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What an anti-cardiovascular diet should be in 2015

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Abstract

Purpose of review—Given scientific and public debate about optimal diet to prevent cardiovascular disease, and interest in diet and other chronic diseases, we propose that following a few simple dietary principles would reduce chronic disease incidence.

Recent findings—Nutrition research has been criticized for focusing on individual nutrients and foods, treated like drug therapy. With a few important exceptions, clinical trials of supplemental nutrients have not shown benefit. Although highly specific nutrition information is elusive, diet patterns have provided consistent answers, important for public health. Observational cohort studies have found that some dietary patterns are reported with high reliability over long periods and predict future cardiovascular and other inflammatory-related diseases. Two randomized clinical trials confirmed this finding. There are many common features of Mediterranean and prudent diets, particularly the plant-centered aspect, coupled with variety of foods eaten. A dietary pattern characterized by high fruit, vegetable, legume, whole grain, nut, berry, seed, and fish intakes, and possibly to intakes of dairy, coffee, tea, chocolate, and alcohol (not in excess), but low meat and detrimentally processed foods is associated with reduced incidence of cardiovascular disease and rates of non-cardiovascular, non-cancer chronic inflammatory-related mortality.

Summary—A plant-centered diet may be broadly recommended.

Keywords

chronic disease; cardiovascular disease; diet patterns; plant-centered diet

Introduction

There is substantial scientific and public debate about optimal diet to prevent cardiovascular and other chronic disease. This diet can be represented as a set of menu plans, a list of foods to choose from, or the general characteristics of overall daily food intake. US News and

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World Report captures this debate annually in “Best Diets”, which in 2015 summarized the rankings by a panel of nutrition professionals of 35 different diet plans[1]. The US Dietary Guidelines have made nutrition recommendations, which for many years emphasized reduction in total and saturated fat as one cornerstone, often tending to avoid reference to specific foods[2,3]. Many people have recommended various forms of low carbohydrate diets (for example, the Atkins diet). Many ways to view “what to eat” have been formalized.

Concurrently, epidemiology has been severely criticized [4], particularly observational nutritional epidemiology[5], but also the overwhelming body of detailed studies of nutrition mechanisms[6]. Temple[6] classified research as complex (“the detailed study of disease mechanisms using such methods as biochemistry and molecular genetics”) or simple (“epidemiology, intervention trials, and analogous studies on animals”) and commented that complex research has received most resources, but more practical value has come from simple research. Archer et al[7] found that nutritional surveillance in the US is seriously flawed because energy intake is clearly underestimated. They concluded that “the ability to estimate population trends in caloric intake and generate empirically supported public policy relevant to diet-health relationships from U.S. nutritional surveillance is extremely limited”, thereby eliminating all nutritional epidemiology that might be generated from this source. Ioannidis[5] stated, “Definitive solutions will not come from another million observational papers or a few small randomized trials.” He found a poor track record of observational claims, but lauded two long term randomized clinical trials of dietary patterns[8,9].

Some commentators have focused on “nutritionism”[10,11], a formulation in which nutrition decisions and policies are focused largely on nutrients, with little or no consideration of the complex nature of foods. Nutritionism at least implicitly supports the financially thriving supplement industry. Several isolated food chemicals have been tested as drugs in randomized clinical trials, with no effect or a harmful effect on long term health[12]. A recent clinical trial of niacin plus the anti-flushing agent laropiprant found adverse effects for infection, bleed, and diabetes, among other effects[13]. Exceptions relate to age-related macular degeneration[14] and maternal folate supplementation for prevention of fetal neural tube defects[15] showed benefit. Similarly, viewing diet through the lens of a single nutrient (e.g., low fat, low saturated fat, or low carbohydrate messages) is likely to discard good foods as well as less desirable ones. For example, among highly regarded foods, nuts are high in fat and whole grain foods and all fruits and vegetables are high in carbohydrates. Dairy products are high in saturated fat, but findings related to dairy foods and various outcomes suggest benefit[16].

Therefore concepts about the best diet for long term cardiovascular health have been changing. This review reconsiders diet, focusing on dietary patterns and long term chronic disease outcomes.

