Food Talk: Unique Food Messages Influencing Heart Health and Diabetes

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Introduction

Cardiometabolic disease, including coronary heart disease (CHD), stroke and type 2 diabetes (T2D), accounts for nearly 1 in 4 deaths annually in the United States, amounting to 702,308 deaths in 2012. This includes 371,266 CHD related deaths, 128,294 deaths from stroke and 67,914 from T2D.[1] This highly preventable loss of life leads to a tremendous burden for families and for the nation as a whole. It is estimated that the economic impact from direct and indirect costs [i] of heart disease, stroke and T2D was a staggering $312.6 billion in 2009. [2]

Common among those people suffering from a chronic disease associated with cardiometabolic dysfunction, regardless of gender or race, is a sedentary lifestyle with low levels of physical activity accompanied by the consumption of a Western style diet typically characterized by:

- high intake of saturated fats, sodium and processed sugars
- low intake of omega-3 fatty acids and antioxidant-rich fruits and vegetables

Following a Western dietary pattern is known for its impact on setting the stage for increased risk of a myriad of chronic diseases. Less well studied, however, yet essential to informing future public policy, guiding health reform and creating effective health focused educational programs is a deeper dive into the individual foods which make up a diet and how these affect chronic disease process and risk. Interestingly enough, this takes on two separate points to consider:

a. What foods in the Western diet increase the risk of chronic disease?
b. What foods, NOT included in a typical Western diet, that through their nutritional profile absence, increase the risk for chronic disease?

A publication in JAMA in 2017 entitled, "*Association between Dietary Factors and Mortality from Heart Disease, Stroke, and Type 2 Diabetes in the United States*", estimated the associations of intake of 10 specific dietary factors to mortality due to heart disease, stroke and T2D. This analysis took into account foods which were present and absent within the dietary patterns studied giving a great deal of insight into the effects created by particular food or nutrient excesses as well as deficiencies.

The study evaluated individual dietary factors in relationship to disease-specific and demographic-specific (age, sex, race, and education) mortality between 2002-2012 resulting in eye-opening trends and actionable take-away data. The 10 specific dietary categories which were reviewed included:

- fruits (excluding fruit juices)
- vegetables including legumes
- nuts/seeds, whole grains
- unprocessed red meats
- processed meats
- sugary soft drink beverages (SSB)
- polyunsaturated fatty acids
- seafood
- omega-3 fats
- sodium

[i] *Direct costs* - personal health care expenditures for hospital and professional services care, prescribed medications, and home care reported by the Medical Expenditure Panel Survey (MEPS), Agency for Healthcare Research and Quality (AHRQ), by diagnosis, excluding nursing home care costs and costs due to comorbidities.

Indirect costs - The mortality cost for each disease group was estimated for 2009 by multiplying the number of deaths by age, sex, and cause of death in 2009 by the 2009 present value of lifetime earnings discounted at 3 percent.

Results of this study indicated the largest estimated mortality from cardiometabolic disease in relationship to dietary factors was associated with excess sodium intake followed by low intake of nuts/seeds, seafood, omega-3 fats, vegetables, fruits and whole grains and high consumption of SSBs.

Estimated deaths related to processed meats and SSBs were higher among males than females while, by age, the consumption of SSBs were the leading estimated factor associated with cardiometabolic mortality between the ages of 25 and 64 years of age. For those over 65 years of age, sodium intake was the leading estimated dietary factor associated with cardiometabolic mortality. Taking into account other demographics, there were disparities found by race with excess SSBs consumed by Blacks and insufficient intake of nuts and seeds amongst Hispanics. By education it was found that intake of nuts/seeds and fruits were lower among less-educated adults which was the same population also found to consume a higher level of SSBs. Income levels also play a role in these differences and may be part of the reason for lower consumption of higher priced dietary components such as nuts/seeds and fruits in lower income groups while less expensive items including SSBs are utilized at higher levels in this economic population.[1]

Below are listed observed levels at which the lowest disease risk of cardiometabolic disease occurs (labeled as Optimal) followed by the mean consumption of each of these factors in adults $\geq$ 25 years of age between 2009-2012:

- Fruits Optimal 300 g/d Mean 115.0 g/d
- Vegetables including legumes Optimal 400g/d Mean 182.5 g/d
- Nuts/seeds Optimal 20.2 g/d Mean 11.7 g/d
- Whole grains Optimal 125 g/d Mean 21.2 g/d
- Red meats, unprocessed Optimal 14.3 g/d Mean 47.4 g/d
- Processed meats Optimal no intake Mean 30.8 g/d
- SSB Optimal no intake Mean 1.14, 8 ounce serving/day
- PUFAs Optimal 11% energy Mean 7.7% energy
- Seafood omega-3 fats Optimal 250 mg/d Mean 100 mg/d
- Sodium Optimal 2000 mg/d Mean 3480 mg/d [1]

How does diet affect cardiometabolic disease?

As can be seen, low intake of health optimizing foods such as fruits, vegetables and whole grains along with increased consumption of disease triggering foods can lead to increased risk of cardiometabolic disease.

