

# Healthfulness of the U.S. Food Supply Little Improvement Despite Decades of Dietary Guidance

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**Background:** Every 5 years for the past several decades, the USDHHS and the U.S. Department of Agriculture have issued and updated the *Dietary Guidelines for Americans*, which form the basis of federal nutrition policy and have shown remarkable consistency across various editions among the major themes.

**Purpose:** This paper examines whether the U.S. food supply is sufficiently balanced to provide the recommended proportions of various foods and nutrients per the amount of energy, whether this balance has shifted over time, and which areas of the food supply may have changed more than others.

**Methods:** The Healthy Eating Index-2005 (HEI-2005) was used to measure the dietary quality of the U.S. food supply, from 1970 to 2007. Sources of data were the USDA's food availability data, loss-adjusted food availability data, and nutrient availability data, and the U.S. Salt Institute's data on salt sold for human consumption.

**Results:** Total HEI-2005 scores improved by about 10 points between 1970 and 2007, but they never achieved even 60 points on a scale from 0 to 100. Although meats and total grains were supplied generally in recommended proportions, total vegetables, total fruit, whole fruit, and milk were supplied in suboptimal proportions that changed very little over time. Saturated fat, sodium, and calories from solid fat, alcoholic beverages, and added sugars were supplied in varying degrees of unhealthy abundance over the years. Supplies of dark-green/orange vegetables and legumes and whole grains were entirely insufficient relative to recommendations, with virtually no change over time.

**Conclusions:** Deliberate efforts on the part of policymakers, the agriculture sector, and the food industry are necessary to provide a supply of foods consistent with nutrition recommendations and to make healthy choices available to all.

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## Introduction

The decade of the 1970s might be considered the advent of the modern era of dietary guidance. Following the landmark 1969 White House Conference on Food, Nutrition and Health that addressed the problems of hunger and malnutrition, the 1970s ushered in a period of concern for balance and moderation, in addition to nutritional adequacy.<sup>1</sup>

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Since 1980, the USDHHS and the U.S. Department of Agriculture (USDA) have issued and updated the *Dietary Guidelines for Americans*<sup>2–7</sup> every 5 years. The *Guidelines*<sup>8</sup> are the cornerstone of federal nutrition policy and form the basis of federal nutrition education and information programs. Since their inception, the *Guidelines* have shown remarkable consistency across the various editions in their major themes: increase fruits, vegetables, and whole grains; restrict energy, sodium, solid fats, and added sugars; and moderate intake of alcohol.<sup>7,9</sup>

Throughout this period, the focus of federal nutrition policy has been to assist consumers in making informed, healthy choices through education campaigns directed towards individuals. However, substantial behavioral research data are accumulating<sup>10</sup> that suggest beneficial

changes are not achieved and maintained without concomitant changes in policies and environments to support them. Although individuals must ultimately choose whether or not to consume a healthy diet, it is increasingly clear that in many instances, individuals have little control over their food choices.<sup>10</sup> For example, local environments in which people live and work may not provide healthy food options. At a macro level, the country's aggregate food supply may not deliver the requisite mix of foods to afford all Americans a balanced and healthy diet.

The purpose of this paper is to examine the extent to which the U.S. food supply conforms to federal dietary guidance. Specifically, it examines whether the food supply is sufficiently balanced to provide the recommended amounts of various foods and nutrients per amount of energy—that is, the recommended proportions—and whether this balance has shifted over time. It focuses on the distribution of major categories within the food supply, rather than the overall amount of food produced—a construct here termed “dietary quality.” Further, it provides special attention to the recurring themes in dietary guidance since the 1970s. Finally, the paper assesses whether some areas of the food supply have changed more than others.

## Methods

We used the Healthy Eating Index-2005 (HEI-2005) to measure the dietary quality of the U.S. food supply, from 1970 to 2007.<sup>11–13</sup> The HEI-2005 was developed to monitor American diets and evaluate their concordance with the 2005 *Guidelines*. This measure is particularly suited to the present paper's purpose for several reasons. First, it is density-based, meaning it evaluates the degree to which the food supply provides the recommended amount of foods and nutrients per 1000 calories. As a result, it ascertains quality irrespective of the varying energy needs in the population. Second, each component of the HEI-2005 captures a distinct aspect of diet quality, corresponding to the various themes in dietary guidance. Therefore, the HEI-2005 component scores can indicate whether some sector of the food supply is responding positively to recommendations while another is not.

