Changes in Three Diet Quality Scores and Total and Cause-Specific Mortality

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- **FINANCIAL DISCLOSURE:**
  No relevant financial relationship exists

- **UNLABELED/UNAPPROVED USES DISCLOSURE**
  None
**Nutritional epidemiology shift**

- **Single nutrients or foods**
  - Fats: MUFA, SFA
  - Mg
  - Fruit, Vegetables

- **Dietary patterns**
  - Mediterranean diet
  - Healthy eating pattern
  - DASH pattern
  - Vegetarian pattern

- **Diet quality scores**
  - AMED
  - AHEI
  - DASH

Overall dietary quality

The Alternative Healthy Eating Index-2010 (AHEI) score

- Based on recommendations for food and nutrient consumption with
- Current scientific evidence of beneficial health effects

The Alternative Mediterranean diet (AMED) score

- Comprised of foods and nutrients characteristic of the Mediterranean Pattern

The Dietary Approach to Stop Hypertension (DASH) score

- Developed from the DASH dietary recommendations aiming to reduce blood pressure

Consuming the healthiest quality diet assessed by AHEI, AMED and DASH:

- 8% to 22% of all-cause mortality

Dietary Patterns Methods Project (DPMP): 4 dietary patterns, 3 prospective cohorts

- 18–26% lower all-cause mortality
- 19–28% lower risk of CVD mortality
- 11–23% lower risk of cancer mortality

Healthy dietary patterns as practical way for the public to understand and act upon.

- Few studies have evaluated changes in diet quality over time in relation to mortality risk.

- Diet and other lifestyles occur over the lifetime and may influence health outcomes and mortality risk, it is important to evaluate how much impact improving the diet might have on subsequent mortality risk.
Long-term prospective cohorts: HPFS and NHS

Health Professionals Follow-up Study  (51,529 men, aged 40 to 75 years )


MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS

Diet    Diet    Diet    Diet    Diet    Diet    Diet    Diet    Diet

Nurses’ Health Study  (121,701 women, aged 30 to 55 years )


MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS  MD+LS

Diet    Diet    Diet    Diet    Diet    Diet    Diet    Diet    Diet    Diet    Diet    Diet

Repeated measurements over time:

• Every Two Years: Medical records and lifestyle (MD+LS)
• Every Four Years: Detailed dietary habits (FFQ)
Evaluate the association between 12-y changes (1986-1998) in three diet quality indices assessed by the AHEI, the AMED, and the DASH with total and cause-specific mortality in the NHS and HPFS from 1998-2010.
We also examined shorter- and longer-term changes in diet quality and total and cause-specific mortality.
Using 1986 as baseline for both cohorts, with follow up until 2010

Exclusions:

- CVD history and cancer at baseline
- Missing information on diet and other lifestyle covariates.
- Implausible total daily energy intake (i.e., men <800 or >4200 kcal/day; women <500 or >3500 kcal/day).
- Participants who died before 1998.

23,100 men in the HPFS and 44,501 women in the NHS
# Dietary indices

<table>
<thead>
<tr>
<th>Components</th>
<th>AHEI-2010</th>
<th>AMED</th>
<th>DASH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables (excluding potatoes) s/d</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fruit, s/d</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Whole grains, g/d</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Sugar-sweetened beverages, s/d</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Nuts and legumes, s/d</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Red and processed meat, s/d</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fish, s/d</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Low fat dairy, s/d</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Trans fat, % of energy</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-chain (n-3) fats (EPA + DHA), mg/d</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUFA, % of energy</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>MUFA:SFA ratio</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Sodium, mg/d</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Alcohol, drinks/d</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

**Scoring**

- **A priori cutoff**
  - 0-110
- **Population based median**
  - 0-9
- **Population based quintiles**
  - 8-40

*S=serving*
Cox proportional hazard models with time-varying covariates and age as the underlying time scale were used to estimate HR and 95% CI.

