Validation of self-rated overall diet quality by Healthy Eating Index-2010 score among New York City adults, 2013

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ARTICLE INFO

ABSTRACT

Objective: Chronic conditions such as cardiovascular disease and cancer can result from a number of diet-related environmental and behavioral factors. Screening for poor diet is helpful in developing interventions to prevent chronic disease, but measuring dietary behavior can be costly and time-consuming. The purpose of this study was to test the ability of a self-rated, single-item measure for evaluating diet quality among individuals and populations. *Methods*: A 24-h dietary recall and single-item self-rated diet quality measure were collected for 485 adults. From dietary recalls, Healthy Eating Index-2010 (HEI) scores were computed and compared with self-rated diet quality. Data were collected in 2013 among adult (18 years and older) New York City residents. *Results*: The study sample was 57% female, 47% white, 56% college educated, and 45% in the highest income tertile. The mean HEI score was 56.5 out of a possible 100. Women averaged higher HEI scores compared to men (58.1 vs 54.3, $p = .01$). There was a modest yet significant correlation between HEI scores and self-rated diet quality ($\rho = 0.29$, $p < .01$). Overall, mean HEI score increased as self-rated diet quality improved (from 48.2 for "poor" to 63.0 for "excellent"). *Conclusions*: The single-item measure of self-rated diet quality may provide a simple method of identifying those with the worst diet quality. Further investigation of this measure's validity is needed with alternative measures of dietary intake and with health outcomes.

Introduction[1]

Development of chronic conditions such as cardiovascular disease and cancer can result from a multitude of environmental and behavioral factors. Poor diet is a leading contributor to the occurrence and prevention of such chronic diseases (McCullough et al., 2000; Kant et al., 2000), as well as premature death (Mokdad et al., 2004). In general, recommendations for disease prevention emphasize increased consumption of fruit, vegetables, fat-free or low-fat dairy products, and whole grains, combined with a decrease in consumption of solid fats, added sugars, and refined grains (USDA and HHS, 2010). However, due to the coincident nature of such changes, it is difficult to determine the impact of specific dietary components as they relate to chronic disease prevention (McCullough et al., 2000; Kant et al., 2000). Complex diets contain a variety of nutrients and both beneficial and harmful components; however, there has been research showing that an overall dietary pattern generally consistent with the United States Department of Agriculture (USDA) Dietary Guidelines for Americans (DGA) is associated with decreased mortality risk and improved health outcomes (Kant et al., 2000).

One way to assess diet quality as it relates to DGA adherence is through the use of scores and indices, which can describe both quality and variety of a complex diet (Guenther et al., 2013a; Wirt and Collins, 2009). Refined scoring methods can pinpoint both protective and harmful dietary patterns, while linking them to biomarkers of disease mortality and chronic conditions. Cross-sectional dietary scoring has been used to predict long-term health outcomes, and there is evidence that such tools could be useful to help identify and target those who would benefit from a nutrition intervention, thereby potentially reducing nutrition-related chronic disease (Wirt and Collins, 2009).

The Healthy Eating Index-2010 (HEI) is a single, summary measure of dietary quality which has multiple functions: evaluating compliance to the 2010 DGA, showing changes in diet quality over time, describing and explaining eating patterns of Americans (USDA, 2013; Guenther et al., 2013a), and assessing overall healthfulness, rather than just singular components, of dietary intake (Guenther et al., 2013a). A validation study determined that it is sensitive enough to detect differences in

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[1] HEI: Healthy Eating Index 2010; DGA: Dietary Guidelines for Americans; DOHMH: New York City Department of Health and Mental Hygiene; ASA24: Automated Self-Administered 24-h Recall-2011™; NHANES: National Health and Nutrition Examination Survey; FPL: Federal Poverty Level.

diet quality between individuals and populations (Guenther et al., 2014). The HEI, which is out of a maximum of 100 points, includes 12 components: total fruit, whole fruit, total vegetables, greens and beans, whole grains, dairy (including soy products), total protein foods, seafood and plant proteins, fatty acids, refined grains, sodium, and empty calories. For the majority of components (i.e. those for which adequate consumption is encouraged), higher intake leads to a higher component score. However, for components meant to be eaten in moderation, such as refined grains, sodium, and empty calories, lower intake results in higher scores (Guenther et al., 2013a). The HEI is amenable to capturing diet quality of Americans because (1) it is appropriate for a wide variety of dietary patterns (Guenther et al., 2013b), and (2) it has the capacity to measure quality of the mix of foods consumed, since dietary intakes are assessed on the basis of nutrient density rather than absolute quantities consumed (Guenther et al., 2014). In public health practice, HEI scores can be used to better understand relationships between eating patterns and health outcomes (Guenther et al., 2013b).