## Healthy Eating Index-2005

The HEI-2005 has 12 components, each with its own standards for scoring.<sup>13</sup> To derive the scores, data were first obtained on the amounts of total fruits; whole fruits (fruit other than juice); total vegetables; dark-green vegetables, orange vegetables, and legumes; total grains; whole grains; milk, yogurt, cheese, and soy beverages; meat, poultry, fish, eggs, beans, and nuts; oils; saturated fat; sodium; total energy; and calories from solid fats, alcoholic beverages, and added sugars (SoFAAS) in the U.S. food supply. Pertinent ratios were then derived of the various foods and nutrients to energy, and each component was scored using the relevant standard.

For all HEI-2005 components, higher scores reflect higher quality, and for most components, higher relative amounts in the food

supply result in higher scores. However, for three components—saturated fat; sodium; and calories from SoFAAS—*lower* amounts result in higher scores because lower intakes are more desirable. Further information regarding the development of the HEI-2005 and how to derive scores can be obtained from previous publications.<sup>11,13</sup>

The minimum score for each component is 0, and the maximum score varies somewhat in order to weight the components when deriving the total score. Milk, meat and beans, oils, saturated fat, and sodium each have a maximum value of 10 points. Fruit, vegetables, and grains each have two components (total and a subgroup) that get 5 points apiece, so each of these three food groups is allotted a total of 10 points. The calories from SoFAAS component is weighted twice as heavily as any other (20 points) because the effect of SoFAAS in the diet is twofold: They add energy without adding much in the way of nutrients and they displace nutrient-dense foods in the diet. The optimal score for all 12 components combined is 100 points.

## Food Supply Data

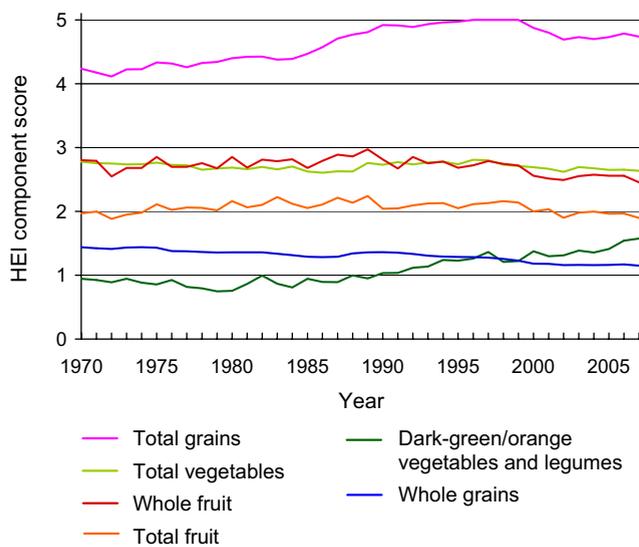
Data on the U.S. food supply signify the amount of food and nutrients available for human consumption in the country. The data are obtained by tracking flows of individual agricultural commodities through domestic marketing channels and are available from several sources. Food availability data are the original source, reported in terms of amounts per person per year. These data overstate the availability of most foods because they capture substantial quantities lost to waste and spoilage.<sup>14</sup> Loss-adjusted food availability data account for such losses and are reported in terms of daily per capita amounts consistent with current guidance (e.g., cups/person/day).<sup>15</sup> Nutrient availability data provide an estimate of the nutrient content of the unadjusted food availability data.<sup>16</sup> Notably, the nutrient availability data do not include the sodium from salt added to foods, except canned vegetables and cheese.<sup>17</sup> However, data on salt sold for human nutrition (including that used in processing, cooking, and at the table) are available through the U.S. Salt Institute.<sup>18</sup>

Using the above-mentioned sources of data (primarily the loss-adjusted food availability data, the U.S. Salt Institute data, and adjustments to data from the other sources as appropriate), and following the procedures that are outlined in a companion publication,<sup>13</sup> HEI-2005 scores for the U.S. food supply were derived for all years between 1970 and 2007. Saturated fat and sodium values were not available in the nutrient availability data for 2007, so the 2006 values for each nutrient were used as a proxy, as recommended (H. Hiza, USDA, personal communication, 2009).

## Results

Figures 1–3 show trends in the various HEI-2005 component scores, with the Y-axis in each scaled according to the optimal score for the relevant components. Total HEI-2005 scores improved by about 10 points between 1970 and 2007, but remained below 60 points on a scale from 0 to 100.

