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2015 Dietary Guidelines Advisory Committee

The National Dairy Council® (NDC) appreciates the opportunity to submit comments for consideration by the 2015 Dietary Guidelines Advisory Committee (DGAC) in response to the Federal Register notice (78 FR 51727) issued August 21, 2013.

The NDC, the non-profit organization founded by U.S. dairy farmers, is committed to nutrition research and education about dairy's role in the diet and health and wellness. NDC provides science-based dairy nutrition information to, and in collaboration with, a variety of stakeholders committed to fostering a healthier nation, including health professionals, educators, school nutrition directors, academia and industry. Established in 1915, NDC comprises a staff of registered dietitians and nutrition research and communications experts across the country. NDC is committed to helping improve child health and wellness through programs such as Fuel Up to Play 60, which encourages youth to consume nutrient-rich foods and achieve at least 60 minutes of physical activity every day.

The following comments are offered regarding dairy intake and type 2 diabetes as the DGAC undertakes the work of evaluating current science on health and nutrition in support of developing national food-based dietary recommendations. During the first 2015 DGAC meeting June 13-14, 2013, Work Group 3 identified "dairy products" as a priority topic for review. The new evidence described in these comments contributes to the body of science on the relationship between dairy intake and T2D reviewed by the 2010 DGAC, thus it is hereby submitted for the Committee's consideration for inclusion in the evidence-based review for the 2015 Dietary Guidelines for Americans (DGA).

### **Dairy intake and type 2 diabetes in the Dietary Guidelines for Americans**

Diabetes affects almost 26 million Americans aged 20 years and older, with type 2 diabetes (T2D) accounting for 90% to 95% of all diagnosed cases (1). A healthy diet is a part of the foundation for T2D prevention, treatment and management. Many people with type 2 diabetes can control their blood glucose by following a healthy meal plan and exercise program, losing excess weight, and taking oral medication. The 2010 DGA stated that "Moderate evidence...indicates that intake of milk and milk products is associated with a reduced risk...of type 2 diabetes..." (2). New research on this topic published since the 2010 DGAC evidence review includes 2 meta-analyses, 11 prospective cohort studies and 2 trials. The majority of evidence comes from prospective cohort studies, and different studies group and evaluate dairy foods differently. In addition, many studies have been conducted outside the U.S., where amounts and types of dairy foods may differ from those available in the U.S. Overall, however, the new studies provide evidence that higher intakes of dairy foods are associated with a reduced risk for T2D and improved glucose metabolism.

### **Meta-analyses on dairy intake and T2D risk find decreased risk with higher dairy intake**

A 2013 meta-analysis of 17 prospective cohort and nested case-control studies (7 studies from the U.S., 6 from Europe, 2 from Asia, and 2 from Australia) found an inverse association between intakes of dairy products, low-fat dairy products and cheese and the risk of T2D. Nonlinear inverse associations were observed for total dairy products, low-fat dairy products, cheese and yogurt (3). A meta-analysis of 7 cohort studies (4 from the U.S., 1 from the U.K., 1 from Japan, 1 from China) found a 14% reduced risk of T2D with daily dairy intake. Dose-response analysis found that T2D risk could be reduced 5% by adding just 1 additional serving of dairy/day, or 10% by adding 1 additional serving of low-fat dairy/day (4).

### **Prospective studies in the U.S. find reduced risk for T2D with higher dairy intake**

A study of 82,076 postmenopausal U.S. women from the Women's Health Initiative Observational Study found that low-fat dairy product consumption was inversely associated with the risk of T2D. The relative risk was reduced by 40-50% in the upper quintiles compared with the lowest quintile. Yogurt consumption had the strongest association with decreased risk for T2D (5). A study of 37,038 U.S. women who had been tracked since adolescence found that those in the highest quintile of high school dairy product intake, when compared with women in the lowest quintile, had a 38% lower risk of T2D after adjustment for risk factors. After adjustment for adult dairy product consumption the risk was attenuated to 27%. Thus, higher dairy product intake during adolescence was associated with a lower risk of T2D in later adulthood (6).

