VALIDITY OF SELF-RATED DIET QUALITY QUESTION

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ABSTRACT

Effective evaluation of diet quality as an outcome of nutrition education programming requires valid, practical tools. This study assessed the feasibility of online administration of the 25-item Dietary Screening Tool (DST) in adults with chronic disease and the concurrent validity of a self-rated diet quality question as compared to the DST. The results confirm the online feasibility of the DST for a chronic disease population. The self-rated diet quality question adequately identified individuals at nutritional risk according to the DST, and thus may be a useful, rapid tool for identifying those in need of education to improve diet quality.

VALIDITY OF A SELF-RATED DIET QUALITY QUESTION

Higher diet quality is associated with a reduced risk of cardiovascular disease, type 2 diabetes, and neurodegenerative disease when assessed using the Healthy Eating Index (HEI) and Alternative Healthy Eating Index, and adherence to the Dietary Approaches to Stop Hypertension (DASH) dietary pattern (Morze, Danielewicz, Hoffmann, & Schwingshackl, 2020). These indices assess adherence to healthful dietary patterns as outlined by various national dietary guidelines (Alkerwi, 2014). To apply indexes of diet quality, such as the HEI, detailed dietary assessment by repeated 24-hour recalls or food records are required to quantify current dietary intake (Krebs-Smith et al., 2018). These methods are time and labor-intensive with a high participant burden (Ortega, Pérez-Rodrigo, & López-Sobaler, 2015). Alternatively, to assess dietary patterns, food frequency questionnaires are used, but due to the number of food items queried, completion may be arduous and impractical for some purposes (Pérez Rodrigo, Aranceta, Salvador, & Varela-Moreiras, 2015).

Rapid screening for the healthfulness of dietary patterns may be more appropriate than undertaking comprehensive dietary assessment, particularly for needs assessment and evaluation of nutrition education programming in Extension.

Valid tools are recommended to evaluate food and nutrition programming targeting older adults (Saffel-Shrier, Johnson, & Francis, 2019). The Dietary Screening Tool (DST) was developed to assess diet quality and dietary patterns of older adults (Bailey et al., 2007), and its validity to screen for nutritional risk has been established in older adults (Bailey et al., 2009), middle-aged adults (Ventura Marra, Thuppal, Johnson, & Bailey, 2018), and the very old (Liu et al., 2019). The DST consists of 25 questions targeting the frequency of consumption of foods such as fruits, vegetables, lean protein, whole grains, dairy, and less healthful choices such as processed meats, sweets, added sugars, and added fats (Bailey et al., 2007). The DST score can be used to classify older adults into three nutritional risk categories, "at risk," "possible risk," and "not at risk" (Bailey et al., 2009) . The DST can be self-administered or completed by an interview in about 10 minutes and scored n 5 minutes (Bailey et al., 2009), and has been used successfully as an outcome measure for nutrition education programming (Cottell, Dorfman, Straight, Delmonico, & Lofgren, 2011; Francis, MacNab, & Shelley, 2014). Given that Extension educators may offer nutrition education programs virtually, the feasibility of an online administration of the DST requires testing.

In some instances, there may be a need for rapid diet quality screening. For example, in a clinical environment, health professionals may not have 15 minutes to administer and score a tool such as the DST. However, screening of individuals with chronic diseases is needed for appropriate referral to community nutrition education classes, such as those offered through Cooperative Extension. Previous research has shown that a single-item, self-rated question demonstrated construct validity and may be used as a proxy for assessing diet quality (fruit and vegetable vs. fast food intake; Loftfield et al., 2015). As evaluated by this single, validated self-rated question, perceived diet quality was significantly correlated with diet quality as assessed by the Healthy Eating Index (HEI-2015) in cancer survivors – a population at high risk for developing chronic disease (Farhadfar et al., 2020).

OBJECTIVES

This study aimed to assess the feasibility of an online administration of the DST in adults with chronic disease and test the concurrent validity of the single item, self-rated question of diet quality, i.e., "How well does the self-rated diet quality question predict nutritional risk as assessed by the DST?"

