



臺北市立萬芳醫院 - 委託臺北醫學大學辦理

Taipei Municipal Wanfang Hospital (Managed by Taipei Medical University)

# Dietary fiber intake and all-cause and cause-specific mortality: An updated systematic review and meta-analysis of prospective cohort studies

Fatemeh Ramezani <sup>a</sup>, Farzad Pourghazi <sup>a</sup>, Maysa Eslami <sup>a</sup>, Maryam Gholami <sup>b</sup>, Nami Mohammadian Khonsari <sup>c</sup>, Hanieh-Sadat Ejtahed, Bagher Larijani <sup>d</sup>, Mostafa Qorbani

營養室

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Meta-analyses

Dietary fiber intake and all-cause and cause-specific mortality: An updated systematic review and meta-analysis of prospective cohort studies

Fatemeh Ramezani <sup>a</sup>, Farzad Pourghazi <sup>a</sup>, Maysa Eslami <sup>a</sup>, Maryam Gholami <sup>b</sup>, Nami Mohammadian Khonsari <sup>c</sup>, Hanieh-Sadat Ejtahed <sup>a,d,1,\*</sup>, Bagher Larijani <sup>d</sup>, Mostafa Qorbani <sup>e,1,\*\*</sup>

<sup>a</sup> Obesity and Eating Habits Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

<sup>b</sup> Elderly Health Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

<sup>c</sup> Student Research Committee, Alborz University of Medical Sciences, Karaj, Iran

<sup>d</sup> Endocrinology and Metabolism Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

<sup>e</sup> Non-communicable Diseases Research Center, Alborz University of Medical Sciences, Karaj, Iran





# 1. Introduction

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- Dietary fiber
- Purpose



# Dietary fiber

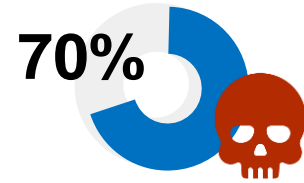
## Non-communicable diseases

Cancer

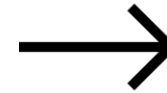
Type 2 diabetes (T2D)

Cardiovascular disease (CVD)

(Akbaraly TN et al., 2011)(Baer HJ et al., 2011)



## Global Burden of Diseases (GBD)



Whole grains

Fruits

Dietary fiber

(Belle FN et al., 2011) (Akbaraly TN et al., 2011)



## Soluble Fiber

- ✓ Decreasing cholesterol levels
- ✓ Stabilizing blood sugar

(Burger KN et al., 2012)(Buyken AE., 2010)(Chan CW et al., 2016)(Chuang SC et al., 2012)(Crowe FL et al., 2012)(Dominguez LJ et al., 2019)



Dietary fiber

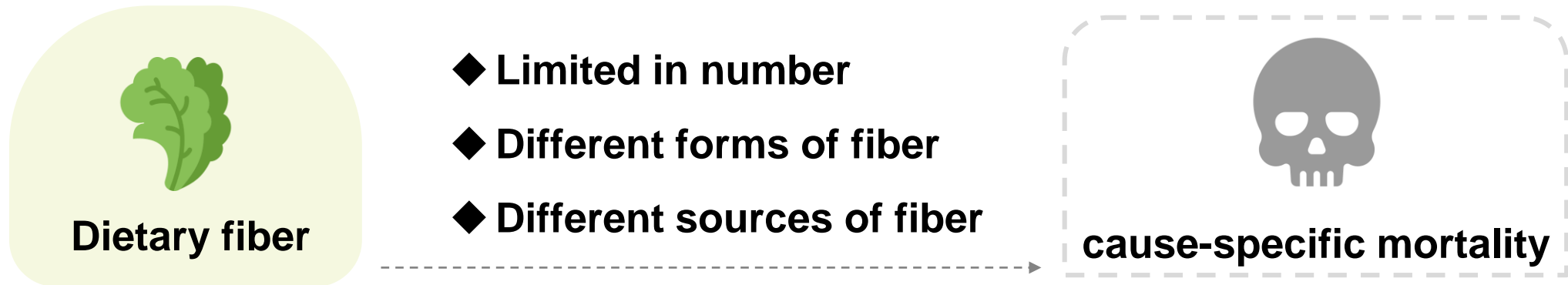
## Insoluble Fiber

- ✓ Increasing stool bulk
- ✓ Preventing constipation
- ✓ Colorectal cancer

(Dray X et al., 2003)(Eshak ES et al., 2010)(Ha K et al., 2021)

# Purpose

- Numerous epidemiological studies have examined the relationship between dietary fiber consumption and mortality from various non-communicable diseases (NCDs)



(Jacobs DR et al., 2000)(Jansen MCJF et al., 1999)(Katagiri R et al., 2020)(Kaushik S et al., 2009)

- A comprehensive **systematic review** and **meta-analysis** of **prospective cohort studies** to examine the associations between the consumption of **different types of dietary fiber from diverse sources** and the **risk of all-cause mortality** and **mortality from CVD, stroke, and cancer**



## 2. FAITH評讀

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- Step 1 :系統性文獻回顧探討的問題為何?
- Step 2 :系統性文獻回顧的品質如何?(FAITH)



# Step 1 : 系統性文獻回顧探討的問題為何?

Participant/problem  
研究族群/問題

**Prospective cohort studies**, including both:

- the general population and
- populations with underlying diseases (e.g., diabetes, chronic kidney disease, cancer survivors)

**Prospective cohort studies  
(F/U years : 3.75 - 40 years )**

Intervention/Exposure  
介入

**Higher dietary fiber intake**, including

- total dietary fiber
- different fiber types (soluble and insoluble fiber)
- fiber from different food sources (whole grains, cereals, vegetables, fruits, legumes, nuts, and seeds)

**FFQ, 24-hour dietary recall,  
Diet history questionnaire**

Comparison  
比較

**Lower dietary fiber intake**

(lowest intake category or reference group within each cohort study)

Outcomes  
結果

**Primary outcome:**

- All-cause mortality

**Secondary outcomes:**

- Cardiovascular disease–related mortality
- Stroke-related mortality
- Cancer-related mortality



# 3. Methods

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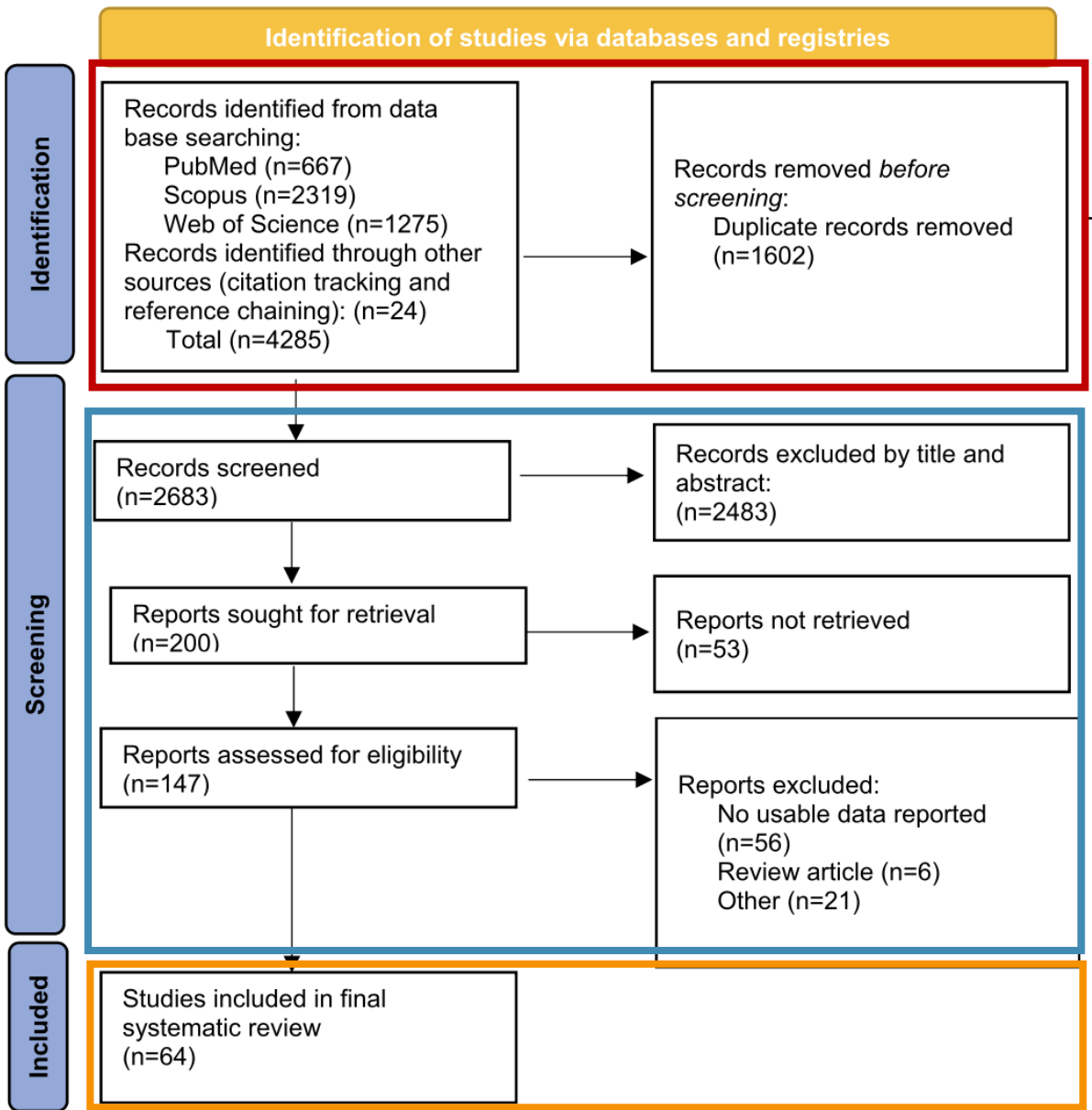


Fig. 1. Flow chart for study identification and selection. Based on PRISMA 2020.

2.1. Search strategy

A systematic literature search was conducted in PubMed, SCOPUS, and Web of Science databases up to October 2022 using the following search terms:

“Dietary fiber” OR “Dietary fibre” OR “Fibre” OR “Fiber” OR “Soluble fiber” OR “insoluble fiber” OR “Added Fiber” OR “Cellulose” OR “Hemicellulose” OR “Lignin” OR “Pectin” OR “Gums” OR “Mucilages” OR “resistant starch” OR “Non-starch polysaccharides” OR “resistant maltodextrin” OR beta-glucan\*OR “glucomannan” OR “Galactomannan” OR Arabinan\* OR “Polydextrose” OR “psyllium” OR fructan\*OR “inulin” OR oligosaccharide\* OR fructooligosaccharide\* OR galactooligosaccharide\* OR galactan\* OR xylooligosaccharide\* OR “oligofructose” OR “Indigestible dextrins” OR “resistant dextrins” AND (“mortality” OR “Death” OR “Fatality”).

2.2.1. Eligibility criteria

All identified articles were systematically evaluated against the inclusion and exclusion criteria, and any disagreement was resolved by mutual discussion and consensus. We retrieved all the studies that reported relative risks (RR) or hazard ratio (HR) for the association of dietary fiber intakes (Total fiber and fiber sourced from various groups, including cereals and whole grains (including cereal, bran, germ, and whole grain), legumes (including legumes and beans), soluble fiber, insoluble fiber (including insoluble fiber, cellulose, and lignin), vegetables, fruits, and non-starch polysaccharides (NCP)) and all-cause or cause-specific mortality (Cardiovascular diseases (CVD) including cerebrovascular diseases, coronary heart disease (CHD), and stroke, as well as different types of malignancy, including colorectal cancer) as the main outcomes of interest. So, the prospective cohort studies were included in this regard.

We excluded duplicate publications, reviews, meta-analyses, case reports, commentary, letters, editorials, studies not published in English, studies that did not report none of the parameters of (RR) or (HR) for the association of dietary fiber intakes and all-cause or cause-specific mortality. In general, papers were included if relative risks (RRs) or hazard ratio (HRs) and their corresponding 95 % confidence intervals (CI) of mortality relating to fiber consumption were reported.