In the cardiometabolic disease state, inflammation is the dominant area of focus for both prevention and treatment. The inflammatory disease process is greatly influenced by nutrition where the dietary signal is active in most people three to five times daily through meals and snacks.

Research has shown that key inflammatory markers and proteins including high-sensitivity CRP (hs-CRP), interleukins (IL-1, IL-6), and tumor necrosis factor alpha (TNF-α) are at the root of atherogenesis and cardiovascular event progression but can be modulated through targeted dietary interventions. It is well known that the Mediterranean food plan, a diet high in anti-inflammatory foods including fish, yogurt, vegetables, pasta, greens, fruit, and wine, plays a protective role against free radicals and oxidants and may reduce the levels of the previously mentioned inflammatory markers.[3]

The Mediterranean food plan is protective for two reasons –both for what it includes and what it does not. For example, the Mediterranean food plan is high in anti-inflammatory components including omega-3 fatty acids, vitamins B1 (thiamine), B2 (riboflavin) and B3 (niacin), folic acid, vitamin A, vitamin C, vitamin E, beta-carotene, magnesium, and zinc while

low in pro-inflammatory triggers such as sodium, saturated fats, sugar, artificial colors and preservatives. [3]

A 2004 study showed that after following a Mediterranean food plan for two years, subjects were found to have significant decreases in numerous markers when compared to controls. These markers included: body weight; body mass index; waist circumference; HOMA score; blood pressure; and levels of glucose, insulin, total cholesterol, and triglycerides and a significant increase in levels of high-density lipoprotein cholesterol. Additionally, the serum concentrations for specific inflammatory markers including IL-6, IL-7, IL-18, and hs-CRP were significantly reduced when compared with those in the control group. Endothelial function score was also improved in the study group indicating lower cardiometabolic disease risk.[4]

A more recent study published in 2017 continues to support these outcomes with additional findings including an inverse relationship between an anti-inflammatory diet and Pulse Wave Velocity (PWV) and a positive relationship with Flow Mediated Dilation (FMD).[3] PWV is a measure of arterial stiffness with lower measurements indicating less stiffness and is a useful tool in predicting future CV events. FMD is helpful in detecting early vascular abnormalities such as endothelial dysfunction with higher values indicating less dysfunction.[5] Both of these markers are improved by following an anti-inflammatory, Mediterranean-like diet indicating an inverse association between cardiometabolic risk score and an anti-inflammatory diet rich in vegetables, fruits, whole grains, nuts, seeds, omega-3s, lean protein and low in saturated fats, processed grains, salt and sugar.

As discussed in the article, "*Association Between Dietary Factors and Mortality From Heart Disease, Stroke, and Type 2 Diabetes in the United States"* there are several categories of bio-actives that are found within these foods that may be partially responsible for the anti-inflammatory protective processes associated with their frequent consumption. Two more common bio-active groups are discussed below and, it should be mentioned, are present in large quantities in diets that favor a Mediterranean and plant-based profile.

Carotenoids – A higher intake of foods rich in *α*- and *β*-carotene were found to be associated with a reduction in risk of coronary artery disease (CAD) [6] while a low serum *β*-carotene concentrations may increase the risk of sudden cardiac death, CVD, and total mortality.[7] Carotenoids can be found in high concentrations in carrots, collards, tomatoes, spinach, pumpkin, sweet potatoes, kale, turnip greens and apricots.[8]

Flavonoids – A 2013 review of twenty publications from 12 prospective cohorts evaluated associations between flavonoid intakes and incidence or mortality from CV disease among adults in Europe and United States. In spite of the limitations of many of the existing studies, evidence is building that some of the flavonoid classes may be associated with lower coronary heart disease mortality. The findings suggest that higher flavonoid consumption may be associated both with primary prevention of CV and possibly lower CV mortality.[9] Foods high in flavonoids include onions, apples, parsley, oranges, blueberries, bananas, bell peppers, grapefruit, lettuce, lemons, strawberries, tomatoes, peaches and cherries.[10]

These are just two of the numerous bio-active groups potentially associated with a reduction in cardiometabolic disease processes; others include **glucosinolates** found in the cruciferous family vegetables, **isoflavones** found in soy products, **ellagitannins** present in walnuts, raspberries, and pomegranates and many others which exist across the full spectrum of plant foods.[11] The high levels of these plant bio-actives found in a Mediterranean diet and other whole foods, plant-based dietary approaches indicate the importance of this type of nutritional profile in reducing the incidence and risk of cardiometabolic disease.

