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Associations of social, physical, and financial factors with diet quality among older, community-dwelling women

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Abstract

Objective: This analysis examined whether specific social, physical, and financial factors were associated with diet quality among older, community-dwelling women.

Methods: This cross-sectional analysis was conducted in a subset of 6,094 community-dwelling Women Health's Initiative participants who completed a food frequency questionnaire, administered from 2012–2013, and a self-administered supplemental questionnaire, administered

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approximately one year later. The supplemental questionnaire included five questions assessing social, physical, and financial factors related to eating. Diet quality was assessed with the Healthy Eating Index-2010 (range of 0–100; higher score indicates a higher quality diet). The total HEI-2010 score was calculated by summing individual scores representing the intake of nine adequacy components (beneficial food groups) and three moderation components (food groups to limit). Associations of responses to the five questions on the supplemental questionnaire with Healthy Eating Index-2010 scores were examined with multiple linear regression, adjusting for relevant covariates.

Results: Mean ± standard deviation age of participants was 78.8 ± 6.7 years. Reporting eating fewer than two meals per day, having dental or other mouth problems causing problems with eating, and not always being able to shop, cook, or feed oneself were associated with statistically significantly lower Healthy Eating Index-2010 scores, compared with those not reporting these issues, after multivariable adjustment: 5.37, 2.98, and 2.39 lower scores, respectively (all P values <0.0001). Reporting eating alone most of the time and not always having enough money to buy food were not associated with Healthy Eating Index-2010 scores.

Conclusions: Among older, community-dwelling women, eating fewer than two meals per day, dental and other mouth problems, and diminished ability to shop for food, prepare meals, and feed oneself were associated with lower diet quality. These are potential targets for interventions to improve diet quality in older women.

Keywords

Diet quality; Food frequency questionnaire; Healthy Eating Index; Older adults; Women’s Health Initiative

As people age, changes in social, physical, and financial factors can influence dietary intake and nutritional status. For example, social isolation and diminished social support, consequences of the loss of family or friends, can result in changes in eating habits, such as eating meals alone and eating fewer meals.[1] Dentition problems, especially those that result in the inability to adequately chew food or painful chewing, often lead to changes in the types of food consumed.[2] Poor physical functioning, especially if this results in a diminished capacity to ambulate, can impact the ability to shop for food, prepare meals, and even feed oneself.[3] Finally, financial insecurity from reduced income and inadequate savings in the latter years of life frequently results in less money to buy food, potentially affecting the quantity and quality of food purchased.[4] Collectively, these factors potentially can impact overall diet quality through changes in the types and amounts of food consumed. As the US population continues to live longer and the number of older adults increases, factors influencing nutritional status, such as diet quality, will become increasingly important.

Several previous studies of the associations of social, physical, and financial factors with diet quality included significant limitations, such as relatively small sample sizes; lack of comprehensive assessments of dietary intake and diet quality, such as using fruit and vegetable intake as a measure of diet quality; combining men and women in the same analysis; and using proxy rather than direct measures of the factors of interest, such as using participant reports of being single, divorced, or widowed as a proxy for eating alone.

The objective of this study was to examine whether specific social, physical, and financial factors were associated with diet quality among participants in the Women's Health Initiative (WHI), a longitudinal study of postmenopausal women, while addressing the limitations of previous studies noted above. Specifically, we evaluated associations of the following factors with diet quality: eating fewer than two meals per day; eating alone most of the time; having tooth or mouth problems that make it hard to eat; not always being able to shop, cook, and/or feed oneself; and not always having enough money to buy food. We hypothesized that each of these factors would be associated with lower overall dietary quality as assessed by the Healthy Eating Index-2010 (HEI-2010).

METHODS

Study population:

The WHI is a long-term national health study focused on strategies for preventing heart disease, breast and colorectal cancers, and osteoporotic fractures in postmenopausal women. Details of the design, recruitment methods, and baseline description of the WHI studies have been described elsewhere.[5–7] Briefly, 68,132 generally healthy postmenopausal women aged 50–79 years were randomized into at least one of three clinical trials – hormone therapy trials, dietary modification trial, and calcium and vitamin D supplement trial – and 93,676 were enrolled into an observational study at 40 clinical centers across the US between 1993 and 1998. Inclusion criteria included planning to reside in the area for at least three years, and exclusion criteria included having a medical condition associated with predicted survival of less than three years, or having conditions such as alcoholism, drug dependency, or dementia. Additional specific eligibility criteria were applied to each of the clinical trials.

