
Healthy Eating Index Scores and the Elderly

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This study explored the positive relationship between advanced age and scores on the Healthy Eating Index (HEI). It did so by comparing component as well as total HEI scores of different age groups and by estimating the independent effect of age, among other demographic variables, on HEI scores. The elderly, compared with younger age groups, had higher HEI scores on the fruits, sodium, and cholesterol components. Results also showed that the independent effect of advanced age upon component scores, as well as upon the total HEI scores, is notably strong. Results provide insight into the relationship between age and healthful eating.

The Healthy Eating Index (HEI) provides a numerical yardstick of diet quality based on the *Food Guide Pyramid* (U.S. Department of Agriculture [USDA], 1996) and the *Dietary Guidelines for Americans* (USDA & U.S. Department of Health and Human Services [DHHS], 1995). It was designed to evaluate diets according to a more contemporary understanding of healthful eating, one that recognizes the role of overconsumption and poor diet choice as contemporary public health problems (Kennedy, Ohls, Carlson, & Fleming, 1995).

Previous study of HEI scores among demographic groups reports that age may be associated with more careful choices of nutritious foods (Basiotis, Hirschman, & Kennedy, 1996; Gaston, Mardis, Gerrior, Sahyoun, & Anand, 2001). In fact, healthful eating as it is currently defined is highest among those in the oldest age categories (McDonald & Webster, 1998; Bowman, Lino, Gerrior, & Basiotis, 1998). This result is surprising given the potential impediments to a nutritious diet such as lower average nutrition knowledge and diet-health awareness (McDonald & Webster, 1998), reduced

mobility, lower average educational attainment, financial resources (Administration on Aging, 2003), and even receptiveness (Bernheim, 1990) to new information among the elderly.

Further exploration of the HEI and its components is needed to understand better the relationship between advanced age and higher HEI scores. Gaston et al. (1999) note that mean scores among the elderly may be attributed to reduced consumption of food energy, which leads to better scores for components (e.g., fat, saturated fat, cholesterol, and sodium) that penalize for overconsumption. Compared with younger groups, the elderly also appear to consume more fruits. Identifying the independent effect of age on HEI components may provide insight into elderly nutrition and ultimately into the factors leading to variation in HEI scoring.

The HEI score comprises 10 components that represent different aspects of a healthful diet. The first five components measure adherence to the food groups of the *Food Guide Pyramid*: grains, vegetables, fruits, milk, and meat. Components 6 and 7 measure total fat and saturated fat consumption,

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respectively, as a percentage of total food energy intake. Components 8 and 9 measure total cholesterol and sodium intake, respectively, and component 10 examines the variety in a person's diet. Scores for each component range from 0 to 10; thus, 100 is the highest HEI score attainable. According to the USDA Center for Nutrition Policy and Promotion (CNPP), an HEI score at or below 80 suggests that one's diet needs to improve, a score below 51 rates a diet as poor, and a score above 80 is considered a good diet (USDA, 1995).

This study compares average scores and CNPP ratings of diet quality for the total HEI as well as for component scores among age groups. A multivariate analysis is also performed on the total HEI and each component to estimate the independent effect of age upon scores.

Methods

HEI mean scores for each of the 10 components were compared among five age groups: less than 35, 35-49, 50-64, 65-79, and 80 and above. Those age 65 and above were considered elderly in this analysis. To conduct the comparison, we used CNPP's categorical scoring system for overall diet quality to determine the proportion of diets designated "poor," "needs improvement," or "good." Each person's HEI component was also graded according to guidelines as outlined by Variyam, Blaylock, Smallwood, and Basiotis (1998). For the first five components (grains, vegetables, fruits, milk, meat), a score of 10 was awarded if the respondent met the recommended servings for that component. If the respondent had no servings, a score of 0 was assigned. For all other servings, proportional points were awarded based on the number of servings consumed.

Similarly, points were awarded to components 6 through 10 according to certain thresholds or awarded proportionally for scores between the cutoff points of 0 and 10. A score of 10 was awarded to each respective HEI component if a respondent's intake met the following standards: total fat equaled or was less than 30 percent of total calories, saturated fat was less than 10 percent, cholesterol intake was 300 milligrams (mg) or less, sodium intake was 2,400 mg or less, or eight or more different foods were consumed in a day (variety). A score of 0 was awarded to each respective component when an individual's intake of total dietary fat equaled or exceeded 45 percent of total calories, saturated fat was 15 percent or more, cholesterol was 450 mg or more, sodium intake was 4,800 mg or more, or when the person consumed three or fewer different foods in a day.

