

## Dietary Patterns and Risk of Stroke in Adults: A Systematic Review and Meta-analysis of Prospective Cohort Studies

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*Background:* The effect of whole diet on the development of stroke has recently achieved much interest by various prospective studies, but with inconclusive results. Herein, we carried this meta-analysis to identify the potential associations between different dietary patterns and the risk of stroke by pooling available data from existing studies. *Methods:* PubMed and EBSCO were searched for pertinent articles that identify dietary patterns published from January 1991 to November 2014, with the following keywords: dietary pattern, dietary patterns, food pattern, eating pattern, alcohol drinking, alcohol consumption, and stroke. *Results:* A total of 21 studies met the inclusion criteria and were included in this meta-analysis. A decreased risk of stroke was shown for the highest compared with the lowest categories of healthy dietary pattern (odds ratio [OR] = .77; 95% confidence interval [CI] = .63-.93;  $P < .00001$ ) and light-moderate drinking pattern (OR = .80; 95% CI = .72-.90;  $P = .0002$ ). There was evidence of the increase in the risk of stroke in the highest compared with heavy alcohol-drinking pattern (OR = 1.25; 95% CI = 1.17-1.33;  $P < .00001$ ), whereas no significant association with Western-style dietary pattern was observed (OR = 1.05; 95% CI = .82-1.35;  $P = .70$ ). *Conclusions:* The results of this meta-analysis indicated that some dietary patterns may be associated with the risk of stroke. **Key Words:** Dietary patterns—stroke—alcohol drinking—a meta-analysis.

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Although the annual death rate from stroke decreased by 34.8% between 1998 and 2008, it still remains as a major cause of disability and death worldwide and ranks third among all causes of death.<sup>1</sup> In China, stroke is the

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second leading cause of death among both the urban and rural population, and it is estimated that 1.5-2 million incident stroke may occur each year.<sup>2</sup> It is well known that stroke is considered as a multifactorial chronic disease that may be related to unhealthy lifestyles (eg, smoking, heavy alcohol drinking, obesity, and low physical activity), genetic factors, and dietary factors.<sup>3-5</sup>

In the past several decades, many epidemiology studies have focused on diet modification as an important factor for the prevention of stroke and have examined individual nutrients or foods and food groups and their effect on stroke.<sup>6-8</sup> However, because of the complexity of diets and the potential interactions between food components,<sup>9</sup> previous some studies revealed limited impact of diets on occurrence of stroke. Consequently, the analysis of dietary pattern has emerged as an alternative and complementary approach to examine the effects

of whole diet on the risk of stroke instead of the assessment of individual nutrients or foods and food groups, because it included the complexity of overall diet and can potentially facilitate nutritional recommendations.<sup>10</sup>

To date, a substantial amount of prospective cohort studies have reported the association between dietary patterns and the risk of stroke.<sup>11-20</sup> However, the findings of the association between dietary pattern and stroke were inconsistent. Although some studies have reported an inverse association between Western/unhealthy dietary pattern and risk of stroke,<sup>15,18</sup> others have reported no significant association or a positive association between this dietary pattern and risk of stroke.<sup>11,14</sup> In the reports of Japan Collaborative cohort by Chan et al,<sup>19</sup> the healthy and Western-style dietary patterns were not observed to be associated with the risk of stroke. Therefore, we conducted this meta-analysis of the literature published from January 1991 up to November 2014 to further identify the exact associations of dietary patterns with the risk of stroke.

## Methods

### *Literature Search Strategy*

We carried out a search through PubMed and EBSCO to identify all the human studies published from January 1991 to November 2014, with the following keywords: dietary pattern, dietary patterns, food pattern, eating pattern, alcohol drinking, alcohol consumption, and stroke. No restrictions on the language or location of the study were imposed. In addition, we manually searched all references cited in original studies and reviews identified.

### *Study Included Criteria*

Two independent reviewers (L.S. and C.S.) independently conducted the literature search and read the abstracts of the papers retrieved in the initial search to identify studies that examined the associations between dietary patterns and stroke risk. When all reviewers agreed, the articles were reviewed against inclusion and exclusion criteria for this meta-analysis. To be eligible, studies had to fulfill the following criteria: (1) the study was published as an original article; (2) the relationship of the dietary patterns with the risk of stroke has been reported in studies; (3) principal component analysis, cluster analysis, and/or factor analysis were used to identify food patterns; (4) odds ratios (ORs) and percentage of stroke (or data can be calculated) have been provided; (5) the diagnosis of stroke was based on self-report, defined as ever having been or currently diagnosed by a hospital as stroke.

### *Data Extraction*

Information extracted from each study included authors and year of publication, geographic region, study

design, sample size, age, dietary assessment method, identification of dietary patterns, and factors that were adjusted in the analysis.

### *Definition of "High Intake"*

Dietary patterns were identified by factor analysis or principal component analysis. Factor scores for each pattern were categorized into tertiles, quartiles, or quintiles (the lowest category and the highest category represented low and high intake of each dietary pattern, respectively). The different forms of alcohol consumption were converted into grams of ethanol per day. Alcohol consumption of more than 50 g/day (4 drinks) was defined as a high intake of alcohol or heavy alcohol drinking.<sup>21</sup>

### *Assessment of Heterogeneity*

Heterogeneity of study results was assessed by the chi-squared test. Statistical significance was considered when *P* value was less than .05. A random-effects model was used to account for possible heterogeneity between studies, whereas a fixed-effects model was adopted in the absence of heterogeneity.<sup>22</sup>

### *Quality Assessment*

The Newcastle–Ottawa quality assessment scale was used for quality assessment.<sup>23</sup> Eight questions were assessed and each satisfactory answer received 1 point, resulting in a maximum score of 9. Only these studies in which the majority of the questions were deemed satisfactory (ie, with a score of 6 or higher) were considered to be of high methodological quality.

### *Publication Bias*

Publication bias was assessed by inspection of the funnel plot and by formal testing for "funnel plot" asymmetry using Begg's test and Egger's test.<sup>23</sup>

### *Statistical Analysis*

The original studies reported the results of dietary patterns in terms of tertiles, quartiles, and quintiles of dietary factor scores and the risk of stroke. We conducted this meta-analysis to evaluate the risk of stroke in the highest versus the lowest categories of "healthy," "Western-style," and "alcohol-drinking" dietary patterns. Multivariable adjusted hazards ratios, ORs, and relative risks with 95% confidence intervals (CIs) from individual studies were combined to produce an overall OR. Sensitivity analysis was performed to determine whether differences in study design, sample size, age, and race affected study conclusions.

Statistical analyses were conducted with Review Manager, version 5.0 (Nordic Cochrane Centre, Copenhagen, Denmark) and Stata/SE, version 12 (Stata Corporation,

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