The sample for the current analysis included all WHI participants who completed two additional questionnaires during follow-up: 1) a food frequency questionnaire (FFQ), administered as part of the Long Life Study (LLS), and 2) a supplemental questionnaire, administered as part of the WHI Extension Study 2010–2020. The LLS was a WHI ancillary study that included community-dwelling WHI participants who provided informed consent and who had been in the WHI hormone therapy trials or were African American or Hispanic. Participants were excluded if they were unable to provide informed consent or were living in an institution such as a skilled nursing facility.

Dietary assessment:

Usual dietary intake during the previous three months was assessed using the General Nutrition Assessment FFQ developed by the Nutrition Assessment Shared Resource at the Fred Hutchinson Cancer Research Center (Seattle, WA). This is a 124-item FFQ, with an additional 13 adjustment questions pertaining to fat intake, fortification of juices consumed, and type of cold cereal consumed. The FFQ was administered in the LLS by mail from March 2012 through May 2013. Nutrient calculations based on reported intake were performed using the Nutrition Data System for Research (NDSR) software version 2012, developed by the Nutrition Coordinating Center, University of Minnesota (Minneapolis, MN).[8]

HEI-2010:

The HEI-2010 is a measure of diet quality in terms of conformance with federal dietary guidelines as propagated through *Dietary Guidelines for Americans 2010*.[9] The HEI-2010 includes 12 components, including nine adequacy components – total fruit, whole fruit, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, and fatty acids – and three moderation components – refined grains, sodium, and empty calories – to capture the key recommendations of the 2010 *Guidelines*. The total HEI-2010 score is the sum of the component scores, with a maximum possible score of 100, reflecting high intake of each adequacy component and low intake of each moderation component. In addition to the availability of HEI-2010 scores in the nutrient database from the NDSR analysis of the FFQs administered during the LLS, the HEI-2010 was the version of the HEI in effect at the time of the administration of the supplemental questionnaire described below.

Supplemental questionnaire:

To begin to address the special nutritional needs of aging participants, five questions from the DETERMINE Your Nutritional Health Checklist, developed by The Nutrition Screening Initiative,[10,11] were added to the WHI supplemental questionnaire addressing factors that were hypothesized to adversely impact nutritional status. These specific questions were: 1) “I eat fewer than 2 meals per day;” 2) “I eat alone most of the time;” 3) “I have tooth or mouth problems that make it hard for me to eat;” 4) “I am not always physically able to shop, cook and/or feed myself;” and 5) “I don’t always have enough money to buy the food I need.” Participants responded “yes” or “no” to each question. The supplemental questionnaire was administered by mail in the third year of the WHI Extension Study 2010–2020, from October 2013 through December 2014, approximately one year after the LLS FFQ was administered. While the FFQ and supplemental questionnaire data were not collected concurrently, they were deemed to be close enough temporally (i.e., within approximately one year of each other) for the purposes of this analysis.

Assessment of covariates:

Sociodemographic characteristics were assessed by self-report (by mail) at the start of the WHI Extension Study 2010–2020 (age), in person at baseline in WHI (1993–1998; race/ethnicity), or at WHI follow-up (by mail), assessed through 2013 (education, marital status). Lifestyle characteristics (smoking, alcohol use, physical activity) were assessed by self-report at the start of the WHI Extension Study 2010–2020. Components of the activities of daily living (ADL) construct were assessed by self-administered questionnaire responses at this same time point. The ADL items included the ability to feed oneself, dress, get in and out of bed, and take a bath. Self-rated health also was assessed at the start of the WHI Extension Study 2010–2020. The presence of specific chronic medical conditions for the determination of multimorbidity was assessed by self-report, physician diagnosis, and adjudicated outcomes at baseline, during the WHI Extension Study 2005–2010, and during the WHI Extension Study 2010–2020. Multimorbidity was defined as having at least two of the following chronic conditions: coronary heart disease, stroke, cancer, diabetes, hip fracture, osteoarthritis, depression, chronic obstructive pulmonary disease, cognitive

impairment, sensory impairment, frequent falls, and urinary incontinence.[12] Body mass index (BMI) was calculated from measured height and weight (kg/m^2) at the LLS home visit conducted between March 2012 and May 2013.