**Table 1**  
Main characteristics of cohort studies examined the association of fiber intake with mortalities.

No	First Author/year	Study type	Country	Cohort name	F/U (Year)	Age range/mean age (at base line)	Sample size (n) Men (%)	Population	Outcomes (Causes and Number of death)	Dietary assessment method	Fiber types	Dietary fiber categories (g/day)	Quality score
1	Akbaraly/2011	Cohort	United kingdom	Whitehall II cohort study	18	39–63 Mean = 49.5	7319/(69.7 % men)	Nationally representative	All cause = 534 Cancer = 259 CVD = 141 (CHD = 74/stroke = 28) Non-cancer non-CVD = 127 Missing deaths = 7	Semi-quantitative FFQ	Total fiber	with each increase of 1 SD of component score.	Good
2	Baer/2010	Prospective Cohort	United States	the Nurses' Health Study (NHS)	18	30–55 Mean = 52.5	50112/(0 % Men)	Female nurses, No CVD - No cancer (Healthy)	All cause = 4893 CVD = 1026 Smoking related cancer = 931 Cancers not related to Smoking = 1430 All other causes = 1506	Semi-quantitative FFQ	Cereal fiber, (energy adjusted)	Per 4 g, energy adjusted	Good
3	Bazzano/2003	Prospective Cohort	United States	(NHANES 1) survey 1	19	25–74	9776/(38.3 % Men)	Civilian – No CVD (Healthy)	All cause = 2632 (Q4 = 740) CVD = 1198 (Q4 = 344) Stroke = 233 (Q4 = 67) CHD = 668 (Q4 = 192)	Standardized protocol used (24-h dietary recall)	Total fiber Soluble fiber	4 Quartile - Total fiber Q1 (<7.7) Q2 (7.7–11) Q3 (11.1–15.9) Q4 (>15.9) 4 Quartile - soluble fiber Q1 (<1.3) Q2 (1.3–2.3) Q3 (2.4–4) Q4 (>4)	Good
4	Belle/2011	Prospective Cohort	United States	Health, Eating, Activity, and Lifestyle (HEAL) study	6.7	>18 Mean = 55.3	688/(0 % Men)	Women with breast cancer stage 0–3A survivors	All cause = 106 Breast cancer = 83	FFQ	Total fiber	4 Quartiles/Q1 (<8.8) Q2 (8.8–12.8) Q3 (12.8–18.3) Q4 (>18.3)	Good
5	Buck/2011	Prospective Cohort	Germany	two German study regions (Hamburg and Rhein-Neckar-Karlsruhe (RNK))	6.4	50–74	2653/(0 % Men)	Postmenopausal women with diagnosed breast cancer	All cause = 321 Breast cancer = 235	FFQ	Total fiber	5 Quintiles/Q1 (13.3) Q2 (16.9), Q3 (19.9), Q4 (23.2), Q5 (28.9)	Good
6	Buil-Cosiales/2014	Prospective Cohort	Spain	Prevençio'n con Dieta Mediterra'nea (PREDIMED) trial,	5.9	55–75 m/60–75 f/	7216/(43 % Men)	No CVD + T2DM or 3 CVD risk factor	All cause = 425 Cancer = 169 No cancer no CVD death = 153 CVD = 103	Validated FFQ	Total fiber	5 Quintile (medians) Q1 = 17, Q2 = 21, Q3 = 24, Q4 = 28, Q5 = 35	Good

# Study characteristics

Category	Description
Study design	All studies were prospective <b>cohort studies</b>
Publication years	1987–2022
Study regions	<b>16 countries</b> in total
<b>Country distribution</b>	<ul style="list-style-type: none"><li>- USA (30 studies)</li><li>- UK (4)</li><li>- China &amp; Japan (6 combined)</li><li>- Korea, Australia, Italy, France, Sweden (2 each)</li><li>- Israel, Malaysia, Canada, Finland, Germany, Spain, Netherlands (1 each)</li><li>- 7 multinational studies</li></ul>
Sample size	Range: 148–452,717 participants Total: 3,512,828 subjects
Age range	<b>15-85 years</b>
Follow-up period	3.75–40 years
Participant characteristics	<ul style="list-style-type: none"><li>- 11 studies included only females</li><li>- 6 studies included only males</li><li>- <b>13 studies conducted in populations with baseline diseases (e.g., CKD, type 2 diabetes, colorectal cancer, breast cancer)</b></li></ul>

# Dietary assessment method

Dietary Assessment Method	No. of Studies (n = 64)	% of Total Studies	Representative Examples (First Author – Year)
<b>Food Frequency Questionnaire (FFQ)</b> (including semi-quantitative and validated versions)	46	71.9 %	Akbaraly 2011 (Whitehall II); Baer 2010 (NHS); Buil-Cosiales 2014 (PREDIMED); Buyken 2010 (BMES); Larsson 2015 (SMC); Touvier 2011 (SU.VI.MAX); Zhang 2020 (CNHHS)
<b>24-hour dietary recall / 24-h recall interview</b>	8	12.5 %	Bazzano 2003 (NHANES I); Chan 2018 (NHANES); Crowe 2012 (EPIC Heart); Ha 2021 (NHANES 1999-2010); Ricci 2020 (NHANES 1999-2014); Zeng 2022 (NHANES 2007-2014)
<b>Diet record / 3-day or 7-day recall record</b>	5	7.8 %	Schroeder 2012 (EURODIAB PCS); Xu 2014 (ULSAM); Zhang 2022 (CNHHS); You 2012 (Malaysia LNCFS); Xu 2019 (China HD patients)
<b>Diet history questionnaire / validated questionnaire</b>	3	4.7 %	Pietinen 1996 (ATBC); Buck 2011 (German regions); Wolk 1989 (NHS subset)
<b>Interview / non-standardized questionnaire (no FFQ)</b>	2	3.1 %	Streppel 2008 (Zutphen Study); Burger 2012 (EPIC multi-country)

攝取組別	大致範圍 ( g/day )	代表說明	代表研究 ( 作者 · 年份 )
最低膳食纖維攝取組	約 7–15 g/day	多為 Q1 / T1 / 最低分位	Bazzano, 2003 ; Belle, 2011 ; Wolk, 1999
最高膳食纖維攝取組	約 30–35 g/day	多為 Q4–Q5 / 最高分位	Buil-Cosiales, 2014 ; Ward, 2016 ; Zhao, 2022

# Statistical analysis

- (1) Heterogeneity Assessment :I squared ( $I^2$ ) and Cochran's Q tests
- (2) High heterogeneity ( $P < 0.1$  or  $I^2 > 50\%$ ) ->Random-effects model  
Low heterogeneity ->Fixed-effect model
- (3) Only categorical HRs/RRs were pooled(Used highest vs. lowest fiber intake categories) ; Continuous fiber intake was excluded
- (4) Subgroup analysis :sex, baseline health status, dietary assessment, and dietary fiber
- (5) Publication bias :Egger's test and funnel plots
- (6) Heterogeneity :Meta-Regression and sensitivity analysis

- STATA (Stata Corporation, College Station, Texas, USA) version 17

## 2.5. Statistical analysis

The  $I$  squared ( $I^2$ ) and Cochran's  $Q$  tests were used to assess the heterogeneity between the studies and in cases of significant heterogeneity ( $P$ -value  $< 0.1$  or  $I^2 > 50\%$ ), a random-effect model (DerSimonian and Laird model) was used for analyses; otherwise, a fixed-effect model was adapted [26]. Only the categorical HRs or RRs (for the highest category to the lowest category of fiber intake) of the included studies were pooled as an effect size for assessing the association of dietary fiber intake with mortality, and hazard ratios for continuous fiber intake were removed from the analysis. Meta-analysis was performed for outcomes with at least three observations within the studies. Sub-group analysis was performed for all-cause, CVD, and malignancy-related mortalities (stratified by sex, baseline general health status of study population, dietary assessment, and dietary fiber). Egger's test and funnel plots were used for publication bias assessment for each all-cause, CVD, and malignancy-related mortalities, and trim-fill analysis was performed if publication bias was present. To assess possible causes of heterogeneity among studies, Meta-Regression and sensitivity analysis were performed. STATA (Stata Corporation, College Station, Texas, USA) version 17 was used to analyze the data.



# 4. Results

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- The pooled associations between dietary fiber usage and mortality
- The pooled associations between dietary fiber usage and CVD-related mortality
- The pooled associations between dietary fiber usage and malignancy-related mortality



# The pooled associations between dietary fiber usage and mortality

**Table 2**

The pooled associations between dietary fiber usage and mortality.

Variable	N Observations <sup>a</sup>	HR 95 % CI	Heterogeneity		
			I Squared%	Model	P-Value
<b>All-Cause Mortality</b>					
Overall	33	0.77 (0.73,0.82)* ↓	67.89	Random	<0.001
<b>By Sex</b>					
Male	5	0.81 (0.75,0.87)* ↓	49.61	Random	<0.001
Female	9	0.76 (0.67,0.85)* ↓	58.11	Random	<0.001
Both Sexes	23	0.77 (0.71,0.83)*	67.92	Random	<0.001
<b>By Population</b>					
General	19	0.82 (0.77,0.86)* ↓	71.13	Random	<0.001
Non-General <sup>b</sup>	14	0.67 (0.61,0.72)* ↓	32.54	Fixed	0.11
<b>By Diet Assessment</b>					
FFQ	20	0.78 (0.72,0.84)* ↓	59.50	Random	<0.001
24 h Recall	10	0.79 (0.67,0.90)* ↓	78.67	Random	<0.001
<b>By Fibre</b>					
Cereal, Bran, Germ, Whole grain	10	0.84 (0.79,0.89)*	77.02 ↓	Random	<0.001
Soluble	8	0.84 (0.76,0.91)*		Random	<0.001
Insoluble, Cellulose, Lignin	7	0.77 (0.72,0.82)*	80.67 ↓	Random	0.04
Vegetable	8	0.87 (0.80,0.95)*		Random	<0.001
Fruit	8	0.94 (0.86,1.02)		Random	<0.001
Legume, Bean	7	0.92 (0.89,0.95)*		Fixed	0.10

13~23%

N: number, HR: Hazard Ratio, CI: Confidence interval, FFQ: Food Frequency Questionnaire, 24 h: 24 h, CVD: Cardio-Vascular Diseases, NSP: Non-Starch Polysaccharides, CHD: Congestive Heart Disease.

\*: Statistically significant (P-value < 0.05).

<sup>a</sup> Refers to the number of reports, Not the number of studies, as some studies may have reported more than one HR or RR for different populations.

<sup>b</sup> Participants who could not be categorized as the general population (e.g. cancer survivors, Smokers, individuals with type II diabetes mellitus, etc.).

# The pooled associations between dietary fiber usage and CVD-related mortality

**Table 3**

The pooled associations between dietary fiber usage and CVD-related mortality.

Variable	N Observations <sup>a</sup>	HR 95 % CI	Heterogeneity		
			I Squared%	Model	P-Value
<b>CVD related mortality</b>					
Overall	47	0.74 (0.71,0.77)*	20.31	Fixed	0.12
<b>By Sex</b>					
Male	19	0.76 (0.71,0.80)*	26.19	Fixed	0.14
Female	17	0.72 (0.67,0.77)*	6.67	Fixed	0.15
Both Sexes	13	0.74 (0.68,0.79)*	22.99	Fixed	0.21
<b>By Population</b>					
General	41	0.74 (0.71,0.78)*	24.82	Random	0.08
Non-General <sup>b</sup>	6	0.69 (0.58,0.79)*	<0.001	Fixed	0.62
<b>By Diet Assessment</b>					
FFQ	23	0.77 (0.73,0.81)*	8.42	Fixed	0.35
24 h Recall	9	0.75 (0.67,0.84)*		Random	0.05
Other Questionnaires <sup>c</sup>	13	0.74 (0.71,0.77)*		Fixed	0.48
<b>By Fibre</b>					
Cereal, Bran, Germ, Whole grain	20	0.85 (0.80,0.89)*	34.05	Random	0.07
Soluble	16	0.80 (0.75,0.86)*	<0.001	Fixed	0.90
Insoluble, Cellulose, Lignin	15	0.74 (0.68,0.79)*	<0.001	Fixed	0.50
Vegetable	17	0.89 (0.85,0.93)*	<0.001	Fixed	0.91
Fruit	18	0.79 (0.70,0.88)*	77.63	Random	<0.001
Legume, Bean	11	0.87 (0.82,0.91)*	<0.001	Fixed	0.79
NSP	3	0.72 (0.39,1.04)	<0.001	Fixed	0.85
NSP Density	3	0.94 (0.65,1.23)	<0.001	Fixed	0.97
Nuts and Seeds	3	0.57 (0.38,0.77)*	<0.001	Fixed	0.47
<b>By Type of CVD</b>					
CHD	7	0.83 (0.73,0.92)*	<0.001	Fixed	0.87
Stroke	11	0.78 (0.69,0.87)*	22.23	Fixed	0.23

**23~26%**

N: number, HR: Hazard Ratio, CI: Confidence interval, FFQ: Food Frequency Questionnaire, 24 h: 24 h, CVD: Cardio-Vascular Diseases, NSP: Non-Starch Polysaccharides, CHD: Congestive Heart Disease.

