Science Summary
Dairy and Type 2 Diabetes

Overview

Dairy foods such as milk, cheese and yogurt are foundational foods in healthy dietary patterns. The dairy group contributes important shortfall nutrients, including calcium, vitamin D and potassium to the American diet. Low-fat and fat-free dairy foods are part of the Dietary Guidelines for Americans (DGA) recommendations for healthy dietary patterns for Americans 2 years and older. A growing body of research indicates that consuming dairy foods is associated with multiple health benefits, including a reduced risk of type 2 diabetes (T2D). This summary provides an overview of studies conducted since 2015 on the links between dairy food consumption and T2D and provides further support for consuming dairy foods as recommended in the 2020 DGA.

Healthy dietary patterns can help lower risk for T2D and decrease public health costs

T2D affects the lives of more than 30 million American adults and accounts for 90–95 percent of all diagnosed cases of diabetes.[1] Another 84 million American adults have prediabetes, putting them at greater risk of developing T2D.[2] Poor-quality diet and physical inactivity are recognized as key contributors to the epidemics of overweight, obesity and other diet-related chronic diseases including T2D.[3–5] A healthy diet is part of the foundation for T2D prevention, treatment and management.[6] Milk, cheese and yogurt, regardless of fat content, are recommended parts of healthy dietary patterns, within calorie limits, according to the Joslin Diabetes Center's 2018 clinical nutrition guidelines for overweight and obese adults with T2D or prediabetes or those at risk for developing T2D.[7] The 2020 DGA states that healthy dietary patterns are associated with reduced risk for several chronic diseases, including T2D,[5] and the DGA's Healthy U.S.-Style Dietary Pattern recommends 3 daily servings of low-fat or fat-free dairy foods for those 9 years and older, 2½ servings for children 4-8 years and 2 servings for children 2-3 years.[5] It also recommends 1⅔ to 2 servings of whole- and reduced-fat dairy foods for toddlers 12-23 months and small amounts of yogurt and cheese for infants 6 to 12 months, depending on developmental readiness.[5]

Research continues to explore links between dairy food consumption and lower risk for T2D

The 2020 DGA recommendations to include dairy foods in healthy dietary patterns builds on conclusions from previous DGAs as well as from the body of scientific evidence published on the topic. Since 2015, 1 meta-analysis,[8] 2 systematic reviews,[9,10] 4 systematic reviews with meta analyses,[11–14] 14 prospective studies[15–28] and 2 longitudinal studies[29,30] have been published on the links between consuming dairy foods and T2D risk. These studies, discussed in the following sections, indicate that consuming dairy foods has beneficial or neutral associations with T2D incidence in adults and that these associations vary with specific dairy foods.

Low-fat dairy foods linked to reduced T2D risk in systematic reviews and meta-analyses

Six systematic reviews of prospective cohort studies or randomized control trials report that consuming dairy foods, especially yogurt and low-fat dairy foods, is linked with a reduced risk of T2D.[8–13] A systematic review[9] concluded that high-quality evidence indicates that consuming low-fat dairy foods, as well as eating yogurt, is associated with lower risk for T2D. It also indicated that total dairy food consumption, as well as cheese consumption, is associated with lower risk for T2D, based on moderate-quality evidence. Three reviews that conducted meta-analyses[8,10,12] assessed results of over 15 cohort studies and found that both total and low-fat dairy consumption were linked with a reduced risk of T2D. Mishali et al.[12] also concluded that women consuming the highest amounts of dairy compared to women consuming the lowest amounts of dairy were 13 percent less likely to develop T2D. This finding was not observed in males in this meta-analysis. Alvarez-Bueno et al. found that consuming 200-400 grams (g) of dairy foods per day led to the largest reduction in T2D risk.[10] Results of three meta-analyses[8,11,13] found that eating yogurt was linked to lower risk of T2D. In one study, eating 80 g of yogurt daily (245 g yogurt = one 8-ounce cup) was linked with a 14 percent lower risk for T2D.[8] In the second study, eating yogurt regularly (daily or weekly) was associated with a 27 percent lower risk for T2D in seven prospective cohort studies.[11] In the third study, Fan et al. concluded that eating 60 g of yogurt per day decreased T2D risk by 17 percent, and drinking 200 g of milk per day decreased the risk for developing T2D by 9 percent.[13]