A Multi-Dimensional View of Food

Food is complex[17]. There are major differences between drug and food research[17,18]. Most salient is the nature of a drug vs food. Drugs are well-defined, purified compounds which can be unobtrusively consumed and compared to another well-defined regimen, such as a placebo or accepted therapy. Foods are the opposite of well-defined and constant: we eat

formerly living organisms that have all the complexity and variety of life forms, nurtured in various ways by farmers, breeders, and genetic modifiers, consumed several times per day, every day, one food balanced against another to maintain energy balance, and affecting chronic disease as some sort of average across foods and time. Many authorities require the internal validity of long term, randomized, clinical trials characteristically used in inferences about drugs before they consider evidence to of the most persuasive nature. Such trials are difficult at best for study of food, yet it is critical to appraise health value of foods. To this end, several authors have favored reappraisal of the body of nutrition studies with a view towards valid inference; and a more holistic view of nutrition[17-21], in which dietary policy and even understanding of nutrition itself does not need a meticulous and reductionist breakdown into separate constituent parts[19].

Reductionist science employs syllogisms. An example is the logic underlying avoidance of saturated fat. A syllogism considers 3 propositions, A, B, and C. It asserts that if A being true implies that B is true, and B being true implies that C is true, then it follows without further testing that A being true implies that C is true. The problem of judging the validity of C is reduced to solutions of easier problems. In the particular case, the proposition that intake of saturated fat raises serum cholesterol is strongly supported (A implies B)[22-24]. The proposition that cholesterol in the serum leads to atherosclerotic disease (B implies C) is also strongly supported by many kinds of studies, for example by presence of cholesterol in atherosclerotic plaque[25,26], observational epidemiology[27,28] , and the success of statin drugs (which dramatically reduce low density lipoprotein cholesterol, among other things) in reducing coronary heart disease and total mortality[29]. That coronary heart disease reduction also follows serum cholesterol reduction even when total mortality is not reduced[30] strengthens the proposition that cholesterol in the serum plays a role in atherosclerotic disease, because it suggests that cholesterol reduction is specific to coronary heart disease, whatever else might eventuate from serum cholesterol lowering. Yet this “efficient” logic is not necessarily correct. Saturated fat is not the only component of saturated fat-containing food; other food components might be important. Many biological changes occur with cholesterol changes, particularly considering the pleiotropic nature of statins, and these also could be important. Direct observation of the association between saturated fat and coronary heart disease did not find the association of saturated fat intake with coronary heart which as expected by the syllogism[31]. Such syllogisms are standard in science, for linking and interpreting chains of evidence, but they should be used cautiously because they are not always right.

In contrast, direct observation of certain dietary patterns with various cardiovascular and other chronic diseases has consistently shown reduced risk[32-36], although meta-analysis of specific foods and nutrients was found to be confusing[37]. This difference in findings possibly relates to the stability of diet patterns over time and reliability of reporting. Jacobs and Orlich[19] pointed out that in most cases diet patterns derived from food frequency questionnaires had high correlation within person over periods of years; two studies reported tracking correlation over 0.5 over 18 and 20 years. Correlations over time of most foods and nutrients are much lower, on the order of 0.2 or less, although a few well-defined foods that are habitually consumed by some people, such as coffee, tea, or alcohol, have high tracking

correlations. In addition, diet patterns integrate over foods eaten and over long periods, whereas individual foods and nutrients do not capture the sum of complex nutrition effects.

Mediterranean and Prudent Diet Patterns That Protect against Chronic Disease

There are many ways of describing diet patterns that attempt to capture key characteristics, and to a certain extent, culture, such as Mediterranean (characterizing foods from that region), prudent (implying wise, judicious food choices), and western (reflecting certain aspects of food industrialization in Western culture). The central focus of diet pattern research has been Mediterranean or prudent diets with various definitions[32]. In an early article studying middle aged male health professionals, Hu et al.[33] performed principal components analysis and found 2 patterns: “prudent”, with high weightings on green leafy vegetables, dark-yellow vegetables, cruciferous vegetables, other vegetables, legumes, fruit, tomatoes, fish, garlic, poultry, and whole grains; and “western”, with high weightings on red meat, processed meat, refined grains, sweets and desserts, french fries, high-fat dairy products, eggs, high-sugar drinks, snacks, condiments, margarine, potatoes, and butter. The prudent diet was inversely related to incident coronary heart disease, while the western diet was adversely related. This list of foods closely resembles the DASH diet, in which vegetables, fruit, fruit juice, whole grains, nuts, seeds, legumes, and dairy products other than whole milk were increased, and meat, poultry, fish, refined grain, whole milk, sweets, snack foods, fats, oils, and salad dressings were decreased[38].

