Disparities in Cardiovascular Health by Food Security Status and Supplemental Nutrition Assistance Program Participation Using Life’s Essential 8 Metrics

Cindy W. Leung, ScD, MPH; Julia A. Wolfson, PhD, MPP; Eric J. Brandt, MD, MHS; Eric B. Rimm, ScD

Introduction

The American Heart Association recently updated its definition of ideal cardiovascular health (CVH) to encompass 8 health behaviors and clinical measures (ie, Life’s Essential 8 [LE8]) and to centralize the importance of social determinants of health in cardiovascular disease prevention.1 Food insecurity, a condition of limited food availability due to insufficient resources, is one critical social determinant of health affecting 10% of US households.2 Few studies have examined food insecurity in relation to multidimensional cardiovascular outcomes. Furthermore, this association may be complicated by participation in the Supplemental Nutrition Assistance Program (SNAP), which aims to alleviate food insecurity and also targets populations most vulnerable to poverty and poor health. This study examined the associations among household food security, SNAP participation, and LE8 as a measure of ideal CVH.

Methods

We used data from the 2013-2018 National Health and Nutrition Examination Survey, a continuous, multistage survey representative of the noninstitutionalized US population. The study population included 11,520 nonpregnant adults 20 years and older. Analysis of publicly available secondary data was deemed exempt from approval by the Harvard University Institutional Review Board, and informed consent was not required. The study followed the STROBE reporting guideline.

The primary exposure was household food security, measured using the US Household Food Security Survey Module, and categorized as high, marginal, low, and very low using US Department of Agriculture guidelines.2 The secondary exposure was household SNAP participation in the last 12 months. Nonparticipants were classified as low income (≤130% of the federal poverty level) or higher income (>130% of the federal poverty level).

The primary outcomes were the LE8 measures (physical activity, diet, tobacco use, sleep health, body mass index [BMI], blood pressure, and serum glucose and lipid levels).1 Published algorithms were applied to create component scores ranging from 0 to 100.3 The overall LE8 score is the mean of all component scores.

We used multivariable linear regression models to examine differences in continuous overall and component LE8 scores by household food security and SNAP participation and multivariable logistic regression to examine joint associations between household food security and SNAP participation with moderate or ideal CVH (overall LE8 score ≥50). Models were adjusted for sociodemographic covariates. Complex sampling weights were applied to all analyses.

Results

Among the 11,520 participants (51.7% women and 48.3% men; mean [SE] age, 47.9 [0.4] years), 9.9% had marginal food security, 10.2% had low food security, and 6.5% had very low food security. Compared with adults with high food security (66.9 [0.4]), those with marginal (65.4 [0.6]), low (63.9 [0.8]), and very low (62.3 [0.8]) food security had lower overall mean (SE) LE8 scores in a

Open Access. This is an open access article distributed under the terms of the CC-BY License.
dose-response manner (P < .001 for trend) (Table). Greater severity of food insecurity was also inversely associated with diet, tobacco use, sleep health, BMI, and serum glucose scores (P < .05 for trend). SNAP participants had the lowest overall mean (SE) LE8 score (62.8 [0.6]) compared with low- (65.5 [0.7]) and higher-income (65.4 [0.5]) nonparticipants. SNAP participation was also associated with lower scores for diet, tobacco, sleep, and BMI.

SNAP participation modified the association between household food security and moderate to ideal CVH (Figure). Greater severity of food insecurity was associated with lower probabilities of moderate to ideal CVH for all SNAP participation groups. SNAP participants with very low food security had the lowest probability of moderate to ideal CVH (74.9% [95% CI, 66.4%-81.8%]).

### Table. Least Square Means of Overall and Component Life's Essential 8 Scores by Household Food Security Status and Supplemental Nutrition Assistance Program Participation