Statistical analysis:

Descriptive statistics were used to characterize the study sample. For the comparison of participant characteristics across quartiles of HEI-2010 scores, chi-square tests for categorical variables and analysis of variance for continuous variables were used. Sociodemographic characteristics (age, race/ethnicity, education, marital status), lifestyle characteristics (smoking, alcohol use, physical activity), ADL construct, self-rated health, history of multimorbidity, and BMI were compared in those who responded “yes” with those who responded “no” to each of the five questions from the supplemental questionnaire, using chi-square tests for categorical variables and two-sample t-tests for continuous variables. Differences in HEI-2010 component scores and overall scores were compared in those who responded “yes” with those who responded “no” to each of the five questions from the supplemental questionnaire, using two-sample t-tests for these continuous variables.

Associations of the five questions from the supplemental questionnaire with total HEI-2010 scores were examined by using simple linear regression models for crude analysis and multiple linear regressions to adjust for the relevant sociodemographic characteristics, lifestyle characteristics, ADL construct, self-rated health, history of multimorbidity, and BMI. A composite measure was formed by including responses from each of the five questions. The supplemental questionnaire included “yes/no” responses (1=Yes, 0=No) for the five questions. Based on the responses to these five questions, a summary score was calculated by adding all responses (a total score ranging from 0–5) in order to explore the association of an increasing number of “yes” responses with diet quality. We explored the possible pre-specified modifying effects of age, race/ethnicity, education, marital status, self-rated health, and BMI in the analysis by including interaction terms in the models. The variance inflation factor was used as an indicator of multicollinearity among the independent variables; multicollinearity of predictors using the variance inflation factor cutoff of five was not observed. Analyses were conducted with SAS, version 9.4 (SAS Institute Inc., Cary, NC.).

RESULTS

Participant characteristics:

Mean ± standard deviation (SD) age of participants was 78.8 ± 6.7 years. Compared with women in the lowest quartile of HEI-2010 scores, women in the highest quartile were more likely to be <80 years of age and black, have a college degree, drink less alcohol, be more physically active, and have higher self-rated health, and less likely to be current smokers, have a history of multimorbidity, and be obese (Table 1).

Of the 6094 LLS participants with a completed FFQ and calculated HEI-2010 scores, the number of participants responding to each of the five questions ranged from 5339 (question

5) to 5374 (question 2). Approximately 5–7% of participants responded affirmatively to each question, with the exception of the question “I eat alone most of the time,” for which 50% responded affirmatively (see Tables, Supplemental Digital Content 1–5, which present participant characteristics according to the response to each of the five questions on the supplemental questionnaire). With few exceptions, compared with women answering “no” to each of the five questions, a higher proportion of those answering “yes” were black, had less than a high school education, smoked currently, had fair/poor self-rated health, had a history of multimorbidity, and were obese. Also noted consistently, compared with women answering “no” to each of the five questions, those answering “yes” were less likely to have a college degree, be married or living as married, have excellent self-rated health, and have a BMI in the normal range (see Tables, Supplemental Digital Content 1–5, which present participant characteristics according to the response to each of the five questions on the supplemental questionnaire).

HEI-2010 scores:

Women in the highest vs. lowest quartile of HEI-2010 scores were significantly less likely to answer “yes” to the questions “I eat fewer than 2 meals per day” (2.8% vs. 10.4%, P <0.0001), “I have tooth or mouth problems that make it hard for me to eat” (2.5% vs. 8.1%, P <0.0001), “I am not always physically able to shop, cook, and/or feed myself” (4.2% vs. 10.4%, P <0.0001), and “I don’t always have the money to buy the food I need” (4.1% vs 7.6%, P = 0.0002), but not to the question “I eat alone most of the time” (50.8% vs. 52.4%, P = 0.06) (Table 1).