The Prevención con Dieta Mediterránea (PREDIMED) study[9] instituted a 14 point Mediterranean diet compliance score. Foods favored are olive oil, vegetables, fruit (including natural juices), wine, legumes, fish or shellfish, nuts (including peanuts), chicken, turkey or rabbit meat instead of veal, pork, hamburger or sausage, and sofrito (a sauce made with tomato and onion, leek, or garlic, simmered with olive oil). Foods not favored are red meat, hamburger, or meat products (ham, sausage, etc.), butter, margarine, or cream, sweet/carbonated beverages, and commercial sweets or pastries (not homemade), such as cakes, cookies, biscuits, or custard. Participants randomized to Mediterranean diet groups had about 2 out of 14 points higher score than the randomized control group, starting soon after baseline and throughout the study (Table S1 and Figure S3 in reference 9). Higher baseline scores predicted cardiovascular disease outcomes[39].

Mursu et al[36] studied various mortality outcomes in the Iowa Women's Health Study (IWHS) according to two diet scores, the A Priori Diet Quality Score (APDQS)[40-45] and the Alternative Healthy Eating Index 2010 (AHEI)[46].

The APDQS originated in a case control study to differentiate myocardial infarction from healthy controls according to combinations of foods[40]. It was applied in several studies subsequently, showing relationships with demographics[41], several biomarkers[42-45], cognitive function[46], and fitness[47]. It has been reformulated for different studies, depending on the questionnaire data available. Approximately 40 food groups, covering many aspects of diet, are rated as favorable, adverse or neutral and placed in quantiles according to intake. For example, in the IWHS[36], 34 food groups were rated favorable (n=17), adverse (n=10), or neutral (n=7) relative to future chronic disease, based on the literature and expert judgment, then placed in quartiles (or a large nonconsumer group and tertiles among

consumers). Mursu et al[36] stated: “The positively rated food groups were beans and legumes, beer, coffee, fish, fruit, green vegetables, low-fat dairy, liquor, oil, other vegetables, poultry, seeds, and nuts, soy products, tea, tomato, whole grains, and wine. The negatively rated food groups were butter, fried foods, fried potatoes, red meat, liver, processed meat, salty snacks, soft drinks, sweets, and whole-fat dairy. The remaining neutrally rated food groups were chocolate, diet soft drinks, eggs, fruit juice, margarine, potatoes, and refined grains.”

Groups were given scores of 0 for lowest quartile of consumption or nonconsumers to 3 for highest consumption grouping. The APDQS was formed by adding these values in a positive direction for beneficially-rated food groups, in a negative direction for adversely-rated food groups, and 0 for neutrally-rated food groups, for a theoretical maximal score of 81. Thus 1 point in the APQDS corresponds to a difference of one higher intake category in beneficially-rated food groups or one lower intake category in adversely-rated food groups. Mean±standard deviation of the APDQS was 38.4±8.2 in the 29,634 women aged 55-69 years and free of self-reported heart disease, diabetes, and cancer at baseline in 1986 and followed for 22 years.

The AHEI-2010[48] was formulated as an improvement to an earlier similar score that provided dietary guidance related to the US Dietary Guidelines. AHEI-2010 contains 11 components, each of which receives 0-10 points (theoretical maximum 110). Components included vegetables, whole fruit, whole grains, nuts and legumes, red and processed meat, long-chain (n23) fatty acids EPA+DHA, PUFAs, and moderate alcohol intake (all rated favorably) and trans fatty acids, sugar-sweetened beverages and fruit juices, and sodium (all rated adversely). In the IWHS, the mean AHEI-2010 was 40.0±10.4, with correlation of 0.65 between the AHEI-2010 and the APDQS.

Both the APDQS and AHEI-2010 predicted total, cardiovascular, cancer, and non-cardiovascular, non-cancer inflammatory-related mortality, but not other and external causes of mortality. Prediction was numerically strongest for inflammatory-related mortality and weakest for cancer mortality, but statistically significant for all. The risk factor adjusted total mortality rates were 36.9, 34.6, 32.5, and 30.2 per 100 women followed for 22 years across the increasing APDQS quartiles, and similarly for the AHEI-2010. We regard a difference of 36.9 vs 30.2 as of considerable clinical importance in women initially average age 62 years, followed into old age. Furthermore, the women were resurveyed in 2004 (n=15,076) at average age 79 years, and findings were similar or numerically stronger for diet score prediction of all outcomes.

One of the goals of Mursu et al[36] was to identify information in each score beyond what was found in the other score. Each score did add some prediction when the other was in the model, but it was difficult to sort out what that information was. More to the point for this review is the commonality between these scores and of these scores with other prudent and Mediterranean diet patterns.