**Model 1**: age, initial diet quality score, race, family history of MI, diabetes, and cancer, aspirin use, multivitamin use, initial BMI category, menopausal status and hormone use in women, and baseline and simultaneous changes in other lifestyle factors: smoking status, physical activity, and total energy intake.

**Model 2**: Model 1 + history of hypertension, hypercholesterolemia or type 2 diabetes, weight change

20-percentile increase in each score was calculated from the median value of each quintile

Pooled analysis: inverse, variance-weighted meta-analysis model, accounting for heterogeneity between studies
During 758,683 person-years of follow-up we documented 9,772 deaths, including 2,292 CVD deaths and 3277 cancer deaths.

### Results

#### Nurses’ Health Study vs. Health Professional Follow-up Study

<table>
<thead>
<tr>
<th></th>
<th>Nurses’ Health Study</th>
<th>Health Professional Follow-up Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1 (Largest decrease)</td>
<td>Q3 (Relatively no change)</td>
</tr>
<tr>
<td>No. of participants</td>
<td>8900</td>
<td>8901</td>
</tr>
<tr>
<td>Initial diet score</td>
<td>59.1 (10.0)</td>
<td>50.0 (9.5)</td>
</tr>
<tr>
<td>Changes in diet score</td>
<td>-11.1 (5.0)</td>
<td>3.0 (1.4)</td>
</tr>
<tr>
<td>Age, years</td>
<td>65.5 (7.1)</td>
<td>63.6 (7.0)</td>
</tr>
<tr>
<td>Initial BMI, Kg/m²</td>
<td>25.5 (4.6)</td>
<td>25.4 (4.7)</td>
</tr>
<tr>
<td>Weight change, Kg</td>
<td>10.5 (18.1)</td>
<td>8.3 (16.0)</td>
</tr>
<tr>
<td>Changes in physical activity</td>
<td>0.1 (2.3)</td>
<td>0.4 (2.3)</td>
</tr>
<tr>
<td>Initial alcohol intake, g/d</td>
<td>5.8 (8.4)</td>
<td>6.0 (10.4)</td>
</tr>
<tr>
<td>Changes in alcohol intake, g/d</td>
<td>-0.3 (8.2)</td>
<td>-1.2 (7.4)</td>
</tr>
<tr>
<td>Total energy intake, Kcal/d</td>
<td>1742 (521)</td>
<td>1777 (516)</td>
</tr>
<tr>
<td>Change in total energy intake, kcal/d</td>
<td>-11.6 (527)</td>
<td>-46.0 (496)</td>
</tr>
</tbody>
</table>
12-year changes (1986-1998) in diet quality scores and risk of total mortality

<table>
<thead>
<tr>
<th>Diet Quality Score</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>P-trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative Healthy Eating Index (range 0-110)</td>
<td>MV-adjusted model2</td>
<td>1.14 (1.07, 1.22)</td>
<td>1.06 (0.99, 1.13)</td>
<td>0.94 (0.88, 1.00)</td>
<td>0.89 (0.83, 0.95)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Alternate Mediterranean Diet (range 0-9)</td>
<td>MV-adjusted model2</td>
<td>1.08 (0.97, 1.19)</td>
<td>0.97 (0.91, 1.03)</td>
<td>0.92 (0.82, 1.03)</td>
<td>0.83 (0.65, 1.05)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Dietary Approach to Stop Hypertension (range 8-40)</td>
<td>MV-adjusted model2</td>
<td>1.10 (1.03, 1.16)</td>
<td>1.02 (0.91, 1.15)</td>
<td>0.92 (0.86, 0.99)</td>
<td>0.88 (0.83, 0.94)</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Abbreviations: MV, multivariable; Multivariable-adjusted model adjusted for age (in month), Model2=age, initial diet quality score, race, family history of MI, diabetes, and cancer, aspirin use, multivitamin use, initial body mass index and simultaneous changes in other lifestyle factors: smoking status and initial and changes (all in quintiles) in physical activity and total energy intake and menopausal status and hormone use in women. history of hypertension, hypercholesterolemia and type 2 diabetes, and weight change (quintiles) during the 4-year period. For DASH additionally adjusted for change and initial alcohol intake (in quintiles). Results for NHS and HPFS from the multivariate model were combined with the use of the random-effects model. P>0.05 for heterogeneity between women and men in all categories of diet change categories.
## Results: 12-years change in diet and cause specific mortality

