Citation:

He FJ, Nowson CA, Lucas M, MacGregor GA. Increased consumption of fruit and vegetables is related to a reduced risk of coronary heart disease: Meta-analysis of cohort studies. *J Hum Hypertens*. 2007 Sep; 21(9): 717-728.

PubMed ID: 17443205

Study Design:

Meta-analysis or Systematic Review

Class:

M - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To quantitatively assess the relation between fruit and vegetable intake and the risk of coronary heart disease (CHD) by a meta-analysis of prospective cohort studies.

Inclusion Criteria:

- Published as a full article in English
- Prospective cohort design
- Report relative risks (RR) of hazard ratios (HR) and 95% CI of CHD in relation to each category of fruit and vegetable intake
- Provide frequency of amount of fruit and vegetable consumption (in order to standardize classification of fruit and vegetable intake).

Exclusion Criteria:

- Case-control study design
- Mixed healthy diet was reported, where the effect of fruits and vegetables could not be separated
- Only surrogate nutrients of fruits or vegetables were reported, whereas fruits or vegetables themselves were not reported
- Only two categories of fruit and vegetable intake were reported, which could not allow for adequate characterization of fruit and vegetable intake.

Description of Study Protocol:

Recruitment (Search Strategy)

- Studies that reported the association between fruit and vegetable intake and CHD were

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searched for in MEDLINE (1966 to November 2005) and EMBASE (1980 to November 2005) using MeSH terms and text words
- The Cochrane Library was also searched with the terms, 'fruit' and 'vegetables'
- The reference lists of review and original articles were searched for more studies.

Design

Meta-analysis.

Dietary Intake/Dietary Assessment Methodology (if applicable)

- Fruit and vegetable intake was standardized among studies and grouped into three categories (less than three servings per day, three to five servings per day and more than five servings per day)
- The average serving size was 80g for fruits and 77g for vegetables.

Statistical Analysis

- Relative risks or hazard ratios were used as a measure of the relation between fruit and vegetable intake and CHD
- Relative risks and hazard ratios in each study were transformed by taking their natural logarithms
- The RR for non-fatal myocardial infarction and CHD death were combined for the main analysis
- By comparison with the lowest category of fruit consumption, the pooled RR of CHD for the middle and highest categories was calculated using a random effects model due to the presence of significant heterogeneity.

Data Collection Summary:

Dependent Variables

CHD (included both non-fatal myocardial infarction and fatal CHD).

Independent Variables

Fruit and vegetable intake in servings per day.

Control Variables

Potential confounders controlled for in the original studies.

Description of Actual Data Sample:

- *Initial N:* 13 independent cohort studies
- *Attrition (final N):* 13 studies with a total of 278,459 individuals, 9,143 events and a median of 11 years of follow-up
- *Age:* Mean for all studies not reported
- *Location:* Studies conducted in the US and Europe.

Summary of Results:

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Key Findings

- Compared with individuals who had less than three servings per day of fruit and vegetables, the pooled RR of CHD was 0.93 (95% CI: 0.86 to 1.00; P=0.06) for those with three to five servings per day and 0.83 (95% CI: 0.77 to 0.89, P<0.0001) for those with more than five servings per day
- Compared with individuals who had less than three servings per day of fruits and vegetables, the pooled RR of myocardial infarction was 0.94 (95% CI: 0.80 to 1.10), P=0.43) for those with three to five servings per day and 0.83 (95% CI: 0.70 to 0.99, P=0.04) for those with more than five servings per day
- Compared with those who had fruit and vegetable intake of less than three servings per day, individuals with more than five serving per day had a significantly lower risk of CHD irrespective of subjects' gender, duration of follow-up and method of dietary assessment.

Author Conclusion:

This meta-analysis of prospective cohort studies demonstrates that increased consumption of fruit and vegetables from less than three to more than five serving per day is related to a 17% reduction in CHD risk, whereas increased intake to three to five servings per day is associated with a smaller and borderline significant reduction in CHD risk.

Reviewer Comments:

- *Study strengths:*
  - *Heterogeneity among studies and publication bias was assessed*
  - *Average serving size was standardized for exposure measurement across studies*
  - *Included only prospective cohort designs*
  - *Large sample size and long duration of follow-up*
  - *Data were extracted by three independent people*
  - *Studies adjusted for major confounding factors*
- *Study limitations:*
  - *Heterogeneity among studies was present*
  - *Residual confounding may have been present*
  - *Measurement error in studies' dietary assessment may have been present (only three of the 12 took account of changes in dietary intake over time)*
  - *Biases may have existed due to misclassification of fruit and vegetable intake because there was study variation in dietary assessment method, the number of groups of fruit and vegetable consumption and the reference category.*

Research Design and Implementation Criteria Checklist: Review Articles

Relevance Questions

1.	Will the answer if true, have a direct bearing on the health of patients?	Yes
2.	Is the outcome or topic something that patients/clients/population groups would care about?	Yes

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3.	Is the problem addressed in the review one that is relevant to nutrition or dietetics practice?	Yes
4.	Will the information, if true, require a change in practice?	Yes

Validity Questions		
1.	Was the question for the review clearly focused and appropriate?	Yes
2.	Was the search strategy used to locate relevant studies comprehensive? Were the databases searched and the search termsused described?	Yes
3.	Were explicit methods used to select studies to include in the review? Were inclusion/exclusion criteria specified and appropriate? Were selection methods unbiased?	Yes
4.	Was there an appraisal of the quality and validity of studies included in the review? Were appraisal methods specified, appropriate, and reproducible?	Yes
5.	Were specific treatments/interventions/exposures described? Were treatments similar enough to be combined?	Yes
6.	Was the outcome of interest clearly indicated? Were other potential harms and benefits considered?	Yes
7.	Were processes for data abstraction, synthesis, and analysis described? Were they applied consistently across studies and groups? Was there appropriate use of qualitative and/or quantitative synthesis? Was variation in findings among studies analyzed? Were heterogeneity issued considered? If data from studies were aggregated for meta-analysis, was the procedure described?	Yes
8.	Are the results clearly presented in narrative and/or quantitative terms? If summary statistics are used, are levels of significance and/or confidence intervals included?	Yes
9.	Are conclusions supported by results with biases and limitations taken into consideration? Are limitations of the review identified and discussed?	Yes
10.	Was bias due to the review's funding or sponsorship unlikely?	Yes

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