The Role of Soyfoods in Dietary Patterns Recommended for Heart Disease Prevention

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Introduction

Over the past decade, there has been a shift in nutrition guidance from focusing on single nutrients (such as reducing saturated fat and sodium and increasing fiber and potassium) to now concentrating on dietary patterns.[1] This shift likely occurred for several reasons: 1) some specific nutrient recommendations fail to improve heart health, 2) nutrients are not consumed in isolation and therefore interactions between foods are missed, 3) dietary patterns that combine various foods and nutrients will have a more significant effect on health, and 4) dietary pattern recommendations may be easier to translate to the public.[1]

Dietary patterns frequently recommended by international dietary and clinical practice guidelines for heart disease risk reduction include: 1) the Mediterranean diet, 2) the Dietary Approaches to Stop Hypertension (DASH) diet, 3) a low glycemic index (GI) diet, 4) a vegetarian diet, and 5) the Portfolio Diet. The 2015-2020 Dietary Guidelines for Americans also recommends the healthy Mediterranean-style and healthy vegetarian dietary patterns.[2] A common theme among these five dietary patterns is that they are primarily plant-based, and soyfoods can play a significant role.

Mediterranean Diet

The Mediterranean diet is a traditional way of eating in countries along the Mediterranean Sea which became popular because fewer cardiovascular disease (CVD) deaths occurred in these countries. The diet is high in fruits and vegetables, whole grains, legumes, nuts, and olive oil. In the landmark PREDIMED trial which involved high-risk persons without cardiovascular disease, assignment to an energy-unrestricted Mediterranean diet supplemented with either extra-virgin olive oil or nuts was associated with a lower risk of major cardiovascular events over a 5 year period than assignment to a control

(low-fat) diet, with a relative difference of 30% and an absolute difference of 1.7 to 2.1 percentage points.[3] Similar findings were also found in a meta-analysis of prospective cohort studies comparing those who were most adherent to the Mediterranean diet to those who were the least adherent.[4]

DASH Diet

The DASH diet was originally developed to treat high blood pressure and has resulted in clinically meaningful reductions in blood pressure.[5] The diet emphasizes fruits, vegetables, low-fat dairy, whole grains, nuts and legumes (including soy), and limits red and processed meats, sugary foods and sodium. Specifically, the diet recommends four to five servings of nuts and legumes per week. A recent meta-analysis of prospective cohort studies and controlled trials found that higher adherence to the DASH diet was associated with a ~20% decreased risk of CVD, coronary heart disease (CHD), and stroke in the cohorts.[6] In the trials, the DASH diet significantly reduced systolic (mean difference (MD): -5.2 mmHg) and diastolic (-2.60 mmHg) blood pressure, total cholesterol (-7.73 mg/dL), LDL-C (-3.87 mg/dL), and body weight (-3.13 lbs) compared to a usual or low-fat diet.[6]

Low Glycemic Index (GI) Diet

The GI is a scale that ranks carbohydrate-containing foods by how much they raise blood glucose compared to a standard food consumed by the same person.[7] The scale ranges from 0 to 100, with higher numbers indicating a higher GI. A low GI diet is a dietary pattern that focuses on consuming carbohydrate-containing foods that have a low GI. Soyfoods such as tofu, edamame, and soymilk all have a low GI (<55)[8] and, therefore result in a slower rate of glucose absorption after consumption that reduces the post-meal rise in gut hormones (i.e., incretins) and insulin.[7] A recent dose-response meta-analysis found that for each 10 unit increase in GI, the associated risk for CHD increased by 24%.[9] This evidence is also in line with evidence from controlled trials, which showed that a low GI diet reduced markers of glycemic control (HbA1c) by ~0.5% in patients that have diabetes,[10] a major risk factor for CVD. Total cholesterol and LDL-C were also significantly reduced (MD: -5.03 mg/dL and -6.19 mg/dL, respectively) in patients with and without diabetes compared to high GI diets.[10]

