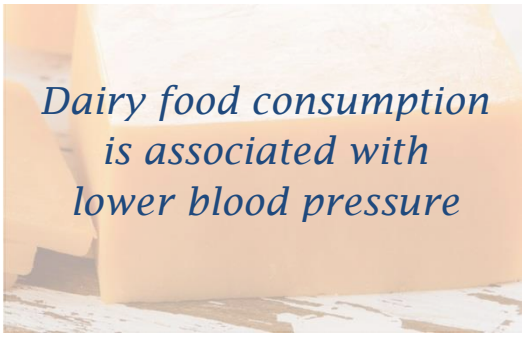
SCIENCE SUMMARY: Blood Pressure



Overview

Dairy foods such as milk, cheese and yogurt are foundational foods in healthy eating patterns that contribute important shortfall nutrients, including calcium, vitamin D and potassium. Low-fat and fat-free dairy foods are part of the Dietary Guidelines for Americans (DGA) and American Heart Association (AHA) dietary recommendations. A growing body of research indicates that dairy food consumption is associated with multiple health benefits, including lower blood pressure. This summary reviews studies about dairy food consumption and blood pressure published between 2009 and 2015, building on the scientific review conducted for the 2010 DGA. This research provides further support for consuming low-fat or fat-free dairy foods as recommended in 2015 DGA.

Healthy eating patterns, such as the DASH diet, can help maintain normal blood pressure and decrease public health costs

High blood pressure is a major risk factor for heart disease, stroke, congestive heart failure and kidney disease (1). Almost 70 million American adults (29%) have hypertension (i.e., high blood pressure) and nearly one out of every three adults in the U.S. has pre-hypertension (1). Total U.S. healthcare costs and lost productivity associated with high blood pressure in 2011 was $46 billion (2). Guidelines for the prevention of high blood pressure and cardiovascular disease highlight the importance of weight control, physical activity, smoking avoidance, limited alcohol consumption, and healthy dietary patterns (1, 2). The AHA identifies suboptimal diet quality as the leading risk factor for death and disability in the U.S. (2).

The Dietary Approaches to Stop Hypertension (DASH) diet, a reduced-fat diet containing up to three servings of dairy foods and 8-10 servings of fruits and vegetables, has been demonstrated to lower elevated blood pressure (3, 4). The 2013 AHA/American College of Cardiology (ACC) Guideline on Lifestyle Management to Reduce Cardiovascular Risk includes low-fat dairy foods in recommended dietary patterns for adults who would benefit from blood pressure lowering (5). The 2015 DGA states that healthy eating patterns are associated with reduced risk for several chronic diseases, including cardiovascular disease (strong evidence) and type 2 diabetes (moderate evidence) (6). The DGA recommends three daily servings of low-fat or fat-free dairy foods for those 9 years and older, 2½ servings for children 4-8 years, and two for children 2-3 years in the Healthy U.S.-Style Eating Pattern (6).

Strong evidence shows adults may benefit from combining the Dietary Approaches to Stop Hypertension (DASH) eating pattern with lower sodium to lower elevated blood pressure (6).

Accumulating evidence finds dairy food consumption is linked to lower blood pressure

The 2010 Dietary Guidelines, based on evidence published through mid-2009, stated: “Moderate evidence…indicates that intake of milk and milk products is associated with a reduced risk of cardiovascular disease and type 2 diabetes and with lower blood pressure in adults” (7). Since 2009, the body of evidence on dairy foods and blood pressure has continued to grow.

Research published between 2009 and 2015 has explored the effects of dairy food consumption on blood pressure via two meta-analyses (8, 9), six prospective cohort studies (10-15), and 11 clinical trials (16-26). The majority of these studies provide support for the link between higher dairy food consumption and improvements in blood

pressure, especially in at risk populations. Overall, findings are consistent with, and provide additional support for, the role of dairy foods in eating patterns recommended in the DGA.

Meta-analyses find higher dairy food consumption is linked to lower blood pressure

Two meta-analyses of prospective cohort studies in adults found that total dairy food consumption, especially consumption of low-fat dairy foods, was associated with reduced risk for high blood pressure (8, 9). One of these meta-analyses included five prospective studies, and found higher total dairy, low-fat dairy, and fluid dairy food (milk and yogurt) consumption was associated with reduced risk for high blood pressure (8). The other meta-analysis included nine prospective studies, and it examined the dose-response relationship between dairy food consumption and blood pressure (9). Total dairy food intake was associated with a 3% lower risk of high blood pressure for each 200 grams per day (one 8 ounce cup = ~240 grams). Among different types of dairy foods, low-fat dairy foods and milk were also associated with lower blood pressure.