To estimate the extent to which age contributes independently to each component score and total HEI score, we used 11 multiple regressions. In addition to controlling for age (35-49, 50-64, 65-79, 80 and above, less than 35=reference), the multiple regressions also controlled for region (Midwest, Northeast, West, and South=reference), urbanization (rural, suburban, city=reference), gender, race (Black, Asian, other=reference), log of income, and total food energy. Food energy was included to capture potential under-reporting or physiological differences that were not accounted for in other demographic variables that may contribute to higher or lower HEI scores. We report the regression results for age only.

Data

This study used data from USDA's 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) and HEI data. The CSFII, which is nationally

representative, contains information regarding Americans' food intake as well as data regarding their demographic and socioeconomic characteristics. The CSFII uses the 24-hour dietary recall method to collect data about food and nutrient intakes of each respondent. This information is collected over 2 nonconsecutive days. The HEI data provides a summary measure of overall diet quality and is computed for people with complete food intake records for the first day of the CSFII (USDA, 1995; Bowman et al., 1998).

This study examined a sample of 9,925 respondents who were 18 years of age and older, who had completed the CSFII, and were represented in the HEI. For purposes of this research, the data were grouped by age: 2,558 respondents were 18 to 34 years old, 2,572 were 35 to 49 years old, 2,539 were 50 to 64 years old, and 2,256 were age 65 and older. Among those age 65 and older, 1,776 were 65 to 79 years old; the remaining 480 respondents were 80 years old or older.¹

Results

The main demographic differences between the elderly and younger respondents were education and income (table 1). The proportion of those who were age 65 to 79 and who had less than a high school education was three times—36 vs. 12 percent—that of those between age 35 and 49. Also, 17 percent of those who were 65 to 79 years old, compared with 30 percent of respondents age 35 to 49, had a college degree. Even fewer of the oldest age group—80 and above—had a college degree (12 percent). The average income for respondents age 65 to 79 was \$28,028; for those age 80 and above, \$4,525 less. For the 35- to 49-year-olds, the average income was

Table 1. Descriptive statistics for the whole sample and by age group

Variables	Age groups					
	All	<35	35-49	50-64	65-79	80+
Sample	9,925	2,558	2,572	2,539	1,776	480
	<i>Percent</i>					
Education						
Less than high school	22	15	12	23	36	49
High school	35	35	35	38	32	25
Some college	21	28	23	17	15	13
College	23	22	30	22	17	12
Region						
Northeast	18	15	18	18	21	23
Midwest	24	22	23	25	28	28
South	36	39	35	38	34	29
West	21	25	24	19	17	20
Urbanization						
Rural	26	21	25	27	29	29
City	30	38	27	27	29	30
Suburban	44	41	48	46	42	41
Gender						
Male	51	50	51	51	52	52
Female	49	50	49	49	48	48
Race						
White	81	76	80	82	86	88
Black	12	12	11	12	11	10
Asian	2	4	3	2	1	1
Other ¹	5	8	6	4	2	1
Diet rating						
Poor	20	21	23	21	15	17
Needs improvement	69	73	69	65	66	66
Good	11	6	8	14	19	17
	<i>Mean</i>					
Food energy (kcal)	2003	2315	2108	1895	1684	1521
Age	49	26	42	57	71	84
Income	\$37,778	\$35,973	\$44,844	\$41,959	\$28,028	\$23,503

¹American Indians, Alaskan Native, and other races.

¹The released data are top-coded at age 90.

\$44,844. Other notable differences were the greater proportion of the elderly, versus other age groups, living in the Northeast (23 percent), Midwest (28 percent), and rural areas (29 percent) and those more likely to be White, 86 and 88 percent (65 to 79 years old and 80 and older, respectively), compared with 76 and 81 percent (less than 35 years old and 35 to 49, respectively).

HEI Scores

The total HEI score ranged from 61.03 (for those less than age 35) to 66.68 (for those age 65 to 79) (table 2). The lowest average score for all respondents was for the fruits component (3.78); the highest score was for cholesterol and variety (7.57 each). Compared with the younger groups, respondents age 65 to 79 had higher than average component scores for the fruits, total fat, saturated fat, cholesterol, sodium, and variety components (5.07 to 8.11). Those age 80 and over, compared with those less than age 65, had higher than average scores for the fruits, cholesterol, and sodium components (5.10 to 8.21). However, only the scores for fruits, cholesterol, and sodium were at least 0.50 points higher, on average, for respondents between age 65 and 79 and for those over 80 years of age, compared with all other age groups.