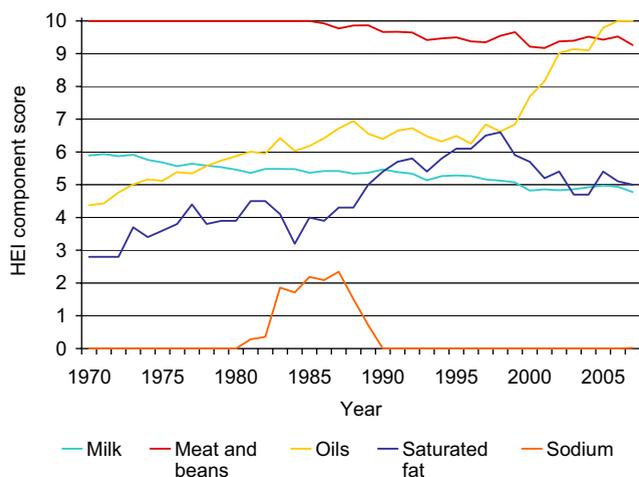
Figure 1 displays the quality of the U.S. food supply with regard to fruits, vegetables, and grains, from 1970 to 2007, in terms of HEI-2005 component scores. These



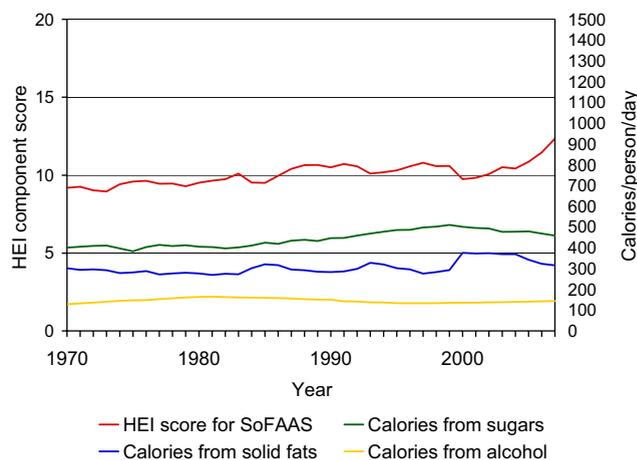
**Figure 1.** Quality of the U.S. food supply with regard to fruits, vegetables, and grains, 1970–2007  
HEI-2005, Healthy Eating Index-2005

components are all measured on a scale from 0 (which indicates total absence in the food supply) to 5 (which indicates presence in at least recommended amounts). The score for total grains was relatively high ( $\geq 4$ ) across the time period, and it increased during the 1980s and 1990s. The score for whole grains, on the other hand, was consistently less than 1.5 and even declined over the years.

The dark-green vegetables, orange vegetables, and legumes component also scored consistently low (from 0.9 to 1.6), although it improved over time. Total vegetables, whole fruit, and total fruit each received scores of about 2



**Figure 2.** Quality of the U.S. food supply with regard to milk, meat and beans, oils, saturated fat, and sodium, 1970–2007  
HEI-2005, Healthy Eating Index-2005



**Figure 3.** Quality of the U.S. food supply with regard to calories from solid fats, alcoholic beverages, and added sugars (SoFAAS) and actual calories from each, 1970–2007  
HEI-2005, Healthy Eating Index-2005

to 3—suggesting that the food supply contained only about half the recommended amount—for all years and changed little from 1970 to 2007.

The trends in HEI component scores for milk, meat and beans, oils, saturated fat, and sodium are shown in Figure 2. These components are measured on a scale from 0 to 10. In the case of milk, and meat and beans, a score of 10 indicates that the food supply contains at least the recommended amount, whereas a score of 5 indicates half the recommended amount. The score for the meat and beans component has been near optimal (between 9 and 10) consistently over time. The milk component has fared less well, scoring about 5 to 6, and has been declining over time.

In the case of both the oils and saturated fat components, higher scores indicate greater dietary quality. However, the oils score rises with *increasing* amounts of oils in the food supply (up to a score of 10), because unsaturated fats are desirable (up to a point); on the other hand, the saturated fat score rises with *decreasing* amounts in the food supply. The supply of oils, and consequently the oils score, rose between 1970 and the mid-1980s then leveled off through the 1990s. Saturated fat fluctuated between 1970 and 1985; then from 1985 to the late 1990s, supply decreased and the score climbed from 4.0 to 6.6. Since the late 1990s, supplies of both oils and saturated fat have risen, causing a rise in the oils component score (to 10.0 in 2007) and a fall in the saturated fat component score (to 5.0 in 2007). This indicates that there have been more fats and oils in the food supply since the late 1990s compared to the preceding 10 years.