\*: Statistically significant (P-value <0.05).

<sup>a</sup> Refers to the number of reports, Not the number of studies, as some studies may have reported more than one HR or RR for different populations.

<sup>b</sup> Participants who could not be categorized as the general population (e.g. cancer survivors, Smokers, individuals with type II diabetes mellitus, etc.).

<sup>c</sup> Diet History Questionnaire (DHQ), Interview, Pre-coded Menu Book and other dietary questionnaires. NSP = Non-Starch Polysaccharides

# The pooled associations between dietary fiber usage and malignancy-related mortality

**Table 4**  
The pooled associations between dietary fiber usage and malignancy-related mortality.

Variable	N Observations <sup>a</sup>	HR 95 % CI	Heterogeneity		
			I Squared%	Model	P-Value
<b>Malignancy related mortality</b>					
Overall	18	0.78 (0.68,0.87)*	77.81	Random	<0.001
By Sex					
Male	6	0.80 (0.68,0.92)*	52.07	Random	0.06
Female	5	0.97 (0.89,1.06)	23.65	Fixed	0.26
Both Sexes	9	0.70 (0.54,0.87)*	76.90	Random	<0.001
By Population					
General	10	0.85 (0.76,0.94)*	73.67	Random	<0.001
Non-General <sup>b</sup>	8	0.64 (0.44,0.85)*	62.39	Random	0.01
By Diet Assessment					
FFQ	11	0.79 (0.65,0.93)*	63.12	Random	<0.001
24 h Recall	3	0.65 (0.29,1.01)	88.90	Random	<0.001
By Fibre					
Cereal, Bran, Germ, Whole grain	7	0.85 (0.82,0.88)*	26.37	Fixed	0.23
Soluble	3	0.98 (0.67,1.29)	71.37	Random	0.03
Insoluble, Cellulose, Lignin	3	0.80 (0.73,0.88)*	48.39	Fixed	0.14
Vegetable	5	0.93 (0.85,1.01)	60.66	Random	0.04
Fruit	5	0.97 (0.92,1.02)	<0.001	Fixed	0.45
Legume, Bean	4	1.00 (0.96,1.05)	<0.001	Fixed	0.77
By Type of Malignancy					
Colorectal	4	0.82 (0.67,0.96)*	56.54	Random	0.06

N: number, HR: Hazard Ratio, CI: Confidence interval, FFQ: Food Frequency Questionnaire, 24 h: 24 h, CVD: Cardio-Vascular Diseases, NSP: Non-Starch Polysaccharides, CHD: Congestive Heart Disease.

\*: Statistically significant (P-value < 0.05).

<sup>a</sup> Refers to the number of reports, Not the number of studies, as some studies may have reported more than one HR or RR for different populations.

<sup>b</sup> Participants who could not be categorized as the general population (e.g. cancer survivors, Smokers, individuals with type II diabetes mellitus, etc.).



# 4. Discussion

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- Association between dietary fiber intake and mortality risk
- About dietary fiber
- Effects by source of dietary fiber
- High-risk populations and clinical recommendation
- Strengths and limitations



# Association between dietary fiber intake and mortality risk

- Our findings showed that the consumption of dietary fiber had a **significant inverse association** with the rate of **total mortality** and mortality due to specific causes, including CVD and cancer.

➤ **Multiple meta-analyses and large prospective cohort studies** have found **significant inverse associations** between dietary fiber intake and mortality rate, and CVD- and cancer-related mortality

(Ha K et al., 2020)(Huang T et al., 2015)(Jacobs DR et al., 2000)(Jansen MCJF et al., 1999)(Katagiri R et al., 2020)(Krishnamurthy VM et al., 2012)(Kwon YJ et al., 2022)(Lan T et al., 2021)



Dietary fiber intake

All-cause mortality



23%

- All-Cause Mortality 23%
- CVD-Related Mortality 23%
- Malignancy-Related Mortality 17%

**Dose-response relationship**

(Liu et al., 2015)

➤ **Some earlier studies** reported **no significant association** between fiber consumption and all-cause or CVD-related mortality

(Li S et al., 2014)(Lin Z et al., 2021)(Liu X et al., 2021)(Lubin F et al., 2003)(Mann JI et al., 1997)

# About dietary fiber

## Soluble Fiber

- ✓ Slows glucose & nutrient absorption
- ✓ Lowers cholesterol

- Reduce the risk of **type 2 diabetes** and other metabolic disorders
- **Lower blood cholesterol levels**, and **reduce the risk of heart disease and stroke**

(Lambeau KV et al., 2017) (Fujii H et al., 2013) (McRae MP et al., 2017) (Wojda A et al., 2021)



## Feelings of satiety

- ✓ Increases CCK

- Helps weight loss → **lowers NCD risk**

(Veronese N et al., 2018) (Hadrevi J et al., 2017) (Rao TP et al., 2016) (Hall WL et al., 2006)



Dietary fiber

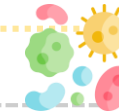
## Insoluble Fiber

- ✓ Increasing stool bulk
- ✓ Preventing constipation
- ✓ Reduces exposure to carcinogens

- **Protects against the development of cancer** (Qi J et al., 2022) (Kritchevsky D et al., 2001) (Kumar V et al., 2012)



## Insoluble Fiber vs Soluble Fiber




## Prebiotic

- ✓ SCFAs inhibit pathogens & inflammation
- ✓ Enhances beneficial bacteria
- ✓ Improves gut barrier

- Preventive effects against **CVD, obesity, diabetes, and cancers**, reducing their mortality rates

# Effects by source of dietary fiber

- Overall, **high-fiber diets** are **more effective than fiber supplementation** in improving disease outcomes (Wagenaar CA et al., 2021)
- Including **phytochemicals, antioxidants, and vitamins**, which are capable of inhibiting cancer growth (Gianfredi V et al., 2017)(Gianfredi V et al.,2017)
- Dietary fiber intake from **whole grains, cereals, and vegetables** showed a **reduction in the risk of all-cause mortality**, whereas fiber from **fruits did not show** such an association

Source	Mortality risk reduction effects
 <b>Cereal fiber</b>	<b>Strongest effect</b> (all-cause, CVD, and cancer mortality) <span style="float: right;">(Zhang Z et al., 2013)(Threapleton DE et al., 2013)(Yao B et al., 2014)</span>
<b>Vegetable fiber</b>	Mild effect; protective
<b>Fruit fiber</b>	No significant protective effect <span style="float: right;">(Kim et al., 2016) (Buyken AE et al., 2010)</span>
<b>Nuts &amp; seeds</b>	CVD mortality ↓ 43% (limited number of studies) <span style="float: right;">(BitokE et al., 2018)</span>

- That **cereal fiber** demonstrated a **higher inverse connection with total mortality than other food sources**, particularly with regard to cancer-related mortality

# High-risk populations and clinical recommendation

- That consuming dietary fiber can **33 % reduce the risk of death** in the subgroup of subjects with certain diseases such as **diabetes, kidney failure, and various types of cancer**
  - Several studies have suggested that dietary fiber intake may be particularly **beneficial for individuals with certain health conditions**
  - **High-fiber diet** for those with NCDs to **improve disease management and prolong their lifetime**

( He M et al., 2010)( Reynolds AN et al.,2020)(Fujii H et al.,2013)(Xu H at al., 2014)



**Dietary fiber intake**

**25-30 g/day**

- **From a variety of sources, including fruits, vegetables, whole grains, and legumes**

(Slavin J et al., 2017)( Tashiro H et al., 2020)(Qi J et al., 2022)

# Strengths and limitations

## Strengths

- This study is the most **comprehensive and largest meta-analysis** to date on dietary fiber and mortality
- Examined **different types and sources** of dietary fiber
- Conducted **subgroup analyses** and **meta-regression** to explore sources of heterogeneity
- Performed **quality assessment** of included studies using the Newcastle–Ottawa Scale (NOS)
- **Most studies used validated FFQs**, improving reliability of dietary assessment

## Limitations

- FFQs may **underestimate** dietary fiber intake
- As an observational design, cohort studies are subject to **confounding, measurement error, and selection bias**
- Causality **cannot** be established
- Variability in study populations, designs, quality, and covariate adjustment may influence results
- **HR and RR were treated similarly in the meta-analysis**, but the **two metrics differ conceptually**; interpretation requires caution



# 5. Conclusion

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- Conclusion



# Conclusion

- The results of the present meta-analysis confirmed the association between **dietary fiber intake and total mortality risk reduction**
- This association was more **significant for CVD-related mortality**
- In particular, **insoluble fiber** consumption was found to be **more effective than soluble fiber intake** in lowering the risk of mortality, especially **cancer-related mortality**
- Fiber consumption confers greater benefits to individuals with compromised health
- Overall, the findings of this study have significant implications for individuals, clinicians, and policymakers concerned with **reducing mortality rates and improving population health**



## 6. FAITH評讀

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- Step 1:系統性文獻回顧探討的問題為何?
- Step 2 :系統性文獻回顧的品質如何?(FAITH)



## Step 2: 系統性文獻回顧的品質如何?(FAITH)

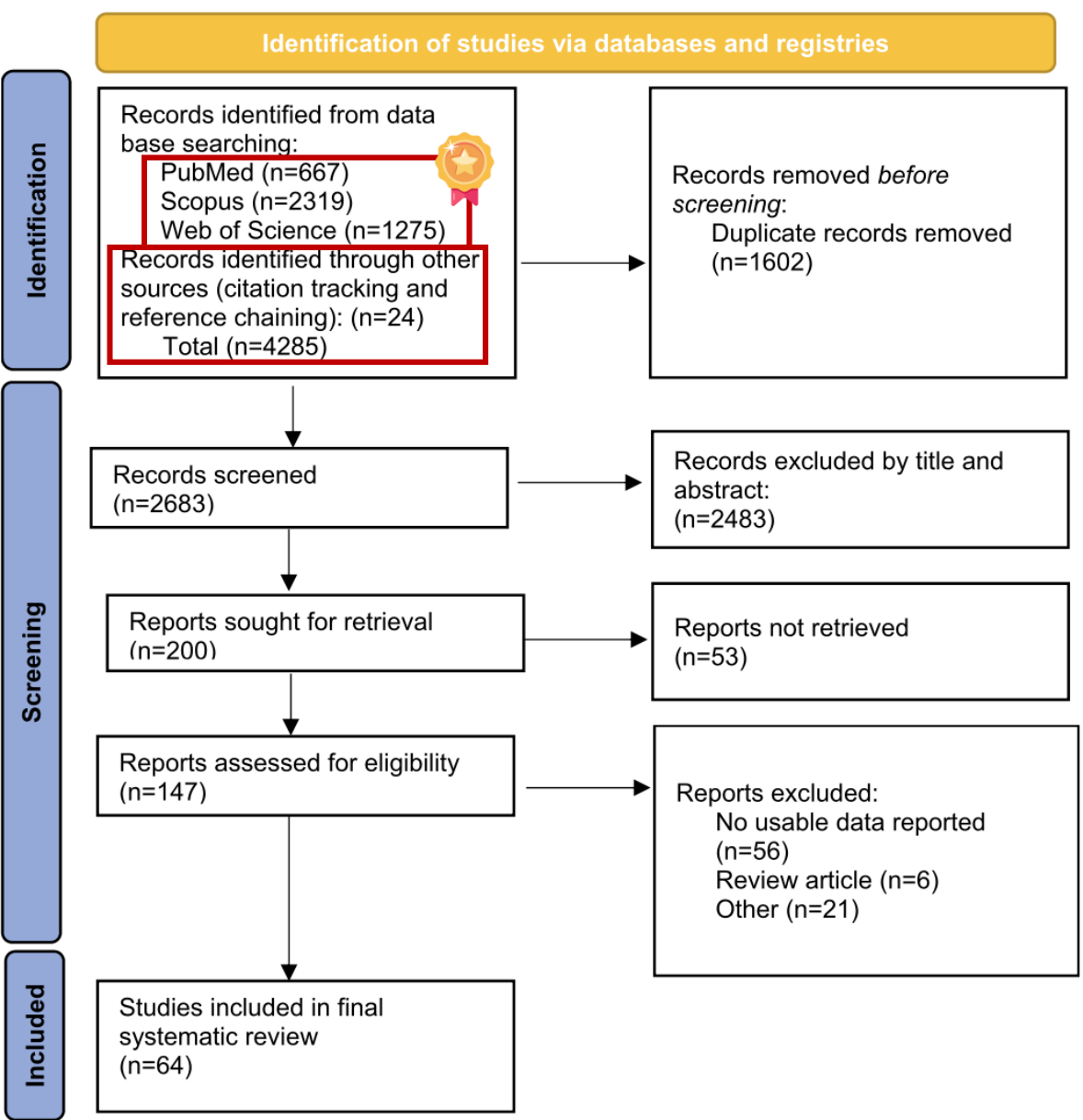
### F-研究是否找到 (Find) 所有的相關證據?