Prospective evidence indicates beneficial or neutral links between dairy intake and T2D

Results of 12 of the prospective cohort studies explored the relationship between dairy consumption and T2D, primarily reporting beneficial and neutral associations.[15–18,21,22,25–30] Large cohort studies in the U.S., Europe and Australia found no association between total dairy,[15] dairy fat,[16] yogurt[30] or milk[25] intake with T2D risk. In an Australian cohort, a healthy dietary pattern with adequate fruit and dairy food intake was linked with reduced risk of T2D and could have prevented 23-37 percent of cases.[26] Total intake of dairy foods, as well as eating yogurt and drinking low-fat milk, were associated with lower T2D risk in a Mediterranean cohort of older adults.[19] Results of other studies also indicate that total intake of dairy foods, including whole-fat dairy foods like milk, cheese and yogurt, is associated with a lower risk of T2D.[17,27,28] Consuming whole-fat yogurt was linked to lower rates of T2D in one prospective cohort study.[20] A cohort study of 8,574 Korean adults found that eating yogurt was associated with reduced risk of T2D, though consuming milk, cheese and other sources of calcium was not linked with T2D risk.[18] In a smaller study of 699 adults, participants who consumed more yogurt (1 or more servings per week) had a lower incidence of T2D than less frequent consumers.[29]

Among a cohort of Swedish adults, higher intakes of cheese, fermented milk and butter were associated with lower T2D risk.[21] One study of three large U.S. cohorts concluded that decreasing total dairy intake by one or more servings daily was linked with a higher risk of T2D. This study also found that eating more yogurt (½ cups or more) daily decreased T2D risk by 11 percent while eating more cheese (½ servings or more daily) increased T2D risk by 9 percent.[22] Similarly, Guasch-Ferré et al. found that drinking whole milk was not associated with T2D risk, while consuming 1 serving of either butter or cheese was associated with higher risk.[20]

Fatty acid biomarkers of dairy food intake also associated with lower T2D risk

Results of a systematic review and meta-analysis and two additional prospective cohort studies indicate that biomarkers of dairy fatty acid consumption or consuming dairy fat in cheese may be linked with lower risk of T2D. A systematic review and meta-analysis found that individuals with higher blood levels of the biomarker trans-palmitoleic acid, a fatty acid principally derived from dairy, were less likely to develop T2D.[14] Results from two large prospective cohorts also indicate that higher levels of dairy fat biomarkers in plasma were associated with lower incidence of T2D.[23,24] One of these studies found that higher levels of saturated fatty acids derived from cheese were linked with a lower risk of T2D but this same relationship was not observed in milk-derived saturated fatty acids.[24] More research is needed to better understand these links.

References

[1] Type 2 Diabetes | CDC. https://www.cdc.gov/diabetes/basics/type2.html. Accessed February 1, 2021.

[2] Centers for Disease Control and Prevention. Division of Diabetes Translation At A Glance. https://www.cdc.gov/chronicdisease/resources/publications/aag/diabetes.htm. Published 2019.

[3] Malik VS, Willett WC, Hu FB. Global obesity: trends, risk factors and policy implications. Nat Rev Endocrinol. 2013;9(1):13-27. doi:10.1038/nrendo.2012.199

[4] Oggioni C, Lara J, Wells JCK, Soroka K, Siervo M. Shifts in population dietary patterns and physical inactivity as determinants of global trends in the prevalence of diabetes: An ecological analysis. Nutr Metab Cardiovasc Dis. 2014;24(10):1105-1111. doi:10.1016/j.numecd.2014.05.005

[5] USDA and HHS. 2020-2025 Dietary Guidelines for Americans.; 2020. https://www.dietaryguidelines.gov/sites/default/files/2020-12/Dietary_Guidelines_for_Americans_2020-2025.pdf.