Women answering “yes” to the question “I eat fewer than 2 meals per day” had a mean ± SD total HEI-2010 score of 65.5 ± 12.0 compared with a score of 72.3 ± 10.1 in those answering “no” (P <0.0001) (Supplemental Digital Content 6). All HEI-2010 component scores were significantly lower in those answering “yes” compared with those answering “no,” except for dairy, fatty acids, and sodium, which did not differ significantly between the groups.

Women answering “yes” to the question “I have tooth or mouth problems that make it hard for me to eat” had a total HEI-2010 score of 67.3 ± 10.9 compared with a score of 72.1 ± 10.3 in those answering “no” to this question (P <0.0001) (Supplemental Digital Content 6). All HEI-2010 component scores were significantly lower in those answering “yes” compared with those answering “no,” except for dairy, total protein foods, fatty acids, and sodium, which showed no differences between the groups.

Women answering “yes” to the question “I am not always physically able to shop, cook and/or feed myself” had a total HEI-2010 score of 68.4 ± 11.0 compared with a score of 72.1 ± 10.3 in those answering “no” (P <0.0001) (Supplemental Digital Content 6). All HEI-2010 component scores were significantly lower in those answering “yes” compared with those answering “no,” except for total fruit, whole grains, dairy, fatty acids, and sodium, which did not differ between the groups.

Women answering “yes” to the question “I don’t always have enough money to the buy the food I need” had a total HEI-2010 score of 69.2 ± 11.2 compared with a score of 72.0 ± 10.3

in those answering “no” to this question (P <0.0001) (Supplemental Digital Content 6). All HEI-2010 component scores were significantly lower in those answering “yes” compared with those answering “no,” except for total fruit, total vegetables, greens and beans, whole grains, total protein foods, and empty calories.

There was no significant difference in total HEI-2010 scores between those answering “yes” or “no” to the question “I eat alone most of the time” (71.7 ± 10.7 vs. 72.0 ±10.0, respectively; P = 0.26) (Supplemental Digital Content 6).

In multivariable models adjusted for age, race/ethnicity, education, marital status, smoking, alcohol, physical activity, ADL construct (except for question 4), self-rated health, history of multimorbidity, and BMI, positive responses to the individual questions “I eat fewer than 2 meals per day,” “I have tooth or mouth problems that make it hard for me to eat,” and “I am not always physically able to shop, cook and/or feed myself” were significantly associated with lower total HEI-2010 score (all P values <0.0001) (Table 2).

When all five questions were combined, in the multivariable-adjusted model an association in the opposite direction was observed – a significant positive association was seen between the number of “yes” responses and total HEI-2010 score (parameter estimate = 2.93; 95% confidence interval [CI]: 2.21, 3.64) (Table 3). Further analysis revealed a significant interaction between the composite score and self-rated health ($P_{Interaction}$ = 0.0012). After stratifying by self-rated health, women reporting lower self-rated health (i.e., good/fair/poor) demonstrated a significant inverse association between the number of “yes” responses to the questions combined and total HEI-2010 score (parameter estimate = −2.01; 95% CI: −2.64, −1.38). There was no association in women self-rating excellent/very good health (Table 3). No interactions by age, race/ethnicity, education, marital status, or BMI were detected.

DISCUSSION

In this cross-sectional analysis among WHI participants, self-reported eating fewer than two meals per day, having dental or other mouth problems causing problems with eating, or not always being able to shop, cook, or feed oneself were associated with statistically significant lower diet quality, as assessed by HEI-2010 scores, independent of sociodemographic, lifestyle and health/medical history factors. Self-reported eating alone most of the time and not always having enough money to buy food were not associated with diet quality. When the five questions were combined, having more “yes” responses was associated with a significantly lower HEI-2010 score in women reporting good/fair/poor health, while there was no association in women reporting excellent/very good health. No interactions by age, race/ethnicity, education, marital status, or BMI were detected.