良好的文獻搜尋**至少應包括二個主要的資料庫** (如 :  
Medline, Cochrane 考科藍實證醫學資料庫, EMBASE 等)

加上文獻引用檢索(參考文獻中相關研究、Web of  
Science, Scopus 或 Google Scholar)、試驗登錄資料等。

文獻搜尋應不只限於英文，並且應同時使用 MeSH 字串及  
一般檢索詞彙(text words)

評讀結果:是 否 不清楚

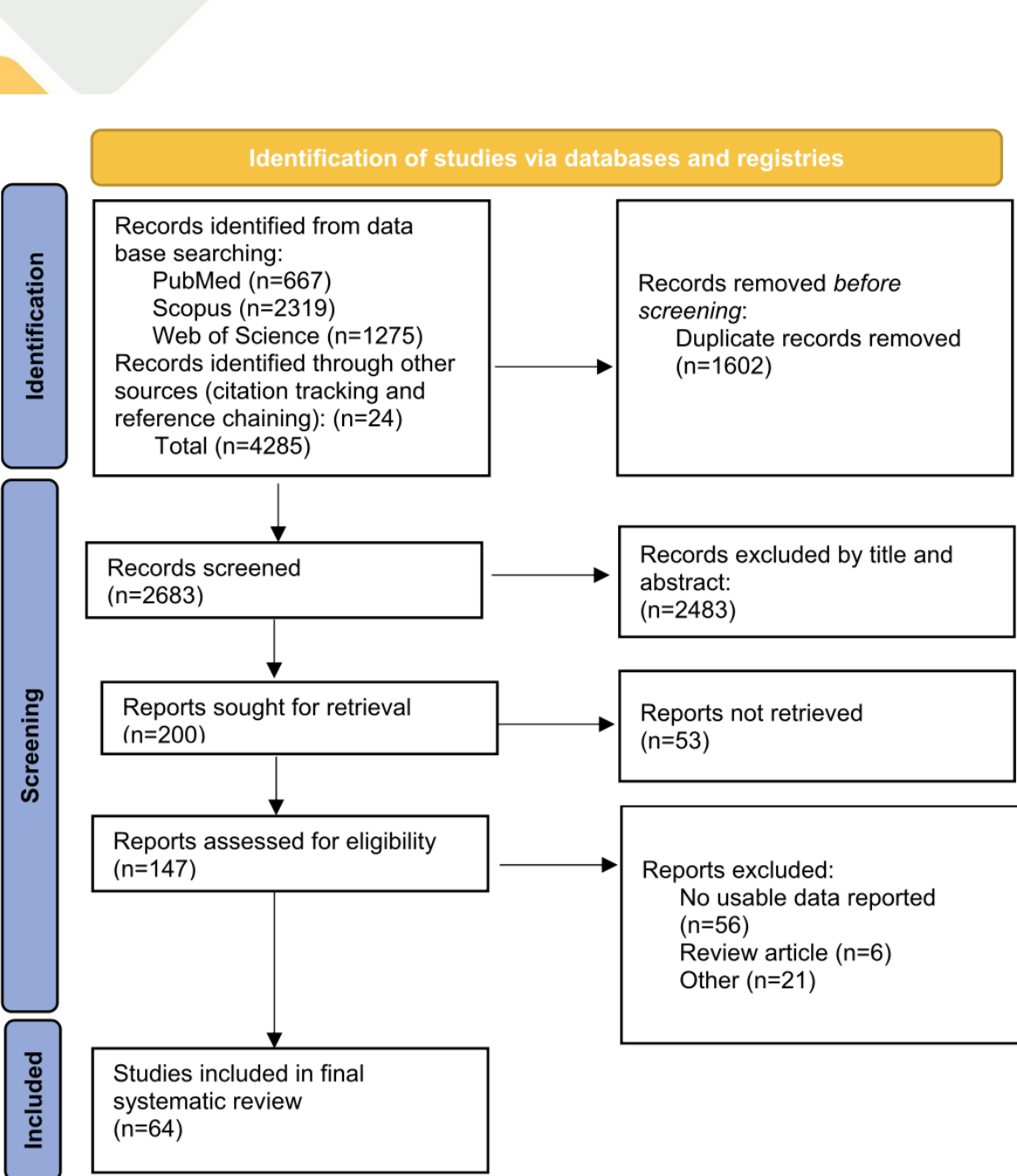


2.1. Search strategy

A systematic literature search was conducted in PubMed, SCOPUS, and Web of Science databases up to October 2022 using the following search terms:

F-研究是否找到 (Find) 所有的相關證據?	
良好的文獻搜尋至少應包括二個主要的資料庫 (如：Medline, Cochrane 考科藍實證醫學資料庫, EMBASE 等)	✓
加上文獻引用檢索(參考文獻中相關研究、Web of Science, Scopus 或 Google Scholar)、試驗登錄資料等。	✓

Fig. 1. Flow chart for study identification and selection. Based on PRISMA 2020.



### 2.1. Search strategy

A systematic literature search was conducted in PubMed, SCOPUS, and Web of Science databases up to October 2022 using the following search terms:

(“Dietary fiber” OR “Dietary fibre” OR “Fibre” OR “Fiber” OR “Soluble fiber” OR “insoluble fiber” OR “Added Fiber” OR “Cellulose” OR “Hemicellulose” OR “Lignin” OR “Pectin” OR “Gums” OR “Mucilages” OR “resistant starch” OR “Non-starch polysaccharides” OR “resistant maltodextrin” OR beta-glucan\*OR “glucomannan” OR “Galactomannan” OR Arabinan\* OR “Polydextrose” OR “psyllium” OR fructan\*OR “inulin” OR oligosaccharide\* OR fructooligosaccharide\* OR galactooligosaccharide\* OR galactan\* OR xylooligosaccharide\* OR “oligofructose” OR “Indigestible dextrins” OR “resistant dextrins” AND (“mortality” OR “Death” OR “Fatality”).



## F-研究是否找到 (Find) 所有的相關證據?

文獻搜尋應不只限於英文，並且應同時使用 MeSH 字串及一般檢索詞彙(text words)

✓

We excluded duplicate publications, reviews, meta-analyses, case reports, commentary, letters, editorials, studies not published in English, studies that did not report none of the parameters of (RR) or (HR) for the association of dietary fiber intakes and all-cause or cause-specific mortality. In general, papers were included if relative risks (RRs) or hazard ratio (HRs) and their corresponding 95 % confidence intervals (CI) of mortality relating to fiber consumption were reported.



Fig. 1. Flow chart for study identification and selection. Based on PRISMA 2020.

## Step 2 : 系統性文獻回顧的品質如何?(FAITH)

### F-研究是否找到 (Find) 所有的相關證據?

良好的文獻搜尋至少應包括二個主要的資料庫 (如 : Medline, Cochrane 考科藍實證醫學資料庫, EMBASE 等)



加上文獻引用檢索(參考文獻中相關研究、Web of Science, Scopus 或 Google Scholar)、試驗登錄資料等。



文獻搜尋應不只限於英文，並且應同時使用 MeSH 字串及一般檢索詞彙(text words)



評讀結果: 是 否 不清楚

## Step 2 : 系統性文獻回顧的品質如何?(FAITH)

### A-文獻是否經過嚴格評讀 (Appraisal)?

應根據不同臨床問題的文章類型，選擇適合的評讀工具



說明每篇研究的品質(如針對治療型的臨床問題，選用隨機分配、盲法、及完整追蹤的研究類型)。

評讀結果: 是 否 不清楚

#### 2.4. Quality assessment

The quality of the included studies was appraised using the Newcastle-Ottawa Quality Assessment Scale (NOS) for cohort studies [25]. Two authors assessed the articles independently. Any disagreement between the two researchers was resolved by discussion until reaching a consensus. The NOS evaluates the methodological quality of the studies in eight items for cohort studies within three categories [1]: Selection of participants (maximum 4 scores) [2], Comparability of subjects (maximum 2 scores) [3], Assessment of outcome (maximum 3 scores) (See [Appendix](#) for included articles). The quality of each study is classified as follows:

**Good quality:** 3–4 points (selection) + 1–2 points (comparability) + 2–3 points (outcome)

**Fair quality:** 2 points (selection) + 1–2 points (comparability) + 2–3 points (outcome)

**Poor quality:** 0–1 point (selection) OR 0 point (comparability) OR 0–1 point (outcome)

## A-文獻是否經過嚴格評讀 (Appraisal)?

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評讀結果: 是 否 不清楚

Supplementary Table 1: Quality Assessment of the included studies according to Newcastle Ottawa Scale.

Number	Author/Year	Selection				Comparability	Outcome			Overall Quality
		Representative	Non-exposed	Exposure	Outcome of interest		Assessment	Duration of F/U	Adequacy of F/U	
1	Akbarali 2011	*	*	*	*	**	*	*	*	Good
2	Baer 2010		*	*	*	**	*	*	*	Good
3	Bazzano 2003	*	*	*	*	**	*	*	*	Good
4	Belle et al 2011		*	*	*	*	*	*	*	Good
5	Buck 2011		*	*	*	**	*	*	*	Good
6	Buil-Cosiales 2014		*	*	*	**	*	*	*	Good
7	Burger 2012		*	*	*	**	*	*	*	Good
8	Buyken 2010	*	*	*	*	**	*	*	*	Good
9	Chan 2016	*	*	*	*	**	*	*	*	Good
10	Chuang 2012	*	*	*	*	**	*	*	*	Good
11	Crowe 2012	*	*	*	*	**	*	*	*	Good
12	Dominguez 2018	*	*	*	*	**	*	*	*	Good
13	Dray 2015		*	*	*	**	*	*	*	Good
14	Eshak 2010	*	*	*	*	**	*	*	*	Good
15	Ha et al 2021	*	*	*	*	**	*	*	*	Good
16	He et al 2010		*	*	*	**	*	*	*	Good
17	Hertog 1996	*	*	*	*	**	*	*	*	Good
18	Holmes 1998		*	*	*	**	*	*	*	Good
19	Holmes 2009		*	*	*	**	*	*	*	Good
20	Huang 2015	*	*	*	*	**	*	*	*	Good
21	Jacobs 2000		*	*	*	**	*	*	*	Good
22	Jansen 1999	*	*	*	*	*	*	*	*	Poor
23	Katagiri 2020	*	*	*	*	**	*	*	*	Good
24	Kaushik 2008	*	*	*	*	**	*	*	*	Good
25	Khaw 1987	*	*	*	*	*	*	*	*	Good
26	King 2021	*	*	*	*	**	*	*	*	Good
27	Krishnamurthy 2012		*	*	*	**	*	*	*	Good
28	Kwon 2022		*	*	*	**	*	*	*	Good
29	Kwon 2022	*	*	*	*	*	*	*	*	Good
30	Lan 2021	*	*	*	*	**	*	*	*	Good
31	Li 2014		*	*	*	**	*	*	*	Good
32	Lin 2021		*	*	*	**	*	*	*	Good
33	Liu 2021	*	*	*	*	**	*	*	*	Good
34	Lubin 2003	*	*	*	*	**	*	*	*	Good
35	Mann 1997		*	*	*	*	*	*	*	Good
36	McEligot 2009		*	*	*	**	*	*	*	Good
37	Miyazawa 2019	*	*	*	*	**	*	*	*	Good

**Good quality:** 3–4 points (selection) + 1–2 points (comparability) + 2–3 points (outcome)  
**Fair quality:** 2 points (selection) + 1–2 points (comparability) + 2–3 points (outcome)  
**Poor quality:** 0–1 point (selection) OR 0 point (comparability) OR 0–1 point (outcome)

# Step 2 : 系統性文獻回顧的品質如何? (FAITH)

Overall quality (NOS)	Number of studies	Percentage
Good quality	63	98.4%
Poor quality	1	1.6%
Fair quality	0	0%
<b>Total</b>	<b>64</b>	<b>100%</b>

Supplementary Table 1: Quality Assessment of the included studies according to Newcastle Ottawa Scale.

