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Meta-analyses

Association between dietary fiber intake and risk of coronary heart disease: A meta-analysis

Yihua Wu [c, 1], Yufeng Qian [b, 1], Yiwen Pan [b], Peiwei Li [c], Jun Yang [c], Xianhua Ye [a, *], Geng Xu [b, **]

[a] Department of Cardiology, The First People's Hospital of Hangzhou, Hangzhou, 310000, China
[b] Department of Cardiology, Second Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou, 310009, China
[c] Department of Epidemiology and Health Statistics, Zhejiang University School of Public Health, Hangzhou, 310058, China

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SUMMARY

Background & aims: The association between coronary heart disease (CHD) and dietary fiber intake is not consistent, especially for the subtypes of dietary fiber. The aim of our study was to conduct a meta-analysis of existing cohort published studies assessing the association between dietary fiber intake and risk of CHD, and quantitatively estimating their dose–response relationships.

Methods: We searched PubMed and EMBASE before May 2013. Random-effect model was used to calculate the pool relative risk (RRs) for the incidence and mortality of CHD. Dose–response, subgroup analyses based on fiber subtypes, heterogeneity and publication bias were also carried out.

Results: Eighteen studies involving 672,408 individuals were finally included in the present study. The pooled-adjusted RRs of coronary heart disease for the highest versus lowest category of fiber intake were 0.93 (95% confidence interval (CI), 0.91–0.96, $P < 0.001$) for incidence of all coronary events and 0.83 (95% CI, 0.76–0.91, $P < 0.001$) for mortality. Further subgroup analyses based on fiber subtypes (cereal, fruit, and vegetable fiber), indicated that RRs were 0.92 (95% CI, 0.85–0.99, $P = 0.032$), 0.92 (95% CI, 0.86–0.98, $P = 0.01$), 0.95 (95% CI, 0.89–1.01, $P = 0.098$) respectively for all coronary event and 0.81 (95% CI, 0.72–0.92, $P = 0.001$), 0.68 (95% CI, 0.43–1.07, $P = 0.094$), 0.91 (95% CI, 0.74–1.12, $P = 0.383$) for mortality. In addition, a significant dose–response relationship was observed between fiber intake and the incidence and mortality of CHD ($P < 0.001$).

Conclusions: Our results indicate that consumption of dietary fiber is inversely associated with risk of coronary heart disease, especially for fiber from cereals and fruits. Besides, soluble and insoluble fibers have the similar effect. A significant dose–response relationship is also observed between fiber intake and CHD risk.

1. Introduction

Coronary heart disease (CHD) is a major cause of death worldwide [1,2] With the global aging of populations, the prevalence of CHD is increasing rapidly. Although treatment such as the percutaneous coronary intervention is usually available and effective, the growing need for CHD therapy still imposes a heavy personal and societal economic burden [3,4]. Therefore, prevention through modifying potential risk factors appears to be excellent nonsurgical strategies for preventing CHD.

Various risk factors including age, gender, hypercholesterolemia, diabetes, hypertension, smoking, obesity and diet play critical roles in atherosclerosis of coronary artery, which is the main cause of CHD [5–7]. Reports of studies have strongly suggested that dietary fiber intake might provide protection against coronary heart disease [8–11] and the potential mechanisms include that fiber can modify blood lipid profiles, lower blood pressure, as well as reduce blood glucose concentrations by slowing intestinal absorption. Mark A, etc [12] reported a pooled analysis of the association between dietary fiber and risk of CHD in 2004, which showed that higher dietary fiber intake was inversely associated with CHD incidence and mortality (pooled RR was 0.86 for all CHD events, and

* Corresponding author. Department of Cardiology, The First People's Hospital of Hangzhou, No. 261 Huansha Road, Hangzhou, China.
** Corresponding author. Department of Cardiology, Second Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, 310009, PR China. Tel.: +86 057187767061.
E-mail addresses: doctoryexianhua@126.com (X. Ye), Xugeng@21cn.com (G. Xu).
[1] Co-first authors.

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0.73 for CHD mortality). Although the association of those studies [8–11] between total fiber and risk of CHD in humans were consistent, the results of subtypes (cereal, fruit, vegetable, soluble and insoluble fiber) were not [12]. Therefore, it's necessary to conduct a more timely study to assess that association, because there have been many new independent studies completed since 2004. Thus, much larger sample size and more accurate subgroups and dose–response analysis were available in our present research.

The aim of our study was to systematically reevaluate the evidence from these studies on fiber quantity and type and the risk of CHD by summarizing it quantitatively with a meta-analysis approach.

2. Methods

2.1. Data sources, search strategy and section criteria

Systematic literature searches were conducted of 2 databases: PubMed, and EMBASE up to May 2013. "Fiber" OR "fibre" was used as search terms together with "coronary heart disease" OR "CHD" OR "CVD" OR "CAD" OR "IHD", and "risk" OR "morbidity" OR "incidence" OR "mortality". Coronary heart disease is a narrowing of the small blood vessels that supply blood and oxygen to the heart including angina, myocardial infarction, latent coronary heart disease, ischemic heart disease and sudden death according to World Health Organization. The references of relevant reviews and original articles were also scanned for potential studies missed in the primary searches. Titles and abstracts of articles identified from the initial search were fires scanned, and then full papers of potential eligible studies were reviewed. This meta-analysis was designed, conducted and reported according to PRISMA and MOOSE statements [13].