Conclusion

The many diet pattern analyses cited here, though consistent across many settings and having substantial commonality across patterns studied, are observational and therefore considered insufficient in themselves to make causal statements about diet protecting against future chronic disease. However, coupled with the randomized findings of the Lyon Diet-Heart Study[8] and PREDIMED[9], we assert that certain diet patterns can prevent or delay a substantial amount of currently existing chronic disease, particularly cardiovascular and non-cardiovascular, non-cancer inflammatory-related diseases. Such diet patterns are plant-centered, at the same time minimizing intake of nutritionally poor plant foods such as sugar, refined grains and highly processed and very salty foods. Intake of plant seeds, including whole grains, nuts, berries, coffee, and chocolate, is promising[50]. The recommended prudent/Mediterranean diet patterns are highly varied, as can be gleaned from the small increments to the APDQS from 34 widely varying food groups. Apparently there are many ways to achieve a protective diet pattern.

The “prudent/Mediterranean” diet pattern solution appears to be robust, based on its consistency across many cohort studies, the Lyon Diet-Heart Study, and PREDIMED. However, some caveats are in order. It seems to us that vegetarian diet patterns “work” because of the presence of nutritionally-rich plant foods, not because of the absence of meat. Thus “prudent/Mediterranean” diet patterns are not necessarily vegetarian, although much of the meat in the diet is rated poorly in all patterns. However, meat is less sustainable than other foods, given the energy cost of growing meat products of all types, and sustainability is a major issue for the future[51]. Another caveat concerns fish, which is highly recommended across all diet patterns. A problem is that the fish stock is substantially polluted with heavy metals and other industrial chemicals; this is an ongoing problem[52,53].

We may not ever know the more specific details that have been so earnestly sought in many, many nutrition studies. Indeed, the diet pattern approach to nutrition recommendations taken here leaves many questions unanswered. For example, for a beverage with known toxicity at high intake levels, alcohol intake may be over-endorsed in the APDQS, since points are given for each of wine, beer, and liquor separately and with no upper limit for excessive intake, as opposed to the moderate amount of alcohol recommended in the AHEI-2010 or the wine with meals recommended in PREDIMED. There is evidence that would support rating chocolate as favorable rather than neutral[54], but food applications are highly variable. Furthermore, it is not easy to know about separate effects of food groups (as in APDQS) or dietary principles (as in AHEI-2010). For example, prediction of CVD events in PREDIMED from the 14 individual score components is not always consistent with findings for prediction from the whole score, but individual components do not take the whole diet into account and are subject to confounding with the rest of the diet[39]. The treatment groups themselves in PREDIMED[9] and the Lyon Diet Heart Study[8] are not specific, but rather are highly multi-faceted. In PREDIMED it is not possible to fully sort out whether the benefit was from substituting extra virgin olive oil for the customarily consumed and less expensive refined olive oil, from the nut mixture, or from the overall Mediterranean diet. Whether findings would have been different if a different control regimen had been used is not discernible from the PREDIMED trial.

The public and public health researchers do not necessarily need to know details in order to identify diet patterns that improve public health. The small contribution of any one food to the total score enhances robustness of the scores and supports enjoyment of a varied diet as a major aspect of eating. Thus Pollan's 7 word aphorism[2] and our doubling of it to 14 words[19], “eat food, mostly plants, not too much, in colorful variety, maximizing nutrients per bite” is a simple approach to healthy and enjoyable eating.

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between the diet patterns, in the sense of the current review the commonality of the two diet patterns is worthy of note.]

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Key Points

1. Much of the dietary advice over the past decades to prevent cardiovascular disease has focused on reduction of saturated fat intake, associated with lower coronary heart disease mortality and altered meat and dairy intake.
2. Nevertheless, this message appears not to be correct in all respects and to have been too restrictive. It missed important focuses on nutritionally-rich plant food intake.
3. Reductionist science operates through possibly misleading syllogisms; conclusions about saturated fat fostered a view of nutrition that was unnecessarily restrictive and fostered growth of the dietary supplement industry, despite contrary evidence from long-term randomized clinical trials.
4. There are many excellent approaches to a diet that prevents chronic disease, but such approaches do not depend on total fat or total carbohydrate intake.
5. Diets that are associated with reduced chronic disease risk and have been successful in long-term randomized clinical trials are characterized by high fruit, vegetable, legume, whole grain, nut, berry, seed, unrefined unsaturated oils, and fish intakes, and more speculatively intakes of dairy, coffee, tea, chocolate, and alcohol (not in excess), but are low in meat and detrimentally processed foods.