Dietary patterns and depression risk: A meta-analysis

Ye Li[a], Mei-Rong Lv[b], Yan-Jin Wei[c], Ling Sun[b], Ji-Xiang Zhang[d], Huai-Guo Zhang[e], Bin Li[e],*

[a] Outpatient Operation Room, Linyi People's Hospital, Jiefang Road Number 27, Lanshan district, Linyi 276003, Shandong, People's Republic of China
[b] Department of Nursing, Linyi People's Hospital, Jiefang Road Number 27, Lanshan district, Linyi 276003, Shandong, People's Republic of China
[c] Department of Cardiovascular, Linyi People's Hospital, Jiefang Road Number 27, Lanshan district, Linyi 276003, Shandong, People's Republic of China
[d] Department of Psychology, Linyi People's Hospital, Jiefang Road Number 27, Lanshan district, Linyi 276003, Shandong, People's Republic of China
[e] Department of Endocrinology, Linyi People's Hospital, Jiefang Road Number 27, Lanshan district, Linyi 276003, Shandong, People's Republic of China

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ABSTRACT

Although some studies have reported potential associations of dietary patterns with depression risk, a consistent perspective hasn't been estimated to date. Therefore, we conducted this meta-analysis to evaluate the relation between dietary patterns and the risk of depression. A literature research was conducted searching MEDLINE and EMBASE databases up to September 2016. In total, 21 studies from ten countries met the inclusion criteria and were included in the present meta-analysis. A dietary pattern characterized by a high intakes of fruit, vegetables, whole grain, fish, olive oil, low-fat dairy and antioxidants and low intakes of animal foods was apparently associated with a decreased risk of depression. A dietary pattern characterized by a high consumption of red and/or processed meat, refined grains, sweets, high-fat dairy products, butter, potatoes and high-fat gravy, and low intakes of fruits and vegetables is associated with an increased risk of depression. The results of this meta-analysis suggest that healthy pattern may decrease the risk of depression, whereas western-style may increase the risk of depression. However, more randomized controlled trails and cohort studies are urgently required to confirm this findings.

1. Introduction

Depressive disorder is a leading cause of disability worldwide, affecting approximately 350 million people (Vermeulen et al., 2016). According to the statistics from the World Health Organization in 2012, depression is the fourth most common global burden of disease, and will be the second leading cause of disease burden, after cardiovascular disease, by the year 2020 (Lin et al., 2010). In Europe and North America, the lifetime prevalence of depression is estimated between 10–20%, and two times higher in women than in men (Le Port et al., 2012). In China, the incidence of depression in elderly people ranged from 4% to 26.5%, and it has become a substantial burden (Gao et al., 2009). It is well-known that diet is related to inflammation, oxidative stress and brain plasticity and function; all of these physiological factors are potentially involved in depression (Jacka et al., 2011).

In the past several decades, many epidemiological studies have pointed out that diet plays an important role in mental health and investigated the relation between the intake of individual foods or nutrients and the risk of depression (Murakami et al., 2010; Appleton et al., 2007; Lucas et al., 2011). However, in real life, people do not take isolated nutrients or foods, but consume meals containing combinations

of many nutrients and foods that possibly interact with each other (Zhang et al., 2015). In this context, dietary pattern analysis has been recommended to become a more recognizable approach because it considered the complexity of overall diet and can potentially facilitate nutritional recommendations (Ruusunen et al., 2014).

To date, several previous studies have been performed to elucidate the associations between dietary patterns and depression risk. however, the results have been inconsistent (Chocano-Bedoya et al., 2013; Akbaraly et al., 2009; Kim et al., 2015; Gougeon et al., 2015). The healthy/prudent dietary patterns have tended to show inverse associations with depression risk (Chocano-Bedoya et al., 2013; Kim et al., 2015), whereas western dietary pattern has either shown a positive association (Chocano-Bedoya et al., 2013; Akbaraly et al., 2009), or no significant association (Gougeon et al., 2015; Okubo et al., 2011). Besides, the scientific report of the 2015 Dietary Guidelines Advisory Committee has concluded that current evidence on the association of dietary patterns with depression is limited (Dietary Guidelines Advisory Committee, 2015). Meanwhile, a previous systematic review examining the association between dietary patterns and depression was published by Rahe et al. (2014). The authors didn't find a protective effect of healthy dietary pattern on the risk of depression. Recently, another

systematic review has also reported the associations between dietary patterns and risk of depression in community-dwelling adults, but no firm conclusions have been made on the association between the Western diet and risk of depression (Lai et al., 2014). In a word, the evidence about the relation between dietary patterns and depression is limited and inconsistent. In view of this, we carried out this meta-analysis of studies published up to September 2016, to further clarify the potential association between dietary patterns and the risk of depression.

2. Methods

2.1. Literature search strategy

An electronic literature search was performed on MEDLINE and EMBASE databases to identify relevant studies written in the English and Chinese languages published up to September 2016, with the following keywords or phrases: "diet" OR "dietary pattern" OR "dietary patterns" OR "eating pattern" OR "eating patterns" OR "food pattern" OR "food patterns" AND "depression" OR "psychological stress" OR "depressive disorder" OR "depressive symptoms". Besides, no restrictions on the age of the study participants were imposed. Furthermore, we manually searched all references cited in original studies and reviews identified.

