

Dietary Fibre Protective against Colorectal Cancer Patients in Asia: A Meta-Analysis

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Abstract

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BACKGROUND: The association between dietary fibre and colorectal cancer risk is controversial.

AIM: This systematic review and meta-analysis were performed to determine the dietary fibre protective against colorectal cancer patients in Asia.

METHODS: The authors conducted a meta-analysis of published research articles on dietary fibre protective against colorectal cancer patients in Asia published between January 2000 and March 2019 in the online article databases of PubMed, ProQuest and EBSCO. Pooled odds ratios (OR) were calculated with fixed and random-effect models. Publication bias was visually evaluated by using funnel plots and statistically assessed through Egger's and Begg's tests. Data were processed using Review Manager 5.3 (RevMan 5.3) and Stata version 14.2 (Stata Corporation).

RESULTS: This study reviewed 405 articles. There are 10 studies conducted a systematic review and continued with Meta-analysis of relevant data with several sample 49,964 patients. The results showed dietary fibre protective against colorectal cancer patients in Asia (OR = 0.66 [95% CI 0.56-0.77, p=0.008]). There was significant publication bias for studies included in dietary fibre protective against colorectal cancer patients in Asia.

CONCLUSION: This analysis confirmed dietary fibre protective against colorectal cancer patients in Asia.

Introduction

Colorectal cancer is cancer that starts in the colon or the rectum. Colorectal cancer is one of the most common malignancies present in the world, ranks the third most frequent malignant disease diagnosed in the United States and fourth in Asia [1], [2]. Based on data from the World Health Organization, colorectal cancer is increasing rapidly in Asian countries. In Southeast Asia, in 2008, there are an estimated 1.6 million new cases of colorectal cancer and 1.1 million deaths [3].

Based on colorectal cancer risk factors are differentiated into nonmodifiable and modifiable risk

factors. Nonmodifiable risk factors: age, race, genetics, family history, history of tumours, and ulcerative colitis. Modifiable risk factors: lifestyles such as cigarette use, low physical activity, long-term alcohol consumption, and bad dietary patterns [1], [4], [5].

Diet is a food choice that is commonly eaten by a person or population. Diet estimated an effect 30%-50% incidence of colorectal cancer worldwide. One of the dietary factors that contribute to colorectal cancer is a low-fibre diet. Dietary fibre is inversely proportional to the risk of colorectal cancer; high dietary fibre is evident in the prevention of colorectal cancer [6], [7].

The low-fibre diet is associated with an

elevated risk of colorectal cancer [7]. However, due to wide geographical variation, the demography of colorectal cancer patients differs from those between developed and developing countries. This happens changes in dietary patterns and lifestyle, possibly due to globalisation and improving economic status, as well as the availability of screening programme may account for the risk of colorectal cancer.

Several previous studies have shown that dietary fibre is associated with a reduced risk of colorectal cancer [8], [9], [10]. But these results have no effect of dietary fibre for colorectal cancer; high dietary fibre intake was not associated with a reduced risk of colorectal cancer [11], [12]. However, the research results are not always consistent. Therefore, this study aims to determine the association of dietary fibre protective against colorectal cancer patients in Asia with some research through the Meta-analysis study so that the conclusion drawn have stronger strength. This leads to an increase in prevention, detection strategies in colorectal cancer patients.

Material and Methods

Study design and research sample

This research is quantitative research with meta-analysis study design. The meta-analysis followed the preferred reporting items for Systematic Reviews and Meta-Analysis (PRISMA) statement [13]. Meta-analysis was used to figure dietary fibre protective against colorectal cancer patients in Asia. The research samples were published research articles published between January 2000 and March 2019 in online article databases of PubMed, ProQuest and EBSCO.

Operational definitions

The variables of this study included independent variables consisted of dietary fibre (fruit, vegetables, cereals); and dependent variable: colorectal cancer.

Research procedure

This study was conducted by collecting data through the identification of published research articles on dietary fibre protective against colorectal cancer patients in Asia in online article databases of PubMed, ProQuest and EBSCO (Figure 1).

Identification of 405 articles, done by review through the title of the articles, continued by reviewing the abstract, and then the full-text form. The article was excluded if: (a) not the relevant subject outcome, (b) not case-control and cohort study (c) the

information provided in the results were insufficient for data extraction.