Number	Author/Year	Selection				Comparability	Outcome			Overall Quality
		Representative	Non-exposed	Exposure	Outcome of interest		Comparability	Assessment	Duration of F/U	
1	Akbarali 2011	*	*	*	*	**	*	*	*	Good
2	Baer 2010		*	*	*	**	*	*	*	Good
3	Bazzano 2003	*	*	*	*	**	*	*	*	Good
4	Belle et al 2011		*	*	*	*	*	*	*	Good
5	Buck 2011		*	*	*	**	*	*	*	Good
6	Buil-Cosiales 2014		*	*	*	**	*	*	*	Good
7	Burger 2012		*	*	*	**	*	*	*	Good
8	Buyken 2010	*	*	*	*	**	*	*	*	Good
9	Chan 2016	*	*	*	*	**	*	*	*	Good
10	Chuang 2012	*	*	*	*	**	*	*	*	Good
11	Crowe 2012	*	*	*	*	**	*	*	*	Good
12	Dominguez 2018	*	*	*	*	**	*	*	*	Good
13	Dray 2015		*	*	*	**	*	*	*	Good
14	Eshak 2010	*	*	*	*	**	*	*	*	Good
15	Ha et al 2021	*	*	*	*	**	*	*	*	Good
16	He et al 2010		*	*	*	**	*	*	*	Good
17	Hertog 1996	*	*	*	*	**	*	*	*	Good
18	Holmes 1998		*	*	*	**	*	*	*	Good
19	Holmes 2009		*	*	*	**	*	*	*	Good
20	Huang 2015	*	*	*	*	**	*	*	*	Good
21	Jacobs 2000		*	*	*	**	*	*	*	Good
22	Jansen 1999	*	*	*	*	**	*	*	*	Poor
23	Katagiri 2020	*	*	*	*	**	*	*	*	Good
24	Kaushik 2008	*	*	*	*	**	*	*	*	Good
25	Khaw 1987	*	*	*	*	*	*	*	*	Good
26	King 2021	*	*	*	*	**	*	*	*	Good
27	Krishnamurthy 2012		*	*	*	**	*	*	*	Good
28	Kwon 2022		*	*	*	**	*	*	*	Good
29	Kwon 2022	*	*	*	*	*	*	*	*	Good
30	Lan 2021	*	*	*	*	**	*	*	*	Good
31	Li 2014		*	*	*	**	*	*	*	Good
32	Lin 2021		*	*	*	**	*	*	*	Good
33	Liu 2021	*	*	*	*	**	*	*	*	Good
34	Lubin 2003	*	*	*	*	**	*	*	*	Good
35	Mann 1997		*	*	*	**	*	*	*	Good
36	McEligot 2009		*	*	*	**	*	*	*	Good
37	Miyazawa 2019	*	*	*	*	**	*	*	*	Good

38	Mozaffarian 2003	*	*	*	*	*	*	*	*	Good
39	Nilsson 2012	*	*	*	*	*	*	*	*	Good
40	Palli 2000		*	*	*	**	*	*	*	Good
41	Park 2011	*	*	*	*	**	*	*	*	Good
42	Partula / 2020	*	*	*	*	*	*	*	*	Good
43	Pietinen 1996		*	*	*	**	*	*	*	Good
44	Pocobelli / 2010	*	*	*	*	*	*	*	*	Good
45	Qi 2022	*	*	*	*	**	*	*	*	Good
46	Rebello 2014	*	*	*	*	**	*	*	*	Good
47	Ricci 2020		*	*	*	**	*	*	*	Good
48	Ricci 2020	*	*	*	*	**	*	*	*	Good
49	Rimm 1996	*	*	*	*	*	*	*	*	Good
50	Schoenaker 2012		*	*	*	**	*	*	*	Good
51	Skiba 2019		*	*	*	**	*	*	*	Good
52	Song 2017		*	*	*	**	*	*	*	Good
53	Streppel 2008	*	*	*	*	**	*	*	*	Good
54	Threapleto 2013	*	*	*	*	**	*	*	*	Good
55	Ward 2016		*	*	*	**	*	*	*	Good
56	Wolk 1999	*	*	*	*	*	*	*	*	Good
57	Xu 2014	*	*	*	*	**	*	*	*	Good
58	Xu 2019		*	*	*	**	*	*	*	Good
59	Xu 2022	*	*	*	*	**	*	*	*	Good
60	You 2022	*	*	*	*	**	*	*	*	Good
61	Zeng 2022	*	*	*	*	**	*	*	*	Good
62	Zhang 2022		*	*	*	**	*	*	*	Good
63	Zhang 2022	*	*	*	*	**	*	*	*	Good
64	Zhao / 2022	*	*	*	*	**	*	*	*	Good

I-是否只納入 (included) 具良好效度的文章?

系統性文獻回顧納入至少要有一項研究結果是極小偏誤的試驗。

評讀結果: 是 否 不清楚



## Step 2 : 系統性文獻回顧的品質如何?(FAITH)

### T-作者是否以表格和圖表「總結」(total up) 試驗結果?

應該用至少 1 個摘要表格呈現**所納入的試驗結果**

結果相近，可針對結果進行統合分析(meta-analysis)，並以「森林圖」(forest plot)呈現研究結果，最好再加上異質性分析。

評讀結果:是 否 不清楚

**Table 1**  
Main characteristics of cohort studies examined the association of fiber intake with mortalities.

No	First Author/year	Study type	Country	Cohort name	F/U (Year)	Age range/mean age (at base line)	Sample size (n) Men (%)	Population	Outcomes (Causes and Number of death)	Dietary assessment method	Fiber types	Dietary fiber categories (g/day)	Quality score
1	Akbaraly/2011	Cohort	United kingdom	Whitehall II cohort study	18	39–63 Mean = 49.5	7319/(69.7 % men)	Nationally representative	All cause = 534 Cancer = 259 CVD = 141 (CHD = 74/stroke = 28) Non-cancer non-CVD = 127 Missing deaths = 7	Semi-quantitative FFQ	Total fiber	with each increase of 1 SD of component score.	Good
2	Baer/2010	Prospective Cohort	United States	the Nurses' Health Study (NHS)	18	30–55 Mean = 52.5	50112/(0 % Men)	Female nurses, No CVD - No cancer (Healthy)	All cause = 4893 CVD = 1026 Smoking related cancer = 931 Cancers not related to Smoking = 1430 All other causes = 1506	Semi-quantitative FFQ	Cereal fiber, (energy adjusted)	Per 4 g, energy adjusted	Good
3	Bazzano/2003	Prospective Cohort	United States	(NHANES 1) survey 1	19	25–74	9776/(38.3 % Men)	Civilian – No CVD (Healthy)	All cause = 2632 (Q4 = 740) CVD = 1198 (Q4 = 344) Stroke = 233 (Q4 = 67) CHD = 668 (Q4 = 192)	Standardized protocol used (24-h dietary recall)	Total fiber Soluble fiber	4 Quartile - Total fiber Q1 (<7.7) Q2 (7.7–11) Q3 (11.1–15.9) Q4 (>15.9) 4 Quartile - soluble fiber Q1 (<1.3) Q2 (1.3–2.3) Q3 (2.4–4) Q4 (>4)	Good
4	Belle/2011	Prospective Cohort	United States	Health, Eating, Activity, and Lifestyle (HEAL) study	6.7	>18 Mean = 55.3	688/(0 % Men)	Women with breast cancer stage 0–3A survivors	All cause = 106 Breast cancer = 83	FFQ	Total fiber	4 Quartiles/Q1 (<8.8) Q2 (8.8–12.8) Q3 (12.8–18.3) Q4 (>18.3)	Good
5	Buck/2011	Prospective Cohort	Germany	two German study regions (Hamburg and Rhein-Neckar-Karlsruhe (RNK))	6.4	50–74	2653/(0 % Men)	Postmenopausal women with diagnosed breast cancer	All cause = 321 Breast cancer = 235	FFQ	Total fiber	5 Quintiles/Q1 (13.3) Q2 (16.9), Q3 (19.9), Q4 (23.2), Q5 (28.9)	Good
6	Buil-Cosiales/2014	Prospective Cohort	Spain	Prevenio'n con Dieta Mediterra'nea (PREDIMED) trial,	5.9	55–75 m/60–75 f/	7216/(43 % Men)	No CVD + T2DM or 3 CVD risk factor	All cause = 425 Cancer = 169 No cancer no CVD death = 153 CVD = 103	Validated FFQ	Total fiber	5 Quintile (medians) Q1 = 17, Q2 = 21, Q3 = 24, Q4 = 28, Q5 = 35	Good

# 以表格方式呈現 納入的試驗結果

7	Burger/2012	Prospective Cohort	Denmark, Germany, Italy, Netherlands, Spain, Sweden	(EPIC)	9.2	35–70 Mean = 57.4	6192/(54.2 % Men)	DM individuals (Median time = 4.4 y)	All cause = 791 (m = 533/f = 258) CVD = 306 (m = 215) Cancer = 163 (m = 103) Other known causes = 118 (m = 74)	Validated dietary questionnaires	Total fiber	per SD increase of fiber (6.4)	Good
8	Buyken/2010	Prospective Cohort	Australia	The Blue Mountains Eye Study (BMES)	13	≥49	2735 (45.5%Men)	≥49 Postmenopausal women and men, No CVD – No Cancer, (Healthy)	All-cause = 838 (f = 380/m = 458) Inflammatory Death = 170 (f = 84/m = 86) CVD = 260 (f = 109/m = 151)	Validated FFQ	Total Fiber Vegetable Fiber, Fruit Fiber, Cereal Fiber	3 Tertile Total fiber Women/ T1:19.7, T2:24.8, T3:36.2 3Tertile Total fiber Men/ T1:18.4, T2:25.9,T3:36.4 3 Tertile Vegetable Women/ T1:6.5, T2:9.2, T3:13.5 3Tertile Vegetable Men/T1:6, T2:9.1, T3:13.7 3 Tertile fruit Women/T1:2.8,T2:6,T3:11.7 3 Tertile fruit Men/ T1:2.4,T2:5.3,T3:11.1 3 Tertile cereal women/ T1:62.9,T2:6.1,T3:10.9 3 Tertile cereal Men/T1:3,T2:6.5,T3:11.5	Good
9	Chan/2016	Prospective Cohort	United States	Survey III, (NHANES)	13.74	≥20 Mean = 44.53	15740/(46.60 % Men)	US residents – No Cancer (Healthy)	All cause = 3164 Cancer = 656 Colorectal anal cancer = 68	24-h dietary recall	Total fiber Insoluble fiber Soluble fiber	4 Quartiles Q1 (<9.3), Q2=(9.3–14.5) Q3= (14.5–22.1), Q4 (≥22.1) Insoluble fiber Q1<5.9, Q2 (5.9–9.6), Q3 (9.6–15.3) Q4 ≥15.3, Soluble fiber Q1<3.4, Q2 (3.4–5.2), Q3 (5.2–7.7), Q4 ≥7.7,	Good
10	Chuang/2012	prospective	Denmark, France, Germany, Greece, Italy, Netherland, Norway, Spain,	(EPIC)	12.7	25–70 Mean = 50.8	452717 (29 %Men) (m = 130564, f = 322153)	No-Cancer, No-CVD, No DM, (Healthy)	All cause = 23582 (m = 10366/ f = 13216) Cancer: (m = 4039/f = 5575) Smoking-related cancers: (m = 2640/f = 2478) Non-smoking-related cancers:	Semi-quantitative FFQ	Total fiber	5 Quintile (medians) Q1= <16.4 Q2 = 16.4 to <20.1 Q3 = 20.1 to <23.6 Q4 = 23.6 to <28.5 Q5 = ≥ 28.5	Good

(continued on next page)