Eating fewer meals per day likely would predispose an individual to lower diet quality, as fewer meals would mean fewer opportunities to consume healthy component foods of the HEI-2010, such as greens, vegetables, and seafood, which would be less likely to be consumed as between-meal snacks. Few previous studies have investigated the association of the number of meals consumed per day with diet quality in older adults, but in agreement with our results, the number of meals consumed per day was significantly and positively

associated with diet quality, as assessed by the Canadian HEI, in older women in the Quebec Longitudinal Study of Nutrition and Successful Aging (NuAge) cohort.[13]

We hypothesized that eating alone would be associated with lower diet quality, as we speculated that women eating alone would be more likely to consume quickly prepared meals of highly processed/refined foods with fewer whole foods such as greens and vegetables, and would be more likely to consume lower quality convenience foods. However, we found that eating alone most of the time was not associated with diet quality. While previous studies have produced mixed results on this question, many were limited by including only certain components of diet quality (e.g., fruit and vegetable intake), using more indirect measures of diet quality, combining men and women in the same analysis, or using being single, divorced, or widowed as a proxy for living alone and therefore eating alone. Some studies did ask specifically about the living situation; for example, in men and women ≥50 years of age in the European Prospective Investigation of Cancer (EPIC)-Norfolk study, being single or widowed was associated with lower fruit and vegetable variety, especially when combined with living alone.[14] Not living alone was positively associated with diet quality in older men and women consistently across four European Union countries.[15] Being married/living with a partner were associated with higher HEI-2005 scores in older adults in the Cardiovascular Health of Seniors and Built Environment Study.[16] Living alone was associated with lower dietary variety in men and women ≥65 years of age in eight European countries.[17] Interestingly, WHI participants who were married at baseline but divorced or separated by year 3 exhibited statistically significantly greater improvements in Alternate HEI scores between baseline and year 3 compared to participants who were still married.[18]

Conversely, there were no significant differences in fruit or vegetable consumption between single and married older women in a study in England.[19] Eating alone was not associated with diet quality, as assessed by the Dietary Screening Tool, in older adults in the Geisinger Rural Aging Study.[20]

Poor dentition or other mouth problems that inhibit the ability to adequately chew foods could lead to a lower quality diet being consumed. An afflicted person likely would avoid healthy foods that require more chewing, such as whole fruits and whole grains, in favor of more processed foods and fruit juices, requiring less or no chewing. As hypothesized, we did observe significantly lower HEI-2010 scores in women reporting tooth or mouth problems making it hard for them to eat. The results of most previous studies have been in agreement with our results. Older men and women who reported persistent chewing, swallowing, and mouth pain in the Geisinger Rural Aging Study had significantly lower HEI scores compared with participants without these symptoms: 66.7 vs. 70.5, respectively.[21] Edentulous men and women ≥60 years of age and those with 1–20 teeth had significantly lower HEI scores than those with 21 or more teeth (63.4, 66.6, and 68.9, respectively) in NHANES 1999–2002.[22] Difficulty chewing was associated with lower diet quality in older women in the Ontario Health Survey.[23] Chewing problems were significantly associated with lower Canadian HEI scores in older women in the NuAge cohort.[13]

Not being able to shop for food, cook, or feed oneself could both limit overall food intake and lead to greater consumption of convenience foods, both of which could reduce the intake of healthy foods and negatively impact HEI-2010 scores. Few studies have addressed this issue, while some have done so rather indirectly. For example, access to a car was positively associated with dietary variety in a study conducted in men and women ≥65 years of age in eight European countries.[17] While dependence on others for performance of instrumental ADLs was significantly associated with lower diet quality in older women in the Ontario Health Survey, dependence in walking was positively associated with diet quality in these women.[23]

Despite the fact that not having enough money to buy food would seem to impact the amounts and types of food consumed, and therefore diet quality, we did not observe significantly lower HEI-2010 scores in those responding affirmatively to this question after multivariable adjustment. These results may be partially explained by the existence of programs delivering healthy meals to older persons with limited financial resources, although we were unable to account for this in our study. In the Ontario Health Survey, income was significantly and positively associated with diet quality in older women.[23] Income was positively associated with dietary variety in men and women ≥65 years of age in a study conducted in eight European countries.[17] However, in agreement with our results, income was not associated with HEI-2005 score in older adults in the Cardiovascular Health of Seniors and Built Environment Study.[16] Strengths of this study include the focus on older women, the large and well-characterized sample, and the use of established and comprehensive measures of dietary intake and diet quality. Some limitations should be noted, including the cross-sectional nature of the study, which prevents causal inference. We previously acknowledged that the periods of data collection for the FFQ and supplemental questionnaire did not precisely overlap. However, we believe that they were close enough temporally (i.e., within approximately one year of each other) that the chance of this introducing bias was low. Objective information on dentition (e.g., number of teeth) was not available. We also recognize the potential for measurement error with any dietary assessment instrument that relies on recall of dietary intake, in this case FFQs, which could result in misclassification of dietary intake. Women who were sicker, including those with impaired cognition, were less likely to be included in the WHI extension studies due to the inability to complete the required questionnaires, which could have constrained the sample. Finally, the results may not be generalizable beyond older women.