Absence of Nutrients

As was pointed out in the beginning of this article, it's not simply what is *present* in the diet but also what is *missing* from the nutritional profile that will affect the overall risk of cardiometabolic disease. Cardiovascular disease has been associated with the following essential nutrient insufficiencies: calcium, copper, chromium, vitamin D, potassium, magnesium, selenium and zinc while T2D has been associated with insufficiencies of calcium, chromium, vitamin D, magnesium, selenium and zinc.[12]

Interestingly enough, these lists are very similar to a list of nutrients which have been found to be deficient in the typical Western diet and are rarely being consumed at adequate levels when compared to the US recommended dietary allowances. In fact, a 2005 review of the nutrition profile of individuals aged $\geq$ 2 years found that a full 61% of studied individuals were not eating the recommended dietary allowance for magnesium while 65% did not meet recommended allowance for calcium and over 73% were not meeting recommended dietary allowances for zinc. [13]

Food is Information

"Let food be thy medicine and medicine be thy food", a saying commonly attributed to Hippocrates from nearly 2500 years ago. Even then, healers knew that food was information for the body, a signaling mechanism to turn certain messages on, off, up or down. With today's technological advances we are beginning to elucidate the mechanisms underlying the "food as medicine" philosophy and hopefully, with increased awareness, can create the implementation messaging to compel a greater trend for a "food as medicine" society. If successful, this will reduce the effects of suboptimal nutritional status on rates of cardiometabolic disease and mortality both by increasing essential nutrients to optimize cardiometabolic health while reducing detrimental signaling from unhealthy food sources.

Summary

In conclusion, although it is true that a "one size diet does not fit all", the science does indicate that there is a more beneficial nutritional profile that must be adhered to in order to maintain low levels of inflammation thus mitigating the risk of cardiometabolic disease. It seems to be more important to incorporate a high variety of bio-active compounds on a constant basis rather than focusing in on a few select foods. Rather, increasing the variety of plant-based foods or, effectively "consuming the rainbow" on a daily basis, increases the opportunity to incorporate a high level of various bio-actives or phytonutrients in the diet, reduce the risk of micronutrient deficiencies, increase anti-inflammatory molecules and, in general, direct the body towards a lower level of inflammation and a lower risk of chronic disease.

Food groups to encourage in a plant-based, anti-inflammatory, Mediterranean-like diet include: fruits, vegetables, legumes, whole grains, nuts, seeds, sea food/omega-3's, PUFAs while foods that should be avoided include SSBs, sugar, excessive salt, saturated fats, processed meat products, and unprocessed red meat.

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[1] Micha R, Penalvo J, Cudhea F, Imamura F, Rehm C Mozaffarian D. Association Between Dietary Factors and mortality From Heart Disease, Stroke, and Type 2 Diabetes in the United States. *JAMA.* 2017;317(9):912-924.
[2] National Heart, Blood and Lung Institute. Disease Statistics. https://www.nhlbi.nih.gov/about/documents/factbook/2012/chapter4#4_7 Accessed July 5, 2017
[3] Camargo-Ramos C, et al. Dietary Inflammatory Index and Cardiometabolic Risk Parameters in Overweight and Sedentary Subjects. *Int. J. Environ. Res. Public Health.* 2017, 14, 1104; doi:10.3390/ijerph14101104

[4] Esposito K, et al. Effect of a Mediterranean-Style Diet on Endothelial Dysfunction and Markers of Vascular Inflammation in the Metabolic Syndrome: A Randomized Trial *JAMA.* 2004;292(12):1440-1446. doi:10.1001/jama.292.12.1440

[5] Bruno R, et al. Intima media thickness, pulse wave velocity, and flow mediated dilation. *Cardiovasc Ultrasound*. 2014; 12: 34. doi: 10.1186/1476-7120-12-34

[6] Shaish A, Harari A, Hananshvili L, et al. 9-cis *β*-carotene-rich powder of the alga Dunaliella bardawil increases plasma HDL-cholesterol in fibrate-treated patients. *Atherosclerosis*. 2006;189(1):215–221.

[7] Karppi J, Laukkanen JA, Mäkikallio TH, Ronkainen K, Kurl S. Low *β*-carotene concentrations increase the risk of cardiovascular disease mortality among Finnish men with risk factors. *Nutrition, Metabolism and Cardiovascular Diseases*. 2012;22(10):921–928.

[8] Deanna Minich, http://deannaminich.com/10-carotenoid-foods/ (Accessed 10/27/2017)

[9] Peterson J, et al. Do Flavonoids Reduce Cardiovascular Disease Incidence or Mortality in US and European Populations? *Nutr Rev.* 2012 Sep; 70(9): 491–508.

[10] The World's Healthiest Foods, Flavonoids. http://www.whfoods.com/genpage.php?tname=nutrient&dbid=119 (Accessed 10/27/17).

[11] Manach C, et al. Addressing the inter-individual variation in response to consumption of plant food bioactives: Towards a better understanding of their role in healthy aging and cardiometabolic risk reduction. *Mol Nutr Food Res.* 2017 Jun; 61(6): 1600557.

[12] Lord RS, Bralley JA. *Laboratory Evaluations for Integrative and Functional Medicine*, 2nd edition. Duluth, GA: Metametrix Institute; 2008. Adapted from Table 3.4 – reports showing associations of essential element insufficiency with the top causes of death in the United States. (2005), p 71.

[13] Cordain L, et al. *Am J Clin Nutr* February 2005; vol. 81 no. 2 341-354.