### **Prospective studies outside of the U.S. find beneficial or neutral effects of dairy intake on T2D risk**

A large case-cohort study conducted in 8 European countries (n = 340,234; 3.99 million person-years of follow-up) found an inverse association between cheese intake and T2D risk, and an inverse association between a higher combined intake of fermented dairy products (cheese, yogurt, and thick fermented milk) and T2D (7). In a study of 59,796 middle-aged and older Japanese men and women, dairy food intake was associated with a lower risk of T2D in women only (8). A study in 5,582 adults in Australia aged  $\geq 25$  years followed for 5 years found that men who had the highest intake of dairy foods had a significantly reduced risk of developing T2D compared with men with the lowest intake (9). A study of 4,526 adults in Britain with a mean age of 56 years found that while intake of fermented dairy products was associated with decreased overall mortality, intake of total dairy was not associated with incident T2D in this population (10). A study of 3,435 adults in France found that higher intake of dairy products was inversely associated with incidence of metabolic syndrome; dairy products other than cheese also were inversely associated with impaired fasting glucose and T2D (11). Ten-year incidence of T2D data on 1,824 adults in Australia aged 49 years and older found a 63% lower risk of T2D for obese individuals with the highest intake of regular fat dairy foods when compared to the lowest intake, but the association did not persist after adjustment for additional confounders (12).

### **Prospective cohort studies on dairy intake and T2D-related biomarkers find benefit of dairy intake**

A prospective cohort study of 3,736 adults in 4 U.S. communities found that whole-fat and reduced-fat dairy consumption was strongly associated with higher plasma *trans*-palmitoleate levels, which is a component of dairy fat and thus a biomarker for dairy fat intake. Individuals with the highest plasma levels of *trans*-palmitoleate had a 62% lower incidence of T2D compared to those with the lowest levels (13). Prospective analysis of 2,281 U.S. adults in a multi-ethnic population found that the highest plasma concentrations of *trans*-palmitoleate were independently associated with a 48% lower incidence of T2D compared to those with the lowest plasma concentrations (14). A study of 5,953 Danish men and women aged 30-60 years without baseline diabetes or cardiovascular diseases found that cheese intake was inversely associated with 2-hour plasma glucose. Fermented dairy intake was inversely associated with fasting plasma glucose and glycosylated hemoglobin (HbA1c). Though modest beneficial effects of cheese and fermented dairy were found for glucose regulation measures, a significant association with incident T2D was not found (15).

### **Trials find higher dairy intake improves biomarkers associated with insulin resistance and T2D**

In a randomized controlled trial in 100 adults in Iran aged 29-67 years with T2D who consumed 250 mL of an unfortified yogurt drink or a vitamin D3-fortified yogurt drink twice/day for 12 weeks, the intervention resulted in improvement in fasting glucose and blood glucose control indicated by HbA1c (16). A similar study was conducted in 90 adults in Iran who were randomly allocated to 3 groups to consume 250 mL of plain yogurt drink, vitamin D-fortified yogurt drink, or vitamin D plus calcium-fortified yogurt drink twice/day for 12 weeks. Daily intake of a vitamin D-fortified yogurt drink, either with or without added calcium, improved glycemic status in T2D patients (17).

### **Conclusion**

Overall, the new research published since the 2010 DGAC review indicates dairy foods (including milk, cheese and yogurt) are associated with a reduced risk for T2D. Several studies found evidence that dairy products may play a role in mediating glycemia. Additionally, plasma *trans*-palmitoleate has recently been found to be associated with a decreased risk for T2D, indicating a possible beneficial effect of dairy fat-containing foods on T2D. Trials of dairy and T2D are limited, and more research is needed to understand the underlying mechanism of dairy foods; however, the two trials mentioned here indicate that fortified dairy foods may improve glycemic status. The studies contribute to the body of science supporting the relationship between dairy intake and T2D and thus may warrant an update of the 2010 systematic review on dairy and T2D for the 2015 DGA.