Prospective studies find dairy food consumption linked to lower blood pressure

Five prospective studies conducted outside the U.S. found beneficial or neutral effects of dairy consumption on blood pressure. A French cohort followed for nine years found that total dairy food (except cheese) and cheese consumption were associated with lower diastolic blood pressure (10), while a 13-year longitudinal analysis from China found the consumption of dairy foods was associated with lower systolic blood pressure (11). A study from the United Kingdom (UK) of adult men followed for 23 years found that those with the highest milk consumption had lower systolic blood pressure compared to those who did not regularly consume milk (12). Another study of UK adults found dairy food consumption was not associated with a change in blood pressure (13). Higher dairy food consumption also has been associated with lower blood pressure in children and adolescents, either comparing highest to lowest quintiles of intake (14), or as part of a DASH-type eating pattern (15). Overall, the large majority of prospective studies indicate a beneficial or neutral association between higher dairy food consumption and blood pressure in adults.

The nutrient package in milk, cheese and yogurt, including calcium, potassium and protein, may contribute to the beneficial links between dairy foods and blood pressure (27).

Trials find low-fat dairy food consumption lowers or helps maintain blood pressure

Clinical trials comparing higher levels of dairy foods (approximately three or more servings per day) to lower levels provide reliable evidence about the amount of dairy foods needed to see an effect. Clinical trials of overweight or obese individuals with metabolic syndrome have consistently found that dietary interventions with intakes of up to three dairy servings per day can reduce elevated blood pressure or improve markers of vascular function (16-18). One of these, an acute study of 33 obese adults with metabolic syndrome, found that when compared to rice milk, low-fat milk was a more effective option for maintaining markers of normal vascular function after a meal (18).

Results from clinical trials in pre-hypertensive or hypertensive, overweight or obese individuals also indicate that at least three dairy servings per day decreases or does not change blood pressure (19-22). Of particular interest is a randomized crossover trial of 49 adults with hypertension that found the addition of four or more servings per day of fat-free dairy foods for four weeks reduced systolic blood pressure and improved vascular function when compared to a similar diet without dairy foods (19, 20). This is the first study to show an effect from changes in dairy food consumption alone; it may help explain the role of reduced-fat dairy foods in DASH (3). Other studies of overweight and obese adults and those with normal blood pressure found that regular consumption of dairy foods did not raise blood pressure (23-26).

Collectively, clinical studies indicate that consuming recommended amounts of dairy foods doesn't increase blood pressure, and some studies show that dairy food consumption can help maintain normal blood pressure or help lower blood pressure, especially in those adults at risk for elevated blood pressure.