[6] Diabetes Basics | CDC. https://www.cdc.gov/diabetes/basics/. Accessed August 19, 2020.

[7] Hamdy O, Ganda O, Maryniuk M, Gabbay R, Members of the Joslin Clinical Oversight Committee. Evidence Based Diabetes Management: Joslin Clinical Guidelines. Am J Manag Care. 2018;24(7). https://www.ajmc.com/view/chapter-2-clinical-nutrition-guideline-for-overweight-and-obese-adults-with-type-2-diabetes-t2d-or-prediabetes-or-those-at-high-risk-for-developing-t2d.

[8] Gijsbers L, Ding EL, Malik VS, de Goede J, Geleijnse JM, Soedamah-Muthu SS. Consumption of dairy foods and diabetes incidence: a dose-response meta-analysis of observational studies. Am J Clin Nutr. 2016;103(4):1111-1124. doi:10.3945/ajcn.115.123216

[9] Drouin-Chartier J-P, Brassard D, Tessier-Grenier M, et al. Systematic Review of the Association between Dairy Product Consumption and Risk of Cardiovascular-Related Clinical Outcomes. Adv Nutr. 2016;7(6):1026-1040. doi:10.3945/an.115.011403

[10] Alvarez-Bueno C, Cavero-Redondo I, Martinez-Vizcaino V, Sotos-Prieto M, Ruiz JR, Gil A. Effects of Milk and Dairy Product Consumption on Type 2 Diabetes: Overview of Systematic Reviews and Meta-Analyses. Adv Nutr. 2019;10(suppl_2):S154-S163. doi:10.1093/advances/nmy107

[11] Companys J, Pla-Pagà L, Calderón-Pérez L, et al. Fermented Dairy Products, Probiotic Supplementation, and Cardiometabolic Diseases: A Systematic Review and Meta-analysis. Adv Nutr. 2020;11(4):834-863. doi:10.1093/advances/nmaa030

[12] Mishali M, Prizant-Passal S, Avrech T, Shoenfeld Y. Association between dairy intake and the risk of contracting type 2 diabetes and cardiovascular diseases: A systematic review and meta-analysis with subgroup analysis of men versus women. Nutr Rev. 2019;77(6):417-429. doi:10.1093/nutrit/nuz006

[13] Fan M, Li Y, Wang C, et al. Dietary Protein Consumption and the Risk of Type 2 Diabetes: ADose-Response Meta-Analysis of Prospective Studies. Nutrients. 2019;11(11):2783. doi:10.3390/nu11112783

[14] de Souza RJ, Mente A, Maroleanu A, et al. Intake of saturated and trans unsaturated fatty acids and risk of all cause mortality, cardiovascular disease, and type 2 diabetes: systematic review and meta-analysis of observational studies. BMJ. 2015;351:h3978. doi:10.1136/bmj.h3978

[15] Brouwer-Brolsma EM, van Woudenbergh GJ, Oude Elferink SJWH, et al. Intake of different types of dairy and its prospective association with risk of type 2 diabetes: The Rotterdam Study. Nutr Metab Cardiovasc Dis. 2016;26(11):987-995. doi:10.1016/j.numecd.2016.08.003

[16] Ardisson Korat A V., Li Y, Sacks F, et al. Dairy fat intake and risk of type 2 diabetes in 3 cohorts of US men and women. Am J Clin Nutr. 2019;110(5):1192-1200. doi:10.1093/ajcn/nqz176

[17] Bhavadharini B, Dehghan M, Mente A, et al. Association of dairy consumption with metabolic syndrome, hypertension and diabetes in 147 812 individuals from 21 countries. BMJ Open Diabetes Res Care. 2020;8(1):826. doi:10.1136/bmjdrc-2019-000826