12-year changes (1986-1998) in diet quality scores and total mortality, CVD mortality and cancer mortality per 20-percentile of increase in each score (calculated from the median value of each quintile)

<table>
<thead>
<tr>
<th>Score</th>
<th>Overall mortality</th>
<th>CVD mortality</th>
<th>Cancer mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AHEI (range 0-110)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MV model</td>
<td>0.80 (0.76, 0.85)</td>
<td>0.84 (0.74, 0.94)</td>
<td>0.93 (0.84, 1.03)</td>
</tr>
<tr>
<td><strong>AMED (range 0-9)</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MV model</td>
<td>0.91 (0.88, 0.94)</td>
<td>0.94 (0.88, 0.99)</td>
<td>0.96 (0.90, 1.02)</td>
</tr>
<tr>
<td><strong>DASH (range 8-40)</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MV model</td>
<td>0.87 (0.83, 0.91)</td>
<td>0.92 (0.85, 1.02)</td>
<td>0.90 (0.83, 0.98)</td>
</tr>
</tbody>
</table>

A 20% increase was associated:
- 9-20% total mortality
- 6-16% CVD mortality
- 4-10% Cancer mortality

Maintaining a higher adherence:
- 23-24% lower total mortality
- 19-27% lower risk of CVD deaths
- 13-20% lower risk of cancer death
Results: shorter- and longer-term changes in diet quality

<table>
<thead>
<tr>
<th></th>
<th>AHEI (range 0-110)</th>
<th>AMED (range 0-9)</th>
<th>DASH (range 8-40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8y Changes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12y Changes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>16y Changes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hazard Ratio (95%CI) of total mortality</td>
<td></td>
<td></td>
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</tbody>
</table>

The association was strengthened when longer changes were evaluated.
Limitations

- Measurement error and misclassification from self-reported dietary information.
- Individual components
- White nurses and health professionals could limit the generalizability of the results.
- Residual confounding

Strengths

- Prospective population-based design
- A large sample size
- High rates and long follow-up
- Overall quality diet, multiple diet quality indices
- Changes in diet
Improving adherence to ANY of the three diet quality scores over 12 y is associated with significantly lower risk of mortality, CVD and cancer mortality.

Longer term changes in diet strengthened the association.

Maintenance of your diet quality over time as an adult can have a meaningful effect on risk of total mortality, CVD and cancer death.

These results underscore the importance of the strategies to promote and sustain a healthy diet in improving longevity among middle-aged and older adults.
As an example, a person increasing ~22 points (20%) out of 110 for the AHEI score over a 12-year lower the risk of total mortality by 20%.

Emphasizing even small dietary changes should be an important part of nutrition and public health policies.

What can you do to promote healthy eating and translate the public health message? As a community, population level, as a politician? As health policies?
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THANK YOU

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Results: Joint associations

- **Hazard Ratio total mortality**
- **Baseline AHEI score, Pooled**
- **12 years later Low**
- **12 years later Medium**
- **12 years later High**

- **Hazard Ratio cancer mortality**
- **Baseline AHEI score, Pooled**
- **12 years later Low**
- **12 years later Medium**
- **12 years later High**

- **Hazard Ratio CVD mortality**
- **Baseline AHEI score, Pooled**
- **12 years later Low**
- **12 years later Medium**
- **12 years later High**

* denotes statistical significance.