However, collection of detailed dietary data to determine overall consumption patterns can be costly and time-consuming, usually requiring a food frequency questionnaire or 24-h dietary recall. More time- and cost-effective methods to measure diet quality, such as a single-item indicator, would enable public health practitioners and clinicians to more efficiently predict and prevent nutrition-related morbidity. In a similar vein, self-rated general health has been a validated and broadly used health indicator, proven to independently predict morbidity and mortality (Jylhä, 2009). Comprehensive dietary measures undoubtedly reflect true intake with more accuracy than a single-item measure could; however, applying the same logic from self-rated general health to self-rated diet quality, it would seem as though a single-item question could serve as a reliable tool for predicting diet-related health outcomes and/or flagging those with a potential need for dietary intervention. However, limited research has examined the validity of single-item measures, such as self-rated diet quality, in comparison to measured diet quality using HEI-like scales (Milton et al., 2013). The objective of this analysis is to test the construct validity of the single-item survey question against the measured HEI score computed from a sample of 24-h dietary recall surveys collected concurrently.

Methods

Study design

In winter 2013, the New York City Department of Health and Mental Hygiene (DOHMH) administered the NYC Health Survey and 24-Hour Dietary Recall, a cross-sectional study conducted among a representative sample of adult NYC residents. Overall, 2172 respondents first participated in a dual-frame (cellular and landline) random digit dial telephone survey, which was conducted in either English or Spanish. The survey collected information on demographics, Internet access and usage, typical sugary drink consumption, physical activity, general health, and overall diet quality. Self-reported diet quality was assessed through a single-item measure that asked: "In general, how healthy is your overall diet? Would you say excellent, very good, good, fair or poor?"

From these phone surveys, all 2172 participants were asked to participate in a follow-up online dietary recall survey, using the Automated Self-Administered 24-h Recall-2011™ (ASA24) system, which required computer and Internet access. Those without such access were referred to nearby public access options, such as local libraries. Sixty-two percent of phone survey respondents initially agreed to participate (N = 1342); of those, 641 never attempted to complete the recall, and 213 initiated but did not finish the recall. The remaining 488 participants (22.5%) were both recruited to and completed a single online 24-h dietary recall in either English or Spanish. Participants were instructed on how to log

into the study website and provided with follow-up support (helpline, available 9 am–5 pm, M–F, or email support) if they encountered any difficulties.

Propensity scores were estimated for the probability that telephone survey respondents would agree to and complete the online dietary recall survey. Significant predictors for completing the ASA24 included education, age, and Internet access and use. Thus, although HEI scores and self-ratings for overall diet quality cannot be generalized to the population, these two measures can be compared within subjects for validation purposes.

New York City Department of Health and Mental Hygiene Institutional Review Board deemed this study exempt from human subjects research classification. Participants who completed the online survey tool were given a $40 incentive, and data were analyzed anonymously.

Dietary recall

The ASA24 system was developed by the National Cancer Institute, Bethesda, MD. ASA24 is a free online tool that allows respondents to enter all foods and drinks consumed during the previous 24-h period from midnight to midnight. The program is based upon the validated USDA Automated Multiple-Pass Method (AMPM), which is used in the National Health and Nutrition Examination Survey (NHANES) (ASA24, 2011a) and has been shown to reduce bias in the collection of dietary intake data (Moshfegh et al., 2008). The ASA24 system has performed well when validated against true dietary intake as well as the AMPM, despite limitations intrinsic in comparing two self-report methods (Kirkpatrick et al., 2014).

The ASA24 database generated from the participant input includes tables detailing food codes and weights for each food reported by each respondent based on the Food and Nutrient Database for Dietary Studies and MyPyramid Equivalents for each food reported based on the MyPyramid Equivalents Database, which can be used to derive HEI scores. The ASA24 Researcher website provides SAS codes and macros for computing total HEI scores (ASA24, 2011b).

Healthy Eating Index-2010

From reported food and beverage intake, we computed HEI scores, which are comprised of 12 dietary component sub-scores that add to 100 maximum points. Higher scores for each dietary component indicate closer adherence to dietary guidelines, both for "adequacy" and "moderation" components.

Statistical analyses

HEI total and component scores were calculated from participant food intake derived from ASA24 output. Amounts of each component, which are linked to the MyPyramid Equivalents Database, were combined to generate information on total fruit, whole fruit, total vegetables, etc. SAS codes and macros available on the ASA24 Researcher website were used to compute individuals' scores. Descriptive statistics, including frequencies, means, standard errors, and confidence intervals were used to characterize participant demographics and enumerate HEI total and component scores. These scores were then compared with self-rated diet quality responses, which were reported as part of a 5-point Likert scale (5 = "excellent," 4 = "very good," 3 = "good," 2 = "fair," 1 = "poor"). Generalized linear models (proc GLM) and Spearman rank correlation coefficients were used to measure associations between continuous HEI scores and ordinal self-rated diet quality. All analyses were conducted using SAS analysis software version 9.2 (SAS Institute; Cary, NC, USA).