Does the Question “What Should I Eat” Have an Easy Answer?

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Food choice messages based on single nutrients

- To be correct, such a message must assume that the nutrient in question acts independently of everything else in the food and diet generally.
- Such messages and policies include low total fat, low saturated fat, low carbohydrate, high protein, fortification/enrichment with isolated vitamins and minerals, a lot of the diet supplement industry.
- Such messages may be partly right, but are likely also partly wrong, given complexity of food and diet.
- The total fat experience is illustrative.

What happened to “eat less fat”? 
Best position for the time: Context in 1930s-1970s

- Discovery of nutrients
  - Vitamins were understood chemically. Deficiency diseases were cured by fortification.
  - Nutrition was considered explainable by nutrients rather than foods
  - Reducing judgments about what to eat to a common denominator of a nutrient – in this case dietary fat – was deemed useful as it overcame the variation in foods consumed across varietals and human cultures
  - Food was almost regarded as a nuisance, or else was thought to be so complex that it needed to be simplified
- Discovery of predictability and cross cultural differences in CHD, serum cholesterol as one important factor
- Discovery of dietary saturated fat link to serum cholesterol, strong weighting of ecologic data
- Desire for simple message that would accomplish saturated fat lowering

How the total fat message developed

- In this context it was natural for Ancel Keys, Mark Hegsted, and Fred Mattson each to develop serum cholesterol prediction formulae that focused on fat components
  - Saturated fat bad actor, polyunsaturated generally good actor, disagreement about dietary cholesterol
- Animal and experimental human studies found negative impact of saturated fat on health and protective effects of polyunsaturated fat - based on mechanisms of action and a nutrient focus. (Specific foods or diet patterns not considered)
- No consideration of the complexity of the atherosclerotic process
- No consideration of reaction of the food industry to a low fat message
- In Western countries, in which the total fat message was developed, saturated fat was the dominant portion of total fat
- Assumed that we knew something about causes of atherosclerosis and should act on it, partly arguing to act before all the evidence was in (iodized salt and goiter, reduced crowding and Tuberculosis)
- In the late 1970s, an active policy and low fat message made sense
Some issues raised in current thought

- Although diets consumed consisted of foods, they were interpreted primarily through their nutrients
- All food sources of fats were treated as equally implicated which may not be the case. Fats were not delivered in pure form but rather within a complex structure of foods with highly varying nutritional and structural properties
- Translation issue: Low fat, Low SFA are whole diet terms, not a single food term, so good quality high fat foods can be included in a low fat diet. In addition, some high fat cuisines with high quality foods (eg Mediterranean diet) may be better than high fat diets of poor quality foods (eg so called Western diet)
- To comply by getting to low fat (and profit), industry produced lower quality foods, often providing excess energy that was not easy to compensate for

Effects of the total fat message in light of current thinking

- Reduced meat, good for sustainability and probably for health
- Reduced dairy fat, conclusions about this are mixed (milk, yogurt and cheese should perhaps be seen as different foods)
- Increased fish and plant food
- Huge industry reaction, with government support to enforce low fat through regulation of official policy, building on the single nutrient
  - Fostered trans fat in margarine as an alternative to butter fat
  - Fostered sugar/starch-based alternatives to create a large low fat food market
  - The lack of an effective working relationship between science and industry when it comes to food and health became apparent
- Agricultural policy and breeding programs (traditionally known as plant and animal husbandry) developed independently, without much attention from health specialists
- From the perspective of health, diet generally improved, but not as much as it could have and with some adverse and unexpected side effects
Other solutions: other suboptimal directions?

• Low total carbohydrate: continues the tradition of basing all food choices on a single nutrient, has all the same problems as low total fat
• Tends to promotes meat and dairy at the expense of nutritionally rich plant food
• Paleolithic diet: based on “early man diet” and aversion to grains, promotes meat
• If “low fat” is incorrect, the opposite must be true, so eat more meat and butter
  – Not a game of opposites, single nutrient analysis is a weak strategy

No restriction on Total or Saturated Fat does not mean high meat

- Southern European Atlantic Diet (SEAD) and nonfatal AMI. Oliveira A et al. AJCN 2010
- Population-based case-control study in Porto, Portugal, aged ≥18 y.
- 820 hospitalized incident AMI, 2196 randomly selected controls
  - SEAD adherence 0-9 points (above median): cod, other fresh fish, red meat and pork products, dairy products, legumes and vegetables, vegetable soup, potatoes, whole-grain bread, and wine.
  - Highest SEAD quartile (best adherence to traditional pattern vs lowest quartile) 33% lower AMI risk (OR: 0.67; 95% CI: 0.51, 0.88; P for trend = 0.003).
  - A SEAD index calculated by reverse scoring for red meat and pork products led to an even stronger association: 60% lower AMI risk (upper vs lower quartile: (OR: 0.45; 95% CI: 0.34, 0.60; p for trend < 0.001).
What should we do? how to get to a better message