METHODS

Receiver operating characteristic (ROC) curve analysis of raw data was plotted (sensitivity vs. 1- specificity), and the area under the curve (AUC) was calculated. Sensitivity was defined as the ability of the self-rated diet quality question to correctly identify those categorized as at risk by DST screening. Specificity was the ability of the self-rated diet quality question to correctly identify those individuals, not at risk. The positive predictive value was defined as the proportion of respondents who had self-rated diet quality of poor or fair and correctly identified as at risk by the DST. The negative predictive value was defined as the proportion of respondents who had self-rated diet quality of very good or excellent and correctly identified as not at risk. Significance was set at $p < 0.05$.

RESULTS

One hundred and fifteen participants with one or more of the targeted chronic diseases responded to the survey and 109 completed it. The outcome measures of the feasibility of the DST's online administration were time to complete the DST and ease of completion using a 5-point rating scale from very easy to very difficult. The mean time to complete the survey was 8 minutes (range: 2 – 50 minutes), including the responses to the questions on diet quality and ease of completion. Of the 109 respondents who completed the survey, 95% reported the online DST was easy or very easy to complete. The mean DST score for the sample was 58.7 ± 12.0, with 49% at nutritional risk, 41% at possible risk, and 10% at no risk. Most participants perceived their diet quality as poor (4%), fair (26%), or good (44%).

The responses to the self-rated diet quality question, "In general, how healthy is your overall diet?" (poor, fair, good, very good, and excellent) were compared to the total DST scores and the nutritional risk categories (at risk, < 60; possible risk, 60−75; and not at risk, > 75 total points). The comparison of the self-rated diet quality question responses to the DST scores resulted in a correlation coefficient of r = 0.45.

Figure 1 shows the scatter plot of DST scores vs. the responses to the self-rated diet quality question. For those respondents reporting poor or fair diet quality, 75% were classified at risk by the DST (positive predictive value). When the poor, fair, and good categories were collapsed, 64% were correctly classified at risk (Kappa = 0.37; misclassification rate of 0.35). The AUC of the ROC curve analysis was 0.72 for the collapsed category (poor, fair, and good) compared to at-risk by DST. For identifying individuals as at risk by the DST, the self-rated diet quality question responses of
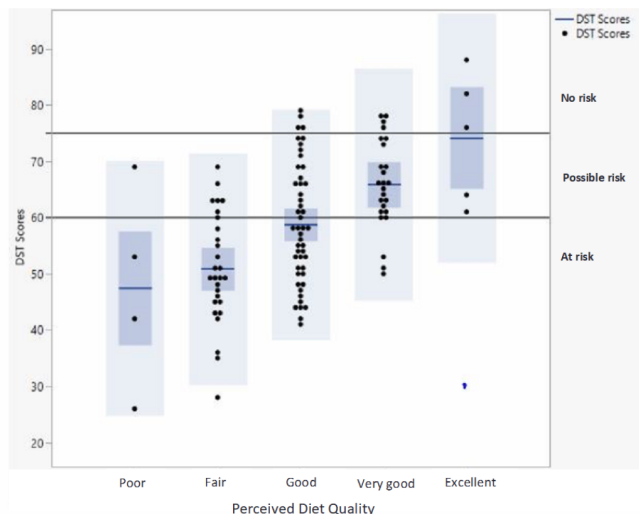

Figure 1. A plot of DST (Dietary Screening Tool) scores versus the responses to the self-rated question of diet quality. Blue line = mean DST score; Black dots = individual DST scores. DST risk categories: No risk = > 75; Possible risk 60-75; At-risk < 60.

