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## Review

# Landscape of dietary factors associated with risk of gastric cancer: A systematic review and dose-response meta-analysis of prospective cohort studies



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## KEYWORDS

Gastric cancer;  
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Prospective;  
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Meta-analysis

**Abstract Background:** The associations between dietary factors and gastric cancer risk have been analysed by many studies, but with inconclusive results. We conducted a meta-analysis of prospective studies to systematically investigate the associations.

**Methods:** Relevant studies were identified through searching Medline, Embase, and Web of Science up to June 30, 2015. We included prospective cohort studies of intake of dietary factors with risk estimates and 95% confidence intervals for gastric cancer.

**Results:** Seventy-six prospective cohort studies were eligible and included in the analysis. We ascertained 32,758 gastric cancer cases out of 6,316,385 participants in relations to intake of 67 dietary factors, covering a wide ranging of vegetables, fruit, meat, fish, salt, alcohol, tea, coffee, and nutrients, during 3.3 to 30 years of follow-up. Evidence from this study indicates that consumption of total fruit and white vegetables, but not total vegetables, was inversely associated with gastric cancer risk. Both fruit and white vegetables are rich sources of vitamin C,

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which showed significant protective effect against gastric cancer by our analysis too. Furthermore, we found concordant positive associations between high-salt foods and gastric cancer risk. In addition, a strong effect of alcohol consumption, particularly beer and liquor but not wine, on gastric cancer risk was observed compared with nondrinkers. Dose-response analysis indicated that risk of gastric cancer was increased by 12% per 5 g/day increment of dietary salt intake or 5% per 10 g/day increment of alcohol consumption, and that a 100 g/day increment of fruit consumption was inversely associated with 5% reduction of risk.

**Conclusion:** This study provides comprehensive and strong evidence that there are a number of protective and risk factors for gastric cancer in diet. Our findings may have significant public health implications with regard to prevention of gastric cancer and provide insights into future cohort studies and the design of related clinical trials.

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## 1. Introduction

Although its incidence has decreased for several decades, gastric cancer is still one major public health concern worldwide [1]. Epidemiological data from the American Cancer Society suggest that gastric cancer is the fourth most common cancer in males and the fifth most common cancer in females, accounting for 6.8% of the total cancer cases and 8.8% of total cancer-related deaths in 2012 globally [2]. Because of this still significant mortality, there is a pressing need to develop gastric cancer specific prevention strategies.

*Helicobacter pylori* infection is a World Health Organisation class I carcinogen for gastric cancer, but only less than 0.5% of those infected people develop gastric cancer, suggesting a considerable contribution of other factors [3,4]. Dietary factors have been recognised to play a very critical role in the prevention of cancer, including gastric cancer [5]. The decreasing incidence of gastric cancer in developed countries may be partly the results of increased use of refrigeration, availability of fresh fruit and vegetables, and decreased reliance on salted or preserved foods [6]. Although many dietary factors were suggested to affect the risk of gastric cancer, the conclusions remain inconsistent and lack firm scientific evidence [7].

In recent decades, quite a number of prospective cohort studies, such as the European Prospective Investigation into Cancer and Nutrition (EPIC) study, have been performed to investigate the association between various dietary factors and gastric cancer. In order to develop effective dietary and nutritional prevention strategies for gastric cancer, we conducted meta-analyses of the evidence across all existing prospective cohort studies. We aimed to provide a comprehensive evaluation of the associations of gastric cancer with a diversity of dietary factors.

## 2. Methods

The design, implementation, analysis, and reporting of our meta-analysis were performed in accordance

with the Meta-Analysis of Observational Studies in Epidemiology protocol [8].

### 2.1. Search strategy and selection criteria

We systematically searched multiple literature databases, including Medline, Embase, and Web of Science, from inception to 30 June 2015 for prospective cohort studies of gastric cancer. The following keywords were used for the literature search: (“gastric cancer” OR “gastric neoplasm” OR “stomach cancer” OR “stomach neoplasm”) AND (cohort OR “prospective study” OR “follow-up study” OR “longitudinal study”). No restrictions were imposed on language of publications. The references of retrieved relevant articles, especially meta-analyses, were reviewed to identify potential studies.

Studies that satisfied the following four criteria were included in our meta-analysis: 1) published prospective cohort studies; 2) the exposure of interest was dietary factors, including foods, beverages, and nutrients; 3) the outcome was the risk of gastric cancer; and 4) the authors reported the relative risk estimates, including 95% confidence intervals (CIs). In addition, we excluded reviews, meta-analyses, retrospective studies, non-human studies, and letters without sufficient data.

### 2.2. Data extraction and quality assessment

Two investigators (XF and PA) independently conducted the literature search, identified potential studies, and extracted detailed information from each included article. Discrepancies were resolved through group discussion with the third investigator (FW). Using a standardised data collection form, we recorded the following information in the identified studies: first author, year of publication, study location, study name, duration of follow-up, gender, sample size (number of cases and participants), dietary exposures and corresponding risk estimates with 95% CIs. We extracted risk estimates with the most adjustment.

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