# 以表格方式呈現 納入的試驗結果

21	Jacobs/2000	Prospective Cohort	United States	The Iowa Women's Health Study	11.3	55–69	11040 (0 % Men)	Post menopausal women	All cause = 1341 Cancer = 527 CHD = 247 Other CVD = 180	FFQ	Total fiber	2 Groups (Whole grain fiber 71 % of total grain fiber intake*/Refined grain fiber 77 % of total grain fiber intake*)	Good
22	Jansen/1999	Prospective Cohort	USA, Finland, Japan, Greece, Italy, Netherland, Serbia, Croatia	from 16 cohorts were enrolled in the Seven Countries Study,	25	40–59	12763/(100 % Men)	Nationally representative	All cause = 5974 Cancer = 1580 Colorectal cancer = 162 (Colon cancer = 100 Rectum cancer = 62)	7 days recall	Total fiber	10 % of mean intake Total fiber = 3.32	Poor
23	Katagiri/2020	Prospective Cohort	Japan	(Japan Public Health Center-based prospective study),JPHC	16.8	45–74	92924/(46 % Men)	No CVD, No stroke, No cancer, Healthy individuals	All cause = 19400 (m = 11773/ f = 7627) Cancer: (m = 4517/f = 2563) Total CVD: (m = 2831/f = 2069) Heart disease: (m = 1506/ f = 1050) Cerebrovascular disease: (m = 1085/f = 828) Respiratory disease: (m = 1000/ f = 511) Injury: (m = 850/f = 426)	FFQ	Total fiber Soluble fiber, Insoluble fiber	5 Quintile/Total fiber (male/ Q1=<8.7 – Q2 = 8.8–10.8/Q3 = 10.8 –12.9/Q4 = 12.9–15.7/ Q5=>15.7) – (Female/Q1=<10.6/ Q2 = 10.6–12.7/Q3 = 12.7 –14.7/Q4 = 14.7–17.4/ Q5=>17.4) 5 Quintile/Soluble fiber (male/Q1=<2.6 – Q2 = 2.6–3.1/Q3 = 3.1–3.7/ Q4 = 3.7–4.5/Q5=>4.5) – (Female/Q1=<3.1/Q2 = 3.1 –3.7/Q3 = 3.7–4.2/Q4 = 4.2 –5/Q5=>5) 5 Quintile/Insoluble fiber (female/Q1=<7.2/Q2 = 7.2 –8.8/Q3 = 8.8–10.3/ Q4 = 10.3–12.3/Q5=>12.3) – (male/Q1=<6.6/Q2 = 6.6 –8.1/Q3 = 8.1–9.5/Q4 = 9.5 –11.4/Q5=>11.4)	Good
24	Kaushik/2008	Prospective Cohort	Australia	(BMES)/until 2005	13	>49	2897/(43.96 % Men)	Nationally representative	All-cause = 1297 Stroke = 95 CHD=NR	validated FFQ	Cereal fiber	Low cereal consumption, Medium cereal consumption, high cereal consumption	Good

# 以表格方式呈現 納入的試驗結果

25	Khaw/1987	Prospective Cohort	United States	Caucasian community in Rancho Bernardo, California, a survey of heart disease risk factors	12	50–79	859/(41.44 % Men)	No CVD - No Stroke (Healthy)	IHD = 65 (m = 42, f = 23)	24-h Dietary recall	Total fiber	Dietary fiber intake (<10/10–16/>16)	Good
26	King/2021	Prospective Cohort	United States	(NHANES)/2015	12.3	>40	5761/(49.5 % Men)	Nationally representative	All cause = 2027 (Breakfast eater = 1719, Non-BF eater = 308) CVD = 469 (Breakfast eater = 383, Non-BF eater = 86)	24-h Dietary recall	Total fiber	fiber intake: High (>25 g) Low (≤25 g)	Good
27	Krishnamurthy/2012	Prospective Cohort	United States	(NHANES III)/until 2000	8.4	>20 Mean = 45	14533/(48 % Men)	Adults with eGFR<150 mL/min per 1.73 m <sup>2</sup>	All cause = 2141	24-h Dietary recall	Total fiber Insoluble fiber Soluble fiber	For each 10 g/day increase of consumption	Good
28	Kwon/2022	Prospective Cohort	Korea	Korean Genome and Epidemiology Study (KoGES)	10.1	40–69	3892/(38.41 % Men)	Individuals with eGFR <60 mL/min/1.73 m <sup>2</sup>	All cause = 602 CVD = 149	validated FFQ	Total fiber	5 Quintiles/Q1 (0.50, 3.01), Q2 (3.02, 4.15), Q3 (4.16, 5.26), Q4 (5.27, 6.76), Q5 (6.77, 27.6)	Good
29	Kwon/2022	Prospective Cohort	Korea	(KoGES)_Ansan–Ansung study (2001–2002), KoGES_health examinee study (2004–2013), and the KoGES_cardiovascular disease association study (2005–2011).	10.1	≥40 mean = 53.9	143050/(35.6 % Men)	Nationally representative	All cause = 5436 CVD = 985	FFQ	Total fiber	5 Quintile: Q1 =(0.37, 3.51) Q2=(3.51, 4.64) Q3=(4.64, 5.79) Q4=(5.79, 7.44) Q5=(7.44, 52.65)	Good
30	Lan/2021	Prospective Cohort	United States	NIH-AARP Diet and Health (AARP) Study	8	50–70 Mean = 61.8	150671 (100 % men)	No cancer	Prostate cancer = 760	Risk factor questionnaire FFQ	Total fiber	5 Quintile/Q1 (<5.2) Q2 (5.2–6.3), Q3 (6.3–7.4), Q4 (7.4–8.9), Q5 (>8.9)	Good
31	Li/2014	Prospective Cohort	United States	(NHS)/until 2008	F = 32 M = 22	30-55 Female 40-75 Male	4098/(44.89 % Men)	No (CVD, stroke, or cancer) at base line + incident MI	All cause = 1133 (m = 451/ f = 682) CVD = (m = 222/f = 336) women	FFQ	Total fiber	5 Quintile/median/(male/ Q1 = 16.34– Q2 = 20.9/ Q3 = 24.36/Q4 = 28.5/ Q5 = 35.6) – (Female/ Q1 = 12.95/Q2 = 16.54/ Q3 = 19.12/Q4 = 22.33/ Q5 = 27.4)	Good
32	Lin/2021	Prospective Cohort	China	multicentre prospective cohort study in China.	3.8	≥18 Mean = 54	1044/(57.7 % Men)	Individuals who underwent maintenance hemodialysis for minimum of 90 days	All cause = 354 CVD = 210	24-h dietary recalls 3 day	Total fiber	3 Tertile T1 (<0.13) T2 (0.13–0.18) T3 (>0.18)	Good

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以表格方式呈現  
納入的試驗結果

43	Pietinen/1996	Prospective cohort	Finland	The Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study	6.1	50–69	21930 (100%men)	smoking men – no CVD, no DM	CHD = 635	Validated questionnaire	Total fiber Soluble fiber, Insoluble fiber, Insoluble NCP, Cellulose Lignin Cereal fiber Vegetable fiber Fruit fiber	5 Quintile dietary fiber Median/Q1 (16.1) Q2 (20.7),Q3 (24.3),Q4 (28.3),Q5 (34.8) 5 Quintile Soluble fiber/Q1 (3.7) Q2 (5.7),Q3 (5.4),Q4 (6.2),Q5 (7.4) 5 Quintile Insoluble fiber/Q1 (12.2) Q2 (15.9),Q3 (18.9),Q4 (22.3),Q5 (27.7) 5 Quintile Insoluble NCP/Q1 (6.8) Q2 (8.9),Q3 (10.7),Q4 (12.6),Q5 (15.9) 5 Quintile lignin/Q1 (2.1) Q2 (3),Q3 (3.7),Q4 (4.5),Q5 (5.8) 5 Quintile Cellulose/Q1 (3.1) Q2 (3.9),Q3 (4.6),Q4 (5.2),Q5 (6.3) 5 Quintile cereal/Q1 (8.8) Q2 (12.4),Q3 (16),Q4 (19.9),Q5 (26.3) 5 Quintile vegetable fiber/Q1 (2.9) Q2 (3.9),Q3 (4.7),Q4 (5.6),Q (7.1) 5 Quintile fruit fiber/Q1 (0.7) Q2 (1.5),Q3 (2.4),Q4 (3.4),Q (5.3)	Good
44	Pocobelli/2010	Prospective cohort	United States	13-county area of western Washington State	5	50–76	77673 (48 % Men)	Nationally representative	All cause = 3577	FFQ	Total fiber	High-use category low-use category none	Good
45	Qj/2022	Prospective cohort	United States	NHANES (2003–2014) cohort	11	≥18	31,164 (48.18 % Men)	Nationally representative	All cause = 2915 Cancer = 631 CVD = 836	2 days 24 h dietary recall	Total fiber	Quintile (mean/sd)/Total dietary fiber, g/day Q1 = 9.18 (4.17) Q2 = 11.16 (4.22) Q3 = 13.99 (4.14) Q4 = 18.08 (4.23) Q5 = 28.12 (8.63)	Good

以表格方式呈現  
納入的試驗結果

46	Rebello/2014	Prospective cohort	Singapore and China	The Singapore Chinese Health Study cohort	15	45–74	53469 (43.9 % Men)	no (cancer, heart attack or angina, stroke, or diabetes.) Healthy	IHD = 1660 (m = 1022/f = 638)	semi-quantitative FFQ	Total fiber	5 Quintiles/men/Q1 = 7.83, Q2 = 10.40, Q3 = 12.13, Q4 = 14.18, Q5 = 17.77 5 Quintiles/Female/ Q1 = 8.50, Q2 = 10.46, Q3 = 12.15, Q4 = 14.18, Q5 = 17.81	Good
47	Ricci/2020	Prospective cohort	United States	NHANES surveys (1999–2014)	5.7	>18	2371 (46.86 % Men)	Cancer survivors	All cause = 532 Cancer = 180	24-h dietary recall	Total fiber	Tertile	Good
48	Ricci/2020	Prospective cohort	United States	NHANES surveys (1999–2014)	5.6	Median = 69	2473 (55.7 % men)	Nationally representative	All cause = 761 CVD = 199 CHD = 229	24 h dietary recall interview	Total fiber	T1= (<11.93 g),T2&T3 (18.9–52.39)	Good
49	Rimm/1996	Prospective cohort	United States	The Health Professionals Follow-up Study (HPFS)	6	40–75	43757 (100%Men)	Healthy male health professional, No CVD No DM		Dietary Questionnaire	Energy adjusted total fiber	5 Quintile/median Q1 (12.4) Q2 (16.6), Q3 (19.6), Q4 (23.0), Q5 (28.9)	Good
50	Schoenaker/2012	Prospective cohort	Europe	The EURODIAB Prospective Complications Study (PCS)	7.4	15–60 Mean = 32.07	2108 (51 %Men)	Individuals with type 1 diabetes mellitus free of CVD at baseline	All cause = 46	3 days dietary record	Total fiber Soluble fiber Insoluble fiber	Tertiles/mean/T1 = 13.4 T2 = 18.6 T3 = 25.2	Good
51	Skiba/2019	Prospective cohort	United States	Women's Health Initiative (WHI) study.	15.4	Mean = 63.2	160195 (0 % Men)	Post menopausal women without history of colorectal cancer	All cause = 35746 Colorectal cancer = 841	Questionnaire	Prebiotic supplement fiber type (soluble, insoluble)	Probiotic supplement yes or no	Good
52	Song/2017	Prospective cohort	United States	(NHS) and (HPFS)	8	30–75 Mean = 68.6	1575 (38.9 % Men)	Health care professionals with stage I-III colorectal cancer	All cause = 773 Colorectal cancer = 174	FFQ	Total fiber Cereal fiber Vegetables fiber Fruits fiber	4 Quartiles/median Q1 (14.4) Q2 (18.2), Q3 (22.2), Q4 (28.9)	Good

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Table 1 (continued)

No	First Author/year	Study type	Country	Cohort name	F/U (Year)	Age range/mean age (at base line)	Sample size (n) Men (%)	Population	Outcomes (Causes and Number of death)	Dietary assessment method	Fiber types	Dietary fiber categories (g/day)	Quality score
53	Streppel/2008	Prospective cohort	Netherland	Zutphen Study	40	>30 Mean = 49	1373 (100%Men)	Nationally representative	All cause = 1130 CHD = 348	In person interview	Total fiber Cereal fiber Potatoes fiber Legums fiber Vegetables fiber Fruits fiber	Per 10 gr/d increment	Good
54	Threapleton/2013	Prospective cohort	United Kingdom	United Kingdom Women's Cohort Study (UKWCS).	14.3	Mean = 51.8	31036 (0 % Men)	no CVD no stroke no heart attacks	All CVD = 258 (Stroke = 130 - CHD = 128)	FFQ	NSP fiber, AOAC fiber, Soluble fiber, Insoluble fiber, nuts, seeds fiber, Legume fiber, Vegetable fiber, Fruit fiber, breakfast cereals fiber, Total cereal fiber	Quintiles	Good
55	Ward/2016	Prospective cohort	Sweden, Denmark, Norway, Netherland,UK, France, German, Spain, Italy, Greece	(EPIC) cohort,	4.1	25–70	3789 (42.3 % men)	Unhealthy patients with colorectal cancer	All cause = 1262 Colorectal cancer = 1008	FFQ	Total fiber	4 Quartiles/Q1 (14.5) Q2 (19.5), Q3 (24.1), Q4 (31.2)	Good
56	Wolk/1999	Prospective cohort	United States	(NHS)/until 1994	10	37–64	68782 (0 % Men)	Women no CVD, no,hyperchlosterolemia no, diabetes (Healthy)	CHD = 162	FFQ	Total fiber	5 Quintile/Q1 (11.5) Q2 (14.3), Q3 (16.4), Q4 (18.8), Q5 (22.9)	Good
57	Xu/2014	Prospective cohort	Sweden	Uppsala Longitudinal Study of Adult Men (ULSAM)	10	69.5–71.9 Mean = 70.9	1110 (100 % Men) GFR>60 = 604 GFR<60 = 506	Nationally representative	All cause = 300 (GFR>60 = 132 GFR<60 = 168) CVD = 138 (GFR>60 = 49 GFR<60 = 168) Cancer = 111 (GFR>60 = 56 GFR<60 = 55) infectious = 19 other causes = 33	7 day record of Validated precoded menu book	Total fiber	4 Quartiles/Q1 (4.8, 14.5) Q2 (0.14.5, 16.8) Q3 (0.16.8, 19.2) Q4 (0.19.2, 34.7)	Good
58	Xu/2019	Prospective cohort	China	a prospective cohort at the PD centre of Peking University First Hospital.	3.75	Mean = 57.7	881 (49.3 %Men)	Patients on peritoneal dialysis (PD)	All cause = 434 CVD = 178 Infection = 107	3-d recall	Total fiber	Tertile of fibre intake/Low (<6.4 g/d) Middle (6.4–9.1 g/d) High (>9.1 g/d)	Good