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### **References**

1. Centers for Disease Control and Prevention. National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011. [http://www.cdc.gov/diabetes/pubs/pdf/ndfs\\_2011.pdf](http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf).
2. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7<sup>th</sup> Edition, Washington, DC: U.S. Government Printing Office, December 2010.
3. Aune D, Norat T, Romundstad P, et al. Dairy products and the risk of type 2 diabetes: a systematic review and dose-response meta-analysis of cohort studies. *Am J Clin Nutr*. 2013 Aug 14. [Epub ahead of print].
4. Tong X, Dong J-Y, Wu Z-W, et al. Dairy consumption and risk of type 2 diabetes mellitus: a meta-analysis of cohort studies. *Eur J of Clin Nutr* 2011;65:1027–1031.
5. Margolis KL, Wei F, de Boer IH, et al. A diet high in low-fat dairy products lowers diabetes risk in postmenopausal women. *J Nutr* 2011;141(11):1969-74.
6. Malik VS, Sun Q, van Dam RM, et al. Adolescent dairy product consumption and risk of type 2 diabetes in middle-aged women. *Am J Clin Nutr* 2011;94:854–61.
7. Sluijs I, Forouhi NG, Beulens J, et al. The amount and type of dairy product intake and incident type 2 diabetes: results from the EPIC-InterAct Study. *Am J Clin Nutr* 2012;96:382–90.
8. Kirii K, Mizoue T, Iso H, et al. Japan Public Health Center-based Prospective Study Group. Calcium, vitamin D and dairy intake in relation to type 2 diabetes risk in a Japanese cohort. *Diabetologia* 2009;52:2542–50.
9. Grantham N, Magliano DJ, Hodge A, et al. The association between dairy food intake and the incidence of diabetes in Australia: the Australian Diabetes Obesity and Lifestyle Study. *Public Health Nutr* 2013;16:339–45.
10. Soedamah-Muthu SS, Masset G, Verberne L, et al. Consumption of dairy products and associations with incident diabetes, CHD and mortality in the Whitehall II study. *Br J Nutr* 2013;109:718-726.

11. Fumeron F, Lamri A, Khalil C, et al. Dairy consumption and the incidence of hyperglycemia and the metabolic syndrome: results from a french prospective study, Data from the Epidemiological Study on the Insulin Resistance Syndrome (DESIR). *Diabetes Care* 2011;34(4):813-7.
12. Louie J, Flood VM, Rangan AM, et al. Higher regular fat dairy consumption is associated with lower incidence of metabolic syndrome but not type 2 diabetes. *Nutr Metab Cardiovasc Dis* 2012;S0939-4753(12):00193-7.
13. Mozaffarian D, Cao H, King IB, et al. Trans-palmitoleic acid, metabolic risk factors, and new-onset diabetes in U.S. adults: a cohort study. *Ann Intern Med* 2010;153:790-799.
14. Mozaffarian D, de Oliveira Otto MC, Lemaitre RN, et al. Trans-Palmitoleic acid, other dairy fat biomarkers, and incident diabetes: the Multi-Ethnic Study of Atherosclerosis (MESA). *Am J Clin Nutr* 2013;97:854–61.
15. Struijk E, Heraclides A, Witte DR, et al. Dairy product intake in relation to glucose regulation indices and risk of type 2 diabetes. *Nutrition, Metabolism and Cardiovascular Diseases* 2012. Article in Press.
16. Shab-Bidar S, Neyestani TR, Djazayeri A, et al. Regular consumption of vitamin d-fortified yogurt drink (Doogh) improved endothelial biomarkers in subjects with type 2 diabetes: a randomized double-blind clinical trial. *BMC Med* 2011;24(9):125.
17. Nikooyeh B, Neyestani TR, Farvid M, et al. Daily consumption of vitamin d- or vitamin d + calcium-fortified yogurt drink improved glycemic control in patients with type 2 diabetes: a randomized clinical trial. *Am J Clin Nutr* 2011;93(4):764-71.