Percentage of Respondents Meeting the Recommendations

Meeting recommended consumption within individual components corresponded to a score of 10. Respondents were separated into groups based on whether they scored 0 (high risk), between 0 and 10 (needs improvement), or 10 (met recommendations) (table 3). A higher proportion of elderly respondents met recommendations for fruits and cholesterol than did any other age group. Whereas 24 to 25 percent of the elderly age groups met the recommendation for fruits, only 11 to 19 percent of the younger groups met this recommendation. Close to three-fourths of the

Table 2. Healthy Eating Index scores for whole sample and by age group

Variables	Age groups					
	All	<35	35-49	50-64	65-79	80+
Sample	9,925	2,558	2,572	2,539	1,776	480
Total HEI	62.91	61.03	61.14	63.48	66.68	65.39
Components						
Grains	6.40	6.53	6.20	6.53	6.49	5.82
Vegetables	6.45	6.39	6.23	6.76	6.46	6.27
Fruits	3.78	2.92	3.13	4.13	5.07	5.10
Milk	4.99	5.10	5.13	4.74	5.07	4.89
Meat	6.79	6.79	6.80	7.14	6.46	6.11
Total fat	6.60	6.80	6.47	6.26	6.94	6.82
Saturated fat	6.53	6.38	6.43	6.52	6.87	6.62
Cholesterol	7.57	7.44	7.41	7.44	8.01	8.21
Sodium	6.22	5.44	5.90	6.34	7.21	7.77
Variety	7.57	7.25	7.44	7.62	8.11	7.79

elderly age groups met the recommendation for cholesterol; about two-thirds of the younger age groups met this recommendation. A greater proportion of those age 65 to 79 also met recommendations for total fat, saturated fat, sodium, and variety than did any other age group. Compared with other age groups, the elderly do not appear to be more at risk based on their consumption of foods in any HEI component.

While those in the two oldest age groups had higher total HEI scores (65.39 to 66.68) than average (62.91) (table 2), only 19 percent of respondents 65 to 79 years old and 17 percent of respondents age 80 and above met the threshold of having a “good” diet, as defined by CNPP (table 3). An equal proportion of those 80 years old and older (17 percent) had a “poor” diet, while a slightly smaller percentage (15 percent) of those between 65 and 79 years old and older had a “poor” diet. Two of three respondents in both eldest age groups had a diet that “needs improvement.” Only 6 and 8 percent of respondents in the two youngest age groups had a “good” diet, and 23

percent of those between 35 and 49 years old had a “poor” diet.

Although the percentage of elders (age 65 and above) consuming enough fruit to meet the recommended level of the fruit component was higher on average than those in younger age categories, only one in four elders met the recommendation (table 3). Fewer than one in ten of those age 65 or older fell within the “high risk” threshold for sodium, compared with one in four (24 percent) of those under age 35. While three of four of those age 80 or older met cholesterol recommendations, only 11 percent, compared with 23 percent of those under age 35, consumed the recommended amount of grains. The only notable deficiency among HEI categories for respondents age 65 or older was a lower proportion (less than one in four) meeting the recommended level of meat consumption.

The comparatively strong independent effect of age upon HEI scores is shown in table 4, where the reference age category is respondents under age 35. Being in the 65 to 79 age group was

Table 3. Diet rating of the Healthy Eating Index for whole sample and by age group

Variables	Age groups					
	All	<35	35-49	50-64	65-79	80+
Sample	9,925	2,558	2,572	2,539	1,776	480
	<i>Percent</i>					
Total HEI rating ¹						
Poor	20	21	23	21	15	17
Needs improvement	69	73	69	65	66	66
Good	11	6	8	14	19	17
Component rating ²						
Grains						
High risk	1	1	1	1	1	<1
Needs improvement	80	76	81	79	82	89
Met recommendation	19	23	18	20	18	11
Vegetables						
High risk	5	4	5	5	6	5
Needs improvement	62	63	65	57	62	68
Met recommendation	33	32	30	38	32	27
Fruits						
High risk	25	31	28	23	15	14
Needs improvement	59	58	59	58	60	62
Met recommendation	17	11	13	19	25	24
Milk						
High risk	10	9	11	11	10	7
Needs improvement	68	68	65	68	69	75
Met recommendation	22	23	24	20	21	18
Meat						
High risk	2	3	2	2	2	2
Needs improvement	66	65	65	62	73	76
Met recommendation	31	32	33	36	25	21
Total fat						
High risk	11	9	11	13	8	8
Needs improvement	53	54	55	52	51	54
Met recommendation	36	37	34	35	41	38
Saturated fat						
High risk	16	17	16	16	14	17
Needs improvement	42	43	43	41	40	39
Met recommendation	42	40	41	43	46	44
Cholesterol						
High risk	18	19	19	20	14	11
Needs improvement	14	15	15	13	14	14
Met recommendation	68	66	66	67	72	74
Sodium						
High risk	17	24	20	16	10	7
Needs improvement	48	48	51	50	47	45
Met recommendation	34	28	31	35	43	34
Variety						
High risk	6	7	6	5	4	4
Needs improvement	42	46	44	42	35	43
Met recommendation	52	47	51	53	61	54

Although most respondents in every age group had total HEI scores within the “needs improvement” range, respondents age 65 and above were more than twice as likely to meet the threshold for a “good” diet, compared with respondents under age 50.