[18] Jeon J, Jang J, Park K. Effects of Consuming Calcium-Rich Foods on the Incidence of Type 2 Diabetes Mellitus. Nutrients. 2018;11(1):31. doi:10.3390/nu11010031

[19] Díaz-López A, Bulló M, Martínez-González MA, et al. Dairy product consumption and risk of type 2 diabetes in an elderly Spanish Mediterranean population at high cardiovascular risk. Eur J Nutr. 2016;55(1):349-360. doi:10.1007/s00394-015-0855-8

[20] Guasch-Ferre M, Becerra-Tomas N, Ruiz-Canela M, et al. Total and subtypes of dietary fat intake and risk of type 2 diabetes mellitus in the Prevencí on con Dieta Mediterŕanea (PREDIMED) study. Am J Clin Nutr. 2017;105(3):723-735. doi:10.3945/ajcn.116.142034

[21] Johansson I, Esberg A, Nilsson LM, Jansson JH, Wennberg P, Winkvist A. Dairy product intake and cardiometabolic diseases in Northern Sweden: A 33-year prospective cohort study. Nutrients. 2019;11(2). doi:10.3390/nu11020284

[22] Drouin-Chartier JP, Li Y, Ardisson Korat AV, et al. Changes in dairy product consumption and risk of type 2 diabetes: Results from 3 large prospective cohorts of US men and women. Am J Clin Nutr. 2019;110(5):1201-1212. doi:10.1093/ajcn/nqz180

[23] Yakoob MY, Shi P, Willett WC, et al. Circulating Biomarkers of Dairy Fat and Risk of Incident Diabetes Mellitus Among Men and Women in the United States in Two Large Prospective Cohorts. Circulation. 2016;133(17):1645-1654. doi:10.1161/CIRCULATIONAHA.115.018410

[24] Liu S, van der Schouw YT, Soedamah-Muthu SS, Spijkerman AMW, Sluijs I. Intake of dietary saturated fatty acids and risk of type 2 diabetes in the European Prospective Investigation into Cancer and Nutrition-Netherlands cohort: associations by types, sources of fatty acids and substitution by macronutrients. Eur J Nutr. 2019;58(3):1125-1136. doi:10.1007/s00394-018-1630-4

[25] Vissers LET, Sluijs I, van der Schouw YT, et al. Dairy product intake and risk of type 2 diabetes in EPIC-interact: A mendelian randomization study. Diabetes Care. 2019;42(4):568-575. doi:10.2337/dc18-2034

[26] Dow C, Balkau B, Bonnet F, et al. Strong adherence to dietary and lifestyle recommendations is associated with decreased type 2 diabetes risk in the AusDiab cohort study. Prev Med (Baltim). 2019;123:208-216. doi:10.1016/j.ypmed.2019.03.006

[27] Ericson U, Hellstrand S, Brunkwall L, et al. Food sources of fat may clarify the inconsistent role of dietary fat intake for incidence of type 2 diabetes. Am J Clin Nutr. 2015;101(5):1065-1080. doi:10.3945/ajcn.114.103010

[28] Kummer K, Jensen PN, Kratz M, et al. Full-Fat Dairy Food Intake is Associated with a Lower Risk of Incident Diabetes Among American Indians with Low Total Dairy Food Intake. J Nutr. 2019;149(7):1238-1244. doi:10.1093/jn/nxz058

[29] Crichton GE, Bogucki OE, Elias MF. Dairy food intake, diet patterns, and health: Findings from the Maine-Syracuse Longitudinal Study. Int Dairy J. 2019;91:64-70. doi:10.1016/j.idairyj.2018.12.009

[30] Buziau AM, Soedamah-Muthu SS, Geleijnse JM, Mishra GD. Total Fermented Dairy Food Intake Is Inversely Associated with Cardiovascular Disease Risk in Women. J Nutr. 2019;149(10):1797-1804. doi:10.1093/jn/nxz128