CONCLUSIONS

In this cross-sectional analysis in older, community-dwelling women, eating fewer than two meals per day, dental and other mouth problems, and diminished ability to shop for food, prepare meals, and feed oneself were associated with lower diet quality. These factors that may impact nutritional status are potential targets for future interventions to improve diet quality in older women.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1.

Participant characteristics according to quartile of Health Eating Index-2010 scores

	Quartile of Healthy Eating Index-2010				
Characteristic	**1 (<65.18)**	**2 (≥65.18, <72.92)**	**3 (≥72.92, <79.38)**	**4 (≥79.38)**	**P value[a]**
All participants	1524 (100.0)	1523 (100.0)	1524 (100.0)	1523 (100.0)	
Age, y[b]					
<80	756 (49.6)	765 (50.2)	779 (51.1)	833 (54.7)	0.0237
≥80	768 (50.4)	758 (49.8)	745 (48.9)	690 (45.3)	
Race/ethnicity[c]					
Black	436 (28.6)	422 (27.7)	487 (32.0)	532 (34.9)	0.0001
White	820 (53.8)	844 (55.4)	802 (52.6)	729 (47.9)	
Hispanic	268 (17.6)	257 (16.9)	235 (15.4)	262 (17.2)	
Education[d]					
Less than high school	113 (7.5)	77 (5.1)	48 (3.2)	50 (3.3)	<0.0001
High school diploma/GED	524 (34.7)	413 (27.2)	364 (24.0)	337 (22.2)	
Some college	438 (29.0)	448 (29.6)	420 (27.7)	384 (25.3)	
College degree or higher	435 (28.8)	578 (38.1)	684 (45.1)	747 (49.2)	
Marital status[d]					
Married/living as married	880 (58.0)	882 (58.0)	905 (59.5)	923 (60.7)	0.35
Widowed/divorced/separated/never married	637 (42.0)	638 (42.0)	615 (40.5)	597 (39.3)	
Smoking, current[b]	72 (5.1)	38 (2.7)	28 (2.0)	21 (1.4)	<0.0001

Characteristic	Quartile of Healthy Eating Index-2010				P value[a]
	1 (<65.18)	2 (≥65.18, <72.92)	3 (≥72.92, <79.38)	4 (≥79.38)	
Alcohol, drinks/wk, mean ± SD[b]	2.21 ± 5.26	2.33 ± 5.04	2.39 ± 4.92	1.90 ± 3.94	0.0273
Physical activity, METs/wk, mean ± SD[b]	10.0 ± 13.3	11.1 ± 12.4	12.9 ± 13.0	15.4 ± 15.4	<0.0001
Activities of daily living construct, mean ± SD[b,e]	4.24 ± 0.94	4.15 ± 0.72	4.15 ± 0.76	4.12 ± 0.70	0.0001
Self-rated health[b]					
Excellent	107 (7.3)	127 (8.5)	137 (9.2)	189 (12.7)	<0.0001
Very good	506 (34.4)	607 (40.8)	648 (43.6)	664 (44.6)	
Good	613 (41.7)	608 (40.9)	566 (38.0)	529 (35.5)	
Fair/poor	244 (16.6)	145 (9.8)	137 (9.2)	108 (7.3)	
History of multimorbidity[f,g]	951 (62.4)	880 (57.8)	862 (56.6)	773 (50.8)	<0.0001
Body mass index, kg/m^2[h]					
18.5–24.9	466 (31.1)	457 (30.3)	503 (33.3)	566 (37.6)	<0.0001
25.0–29.9	509 (33.9)	565 (37.5)	519 (34.4)	547 (36.3)	
≥30.0	525 (35.0)	486 (32.2)	489 (32.4)	394 (26.1)	
Questions, answering “yes”					
“I eat fewer than 2 meals per day.”	136 (10.4)	84 (6.4)	46 (3.4)	38 (2.8)	<0.0001
“I eat alone most of the time.”	694 (52.4)	629 (47.3)	670 (49.8)	698 (50.8)	0.06
“I have tooth or mouth problems that make it hard for me to eat.”	107 (8.1)	85 (6.4)	57 (4.2)	35 (2.5)	<0.0001