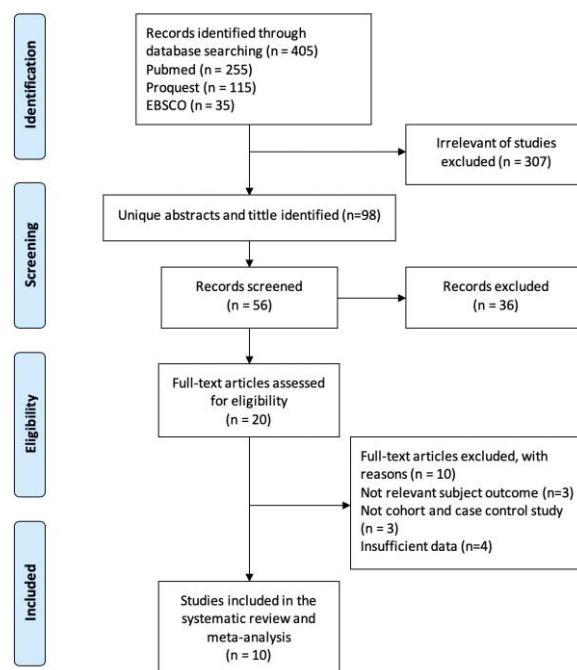


Figure 1: Flow diagram research procedure

Data collection technique

The data collection is done through an online search. The search was limited to English language articles. The article type was limited to journal articles. The research subject was limited to research with a human subject. The time of publication was limited from January 2000 to March 2019. The abstract of articles with potentially relevant titles was reviewed, while the irrelevant articles were excluded.

Furthermore, articles that have potentially relevant abstracts will be reviewed in full-text, while the irrelevant articles were excluded. The inclusion criteria of this study sample were researched on dietary fibre protective against colorectal cancer patients with case-control and cohort study. Exclusion criteria were: the research was not available in full-text form and when these criteria were not satisfied or if the provided information was insufficient for data extraction. The following data were obtained from each article: first author's name and year of publication, region, type of study, characteristics, duration of the study, number of samples, fibre intake (g/day), dietary assessment and effect size.

Two independent investigators carefully extracted information from all studies that satisfied the inclusion criteria by a standardized protocol. Disagreements were resolved by three other investigators. Quality assessment was conducted using Newcastle–Ottawa Quality Assessment Scale (NOS). The papers with a total score of 0-3, 4-6, and 7-9 points were specified as the poor, moderate, and high quality [14].

Table 1: Systematic review association of dietary fibre with colorectal in Asia

First author, year	Region	Type of study	Characteristic	Duration of study	Number of samples	Fibre intake (g/day)	Dietary assessment	Effect size	NOS
Chiu et al [15]	China	Case control	M, F 30-74 years	5 years	2,483	M: 7.0 vs 12.4 F: 6.0 vs 10.5	Food frequency questionnaire	OR (95% CI):0.6 (0.4-1.0)	8
Otani et al [16]	Japan	Case control	M 20-74 years	5 years	331	13.8 vs 14.9	Food frequency questionnaire	OR (95% CI):0.69 (0.45-1.90)	7
Shin et al [17]	China	Cohort	F 40-70 years	2 years	283	N/A	Food frequency questionnaire	RR (95%CI): 1.1(0.6-1.8)	7
Wakai et al [18]	Japan	Cohort	M, F 40-79 years	7.6 years	43,115	M: 6.7 vs 13.4 F: 7.4 vs 13.4	Food frequency questionnaire	RR (95%CI):0.73 (0.51-1.03)	8
Nashar et al [19]	Saudi arabia	Case control	M, F 30 years	1 years	100	11 vs 23	Food frequency questionnaire	OR (95% CI): 0.68 (0.41-1.01)	6
Nayak et al [20]	India	Case control	M, F 18-85 years	2 years	432	N/A	Food frequency questionnaire	OR (95% CI): 0.15 (0.05-0.46)	7
Uchida et al [21]	Japan	Case control	F 20-74 years	5 years	1,631	9.2 vs 19.8	Prosky-AOCA method	OR (95% CI): 0.76 (0.54-1.08)	8
Ramadas et al [22]	Malaysia	Case control	M, F ≥ 30 years	1 years	118	3.94 vs 7.07	Food frequency questionnaire	OR (95% CI): 0.14 (0.05-0.40)	6
Zhong et al [9]	China	Case control	M, F mean age cases 56.7 ± 10.6; age controls 56.4 ± 10.5	2 years	954	9.2 vs 10.5	Food frequency questionnaire	OR (95% CI): 0.68 (0.48-1.02)	7
Shong et al. [8]	China	Case-control	M, F 30-70 years	1 year	517	20.52 vs 22.98	Food frequency questionnaire	OR (95% CI): 0.40 (0.21-0.76)	7
Total of sample					49,964				

