Fish Consumption and Acute Coronary Syndrome: A Meta-Analysis

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ABSTRACT

BACKGROUND: Findings on the association between fish consumption and acute coronary syndrome are inconsistent. We assessed the role of fish consumption in acute coronary syndrome by conducting a dose-response meta-analysis.

METHODS: We conducted a literature search of MEDLINE and Embase databases from 1966 to June 2013 for prospective cohort and case-control studies that evaluated the association between fish consumption and acute coronary syndrome among general populations without cardiovascular disease history. Additional studies were identified via hand search of references of relevant articles. Estimates of relative risk (RR) were pooled using random-effects model. Sex and age effects were also evaluated.

RESULTS: Our search retrieved 11 prospective cohort and 8 case-control studies, totaling 408,305 participants. Among prospective cohort studies, the highest category of fish consumption (ie, $\geq$4 times per week) was associated with the greatest risk reduction in acute coronary syndrome (RR 0.79; 95% confidence interval [CI], 0.70-0.89). In dose-response analysis, each additional 100-g serving of fish per week was associated with a 5% reduced risk (RR per serving 0.95; 95% CI, 0.92-0.97). Subgroup analysis and meta-regression suggested that the risk reduction did not differ across sex or age groups. No heterogeneity was observed among prospective cohort ($P = .73$) and case-control ($P = .29$) studies. There was no evidence of publication bias.

CONCLUSION: Our meta-analysis demonstrated that there is an inverse association between fish consumption and the risk of acute coronary syndrome. Fish consumption appears beneficial in the primary prevention of acute coronary syndrome, and higher consumption is associated with greater protection.

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Fish, especially fatty fish, are a rich source of omega-3 fatty acids. Omega-3 fatty acids are polyunsaturated fatty acids, consisting of eicosapentaenoic acid (EPA; 20:5) and docosahexaenoic acid (DHA; 22:6), which have been shown to have anti-inflammatory, antithrombotic, and antiarrhythmic effects; improve blood lipid profile, and help in vascular relaxation and plaque stability.[1] Yet, controversy exists as to the efficacy of omega-3 fatty acids in preventing cardiovascular diseases, and recent meta-analyses have indicated that omega-3 fatty acid supplements are not associated with cardiovascular disease risk reduction.[2,3] Conversely, it appears that fish, as opposed to omega-3 fatty acid supplements, may be beneficial to cardiovascular health, and the distinction between fish versus omega-3 fatty acid intake requires further exploration.

Evidence from meta-analyses indicate the cardio-protective effects of fish consumption in relation to different end points such as cerebrovascular diseases, heart failure, and overall cardiovascular mortality,[4-8] but none of these reviews have assessed the role of fish consumption in the primary prevention of acute coronary syndrome. Findings from observational studies, including long-term prospective cohort and case-control studies, have not been consistent, with some studies, but not all, reporting an association between fish consumption and acute coronary syndrome. A systematic review and quantitative analysis of these studies is therefore needed to clarify the association between fish consumption and acute coronary syndrome.

The aim of this study was to investigate the association between fish consumption and acute coronary syndrome by conducting a dose-response meta-analysis. As a secondary objective, we evaluated whether this association varied according to sex and age.

CLINICAL SIGNIFICANCE

- Fish consumption is beneficial for the primary prevention of acute coronary syndrome.

- Each additional 100-g serving of fish per week is associated with a 5% reduced risk of acute coronary syndrome.

- Age and sex do not appear to influence the association between fish consumption and acute coronary syndrome.

METHODS

The Meta-analysis Of Observational Studies in Epidemiology (MOOSE) protocol[9] was followed throughout the design, implementation, analysis, and reporting of this systematic review and meta-analysis study.

Study Selection

We conducted a literature search of MEDLINE and Embase databases from 1966 to June 2013 for studies that evaluated the association between fish consumption and acute coronary syndrome, using search terms for fish ("fish" OR "fish meat" OR "seafood") in combination with those for acute coronary syndrome ("acute coronary syndrome" OR "myocardial infarction" OR "heart infarction" OR "heart infarct") (see Supplementary Figure 1, available online for details of search strategy). References of relevant articles were hand searched to identify additional studies. Studies were included if they met the following criteria:

- Prospective cohort or case-control study design.
- Fish consumption as exposure of interest.
- Acute coronary syndrome as outcome of interest.
- The most adjusted relative risk (RR) and 95% confidence interval (CI) were reported.
- The study population consisted of general adult populations without preexisting disease or without a previous acute coronary syndrome event.
- For dose-response analysis, the number of cases and participants or person-years for each category of fish consumption were reported (or data were available to calculate them).

We restricted studies to those published in English or French. If a study reported a measure of association and 95% CI for men and women, the results were treated as 2 separate studies in the meta-analysis. For studies that reported results only by different types of acute coronary syndrome (eg, fatal and nonfatal myocardial infarction) or by different types of fish (eg, low- and high-fat fish), the RRs were pooled. Finally, if data were shared or duplicated in more than one study, the first published or most detailed one was included in the analysis.

Data Extraction

Relevant data were independently extracted by 2 reviewers using a predesigned data collection form. Disagreements were resolved by consensus through discussion, or upon consultation of a third reviewer. The collected data included first author's last name, year of publication, country where the study was conducted, duration and person-years of follow-up, sample size and proportion of men and women, mean and range of age, type and number of acute coronary syndrome events, method used to assess fish consumption, categories of fish consumption, most adjusted RR and corresponding 95% CI for each category of fish consumption, and the variables included in the multivariable model.

Quality Assessment

Quality assessment was performed using the Newcastle Ottawa Scale, which is one of the most comprehensive tools available for assessing the quality of nonrandomized studies (cohort and case-control studies) in meta-analyses.[10] Scores range from 0 to 9, with a higher score indicating better methodological quality. Studies with a score ≥ 7 were considered as being of higher quality.

Statistical Analysis

As some studies reported category of consumption in frequency, we first standardized these intake levels by converting frequency into grams per day, using 100 g as a standard portion size for fish, as per dietary guidelines. The mean or median fish intake per category of each study was then used to categorize the levels of intake into 5 standardized intervals, namely "less than once per month" (the reference category), "1 to <4 times per month," "1 to <2 times per week," "2 to <4 times per week," and "≥ 4 times per week." We assumed that the reported reference exposure category from all studies represented a level of intake that was similar to the standardized reference category. When a range of intake was reported rather than the mean or median, the midpoint value of the upper and lower