamin D status relevant to 6 “rarer” cancers?

An entire issue of the *American Journal of Epidemiology* “reports findings about the relationship between circulating levels of vitamin D and subsequent cancer risk in a set of pooled cohort studies conducted in the United States, Europe, and Asia” for six types of “rarer” cancers – upper gastrointestinal, ovary, endometrial, pancreatic, kidney, and non-Hodgkin lymphoma. The reports are the result of a large-scale collaboration, the Vitamin D Pooling Project of Rarer Cancers. According to an introductory editorial, “These studies offer compelling evidence against the hypothesis that circulating levels of vitamin D are relevant to risk of these cancers.” The editorial praises the investigators in the Pooling Project “for having saved us from years of false leads [as happened with investigations of vitamins A, B, C, and E and cancer], as well as their vision and skill in carrying out this outstanding collaborative project.” Please see the journal for individual articles. [Byers T, *American Journal of Epidemiology*, 172(1), 2010]

Low-carbohydrate diets and mortality

This paper examined the association of low-carbohydrate diets with mortality (all-cause and cause-specific) during 26 years of follow-up in the Nurses’ Health Study and 20 years of follow-up in the men’s Health Professional Follow-up Study. Dietary intake was assessed using self-administered semiquantitative food-frequency questionnaires with percentages of energy from fat, protein and carbohydrate divided into deciles of intake. A low-carbohydrate diet score was calculated for each participant based on quintile of fat, carbohydrate and protein, as well as a vegetable low-carbohydrate score and an animal low-carbohydrate score (based on fat and protein source). Results showed “The overall low-carbohydrate score was associated with a modest increase in overall mortality in a pooled analysis,” the authors report. “The animal low-carbohydrate score was associated with higher all-cause mortality, cardiovascular mortality, and cancer mortality. In contrast, a higher vegetable low-carbohydrate score was associated

with lower all-cause mortality and cardiovascular mortality. The authors say, “These results suggest that the health effects of a low-carbohydrate diet may depend on the type of protein and fat, and a diet that includes mostly vegetable sources of protein and fat is preferable to a diet with mostly animal sources of protein and fat.” [Fung TT, et al., *Annals of Internal Medicine*, 153: 289-298, 2010]

An accompanying editorial discusses the limitations of the above trial and stresses the need for a large-scale clinical trial to determine causality. He points out, for example that men with the highest animal-based low-carbohydrate diet score were three times more likely to smoke and half as likely to exercise as those with the lowest score. “The current state of the evidence,” the author states, “is such that no one can legitimately claim that a low-carbohydrate diet is either harmful or safe with any degree of certainty until a large-scale, randomized study with meaningful clinical end points is done.” [Yancy WS, Maciejewski ML, and Schulman KA, *Annals of Internal Medicine*, 153: 337-339, 2010]

Other Publications of Interest

- *The role of body mass index, physical activity, and diet in colorectal cancer recurrence and survival: a review of the literature.* [Vrieling A and Kampman E, *Am J Clin Nutr*, 92: 471-490, 2010] This review, that analyzed 36 articles based on 31 independent studies on BMI, physical activity, or nutrition in relation to colorectal cancer recurrence and survival. The authors say drawing firm conclusions is difficult because of the wide variability in type of lifestyle assessment, timing on the assessment (before or after cancer diagnosis), and disease outcomes.
- *Associations of red meat, fat, and protein intake with distal colorectal cancer risk.* [Williams CD, et al., *Nutrition and Cancer*, 62(6): 701-709, 2010] This case-control study in whites and African-Americans does “not support the hypothesis that fat, protein, and red meat increase the risk of distal colorectal cancer.”
- *Effect of vitamin D3 and calcium on fracture risk in 65- to 71-year-old women: A population-based 3-year randomized, controlled trial – The OSTPRE-FPS.* [Salovaara K, et al., *Journal of Bone and Mineral Research*, 25(7): 1487-1495, 2010] A 3-year randomized controlled trial among 3,432 women (65-71 years) in Finland evaluated whether a daily dose of 800 IU vitamin D and 1,000 mg calcium per day would prevent fracture. Although the risk of any fracture was reduced in the vitamin D and calcium group by 17%, the risk of non-vertebral fracture decreased by 13%, the risk of distal forearm fractures decreased by 30% and the risk of upper extremity fractures decreased by 25%, compared with placebo, none of these effects reached statistical significance.
- *Point-of-purchase price and education intervention to reduce consumption of sugary soft drinks.* [Block JP, et al., *American Journal of Public Health*, 100(8): 1427-1433, 2010] A point-of-purchase intervention in a hospital cafeteria in Boston found that sales of regular soft drinks declined significantly by 26% with a \$0.45 (35%) increase in price, showing that the “price elasticity of demand was mildly inelastic.”
- *Children in school cafeterias select foods containing more saturated fat and energy than the Institute of Medicine Recommendations.* [Martin CK, et al., *The Journal of Nutrition*, 140: 1653-1660, 2010] This study that measured food intake at lunch of 2,049 4th-6th grade students at 33 Louisiana schools, found that most children met recommendations for protein, calcium, iron, and vitamin A, but <30% consumed the recommended amount of saturated fat (>70% consumed more than recommended).