Characteristic	Quartile of Healthy Eating Index-2010				
	1 (<65.18)	2 (≥65.18, <72.92)	3 (≥72.92, <79.38)	4 (≥79.38)	P value[a]
"I am not always physically able to shop, cook and/or feed myself."	137 (10.4)	95 (7.2)	89 (6.6)	58 (4.2)	<0.0001
"I don't always have enough money to buy the food I need."	100 (7.6)	79 (6.0)	60 (4.5)	56 (4.1)	0.0002

Values are *n* (%) unless otherwise specified. Numbers may not add up to quartile total because of missing values.

GED, General Equivalency Diploma; MET, metabolic equivalent of task; SD, standard deviation; WHI, Women's Health Initiative.

[a]The chi-square test was used to compare differences in categorical variables and ANOVA was used to compare differences in continuous variables across categories of Healthy Eating Index-2010.

[b]Assessed at the start of WHI Extension Study 2010–2020.

[c]Assessed at WHI baseline, 1993–1998.

[d]Assessed at WHI follow-up through 2013.

[e]Includes ability to perform the following four basic activities without help, with some help, or completely unable to do this by oneself: feeding, dressing, getting in and out of bed, and taking a bath or shower.

[f]Assessed at WHI baseline, during WHI Extension Study 2005–2010, and during WHI Extension Study 2010–2020.

[g]Defined as having ≥2 of the following chronic conditions: coronary heart disease, stroke, cancer, diabetes, hip fracture, osteoarthritis, depression, chronic obstructive pulmonary disease, cognitive impairment, sensory impairment, frequent falls, and urinary incontinence.

[h]Assessed at the Long Life Study home visit, March 2012 to May 2013.

TABLE 2.

Unadjusted and adjusted coefficients for each of the five questions from the supplemental questionnaire for prediction of Healthy Eating Index-2010 score

Question	Parameter estimate[a]	Parameter estimate[b]	95% Confidence interval	P value
1. I eat fewer than 2 meals per day.	−6.76	−5.37	−6.65, −4.09	<0.0001
2. I eat alone most of the time.	−0.32	0.19	−0.42, 0.81	0.54
3. I have tooth or mouth problems that make it hard for me to eat.	−4.76	−2.98	−4.31, −1.65	<0.0001
4. I am not always physically able to shop, cook and/or feed myself.	−3.73	−2.39	−3.55, −1.23	<0.0001
5. I don’t always have enough money to buy the food I need.	−2.75	−0.90	−2.23, 0.43	0.18

[a]Univariate.

[b]Adjusted for age, race/ethnicity, education, marital status, smoking, alcohol, physical activity, activities of daily living construct (except for question 4), self-rated health, history of multimorbidity, and body mass index. Note: all variables are categorical (see Table 1 for categories) except for alcohol, physical activity, and activities of daily living construct, which are continuous.

TABLE 3.

Unadjusted and adjusted coefficients for the five questions from the supplemental questionnaire combined and stratified by self-rated health

Question	Parameter estimate[a]	Parameter estimate[b]	95% Confidence interval	P value
Five questions combined	−1.67	2.93	2.21, 3.64	<0.0001
Self-rated health[c]				
Excellent/very good	---	−0.30	−0.92, 0.32	0.35
Good/fair/poor	---	−2.01	−2.64, −1.38	<0.0001

[a]Univariate. The parameter estimates represent the change in HEI-2010 score for each additional “Yes” response.

[b]Adjusted for age, race/ethnicity, education, marital status, smoking, alcohol, physical activity, activities of daily living construct (except for question 4), self-rated health, history of multimorbidity, and body mass index. Note: all variables are categorical (see Table 1 for categories) except for alcohol, physical activity, and activities of daily living construct, which are continuous.

[c]$P_{Interaction} = 0.0012$.