responses of poor, fair, and good demonstrated a sensitivity of 95% and a specificity of 52% (See Figure 2). For those respondents reporting an excellent diet, 100% were correctly classified as not at risk. For those reporting a very good diet, 88% were correctly classified as not at risk, with an overall negative predictive value of 90% .
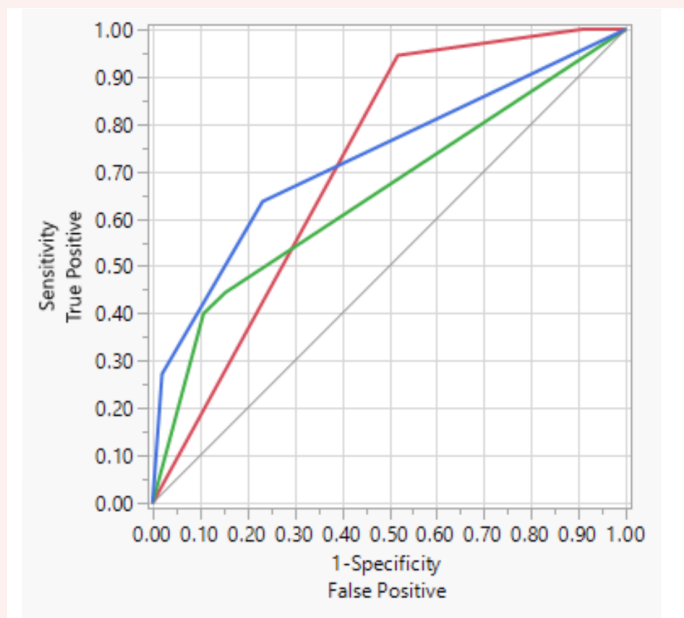
cat	Area
1	0.7158
2	0.6521
3	0.7273

Figure 2. Receiver Operator Curve (ROC) of the self-rated diet quality question responses of Poor, Fair, and Good (collapsed) = red line, Very Good = green line, and Excellent = blue line for predicting nutritional risk (diet quality) by the Dietary Screening Tool (DST).

DISCUSSION

Diet quality is an essential and modifiable lifestyle factor for the prevention of chronic disease and improved chronic disease management, and it is a logical outcome measure for nutrition education programs targeting at-risk populations. Best practices in nutrition education support the use of validated tools to evaluate food and nutrition programming (Saffel-Shrier et al., 2019). The results of this study confirm that the validated DST is a practical tool to use in an online format, in addition to in-person and interview administration (Bailey et al., 2009). The majority of adults with chronic diseases who responded to the survey found it easy or very easy to complete. The ease of DST completion is in contrast to the challenges of completing food records (Ortega et al., 2015) and food frequency questionnaires (Pérez Rodrigo et al., 2015) to

assess diet quality. Additionally, the DST's paper scoring takes 5 minutes per person (Bailey et al., 2009) but the online survey scoring, downloaded as an Excel file, was accomplished by a simple formula – facilitating its use in an online format. The results of this study support the use of an online DST for the evaluation of nutrition education programs targeting middle-aged and older adults with chronic diseases. However, further validation for specific target groups may be warranted.

For the group as a whole, the self-rated diet quality question was effective at predicting the average DST scores within each of the five response categories and overall, was moderately correlated. Additionally, the self-rated diet quality question adequately predicted individuals who were at risk or not at risk by the DST. Individuals who rated their diet as poor and fair perceived their diet quality correctly and were in need of improvement. Similarly, respondents who rated their diet as very good or excellent were consuming a healthful diet and were not at risk as assessed by the DST. However, individuals who rated their diet as good, had DST scores falling into the at-risk, possible-risk, and not-at-risk categories, suggesting that the "good" response was not consistently interpreted. The choice of "good" may be due to it being viewed as a neutral or socially acceptable response, and thus the high response to this choice may have biased the results. Removing the middle option of "good" may improve the validity of the self-rated diet quality question as this would force respondents to choose a positive or negative response. A cross-sectional study of adults with self-reported chronic disease (hypertension, diabetes, and chronic kidney disease) was conducted. Potential participants (> 18 years of age) were recruited through ResearchMatch.org over two months in Fall 2020. A brief description of the study was posted on ResearchMatch.org, and through the website procedures, registered volunteers meeting the inclusion criteria were contacted regarding their interest in participating. Contact information, including email addresses, for interested volunteers, was made available to the principal investigator. A recruitment email was sent to the interested ResearchMatch volunteers (n = 310; 91% middle-aged and older adults, defined as ≥ 45 years) containing a Qualtrics online survey link to the informed consent language, the self-rated question assessing diet quality, and the DST questions. The study was approved by the University of Florida's Institutional Review Board 2, and all respondents provided online informed consent by agreeing to participate.