- Question whether we should act on current assumptions, taking some risk for large public health benefit
- I say yes, but with more awareness of the effects on the whole food system, including agricultural policy, breeders, industry, government, and eaters
- Industry should take responsibility and be part of the solution
- “Eat low fat” was a “best position” for the time, got us focused and to a position where we are today
- We need to move on because we have other evidence that suggests there is more complexity to the diet-disease relationship than the focus on fat (or macronutrients) alone
- I would expect scientists in 20yrs time to be able to elucidate the position even more than we can today

“Knowing” is not easy in nutrition and policy

- The standard for knowing that an action (eating) will cause an effect (prevent chronic disease) is the randomized clinical trial
- The drug trial model applies poorly: food is a part of daily life and hard to dictate, not a constant (varietals, growing conditions), energy removed must be compensated
- Base diet on understanding of food and food preparation, relying heavily for food choice on consistency with diet patterns that have been shown to correlate well with reduced chronic disease and the rare clinical trial
- This is distinct from DGAC which is mandated to be completely evidence-based (could strongly limit interpretation)
DGAC Recommendations 2015

• Based on published evidence
  – Not to advocate for sloppy science, but does this limit thinking given how hard it is to get nutrition knowledge?
  – The assumption that short term published findings link closely to long term disease is not always correct

• Advocate dietary patterns

• Worry about nutrient shortfalls
  – Great for deficiency diseases, but is this appropriate for well-nourished people?

• Responsiveness to special interests
  – The economy is important, but clearly wording of the guidelines has been influenced by financial interests

Simple Rules

• Diet is an average over a lifetime, no one meal matters for chronic disease, no one food group in a pattern is critical
• Eating dinner should not be an academic exercise
• Mediterranean/prudent principles
  – Plant-centered, avoiding foods with nutritionally low content (seeds are especially good for this)
  – low meat and detrimentally processed foods
  – high fruit, vegetables, legumes, whole grains, nuts, berries, seeds generally, unrefined unsaturated oils, fish
  – perhaps dairy, coffee, tea, chocolate, alcohol (not in excess)
  – Many advocates of dietary patterns say similar things, eg DASH diet, major parts of 2015 DGAC recommendations
• Small portions, high variety
• “Real food” (prepared from food close to as grown, sensible preparation)
• Local food (not a strong emphasis, but tends to help with freshness, breadth of local capabilities, advances in animal and plant husbandry, growth of local economy)
• Consistent with local custom, culinary pleasure
The nutrient approach has broad political and social implications

- In “nutritionism”, dietary advice is reduced to statements about a few nutrients.
- I think a broader focus on foods would alter the scientific and political cascade
  - More healthful diet for many people
  - Different relationship between the public and the food industry.

Food Synergy is concerted action: Many constituents of individual foods and dietary patterns acting together on health

- Food consists of nonrandom complex mixtures of compounds, developed under evolutionary control
- The composite nature of food, serving the life of the organism being eaten as well as the life of the eater, is central to the food synergy concept.
- Evolution is seen simply as a sorting mechanism
- Viability of food synergy idea implies
  - Balance in the biochemical constituents of the organism being eaten
  - Pieces of this orchestration survive digestion
  - Coordinated constituents mutually affect human biology
There are probably thousands of compounds in the smallest morsel of food. One small change in a molecule has a huge effect on health. This form of trans fat does not occur in nature.

![Fatty Acid Structure and Desaturation](image)

Example from Wikipedia of fatty acid structure and desaturation

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**Cycle of Misinterpretations of Nutrients/Bioactive Compounds**

- **Regulation:** definitions set "objective standards"
- **Media:** likes controversy, presenting both sides, should be simple
- **Public:** not experts, want clear advice
- **Whole grain food should have 51 whole grain by weight and 2 g fiber**
- **Counts water, doesn’t work for rice**
- **Emphasize contradictory findings between studies**
- **Answer is not simple (whereas “eat apples” is simple)**
- **Listens to advertising, true believers**
- **Not equipped to sort through contradictory messages, cannot “take no action” on indeterminate findings**
Seeds and Phytochemicals: Theory

- Eating whole cereal grain (wheat, oats, rye, corn, rice, etc, all are seeds) predicts lower CVD and total death
- Among all plant foods, seeds are very important, I think because they contain the diverse botanical elements/compounds to support a new plant
- These compounds are many and most are xenobiotic to animals
- Needed in great diversity for health, yet still treated as foreign to our bodies, used by our bodies, but still excreted after days (so need frequent replenishment)
- Variety in consumption helps because there are many compounds with many functions, and we don’t know in advance of eating which is needed on any given day

Why Dietary Patterns?