2.2. Studies included criteria

Two independent reviewers (Y. L. and M.-R.L) read the titles and abstracts of all articles retrieved in the initial search to identify studies that reported the association of overall dietary patterns with the risk of depression. Differences between the two independent reviewer were resolved by consensus or by a third independent reviewer (B. L) if necessary. When all agreed (Y. L., M.-R.L. and B. L), the full-text versions of articles were reviewed against inclusion and exclusion criteria for this meta-analysis. To be eligible, the studies had to fulfill the following criteria: (1) The study was an original report investigating the association of dietary patterns with the risk of depression; (2) Dietary patterns were identified using e.g. factor analysis, cluster analysis, reduced rank regression and principal component analysis in this study; (3) Odds ratios, hazards ratio or relative risks and percentage of depression (or sufficient information to calculate them) had been listed;(4) If the data in original publication lacked sufficient detail, the corresponding author of this study was contacted for additional information by email; (5)Depression was diagnosed based on clinical interviews, or self-report on a previous physician-made diagnosis of depression and antidepressant medication, or validated scales for assessing depressive symptomatology.

Moreover, to minimize error, the independent reviewers ensured that the selected dietary patterns were similar with regard to factor loadings of foods, which are consumed within those dietary patterns. For example, the healthy pattern is characterized to have high factor for foods, such as fruit, vegetables, whole grain, fish, olive oil, low-fat dairy and antioxidants (e.g. vitamin C, vitamin E, flavonoids, and carotenoids). The articles under consideration labelled it as "healthy"(Le Port et al., 2012; Okubo et al., 2011; Rashidkhani et al., 2013; Chatzi et al., 2011; Khosravi et al., 2015; Sugawara et al., 2012), "prudent" (Chocano-Bedoya et al., 2013; Jacka et al., 2014), "whole food"(Akbaraly et al., 2009), "green vegetables"(Kim et al., 2015), "traditional diet"(Gougeon et al., 2015; Weng et al., 2012), "vegetables-fruits"(Chan et al., 2014; Xia et al., 2016; Mihrshahi et al., 2015), "Mediterranean"(Sánchez-Villegas et al., 2015), "AHEI score"(Akbaraly et al., 2013), "whole plant foods"(Liu et al., 2016), "healthy Japanese" (Nanri et al., 2010), "dietary pattern 1″(Miki et al., 2015) and "Balanced Japanese"(Suzuki et al., 2013).The "Western-style" dietary pattern is mainly characterized by high factor loadings for foods, such as refined grains, red and/or processed meat, sweets, desserts, fast food, butter, high-fat dairy products, carbonated drink and low intakes of

fruits and vegetables. The papers labelled it as "Western" (Le Port et al., 2012; Chocano-Bedoya et al., 2013; Okubo et al., 2011; Jacka et al., 2014; Chatzi et al., 2011; Sugawara et al., 2012), "processed food"(Akbaraly et al., 2009), "meats" (Kim et al., 2015), "convenience diet"(Gougeon et al., 2015), "meat-fish"(Chan et al., 2014), "animal foods"(Liu et al., 2016; Nanri et al., 2010; Xia et al., 2016; Weng et al., 2012), "unhealthy"(Rashidkhani et al., 2013; Khosravi et al., 2015) and "westernized"(Suzuki et al., 2013). Finally, twenty-one studies relevant to the role of dietary patterns and/or food and depression risk were included in the current meta-analysis.

2.3. Data extraction

We extracted the following data from all eligible studies: the authors, year of publication, geographic, study design, sample size, percentage of depression, the method of assessment of diet, identification of dietary patterns and the factors that were adjusted for in our analyses.

2.4. Assessment of heterogeneity

Heterogeneity across studies was measured by Cochran's Q statistic and I^2 statistic. I^2 values of 25%, 50%, and 75% were used as evidence of low, moderate, and high heterogeneity, respectively. If the P value of the Q-test was < 0.10 or an I^2 $value \geq 50\%$, ORs were pooled according to the DerSimonnian and Laird method in the random-effect model. In contrast, the fixed-effects model (Mantel-Haenszel) was used to indicate the summary OR (Higgins et al., 2003).

2.5. Quality assessment

The Newcastle-Ottawa Quality Assessment scale was used for quality assessment (Stang et al., 2010). Eight questions were assessed and each satisfactory answer received one point (may receive two points in comparability categories), resulting in a maximum score of nine. Only those studies in which most of the questions were deemed satisfactory (i.e. with a score of six or higher) were considered to be of high methodological quality (Zheng et al., 2016).

2.6. Statistical analysis

Statistical analyses were performed by using Review Manager, version 5.0 (Nordic Cochrane Centre Copenhagen, Denmark) and STATA, version 12 (Stata Corp, College Station, TX, USA). The original studies reported the results of dietary patterns in terms of tertiles, quartiles, and quintiles of dietary factor scores and the risk of depression. We used meta-analysis to evaluate the risk of depression in the highest versus the lowest categories of healthy and western-style dietary patterns. Random-effect models were used to calculate the pooled odd ratio (OR) for dietary patterns in highest categories compared with lowest categories. If studies reported RR instead of OR, it was treated the same as OR when the reported incident depression was less than 20%. Multivariable adjusted Odds ratios, hazards ratios and relative risks with 95% CIs from individual studies were combined to produce an overall OR. 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 (Begg et al., 1994). Sensitivity analysis was conducted to determine whether differences in study design, sample size, age and races affected study conclusions. All statistical tests were two-sided and P values less than 0.05 were considered significant.

3. Results

3.1. Overview of included studies for the systematic review

An electronic literature search in the database of MEDLINE(n = 304) and EMBASE(n = 148) identified 452 studies, 412 of which were excluded based on the floowing reasons(in Fig. 1): duplicate records