The sodium component rises with *decreasing* amounts of sodium per 1000 calories in the food supply. A score of

10 indicates that the sodium content of the food supply is 0.7 gram/1000 kcal, on par with the adequate intake level identified by the Food and Nutrition Board and the amount recommended by the *Guidelines* for sodium-sensitive groups.<sup>11,19</sup> A score of 8 equates to 1.1 gram sodium/1000 kcal, commensurate with the tolerable upper level (UL) of intake recommended by the Food and Nutrition Board and the upper limit imposed by the *Guidelines* for the general population. Any score below 8 indicates amounts greater than the UL. The score was at the lowest possible point for nearly all years, with only a minimal, transient rise in the mid- to late 1980s.

The calories from SoFAAS measure is scaled from 0 to 20, and the score rises with *decreasing* percentages of energy from SoFAAS in the food supply (Figure 3). A score of 20 indicates that calories from SoFAAS are  $\leq 20\%$  of total calories—a level corresponding to discretionary calorie allowances exemplified in the *Guidelines*—and a score of 10 indicates that these “empty calories” represent 35% of total calories. The SoFAAS score fluctuated between 9 and 11, from 1970 to the early part of the 1990s, but ticked upward in the past few years. Overlaid on Figure 3 are the absolute levels of energy from SoFAAS in the food supply over time, to indicate the relative contribution of each. Across all years, added sugars make up the greatest portion of SoFAAS calories, followed by solid fat and alcohol. Calories from added sugars rose steadily in the food supply from 1970 to about 2000 but have dipped somewhat since then. Calories from solid fat fluctuated moderately over the years, whereas calories from alcohol—the smallest contributor to SoFAAS—remained relatively flat.

## Discussion

This analysis is the first to examine trends in the U.S. food supply using an index of dietary quality. Although the HEI-2005 was designed to measure adherence to the 2005 *Guidelines*, those *Guidelines* deviate only modestly in degree—and not in direction—from past editions. According to this analysis, the country’s food supply has been failing to provide diets consistent with federal recommendations on a number of key components for the past several decades. Specifically, although meats and total grains have been supplied generally in recommended proportions; total vegetables, total fruit, whole fruit, and milk or milk alternates each have been supplied at roughly half the recommended level, in proportions that changed very little over time; and saturated fat, sodium, and calories from SoFAAS have been supplied in varying degrees of unhealthy abundance over the years. Supplies of dark-green vegetables, orange vegetables, legumes, and whole grains have been entirely insufficient relative to recommendations, with virtually no change over time.

There are limitations to the food supply data in their ability to account precisely for certain of the HEI-2005 components.<sup>13</sup> However, all of the issues are assumed to represent minor limitations that would affect scores only slightly one way or the other.

For the purposes of the current study, the advantages of the data are several. First, the food supply data provide a valuable lens through which to examine how well the macro food environment in this country conforms to the recommendations embodied in the *Guidelines*. Second, the generally clean separation among commodities makes analysis relatively simple (compared to, say, reported individual-level intakes). And finally, because the methods used to derive the food supply data are used consistently over time, they are ideal for assessing trends.

Previous analyses<sup>20–25</sup> of food supply data in relation to dietary guidance, using absolute amounts rather than an index measure, derived similar conclusions. Comparing food supply data to USDA’s Food Guide Pyramid recommendations up through the mid-1990s, an earlier study<sup>25</sup> found particularly large discrepancies for added sugars, fats and oils, fruits, and certain vegetables—notably dark-green vegetables, orange vegetables, and legumes. It also identified the agricultural implications of addressing these imbalances, which included extensive shifts in production, trade, and prices. Other analyses<sup>21–24</sup> also have projected dramatic agricultural adjustments to bring the food supply into conformance with federal dietary guidance.

Data on the aggregate food supply are not a direct measure of consumption, and cannot address how well individual diets conform to guidance. However, recent assessments<sup>26–28</sup> at the individual level suggest that population average intakes reflect the food supply from which they are drawn, and the prevalence of suboptimal diets is widespread. An earlier study<sup>26</sup> applied the HEI-2005 to data from the 2003–2004 National Health and Nutrition Examination Survey. The study found average diets to score 57.5 overall, similar to what was found in the current study for the food supply during the same period. Regarding the components, individual diets scored somewhat lower than the food supply on oils and calories from SoFAAS and higher on milk, saturated fat, and sodium (although salt added at the table was not ascertained in that analysis). Recent analyses<sup>27,28</sup> of the distribution of usual intake of various foods in the U.S. population noted that across nearly all age/gender groups, 95% of the population is not consuming enough dark-green vegetables, orange vegetables, legumes, or whole grains, and 95% of adult women are not consuming the recommended amounts of milk. A quarter of the