Abbreviation: M, Male; F, Female; NOS, Newcastle–Ottawa Quality Assessment Scale.

Data analysis

The analysis held to get the value of log odds ratio, which is the combined odds ratio value from the research. Results were pooled using the odds ratio with corresponding 95% confidence intervals (CIs). Significant heterogeneity was indicated by $I^2 > 50\%$ because these tests presented minimal statistical power in cases with few studies and small sample sizes. A random effect model was used when significant heterogeneity was observed; otherwise, a fixed effect model was utilised. A two-tailed P -value of < 0.05 was considered statistically significant.

Publication bias was visually evaluated by using funnel plots and statistically assessed through Egger’s and Begg’s tests. Meta-analysis was carried out in Stata version 14.2 (Stata Corporation).

Results

The selection of studies was conducted to obtain 10 studies with total of sample 49,964 patients related to dietary fibre protective against colorectal cancer patients in Asia (Table 1) [8], [9], [15], [16], [17], [18], [19], [20], [21], [22].

Dietary fibre protective against colorectal cancer patients in Asia is shown in Figure 2.

Figure 2 shows meta-analysis of dietary fibre protective against colorectal cancer patients in Asia (OR = 0.66 [95% CI 0.56-0.77, $p = 0.008$]). It's mean the result of the study revealed the protective effect of dietary fibre observed in meta-analysis study was consistent with some previous findings.

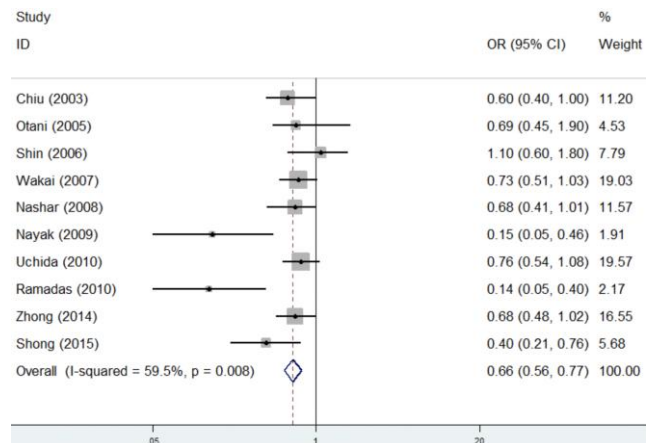


Figure 2: Dietary fibre protective against colorectal cancer patients in Asia

Heterogeneity among studies ($I^2 = 59.5\%$) shows a variation of heterogeneity research for dietary fibre protective against colorectal cancer patients. Funnel plots was constructed to identify publication bias among studies dietary fibre protective against colorectal cancer patients in Asia (Figure 3).

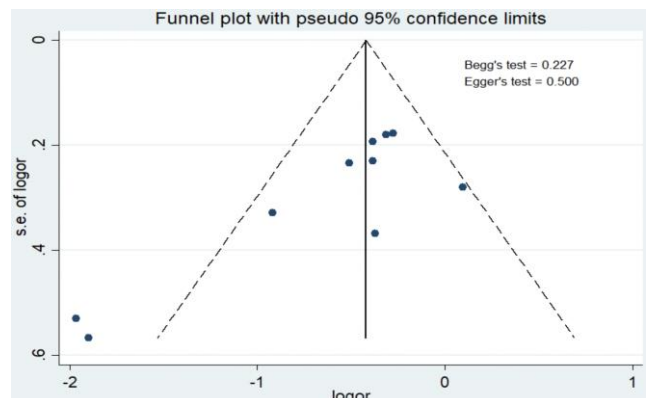


Figure 3: Funnel plots dietary fibre protective against colorectal cancer patients in Asia

There was no significant publication bias for studies included in dietary fibre protective against colorectal cancer patients in Asia, Egger's test ($p = 0.500$) and Begg's test ($p = 0.227$).