The responses to the DST questions were scored with various weightings for a maximum point score of 100 with + 5 points for dietary supplement use as previously described (Bailey et al., 2009). For example, "How often do you usually eat fruit as a snack?" included the responses of "never" (0 points), "less than once a week" (2 points), "1 or 2 times a week" (4 points) and "3 or more times a week" (5 points). Participants were classified into three risk categories by total points: "at-risk" (< 60 points), "possible risk" (60 – 75 points), and "not at risk" (> 75 points). The self-rated diet quality question, "In general, how healthy is your overall diet?", was rated on a 5-point scale including "excellent," "very good," "good," "fair," and "poor," as previously validated (Loftfield et al., 2015). The survey closed with a question on the ease of completing the survey using a 5-point Likert rating from "very easy" to " very difficult." The time to complete the survey was recorded in the Qualtrics data file.

Descriptive analysis (means and standard deviations) was used to describe the DST scores of the three risk categories. The responses to the self-rated diet quality question were compared to the DST scores using a Pearson correlation. The three nutritional risk categories of the DST (at risk, possible risk, and not at risk) were compared to the five responses to the self-rated diet quality question using the chi-square test. Additionally, the three risk categories of the DST were compared to the responses to the self-rated diet quality question, i.e., excellent, very good, and a third category, which collapsed the poor, fair and good responses, using chi-square.

Adding definitions to the five responses may help with the interpretation and improve the sensitivity or specificity of the self-rated diet quality question. However, adding definitions would increase the complexity, reduce the readability, and lengthen the time needed to answer the question. Adding definitions may preclude an oral question and response, the potentially favored approach to screening individuals in a time-constrained environment, and instead necessitate written administration. If the self-rated diet quality question is used for identifying individuals in need of nutrition education to improve diet quality, including the "good" response will decrease the specificity of the tool and result in individuals being referred to nutrition education who may not be at nutritional risk. In circumstances of scarce resources or high program demand, a referral could be limited to only those individuals choosing the poor or fair responses. Still, some individuals at nutritional risk would be missed.

LIMITIATIONS

This study had limitations. The population sampled in this study is not representative of a chronic disease population as respondents had time and interest to be ResearchMatch volunteers, requiring a computer or smart device and internet access. Many middle-aged and older adults with chronic diseases, particularly those in rural areas and with low socioeconomic status, may not have access to these technologies. Additionally, 9% of the sampled population with chronic disease were not middle-aged or older adults, and some of these individuals may have responded to the survey. As the validity of the DST in adult populations less than 45 years of age has not yet been examined, caution should be exercised regarding the prevalence of nutrition risk by DST in the individuals with chronic disease reported in this study. However, the purpose of the study was not to assess the diet quality of the respondents for purposes of generalization to the larger population with chronic diseases. Few respondents reported having very good or excellent diet quality or "no risk" by the DST, but instead, the data was skewed towards respondents reporting a poor, fair, or good diet. The lack of respondents reporting an excellent diet is not surprising, given the low diet quality consumed by U.S. adults in general (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020), but may have impacted the sensitivity and specificity of the self-rated diet quality question. The negative predictive value should be interpreted with caution.

CONCLUSION

In conclusion, the validated DST is feasible for online use and may be an appropriate outcome measure for nutrition education programs aiming to improve diet quality in middle-aged and older adults with chronic disease. Additionally, the self-rated diet quality question may serve as a rapid tool to identify individuals with chronic diseases at nutritional risk due to low diet quality, and therefore in need of nutrition education.

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