U.S. population consumes more than 1000 kcal per day from added sugars, solid fats, and alcoholic beverages.<sup>28</sup>

The HEI-2005 is a measure of diet quality, not quantity, which means it cannot ascertain whether the food supply provides the right amount of energy for the population. However, the rates of obesity and overweight in this country certainly indicate that there is an overabundance of energy available for consumption relative to the amount the population expends. This surplus has been estimated<sup>29</sup> to be 350 calories per day for children and 500 calories per day for adults. Although this estimate is the subject of some debate, 500 kcal/person/day is roughly the size of the increase in energy available in the loss-adjusted food supply between 1970 and 2007, a period in which obesity rates doubled for adults and tripled for children.<sup>30–32</sup>

Calories from SoFAAS are most dispensable, as SoFAAS provide very little else nutritionally. But simply removing SoFAAS is not sufficient to produce a food supply supportive of the dietary recommendations. For the loss-adjusted food supply to decrease by 500 kcal/person/day and achieve optimal HEI-2005 scores, the following changes would be necessary:

- Calories from SoFAAS would need to decrease by 61%, including about 120 kcal of solid fat. This would reduce the overall energy available, make room for increased energy to be supplied by added fruits, vegetables, and milk, and reduce both saturated fat and calories from SoFAAS.
- The supply of fruit would need to more than double, with most of that being whole fruit rather than juice.
- The supply of vegetables would need to increase by 70%, with nearly all of the increase coming from dark-green vegetables, orange vegetables, and legumes.
- Total grain supply could remain about constant, but four times as much of the grain should remain as whole grain, not be refined.
- Milk supply would need to increase about 70%, but virtually all of the increase would need to come from fat-reduced milk, milk products, or fortified soy beverages.
- Salt added to foods (in processing, cooking, and at the table) would need to decrease by more than half.

Although some aspects of the food supply—notably the content of salt, fat, and added sugars—may have shifted in response to dietary recommendations, albeit temporarily, others have changed hardly at all. The supply of salt declined slightly for a few years, only to increase again. Saturated fat (and consequently, calories from solid fat) in the food supply fluctuated over the years, sometimes decreasing only when calories from added sugars were increasing. These trends may be the result of

issues that receive more or less attention over time. Processed foods are major sources of salt, fat, and sugars in the U.S. diet,<sup>33,34</sup> because these ingredients contribute to the taste, mouth feel, and shelf life of foods. The food industry responds to food fads by altering the relative amounts of these ingredients in an effort to market the “healthfulness” of their products, but sometimes they simply replace one ingredient with another. For example, low-fat cookies and other sweets were popular in the 1990s, but these “guilt-free” alternatives were frequently no lower in calories than their full-fat counterparts, because the fat was replaced with added sugars.<sup>35</sup>

The *Dietary Guidelines for Americans* serve as a statement of federal nutrition policy while focusing almost exclusively on educational activities to guide consumers to make healthy choices. Although the *Guidelines* have been available for several decades, there is no clear evidence that they have improved the U.S. diet. A wealth of behavioral research suggests that this may be because educating individuals is not sufficient to produce change. Rather, a comprehensive approach involving action at all levels of the socioecologic spectrum is needed,<sup>10</sup> including structural changes in the food supply. Such an approach was recommended to address inactivity in the government’s first-ever *Physical Activity Guidelines for Americans* released last year.<sup>36</sup>

The amounts and types of food available in the nation’s food supply data reflect the economic balance among forces that both “push” and “pull” foods through distribution channels. Consumer demand exerts the pull, and agriculture and economic policies and industrial marketing efforts provide the push. Indeed, according to the U.S. Department of Agriculture,<sup>15</sup> the purposes of the loss-adjusted food supply data are to monitor the potential of the food supply to meet the nutritional needs of the U.S. populations, translate nutrition goals for Americans into food production and supply goals, and evaluate the effects of marketing practices over time. When applied to those purposes, as in this analysis, the data suggest that it may be unrealistic to expect a groundswell in consumer demand that would be sufficient to pull a healthy food supply through distribution channels. Rather, deliberate efforts on the part of policymakers and industry may be necessary to provide a supply of foods consistent with nutrition recommendations and make healthy choices available to all.<sup>10</sup>

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