Discussion

The result of a meta-analysis of dietary fibre protective against colorectal cancer patients in Asia (OR = 0.66 [95% CI 0.56-0.77, $p = 0.008$]). Dietary fibre has a variation of heterogeneity between studies for the occurrence of colorectal cancer. Several studies have suggested the role of dietary fibre for protective colorectal cancer. High fibre intakes, particularly from cereals or grains and fruit, are associated with a reduced risk of incident colorectal adenoma and cancer [8], [12], [23]. Prospective study within a population-based screening trial suggests that individuals consuming the highest intakes of dietary fibre have reduced risks of incident colorectal adenoma and distal colon cancer and that this effect of dietary fibre, particularly from cereals and fruit, may begin early in colorectal carcinogenesis [11], [24].

Fibre source from fruit, vegetable, legume, cereal and grains. Intakes of carotenoids, light green vegetables, yellow-orange vegetables, broccoli, corn, carrots, bananas, garlic, and legumes (including soy products) were inversely associated with risk, even after adjustment for vegetable fibre. The data support a protective role of fibre from vegetables against colorectal cancer [25]. High intake of dietary fibre, in particular, cereal fibre and whole grains, was associated with a reduced risk of colorectal cancer [10].

A previous study in USA known that mean intake of dietary fibre (DF) is far below recommendations, with children and adolescents aged 2 to 19 years consuming an average of less than 14 g of DF per day. Adults 20+ years old consume, on average, about 17 g of DF per day, and men consume significantly more DF than women. Non-Hispanic black adults consume significantly less DF compared with other race/ethnic groups. Lower family income and living at less than 131% of poverty were associated with lower DF intakes among adults. Federal and local government policies should encourage consumption of all vegetables, including the white potato, as an important source of DF [26].

Another study in Africa known the total median [interquartile range (IQR)] values for total, insoluble, and soluble fiber consumed were 4.6 g [0.0-48.9], 0.0 g [0.0-18.0], and 0.0 g [0.0-15.0], respectively. Females had a higher median [IQR] intake of total (5.1 g [0.0-48.9] vs. 4.3 g [0.0-43.9]), insoluble (0.0 g [0.0-18.0] vs. 0.0 g [0.0-12.0]), and soluble fiber (0.0 g [0.0-14.9] vs. 0.0 g [0.-7.3]) than

males, respectively [27]. Several studies are different from some aspects of others. For instance, the French cohort, who started in 1993, only adjusted for total energy intake.

On the other hand, the US cohort, which adjustment factors were too few, and the Italian cohort, which started in 1987, the range of the highest and lowest dietary fibre intake was relatively narrow (20.1 g/d vs 16.6 g/d, respectively) [28]. Mechanism of dietary fibre may decrease the risk of colorectal cancer by increasing stool bulk, diluting faecal carcinogens, and decreasing transit time, thus reducing the contact between carcinogens and the lining of the colorectum.

Also, bacterial fermentation of fibre results in the production of short chain fatty acids, which may have protective effects against colorectal cancer. Fruit, vegetable, legume, cereal and grains fibre may also protect against colorectal cancer, including antioxidants, vitamins, trace minerals, phytate, phenolic acids, lignans, and phytoestrogens [29], [30], [31].

There were a few limitations in this meta-analysis. First, three studies seemed potentially eligible to be included in this meta-analysis, but the full texts were not accessible. This issue may raise the possibility of selection bias. Second, there were a relatively large number of exclusions due to missing data to be included to meta-analysis, and not analysis for the proportion of participants for the different sex group. Third, validation data were not available for dietary questionnaires in several studies.

Conclusion

This analysis confirmed dietary fibre protective against colorectal cancer patients in Asia. The results of this study recommend the need to maintain the dietary fibre. Dietary fibre may be an effective measure for colorectal prevention. This study suggests the need for education and counselling about eating habits and the importance of avoiding foods with high fibre content.

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