Healthy Vegetarian Diet

Vegetarian diets contain no meat, fish, or poultry, and some may exclude all animal products, including dairy and eggs. Given the avoidance of animal protein foods, soy is an essential high-quality protein source for vegetarians. Recently, a meta-analysis of prospective cohort studies found that vegetarians had an assocation with a 22% lower risk of CHD mortality, but no associations were found with CVD or stroke mortality.[11] A meta-analysis of controlled trials found significant reductions in total cholesterol (mean difference [MD]: -12.5 mg/dl), LDL-C (-12.2 mg/dl), systolic (-4.8 mmHg) and diastolic (-2.2 mmHg) blood pressure in vegetarians compared to non-vegetarians.[12,13]

Portfolio Diet

The Portfolio diet was initially developed to lower cholesterol, and an early trial showed that the LDL-C lowering effect of the diet was similar to a first-generation statin (-30%).[14] The diet is low in saturated fat and cholesterol and emphasizes plant protein (mainly soy), nuts, viscous fiber sources, and plant sterols. One goal of the Portfolio diet is to consume 50g of plant protein per day mostly from soy. Recently, a meta-analysis of controlled trials showed that the diet significantly lowered LDL-C (MD: -28.23 mg/dL) and other CVD risk factors, including non-high-density lipoprotein (non-HDL-C, -32.05 mg/dL), Apolipoprotein B (ApoB, -0.19 g/L), and C-reactive protein (-0.58 mg/L) compared to a low-fat diet.[15]

The Role of Soy in these Heart Healthy Dietary Patterns

The benefits of including soy in these dietary patterns may be attributed to several factors including its provision of high-quality protein, isoflavones, polyunsaturated fat, fiber, vitamins and minerals.[16-18] Indeed, consuming soyfoods in place of other common sources of protein has shown reductions in some CVD risk factors. Evidence from meta-analyses indicates that soy protein decreases the established lipid targets LDL-C, non-HDL-C, and ApoB,[17,19,20] decreases blood pressure,[21] and improves glycemic control in those with diabetes.[22] In 1999, the FDA approved a health claim for soy protein and CHD based on its cholesterol-lowering effect,[23] and many other countries have adopted similar claims.[24]

Soyfoods can also be a significant part of other heart-healthy dietary patterns not discussed here (such as the Healthy Nordic Diet,[25] Healthy American,[2] or Healthy Plant-Based/Flexitarian).[26]

Clearly, many dietary patterns that contain soyfoods play an important role in CVD risk reduction. These soy-containing dietary patterns represent the way forward for dietary guidance and future research to continue to establish the benefits of soy in heart disease prevention.