We included articles if they met all the following criteria: (1) cohort study published as an original article; (2) the study of interest was the dietary fiber intake; (3) the outcome of interest was coronary heart disease, and (4) relative risk (RR) or hazard ratios (HR) estimates and their 95% confidence intervals (95%CI) adjusted for age, sex, smoking, alcohol, BMI, exercise, blood pressure (Table 1) were available or could be calculated. Only the most recent information was include when data was duplicated.

2.2. Data extraction

Two reviewers (Y.Q. and Y.P.) independently extracted data using a standardized data extraction form. Any discrepancy was resolved by a third reviewer (P.L.). Information extracted from each article included the following items: first author, year of publication, country of origin (continent), type of study design, sample size, mean age, sex, outcomes definitions and grading, relative risk (RR) or hazard ratios (HR), and corresponding 95% confidence intervals (CIs) for "the highest versus the lowest category of fiber intake". If a study provided several risk estimates, the most

Table 1
Characteristics of studies evaluating association between fiber intake and coronary heart disease risk.

Study and year	Country	Participants (M/F)	Person-years (M/F)	Age	Total events (M/F)	Deaths (M/F)	Study quality	Adjusted variables
AHS/1992	US	9212/13,430	52,835/78014	35–99	148/75	49/41	7	Age, sex, smoking, exercise, BMI,[a] blood pressure
ARIC/1997	US	5240/6481	45,861/58199	44–66	269/123	51/17	8	Age, race, education, smoking, alcohol, cholesterol, blood pressure, medications for hypertension
FMC/1994	Finland	2748/2385	24,599/23643	35–86	322/162	186/58	7	Age, sex, smoking, energy intake, BMI, hypertesion, hypercholesterolemia
PGS/1995	Denmark	1658/1666	14,365/14605	35–80	102/34	38/14	7	Sex, age, blood pressure, smoking, and triglycerides
VIP/1998	multiple populations	9251/10,555	39,230/43872	39–70	134/23	38/4	6	Age, BMI, smoking, alcohol, blood pressure, sex
ATBC/1996	Finland	21,141/0	121,813	49–70	1339	534	8	Age, sex, BMI, smoking, alcohol, cholesterl, blood pressure, exercise
HPFS/1996	US	43,757/0	383,206	39–77	1273	421	8	Age, BMI, exercise, smoking, alcohol, hypertension, hypercholesterolemia, family history of MI,[b] and profession.
IWHS/1996	US	0/34,486	294,620	52–71	511	229	7	Age, total energy intake, BMI, smoking, hypertension, diabetes mellitus, exercise, alcohol, marital status, educational
NHSa/1999	US	0/81,415	513,915	35–66	397	97	8	Age, study period, BMI, smoking, asprin
NHSb/1999	US	0/61,706	607,049	39–66	696	208	6	Age, BMI, exercise, alcohol, energy intake smoking, hypertesion, asprin intake
WHS/2002	US	0/38,480	230,006	38–89	152	10	8	Age, study period, BMI, smoking, asprin intake, exercise, hypertesion, history of MI, alcohol, energy intake
Peter/2012	Sweden	8139/12,535	149,571	44–73	1089/687	Nr	8	Age, smoking, exercise, alcohol, BMI, hypertension, high cholesterol, diabetes, history of MI, energy intake
Martinette/2008	Netherlands	1373/0	54,920	43–86	Nr	348	7	Age, total energy intake, BMI, smoking, alcohol, blood pressure, antihypertensive and antihyperlipidemic treatment.
Chigusa/2010	Japan	46,465/64327	288,517/454650	40–79	422	419	6	Age, total energy intake, alcohol, smoking, BMI, socio-economic status
Diane/2013	UK	0/31,036	443,814	36–65	Nr	258	8	Age, BMI, blood pressure, diabetes, alcohol, smoking, education, exercise, perceived mental stress, total energy intake, sex
HaWard/2012	UK	25639[c]	282,029	40–79	1377/774	Nr	7	Age, sex, BMI, alcohol, smoking, total energy intake, socio-economic status.
Bazzano/2003	US	9776[c]	161,352	25–74	1843	668	8	Age, sex, race, education, blood pressure, alcohol, exercise, smoking, diabetes mellitus, BMI, fat intake
Kokubo/2011	Japan	40,046/46341	899,141	45–65	485/199	Nr	7	Age, total energy intake, sex, smoking, alcohol, BMI, history of diabetes, medications for hypertension and hypercholesterolemia, exercise
Majken/2004	US	42,850/0	510,182	40–75	1818	557	7	Age, total energy intake, smoking, alcohol, physical activity, family history of MI, use of vitamin E

[a] BMI: body mass index; #: Nr: not reported.
[b] MI: myocardial infarction.
[c] The HaWard and Bazzano have not mentioned Male/Female ratio.