以表格方式呈現  
納入的試驗結果

59	Xu/2022	Prospective Cohort	United States	Prostate, Lung, Colorectal, and Ovarian Cancer (PLCO) Screening Trial	17.1	Mean = 62.1	86642 (54.20 % Men)	No cancer, no heart disease, no stroke, no diabetes (Healthy)	All-cause = 17536 CVD = 4842 Cancer = 5760	Dietary History Questionnaire (DHQ)	Total fiber, Insoluble fiber, Soluble fiber	Total: Q1 (<11.12) Q2 (≥11.12 to < 14.71) Q3 (≥14.71 to < 18.41) Q4 (≥18.41 to < 23.75) Q5 (≥23.75)	Good
60	You/2022	Prospective Cohort	Malaysia	Longitudinal Study on Neuroprotective Model for Healthy Longevity (LRGS TUA) cohort	5	>60	2322/(47.97 % Men)	Nationally representative	All cause = 336	3-Day record Dietary history questionnaire	Total fiber	Alive vs Dead (Total fibre (g/day) 3.98 (2.44) vs 3.21 (1.94) p < 0.001 *)	Good
61	Zeng/2022	Prospective cohort	United States	NHANES survey/2001–2014	7.1	20–85 Mean = 46	35692	No cancer, No CVD, Healthy individuals	All cause = 3854 CVD = 783 Cancer = 884	24-h dietary recall	Total fiber	4 Quartiles/Q1 (4.3), Q2 (6.5), Q3 (8.7), Q4 (12.6)	Good
62	Zhang/2022	Retrospective Cohort	United States	Survey (NHANES) 2003–2014	5.8	>65 (mean = 74.1)	4906/(48.4 % Men)	Adults with hypertension	All cause = 1369 CVD = 270	24-h dietary recall	Total fiber	4 Quartiles/Q1 (<10.2), Q2 (10.2–14.45), Q3 (14.45–19.85), Q4 (>19.85)	Good
63	Zhang/2022	Prospective Cohort	China	China Nutrition and Health Database (CHNS)/until 2015	11	>18	8307/(39.2 % Men)	No CVD – No Cancer/ Nationally representative	All cause = 468	3-day recall	Total fiber, Whole Grain fiber, Legumes fiber Vegetable fiber, Fruit fiber	4 Quartiles/Q1 (<6.21) Q2 (6.21–8.81) Q3 (8.81–13.50) Q4 (>13.50)	Good
64	Zhao/2022	prospective cohort	Canada	The Newfoundland Familial Colorectal Cancer Study (NFCCS)/until 2010	6.4	20–75 Mean = 60.9	504/(60.71 % Men)	CRC patients	All cause = 159 (f = 53/m = 106) CRC-specific = 83 (f = 29/m = 54)	FFQ	Total fiber	4 Quartiles/Mean (g/day) Q1 = 14.17 Q2 = 19.74 Q3 = 24.15 Q4 = 30.35	Good

# All-Cause Mortality

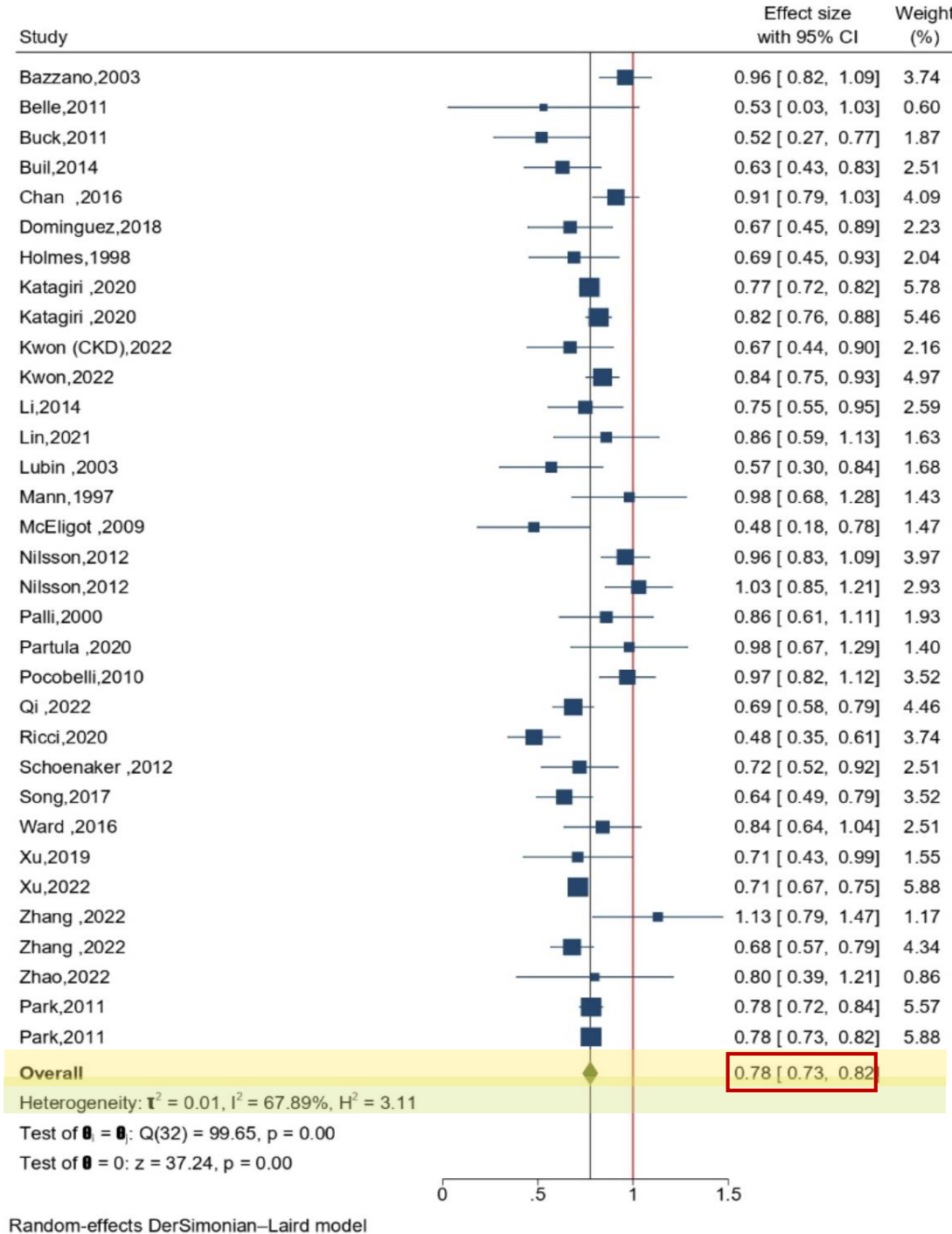
T-作者是否以表格和圖表「總結」(total up) 試驗結果?

應該用至少 1 個摘要表格呈現所納入的試驗結果



結果相近，可針對結果進行統合分析(meta-analysis)，並以「森林圖」(forest plot)呈現研究結果，最好再加上異質性分析。

評讀結果: 是 否 不清楚



Supplementary Figure 1-A: The included studies' pooled (overall) and reported associations with all-cause mortality. (The black line represents the overall effect size and the red line represents null effect)

# CVD-Related Mortality

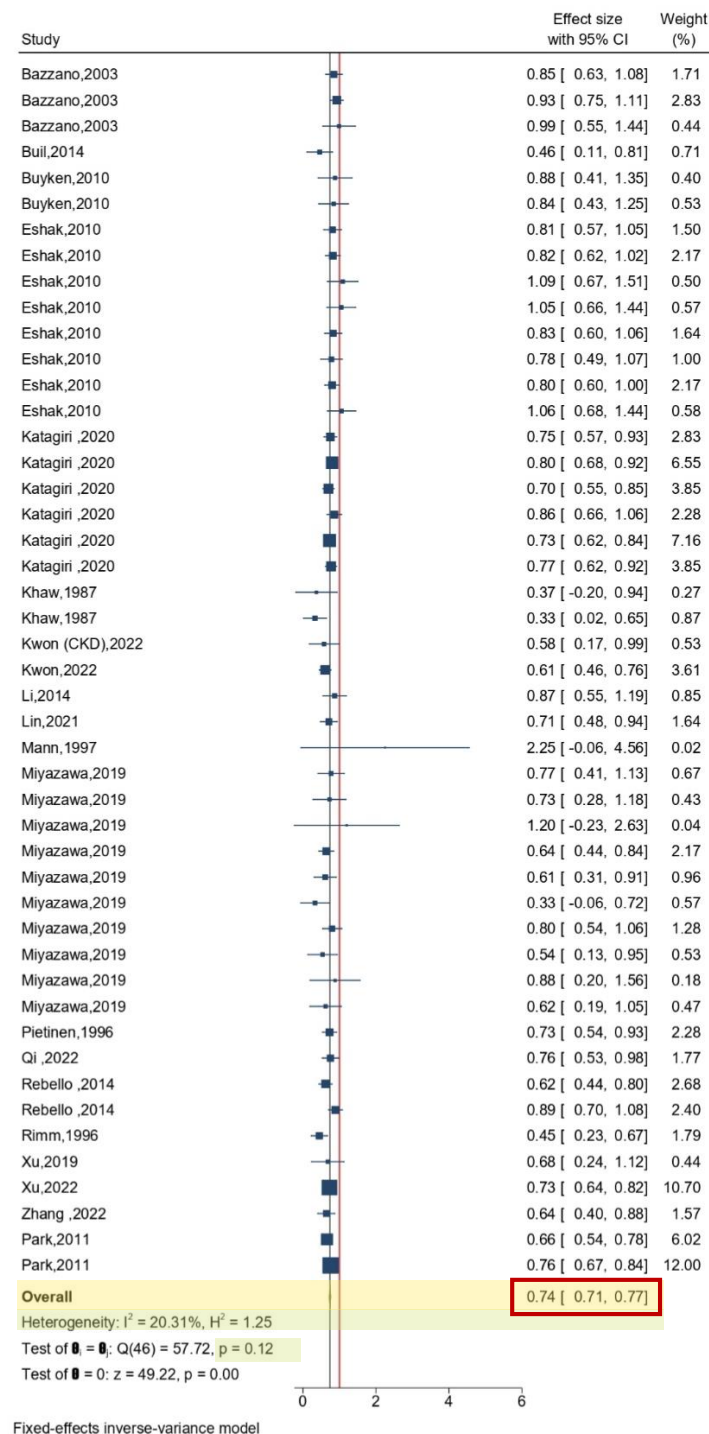
T-作者是否以表格和圖表「總結」(total up) 試驗結果?

應該用至少 1 個摘要表格呈現所納入的試驗結果



結果相近，可針對結果進行統合分析(meta-analysis)，並以「森林圖」(forest plot)呈現研究結果，最好再加上異質性分析。

評讀結果: 是 否 不清楚



Supplementary Figure 1-B: The included studies' pooled (overall) and reported associations with all-cause CVD-related mortality. (The black line represents the overall effect size and the red line represents null effect)

# Malignancy-Related Mortality

T-作者是否以表格和圖表「總結」(total up) 試驗結果?