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References

1. Cespedes EM, Hu FB. Dietary patterns: from nutritional epidemiologic analysis to national guidelines. Am J Clin Nutr 2015;101:899-900.
2. U.S. Department of Agriculture. Dietary guidelines for Americans 2015-2020. 2015. (Accessed April 1, 2020, at https://health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf)
3. Estruch R, Ros E, Salas-Salvado J, et al. Primary Prevention of Cardiovascular Disease with a Mediterranean Diet Supplemented with Extra-Virgin Olive Oil or Nuts. N Engl J Med 2018;378:e34.
4. Galbete C, Schwingshackl L, Schwedhelm C, Boeing H, Schulze MB. Evaluating Mediterranean diet and risk of chronic disease in cohort studies: an umbrella review of meta-analyses. Eur J Epidemiol 2018;33:909-31.
5. Sacks FM, Svetkey LP, Vollmer WM, et al. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. N Engl J Med 2001;344:3-10.
6. Chiavaroli L, Viguiliouk E, Nishi SK, et al. DASH Dietary Pattern and Cardiometabolic Outcomes: An Umbrella Review of Systematic Reviews and Meta-Analyses. Nutrients 2019;11.
7. Jenkins DJ, Kendall CW, Augustin LS, et al. Glycemic index: overview of implications in health and disease. Am J Clin Nutr 2002;76:266S-73S.
8. Atkinson FS, Foster-Powell K, Brand-Miller JC. International tables of glycemic index and glycemic load values: 2008. Diabetes Care 2008;31:2281-3.
9. Livesey G, Livesey H. Coronary Heart Disease and Dietary Carbohydrate, Glycemic Index, and Glycemic Load: Dose-Response Meta-analyses of Prospective Cohort Studies. Mayo Clin Proc Innov Qual Outcomes 2019;3:52-69.
10. Viguiliouk E, Nishi S.K., Wolever T.M.S et al. Point: Glycemic Index - An important but oft misunderstood marker of carbohydrate quality. Cereal Foods World 2018;63:158-64.
11. Glenn AJ, Viguiliouk E, Seider M, et al. Relation of Vegetarian Dietary Patterns With Major Cardiovascular Outcomes: A Systematic Review and Meta-Analysis of Prospective Cohort Studies. Front Nutr 2019;6:80.
12. Yokoyama Y, Levin SM, Barnard ND. Association between plant-based diets and plasma lipids: a systematic review and meta-analysis. Nutr Rev 2017;75:683-98.
13. Yokoyama Y, Nishimura K, Barnard ND, et al. Vegetarian diets and blood pressure: a meta-analysis. JAMA Intern Med 2014;174:577-87.
14. Jenkins DJ, Kendall CW, Marchie A, et al. Effects of a dietary portfolio of cholesterol-lowering foods vs lovastatin on serum lipids and C-reactive protein. JAMA 2003;290:502-10.
15. Chiavaroli L, Nishi SK, Khan TA, et al. Portfolio Dietary Pattern and Cardiovascular Disease: A Systematic Review and Meta-analysis of Controlled Trials. Prog Cardiovasc Dis 2018;61:43-53.
16. Sacks FM, Lichtenstein A, Van Horn L, et al. Soy protein, isoflavones, and cardiovascular health: an American Heart Association Science Advisory for professionals from the Nutrition Committee. Circulation 2006;113:1034-44.
17. Jenkins DJA, Blanco Mejia S, Chiavaroli L, et al. Cumulative Meta-Analysis of the Soy Effect Over Time. J Am Heart Assoc 2019;8:e012458.
18. Ma L, Liu G, Ding M, et al. Isoflavone Intake and the Risk of Coronary Heart Disease in US Men and Women: Results From 3 Prospective Cohort Studies. Circulation 2020.
19. Blanco Mejia S, Messina M, Li SS, et al. A Meta-Analysis of 46 Studies Identified by the FDA Demonstrates that Soy Protein Decreases Circulating LDL and Total Cholesterol Concentrations in Adults. J Nutr 2019;149:968-81.
20. Li SS, Blanco Mejia S, Lytvyn L, et al. Effect of Plant Protein on Blood Lipids: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. J Am Heart Assoc 2017;6.
21. Dong JY, Tong X, Wu ZW, Xun PC, He K, Qin LQ. Effect of soya protein on blood pressure: a meta-analysis of randomised controlled trials. Br J Nutr 2011;106:317-26.
22. Viguiliouk E, Stewart SE, Jayalath VH, et al. Effect of Replacing Animal Protein with Plant Protein on Glycemic Control in Diabetes: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Nutrients 2015;7:9804-24.
23. Food labeling: health claims; soy protein and coronary heart disease. Food and Drug Administration, HHS. Final rule. Fed Regist 1999;64:57700-33.
24. Xiao CW. Health effects of soy protein and isoflavones in humans. J Nutr 2008;138:1244S-9S.
25. Adamsson V, Reumark A, Fredriksson IB, et al. Effects of a healthy Nordic diet on cardiovascular risk factors in hypercholesterolaemic subjects: a randomized controlled trial (NORDIET). J Intern Med 2011;269:150-9.
26. Satija A, Bhupathiraju SN, Spiegelman D, et al. Healthful and Unhealthful Plant-Based Diets and the Risk of Coronary Heart Disease in U.S. Adults. J Am Coll Cardiol 2017;70:411-22.