Monounsaturated Fatty Acid Intake and Stroke Risk: A Meta-analysis of Prospective Cohort Studies

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Background: We performed a meta-analysis aiming to clarify the relationship between monounsaturated fatty acid (MUFA) intake and stroke risk. *Methods:* Relevant studies were identified by searching relevant databases through January 2016. We included cohort studies that reported relative risks (RRs) with 95% confidence intervals (CIs) for the association between MUFA intake and stroke risk. A random-effects model was used to derive composite RR estimates for stroke. *Results:* Ten prospective cohort studies including 314,511 nonoverlapping individuals and 5827 strokes were included. Higher MUFA intake was not associated with risk of overall stroke (RR = .86 [95% CI, .74-1.00]) and risk of ischemic stroke (RR = .92 [95% CI, .79-1.08]), but was associated with a reduced risk of hemorrhagic stroke (RR = .68 [95% CI, .49-.96]). In subgroup analyses, higher MUFA intake was associated with a reduced risk of stroke for a follow-up duration of 14 years or more (RR = .77 [95% CI, .68-.87]), for males (RR = .79 [95% CI, .69-.91]), for 24-hour recall (RR = .74 [95% CI, .63-.86]), and for a quality score of more than 8 stars (RR = .78 [95% CI, .61-.98]). *Conclusions:* There is no significant evidence for concluding that dietary MUFA is associated with a reduced risk of overall stroke. However, higher MUFA intake seems to be associated with a reduced risk of hem orrhagic stroke but not ischemic stroke. Duration of MUFA intake and sex are considered as factors affecting the relationship between MUFA intake and stroke risk. Further studies are needed to evaluate the relationship between specific food sources of MUFA (i.e., plant versus animal) and stroke risk. **Key Words:** Diet—monounsaturated fatty acid—stroke—cerebrovascular accident—meta-analysis.
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Introduction

Stroke is a leading cause of death worldwide.[1] Additionally, stroke survivors are at high risk for development of dementia and are more frequently disabled than stroke-free subjects.[2,3] Thus, effective primary prevention strategies are needed to limit the growing burden of stroke.

Monounsaturated fatty acids (MUFAs) are distinguished from the other types of fatty acids on the basis of having only 1 double bond.[4] There is clinical and epidemiological evidence[5,6] to support that dietary MUFA can lower blood pressure and reduce estimated cardiovascular risk. Multiple studies[7-9] have reported that dietary MUFA can improve atherogenic lipid levels of low-density lipoprotein cholesterol, as well as triacylglycerol. Over the past 20 years, prospective studies[10-20] of MUFA

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intake in relation to primary prevention of stroke have yielded inconsistent results. One cohort study[10] suggests that higher dietary MUFA intake was associated with reduced risk of ischemic stroke in males, and another cohort study[18] provides support for an inverse association between MUFA intake and incidence of cerebrovascular disease. In contrast, 9 cohort studies[11-17,19,20] show that MUFA intake displays no positive effects in reducing risk of stroke. One previous meta-analysis (9 cohort studies on MUFA intake included)[21] indicates that higher dietary MUFA intake is not associated with overall risk reduction of stroke. However, to the best of our knowledge, no meta-analyses have performed subgroup analyses by important factors such as stroke type or sex. Therefore, we performed a meta-analysis of prospective cohort studies to summarize the evidence regarding the association between MUFA intake and risk of stroke by various factors such as follow-up duration, race, stroke type, sex, fatal stroke risk, max multivariate adjusted analysis (blood pressure, diabetes, and smoking controlled simultaneously), method of dietary assessment, and quality score.

Methods

Data Sources and Searches

We conducted a literature search of PubMed, Embase, and Web of Knowledge databases through January 2016 using the key words "monounsaturated fatty acids" or "MUFA" combined with "stroke" or "cerebrovascular disease" or "cerebrovascular disorder" or "cerebrovascular accident." Other potential articles were identified by consulting reference lists of retrieved records and previous reviews.

Study Selection

Studies were included if they met the following criteria: (1) the study had a prospective cohort, and investigated the association between the intake of MUFA and stroke risk; (2) multivariates were controlled with appropriate statistical methods, such as age, sex, smoking, blood pressure, and diabetes; and (3) estimates of the relative risks (RRs) and 95% confidence intervals (CIs) were available in the publication. When multiple publications from the same study were available, we used only the latest publication with the largest number of cases. The exclusion criteria were as follows: (1) the study did not report RRs of stroke by quartiles or quintiles of intake of dietary MUFA; (2) the study was a review; and (3) the study was experimental. Two investigators (F.P.C. and J.X.W.) assessed literature eligibility; any discrepancies were resolved by consensus or by consultation with a third author (W.H.S).

Data Extraction and Quality Assessment

We extracted the following information about the studies: study characteristics (first author and publication year, cohort name and country, age, number of participants and sex, method of dietary assessment, intake comparison, follow-up duration, stroke events, fatal or nonfatal strokes, quality score, and maximum adjustment available). Quality assessment was performed based on the Newcastle–Ottawa Scale.[22]

Data Synthesis

We calculated pooled log RRs of the highest versus the lowest quintile, quartile, or tertile for cohort studies by the inverse–variance method. To enable a consistent approach to meta-analysis and interpretation of findings in this meta-analysis, RR estimates for association of MUFA intake and stroke that were often differently reported by each study (such as per-unit or per-1-standard deviation change or comparing quintiles, quartiles, thirds, and other groupings) were transformed, using methods previously described.[23] Stratification meta-analysis was based on follow-up duration, race, stroke type, sex, fatal stroke risk, max multivariate adjusted analysis (blood pressure, diabetes, and smoking controlled simultaneously), method of dietary assessment, and quality score. To take into account heterogeneity between studies, we used a random-effects model to calculate summary RRs and 95% CIs for the highest versus the lowest level of MUFA intake. Blood pressure, diabetes, and smoking were not controlled simultaneously in 1 included study,[11] so we did not include this study in the max multivariate adjusted analysis. Moreover, publication bias was assessed using Egger's test.[24] Data analysis was performed with Stata software package (version 12.0; StataCorp, College Station, TX) and Review Manager (RevMan) 5.3 Software (version 5.3.5; The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark). *P* values less than .05 were deemed statistically significant.

Results

The meta-analysis included 10 prospective cohort studies[10-15,17-20] including 314,511 nonoverlapping individuals and 5827 individual stroke events (Fig 1). Baseline characteristics are shown in Table 1. The 10 prospective studies were published from 1997 to 2012; ages ranged from 20 to 89 years; 3 studies[10,14,15] used 24-hour recall; 6 studies[11-13,17,18,20] used the food frequency questionnaire (FFQ); and 1 study[19] used the diet history method for dietary assessment. Three studies[10,18,19] were classified as high quality (>8 stars), whereas the remaining 7 studies[11-15,17,20] were deemed low quality (≤8 stars).

Primary Outcome

High dietary MUFA intake was not associated with a reduced risk of overall stroke (RR = .86 [95% CI, .74- 1.00]) (Fig 2).

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