References

1. Roger VL, Go AS, Lloyd-Jones DM, Benjamin EJ, Berry JD, Borden WB, Bravata DM, Dai S, Ford ES, Fox CS, et al. Heart disease and stroke statistics--2012 update: a report from the American Heart Association. Circulation 2012;125:e2-e220.
2. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, de Ferranti S, Despres JP, Fullerton HJ, Howard VJ, et al. Heart disease and stroke statistics-2015 update: a report from the American Heart Association. Circulation 2015;131:e29-e322.
3. Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Sacks FM, Bray GA, Vogt TM, Cutler JA, Windhauser MM, Lin PH, Karanja N. A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. N Engl J Med 1997;336:1117-1124.
4. U.S. Dept. of Agriculture, U.S. Dept. Health and Human Services and the National Heart, Lung and Blood Institute. In Brief: Your Guide to Lowering Your Blood Pressure With DASH. NIH Publication No 06-5834 2006.
5. Eckel RH, Jakicic JM, Ard JD, de Jesus JM, Houston Miller N, Hubbard VS, Lee IM, Lichtenstein AH, Loria CM, Millen BE, Nonas CA, Sacks FM, Smith SC Jr, Svetkey LP, Wadden TA, Yanovski SZ; American College of Cardiology/American Heart Association Task Force on Practice Guidelines. 2013 AHA/ACC guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol. 2014;63:2960-2984.
6. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015-2020 Dietary Guidelines for Americans. 8th Edition, December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/.
7. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th Edition, Washington, DC: U.S. Government Printing Office, December 2010.
8. Ralston RA, Lee JH, Truby H, Palermo CE, Walker KZ. A systematic review and meta-analysis of elevated blood pressure and consumption of dairy foods. J Hum Hypertens 2012;26:3-13.
9. Soedamah-Muthu SS, Verberne LD, Ding EL, Engberink MF, Geleijnse JM. Dairy consumption and incidence of hypertension: a dose-response meta-analysis of prospective cohort studies. Hypertension 2012;60:1131-1137.
10. Fumeron F, Lamri A, Abi Khalil C, Jaziri R, Porchay-Balderelli I, Lantieri O, Vol S, Balkau B, Marre M. 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;34:813-817.
11. Lin PH, Yeh WT, Svetkey LP, Chuang SY, Chang YC, Wang C, Pan WH. Dietary intakes consistent with the DASH dietary pattern reduce blood pressure increase with age and risk for stroke in a Chinese population. Asia Pac J Clin Nutr 2013;22:482-491.
12. Livingstone KM, Lovegrove JA, Cockcroft JR, Elwood PC, Pickering JE, Givens DI. Does dairy food intake predict arterial stiffness and blood pressure in men?: Evidence from the Caerphilly Prospective Study. Hypertension 2013;61:42-47.
13. Heraclides A, Mishra GD, Hardy RJ, Geleijnse JM, Black S, Prynne CJ, Kuh D, Soedamah-Muthu SS. Dairy intake, blood pressure and incident hypertension in a general British population: the 1946 birth cohort. Eur J Nutr 2012;51:583-591.
14. Rangan AM, Flood VL, Denyer G, Ayer JG, Webb KL, Marks GB, Celermajer DS, Gill TP. The effect of dairy consumption on blood pressure in mid-childhood: CAPS cohort study. Eur J Clin Nutr 2012;66:652-657.
15. Moore LL, Bradlee ML, Singer MR, Qureshi MM, Buendia JR, Daniels SR. Dietary Approaches to Stop Hypertension (DASH) eating pattern and risk of elevated blood pressure in adolescent girls. Br J Nutr 2012;108:1678-1685.
16. Stancliffe RA, Thorpe T, Zemel MB. Dairy attentuates oxidative and inflammatory stress in metabolic syndrome. Am J Clin Nutr 2011;94:422-430.
17. van Meijl LE, Mensink RP. Low-fat dairy consumption reduces systolic blood pressure, but does not improve other metabolic risk parameters in overweight and obese subjects. Nutr Metab Cardiovasc Dis 2011;21:355-361.
18. Ballard KD, Mah E, Guo Y, Pei R, Volek JS, Bruno RS. Low-fat milk ingestion prevents postprandial hyperglycemia-mediated impairments in vascular endothelial function in obese individuals with metabolic syndrome. J Nutr 2013;143:1602-1610.
19. Machin DR, Park W, Alkatan M, Mouton M, Tanaka H. Hypotensive effects of solitary addition of conventional nonfat dairy products to the routine diet: a randomized controlled trial. Am J Clin Nutr 2014;100:80-87.
20. Machin DR, Park W, Alkatan M, Mouton M, Tanaka H. Effects of non-fat dairy products added to the routine diet on vascular function: a randomized controlled crossover trial. Nutr Metab Cardiovasc Dis. 2015:25(4):364-369.
21. Drouin-Chartier JP, Gigleux I, Tremblay AJ, Poirier L, Lamarche B, Couture P. Impact of dairy consumption on essential hypertension: a clinical study. Nutr J 2014;13:83.
22. Maki KC, Rains TM, Schild AL, Dicklin MR, Park KM, Lawless AL, Kelley KM. Effects of low-fat dairy intake on blood pressure, endothelial function, and lipoprotein lipids in subjects with prehypertension or stage 1 hypertension. Vasc Health Risk Manag 2013;9:369-379.
23. Wennersberg MH, Smedman A, Turpeinen AM, Retterstol K, Tengblad S, Lipre E, Aro A, Mutanen P, Seljeflot I, Basu S, et al. Dairy products and metabolic effects in overweight men and women: results from a 6-mo intervention study. Am J Clin Nutr 2009;90:960-968.
24. Zemel MB, Sun X, Sobhani T, Wilson B. Effects of dairy compared with soy on oxidative and inflammatory stress in overweight and obese subjects. Am J Clin Nutr 2010;91:16-22.
25. Alonso A, Zozaya C, Vazquez Z, Alfredo Martinez J, Martinez-Gonzalez MA. The effect of low-fat versus whole-fat dairy product intake on blood pressure and weight in young normotensive adults. J Hum Nutr Diet 2009;22:336-342.
26. Toxqui L, Blanco-Rojo R, Wright I, Perez-Granados AM, Vaquero MP. Changes in blood pressure and lipid levels in young women consuming a vitamin D-fortified skimmed milk: a randomised controlled trial. Nutrients 2013;5:4966-4977.
27. Park KM, Cifelli CJ. Dairy and blood pressure: a fresh look at the evidence. Nutr Rev 2013;71:149-157.