<table>
<thead>
<tr>
<th>Status</th>
<th>LE8 domain score</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diet</td>
<td>Physical activity</td>
<td>Tobacco use</td>
<td>Sleep health</td>
<td>BMI</td>
<td>Serum lipid level&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Serum glucose level&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Blood pressure&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Food security</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>43.0 (0.8)</td>
<td>57.0 (1.4)</td>
<td>70.9 (1.1)</td>
<td>81.5 (0.7)</td>
<td>60.5 (0.7)</td>
<td>65.5 (0.8)</td>
<td>77.6 (0.7)</td>
<td>80.0 (0.5)</td>
</tr>
<tr>
<td>Marginal</td>
<td>40.4 (1.2)</td>
<td>59.7 (1.8)</td>
<td>66.7 (2.1)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>79.5 (1.1)</td>
<td>57.4 (1.5)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>65.7 (1.4)</td>
<td>74.0 (1.2)</td>
<td>80.4 (0.7)</td>
</tr>
<tr>
<td>Low</td>
<td>40.1 (2.0)</td>
<td>57.2 (2.2)</td>
<td>64.2 (2.0)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>78.1 (1.1)</td>
<td>54.6 (1.6)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>65.9 (1.3)</td>
<td>73.9 (1.2)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>78.5 (1.1)</td>
</tr>
<tr>
<td>Very low</td>
<td>33.8 (1.5)&lt;sup&gt;e&lt;/sup,f</td>
<td>58.8 (2.6)</td>
<td>56.0 (2.1)&lt;sup&gt;e&lt;/sup,f</td>
<td>76.8 (1.6)&lt;sup&gt;e&lt;/sup,f</td>
<td>58.0 (1.8)&lt;sup&gt;e&lt;/sup,f</td>
<td>63.9 (2.0)</td>
<td>74.3 (1.7)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>77.7 (1.4)</td>
</tr>
<tr>
<td>SNAP participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher-income nonparticipant</td>
<td>39.7 (1.1)</td>
<td>59.1 (1.2)</td>
<td>66.6 (1.3)</td>
<td>80.5 (0.7)</td>
<td>58.7 (1.3)</td>
<td>65.5 (1.2)</td>
<td>75.6 (1.0)</td>
<td>78.6 (0.7)</td>
</tr>
<tr>
<td>Low-income nonparticipant</td>
<td>40.8 (1.5)</td>
<td>57.3 (2.4)</td>
<td>69.2 (2.0)</td>
<td>78.8 (1.2)</td>
<td>59.3 (1.7)</td>
<td>64.1 (1.6)</td>
<td>74.5 (1.3)</td>
<td>80.9 (1.2)</td>
</tr>
<tr>
<td>SNAP participant</td>
<td>38.0 (1.6)&lt;sup&gt;h&lt;/sup&gt;</td>
<td>56.8 (1.6)</td>
<td>58.5 (2.0)&lt;sup)e,h&lt;/sup&gt;</td>
<td>76.1 (1.0)&lt;sup&gt;e,h&lt;/sup&gt;</td>
<td>54.9 (1.2)&lt;sup&gt;e,h&lt;/sup&gt;</td>
<td>65.2 (1.2)</td>
<td>73.8 (1.2)</td>
<td>79.6 (0.7)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); LE8, Life’s Essential 8; SNAP, Supplemental Nutrition Assistance Program.

<sup>a</sup> Includes 11520 participants from the 2013-2018 National Health and Nutrition Examination Surveys. Data are expressed as mean (SE). Means were adjusted for age, sex, race and ethnicity, educational attainment, marital status, and ratio of family income to poverty. Scores of 50 or greater indicate moderate to ideal cardiovascular health.

<sup>b</sup> Calculated from non–high-density lipoprotein (HDL) cholesterol level in measured total and HDL nonfasting cholesterol levels.

<sup>c</sup> Calculated from hemoglobin A<sub>1c</sub> levels assayed from whole blood biospecimens.

<sup>d</sup> Calculated from the mean of 3 readings (systolic and diastolic).

<sup>e</sup> Significant difference from the group with high food security (P < .05).

<sup>f</sup> Significant trend in outcome by severity of food insecurity (P < .05).

<sup>g</sup> Significant difference between SNAP participants and low-income nonparticipants (P < .05).

<sup>h</sup> Significant difference between SNAP participants and higher-income nonparticipants (P < .05).
Discussion

The findings of this nationally representative cross-sectional study suggest that food insecurity and SNAP participation may be critical barriers to CVH, specifically for diet, tobacco use, sleep health, and BMI. SNAP participants with very low food security had the lowest probability of moderate to ideal CVH, suggesting nutrition-forward policies may improve food security and CVH among program participants.4 This study is cross-sectional, which precludes temporality or causality. Our results align with findings from prior studies, supporting the robustness of the results.5,6 Programmatic and policy interventions should consider more holistic approaches to improve behavioral disparities among populations at risk of food insecurity.

ARTICLE INFORMATION

Accepted for Publication: May 17, 2023.
Open Access: This is an open access article distributed under the terms of the CC-BY License. © 2023 Leung CW et al. JAMA Network Open.

Corresponding Author: Cindy W. Leung, ScD, MPH, Department of Nutrition, Harvard T. H. Chan School of Public Health, 665 Huntington Ave, Bldg 2, Room 321, Boston, MA 02115 (cindyleung@post.harvard.edu).

Author Affiliations: Department of Nutrition, Harvard T. H. Chan School of Public Health, Boston, Massachusetts (Leung, Rimm); Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland (Wolfson); Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland (Wolfson); Division of Cardiovascular Medicine, University of Michigan, Ann Arbor (Brandt, Rimm); Department of Epidemiology, Harvard T. H. Chan School of Public Health, Boston, Massachusetts (Rimm); Channing Division of Network Medicine, Department of Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts (Rimm).

Author Contributions: Dr Leung had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: Leung, Wolfson, Rimm.

Acquisition, analysis, or interpretation of data: Leung, Wolfson, Brandt.

Drafting of the manuscript: Leung.

Critical revision of the manuscript for important intellectual content: Wolfson, Brandt, Rimm.

Statistical analysis: Leung.

Conflict of Interest Disclosures: Dr Brandt reported consulting for NewAmsterdam Pharma outside the submitted work and receiving research funding from the National Institutes of Health and the Blue Cross Blue Shield of Michigan Foundation. No other disclosures were reported.

Data Sharing Statement: See the Supplement.

REFERENCES


SUPPLEMENT.
Data Sharing Statement