- A main source of information about diet in relation to disease is prospective epidemiologic cohorts
- PREDIMED was a randomized, 5 year clinical trial, N>7000, Spanish at risk people >middle age.
  - Mediterranean diet plus extra virgin olive oil or nut mixture (42% fat)
  - Comparison lower fat diet (37% fat)
  - Both Mediterranean diets 30% reduction in CVD incidence
  - Recommended diets were broadly defined, yet understandable to participants and predictive of events
- Many other cohort studies consistent
- Epidemiology much less well suited for studies of individual foods
  - Individual foods are less repeatable within person over time
  - Do not account for whole diet
- Oddly, we know something about diet patterns, but are less sure about the individual food components and preparation methods
- Maybe we don’t need all the details if the policy is generally correct
### Diet Pattern is a Personal Characteristic

- We recently showed that the *A Priori* Diet Quality Score was a personal characteristic, in that it tracked ($r=0.6$, 20 years) in Coronary Artery Risk Development in Young Adults (CARDIA)
- Similar in Iowa Women’s Health Study ($r=0.55$, 18 years)
  - Diet pattern not as subject to within person variability as are nutrients or foods
- Score predicts total and cause specific mortality well.
- Correlates $r=0.7$ with Alternative Healthy Eating Index, which is also predictive, but less descriptive of a total diet

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**Food Category**

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>A Priori Diet Quality Score</th>
<th>(++)Beans and legumes, green vegetables, other vegetables, tomato</th>
<th>(--)Fried potatoes</th>
<th>(0) Potatoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit</td>
<td></td>
<td>(++)Fruit</td>
<td></td>
<td>(0)Fruit juice</td>
</tr>
<tr>
<td>Nuts and soy protein</td>
<td></td>
<td>(++)Seeds and nuts, soy products</td>
<td></td>
<td>(0)Fruit juice</td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td>(++)Fish, poultry</td>
<td></td>
<td>(0)Eggs</td>
</tr>
<tr>
<td>Grains</td>
<td></td>
<td>(++)Whole grain</td>
<td></td>
<td>(0)Refined grain</td>
</tr>
<tr>
<td>Trans fat/salt</td>
<td></td>
<td>(--)Red meat, liver, processed meat</td>
<td></td>
<td>(0)Margarine</td>
</tr>
<tr>
<td>Fats</td>
<td></td>
<td>(++)Low fat dairy, oil</td>
<td></td>
<td>(0)Chocolate</td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
<td>(++)Beer, liquor, wine</td>
<td></td>
<td>(0)Diet soft drink</td>
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<tr>
<td>Other beverages</td>
<td></td>
<td>(++)Coffee, tea</td>
<td>(--)Soft drink</td>
<td>(0)Diet soft drink</td>
</tr>
</tbody>
</table>
**Simple Rules to Make a Pattern?**

I expand Michael Pollan’s aphorism and incorporate my own and Gyorgy Scrinis’ aversion to detrimental processing, but maintain individual dietary flexibility:

- **Eat Foods, Mostly Plants, Not Too Much, In Colorful Variety, Maximizing Nutrients per Bite**
- **Eat Foods** = avoid many forms of industrial processing that degrade access to the nutrients/phytochemicals/beneficial compounds
- **Mostly Plants** = plant centered diet (remember the environmental cost of converting plants to animals!)
- **Not Too Much** = energy balance (but some formulations are apparently not detected by the body as energy intake)
- **In Colorful Variety** = this is a clue to phytochemical content and a good way to keep track of eating a variety of plant foods
- **Maximizing Nutrients per Bite** = a reminder that our energy expenditure is low and we shouldn’t waste it on foods that have low nutritional quality = detrimental processing

**Goal: Get Good Food to Everyone, Automatically**

- Nutrition research is heavily based on pathology and disease outcomes, but the question of what to eat involves the entire food system
- The knowledge base is evolving, but will likely never be “complete”
- Decisions will have to be made – and revised – based on an amalgam of sources of evidence. The paradigm “clinical trials are level A evidence so we can never know about food” is defeatist and nonproductive.
- Money is a critical element in what people eat, from motivation to work in the food industry, to economic health of communities, to the ability of people to pay for food
- Sustainability is an increasing and critical issue, as we see currently as the California water shortage affects the world food supply