RESEARCH
Original Research

Evaluation of the Healthy Eating Index-2015

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ABSTRACT

Background The Healthy Eating Index (HEI), a diet quality index that measures alignment with the Dietary Guidelines for Americans, was updated with the 2015-2020 Dietary Guidelines for Americans.

Objective and design To evaluate the psychometric properties of the HEI-2015, eight questions were examined: five relevant to construct validity, two related to reliability, and one to assess criterion validity.

Data sources Three data sources were used: exemplary menus (n=4), National Health and Nutrition Examination Survey 2011-2012 (N=7,935), and the National Institutes of Health-AARP (formally known as the American Association of Retired Persons) Diet and Health Study (N=422,928).

Statistical analyses Exemplary menus: Scores were calculated using the population ratio method. National Health and Nutrition Examination Survey 2011-2012: Means and standard errors were estimated using the Markov Chain Monte Carlo approach. Analyses were stratified to compare groups (with *t* tests and analysis of variance). Principal components analysis examined the number of dimensions. Pearson correlations were estimated between components, energy, and Cronbach's coefficient alpha. National Institutes of Health-AARP Diet and Health Study: Adjusted Cox proportional hazards models were used to examine scores and mortality outcomes.

Results For construct validity, the HEI-2015 yielded high scores for exemplary menus as four menus received high scores (87.8 to 100). The mean score for National Health and Nutrition Examination Survey was 56.6, and the first to 99th percentile were 32.6 to 81.2, respectively, supporting sufficient variation. Among smokers, the mean score was significantly lower than among nonsmokers (53.3 and 59.7, respectively) ($P<0.01$), demonstrating differentiation between groups. The correlation between diet quality and diet quantity was low (all <0.25) supporting these elements being independent. The components demonstrated multidimensionality when examined with a scree plot (at least four dimensions). For reliability, most of the intercorrelations among the components were low to moderate (0.01 to 0.49) with a few exceptions, and the standardized Cronbach's alpha was .67. For criterion validity, the highest vs the lowest quintile of HEI-2015 scores were associated with a 13% to 23% decreased risk of all-cause, cancer, and cardiovascular disease mortality.

Conclusions The results demonstrated evidence supportive of construct validity, reliability, and criterion validity. The HEI-2015 can be used to examine diet quality relative to the 2015-2020 Dietary Guidelines for Americans.
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THE HEALTHY EATING INDEX (HEI) IS A DIET QUALITY index that measures alignment with the Dietary Guidelines for Americans (DGA).[1] As such, it can be used to assess the conformance of any group of foods to the key diet quality recommendations set forth in the DGA. In the past, the HEI has been used to assess diet quality for a variety of research purposes, including epidemiology, population surveillance, and evaluations of food environments, food assistance programs, and nutrition interventions.[2-5]

With the release of the 2015-2020 DGA, the HEI has been updated to reflect current federal dietary advice through a collaboration between researchers at the National Cancer Institute (NCI) and the US Department of Agriculture (USDA)

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Center for Nutrition Policy and Promotion (CNPP). The HEI-2015 includes 13 dietary components (Table 1). Nine adequacy components (those recommended for inclusion in a healthy diet) include Total Fruits, Whole Fruits, Total Vegetables, Greens and Beans, Whole Grains, Dairy, Total Protein Foods, Seafood and Plant Proteins, and Fatty Acids. Four moderation components (those that should be consumed sparingly) include Refined Grains, Sodium, Added Sugars, and Saturated Fats. Added Sugars is a newly distinct component in the HEI-2015, added to address new quantitative recommendations to limit added sugars in the diet. With the inclusion of Added Sugars as a distinct component, Empty Calories (a component in the 2010 index)[6] was removed and Saturated Fats was reintroduced (from the 2005 index).[7] Other details on the changes in the HEI-2015 compared with previous versions have been described elsewhere.[8]

This article presents the evaluation of the index's validity and reliability. As done previously, content validity, or how completely the HEI-2015 captures the dimensions of a healthy diet, is explored and reported in the update article.[8]

RESEARCH SNAPSHOT

Research Question: Does the Healthy Eating Index-2015 (HEI-2015) exhibit construct validity, reliability, and criterion validity?

Key Findings: This evaluation found that HEI-2015 demonstrated construct validity by yielding high scores on exemplary menus, and using National Health and Nutrition Examination Survey data, the index showed variation in scores in the population, differentiated between groups such as smokers and nonsmokers, assessed diet quality independent of quantity, and captured multidimensionality. The HEI-2015 displayed reliability with low to moderate correlations among distinct components and internal consistency. Finally, the index demonstrated criterion validity because the HEI-2015 was associated with a statistically significant reduced risk of mortality in the National Institutes of Health-AARP (formally known as the American Association of Retired Persons) Diet and Health Study.

METHODS

The HEI-2015 was evaluated by assessing its psychometric properties (strategies shown in Figure 1). These included five questions relevant to construct validity, two related to reliability (internal consistency), and one to assess criterion validity.

Data Sources

To examine these questions, three data sources were used.

Exemplary Menus. The exemplary menus, which provide benchmarks representative of high-quality diets, were created by nutrition experts at a variety of organizations. Specifically, these included the 7-day 2,000-kcal sample menu from the USDA Food Patterns[9] (available by contacting US Department of Agriculture's Center for Nutrition Policy and Promotion, 3101 Park Center Dr, Suite 1034; Alexandria, VA 22302); 7-day 2,000-kcal sample menu for

Table 1. Healthy Eating Index-2015 components, point values, and standards for scoring

Component	Maximum points	Standard for maximum score	Standard for minimum score of zero
Adequacy			
Total Fruits	5	≥0.8 c equivalents/1,000 kcal	No fruit
Whole Fruits	5	≥0.4 c equivalents/1,000 kcal	No whole fruit
Total Vegetables	5	≥1.1 c equivalents/1,000 kcal	No vegetables
Greens and Beans	5	≥0.2 c equivalents/1,000 kcal	No dark green vegetables or beans and peas
Whole Grains	10	≥1.5 oz equivalents/1,000 kcal	No whole grains
Dairy	10	≥1.3 c equivalents/1,000 kcal	No dairy
Total Protein Foods	5	≥2.5 oz equivalents/1,000 kcal	No protein foods
Seafood and Plant Proteins	5	≥0.8 c equivalents/1,000 kcal	No seafood or plant proteins
Fatty Acids	10	(PUFAs[a]+MUFAs[b])/SFAs[c] ≥2.5	(PUFAs+MUFAs)/SFAs ≤1.2
Moderation			
Refined Grains	10	≤1.8 oz equivalents/1,000 kcal	≥4.3 oz equivalents/1,000 kcal
Sodium	10	≤1.1 g/1,000 kcal	≥ 2.0 g/1,000 kcal
Added Sugars	10	≤6.5% of energy	≥26% of energy
Saturated Fats	10	≤8% of energy	≥16% of energy

[a]PUFAs=polyunsaturated fatty acids.
[b]MUFAs=monounsaturated fatty acids.
[c]SFAs=saturated fatty acids.

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