¹Poor = a total HEI score below 51; Needs improvement = a total HEI score between 51 and 80; Good = a total HEI score over 80.

²High risk = a score of 0 on the HEI component; Needs improvement = a score between 0 and 10 on the HEI component; Met recommendation = a score of 10 on the HEI component.

Table 4. Regression coefficients for age groups by HEI variables

Dependent variables	Age groups ¹			
	35-49	50-64	65-79	80+
	<i>Parameter estimate (rank² in parentheses)</i>			
Total HEI	-0.010	3.810*** (6)	8.530*** (1)	8.270*** (5)
Grains	-0.005	0.730*** (4)	1.114*** (2)	0.742*** (6)
Vegetables	-0.000	0.865*** (2)	0.964*** (3)	1.069*** (6)
Fruits	0.226** (14)	1.621*** (3)	2.904*** (1)	3.176*** (4)
Milk	0.203** (14)	0.172* (15)	0.797*** (4)	0.854*** (7)
Meat	0.274*** (9)	0.856*** (2)	0.459*** (4)	0.325** (12)
Total fat	-0.440*** (5)	-0.637*** (3)	-0.003	-0.162
Saturated fat	-0.051	0.086	0.470*** (5)	0.233
Cholesterol	-0.480*** (8)	-0.681*** (3)	0.274** (10)	-0.209
Sodium	-0.081	-0.191** (7)	0.135	0.250* (10)
Variety	0.344*** (3)	0.991*** (4)	1.966*** (2)	1.990*** (5)

¹Reference category = <35.

²Ranking determined by standardized parameter estimates. N=9,925.

*Significant at 0.10 level.

**Significant at 0.05 level.

***Significant at 0.001 level.

the strongest independent predictor, by rank, of the fruits and the total HEI scores and the second strongest predictor of the grains and variety scores. Overall, being in the 65 to 79 age group was positively and significantly associated with higher scores for eight of the components and was associated with an 8.53 unit estimated increase in total predicted HEI score—a 13-percent increase over the mean HEI for all respondents. Similarly, being age 80 or older was significantly and positively associated with 7 of the 10 components and a 10-percent

increase over the mean total HEI score for all respondents. This positive association between advanced age and the HEI, and the slight decline in HEI scores among the oldest respondents are also noted in Basiotis et al. (1996). Neither of the oldest respondent groups was associated with a significant reduction in scores for any of the 10 components of the HEI.

Conclusions

Older Americans have higher HEI scores, on average, because of higher average consumption of fruits and lower average consumption of sodium and cholesterol. The proportion of respondents age 65 and older meeting the recommended HEI score for fruits was twice that of those under the age of 50 (table 3), and a greater proportion of respondents age 80 and over consumed a recommended amount of sodium than did any other age group. Only one in six respondents age 65 and older consumed a “poor” diet, compared with nearly one in four respondents between age 35 and 50. Although most respondents in every age group had total HEI scores within the “needs improvement” range, respondents age 65 and above were more than twice as likely to meet the threshold for a “good” diet, compared with respondents under age 50.

A nonlinear relationship appears to exist between age and HEI scores. The lowest scores occurred among those between age 35 and 49;² the highest scores, among those between age 65 and 80. The youngest age groups ate slightly better than did the subsequent generation, and the oldest group ate slightly worse than the previous age groups. This finding suggests the separation of age into categories dictated either by generation cohort or physiological stage, particularly in empirical analyses of the HEI.

A strong relationship between HEI scores and nutrition knowledge and educational attainment was found in Variyam et al. (1998). Given lower

²This age group corresponds to those in this sample who were born between 1945 and 1960—the baby boomers. The low scores among this age group need further exploration, given the significance of this generation being able to meet aggregate public nutrition objectives.

average educational attainment and nutrition knowledge and higher HEI scores among the elderly, it is not surprising that when each of these independent factors was taken into account, the positive effect of age upon HEI scores was magnified. Results show that the 65 to 79 age category was among the four strongest independent predictors for 6 of the 10 HEI components and the strongest predictor of the total HEI score.

Factors related to lifestyle, resources, or cohort effects among the elderly have a strong influence on healthful eating. Increased consumption of fresh fruits and vegetables may be associated with ease of preparation, availability within traditional retirement areas, or even cohort-related familiarity and habit. Higher scores for other groups seem to indicate a more balanced diet overall, which is confirmed by higher variety scores. Evidence shows that a higher HEI score is associated with a reduced risk of disease, particularly cardiovascular disease among men and women (McCullough et al., 2000; Hann, Rock, King, & Drewnowski, 2001). The elderly may also be the group best able to envision the ultimate effects of poor eating upon health. As suggested by Becker and Mulligan (1997), experience improves the ability to imagine one's vulnerability.

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