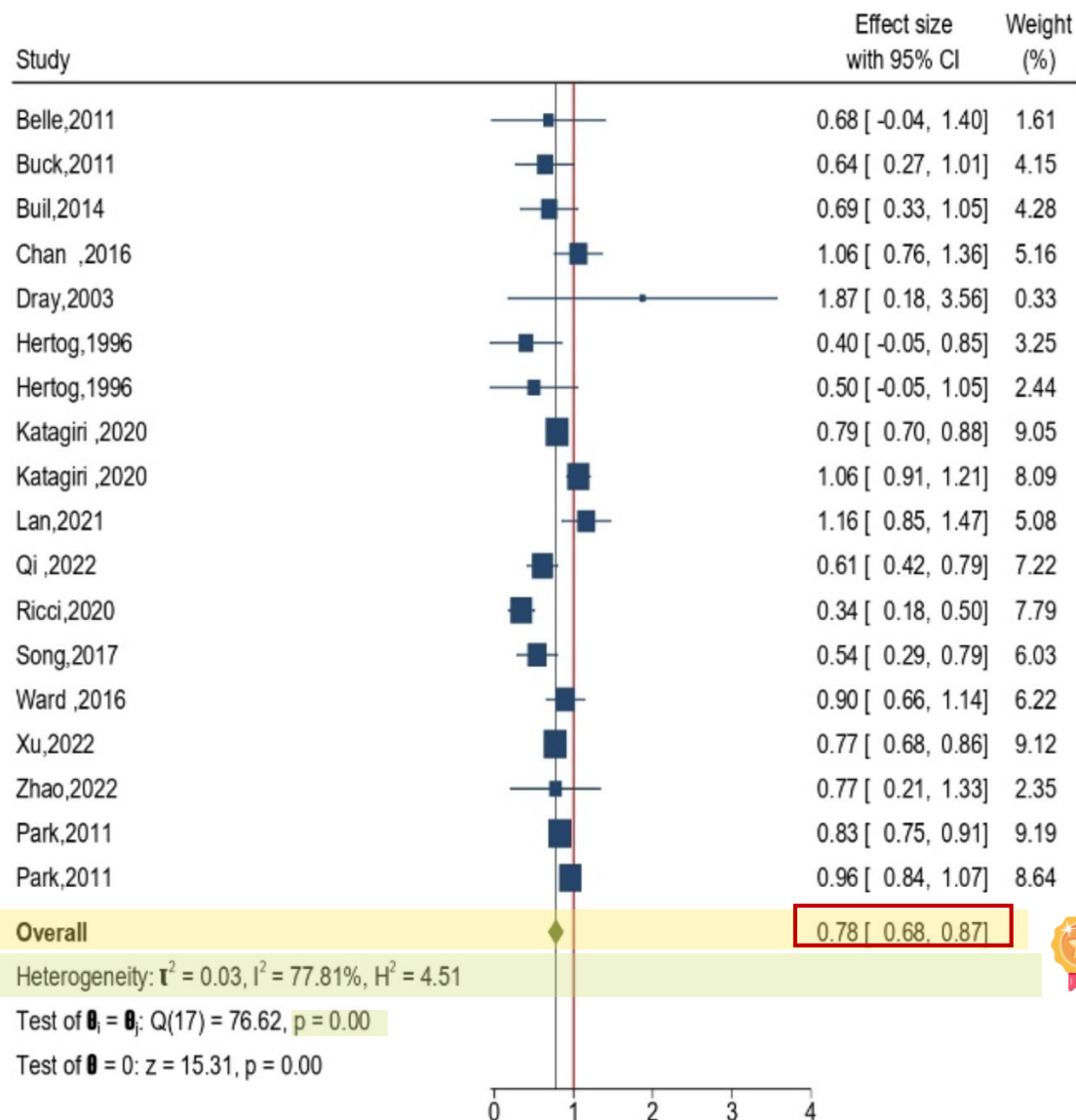
應該用至少 1 個摘要表格呈現所納入的試驗結果

✓

結果相近，可針對結果進行統合分析(meta-analysis)，並以「森林圖」(forest plot)呈現研究結果，最好再加上異質性分析。

✓

評讀結果: 是 否 不清楚



Random-effects DerSimonian-Laird model

Supplementary Figure 1-C: The included studies' pooled (overall) and reported associations with malignancy-related mortality. (The black line represents the overall effect size and the red line represents null effect)

## Step 2 : 系統性文獻回顧的品質如何?(FAITH)

### H-試驗的結果是否相近-異質性 (Heterogeneity) ?

在理想情況下，各個試驗的結果應相近或具同質性，若具有異質性，作者應評估差異是否顯著 (卡方檢定)。

根據每篇個別研究中不同的 PICO 及研究方法，探討造成異質性的原因。

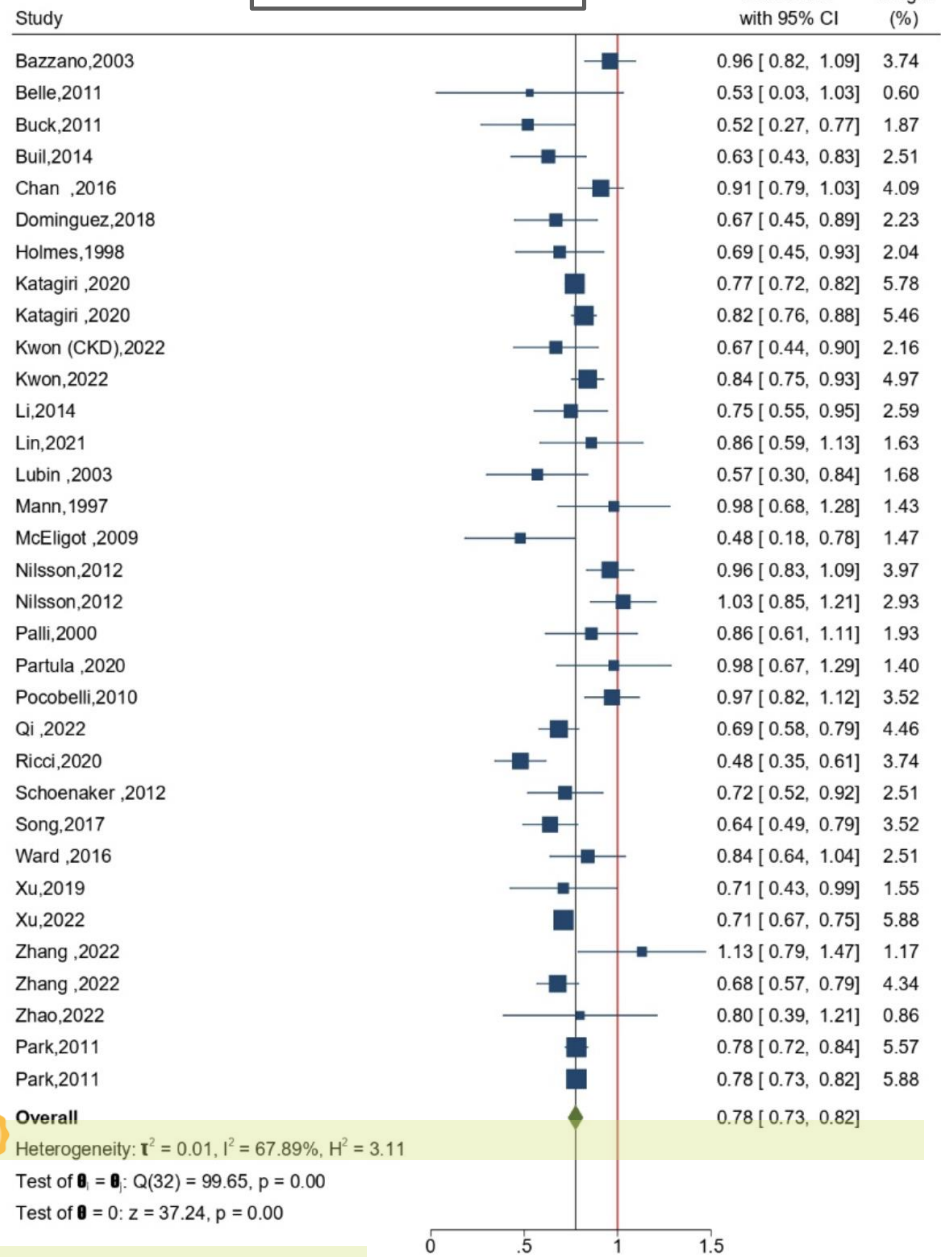
評讀結果: 是 否 不清楚

#### 2.5. Statistical analysis

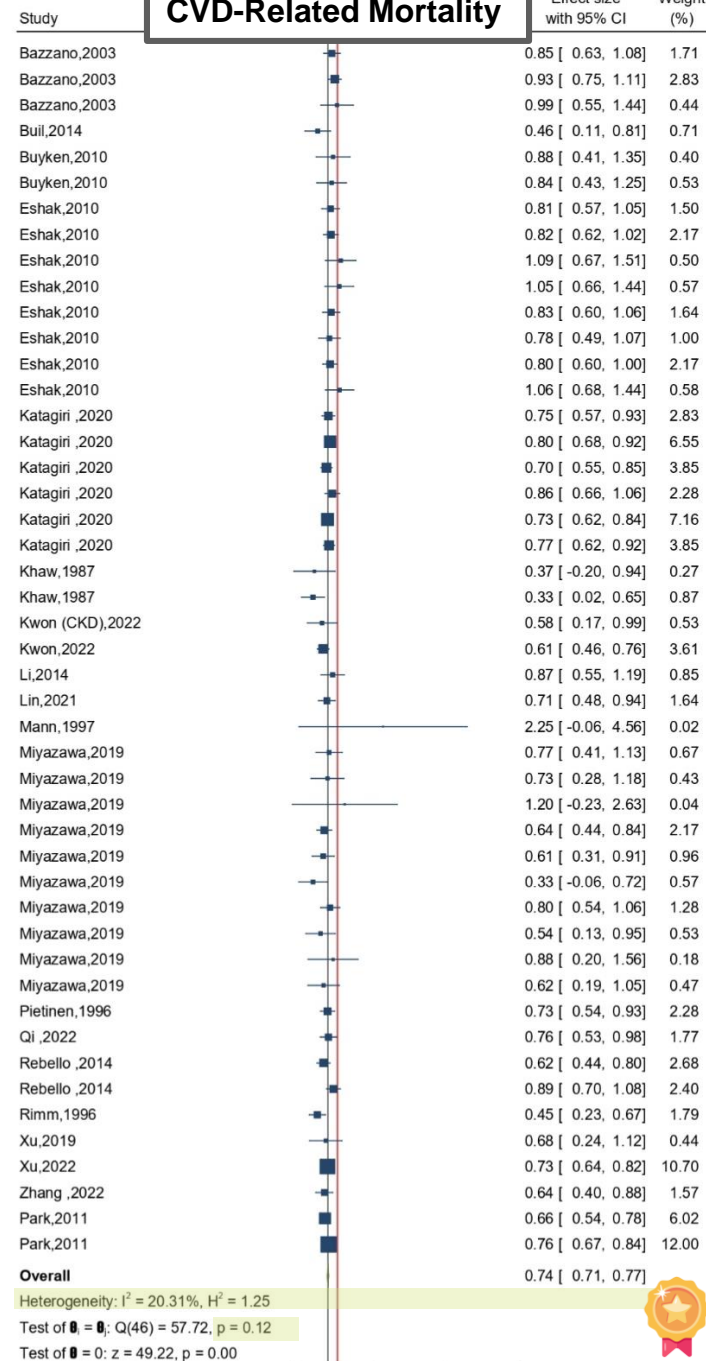
The I squared ( $I^2$ ) and Cochran's Q tests were used to assess the heterogeneity between the studies and in cases of significant heterogeneity (P-value <0.1 or  $I^2$  > 50 %), a random-effect model (DerSimonian and Laird model) was used for analyses; otherwise, a fixed-effect model was adapted [26]. Only the categorical HRs or RRs (for the highest category to the lowest category of fiber intake) of the included studies were pooled as an effect size for assessing the association of dietary fiber intake with mortality, and hazard ratios for continuous fiber intake were removed from the analysis. Meta-analysis was performed for outcomes with at least three observations within the studies. Sub-group analysis was performed for all-cause, CVD, and malignancy-related mortalities (stratified by sex, baseline general health status of study population, dietary assessment, and dietary fiber). Egger's test and funnel plots were used for publication bias assessment for each all-cause, CVD, and malignancy-related mortalities, and trim-fill analysis was performed if publication bias was present. To assess possible causes of heterogeneity among studies, Meta-Regression and sensitivity analysis were performed. STATA (Stata Corporation, College Station, Texas, USA) version 17 was used to analyze the data.



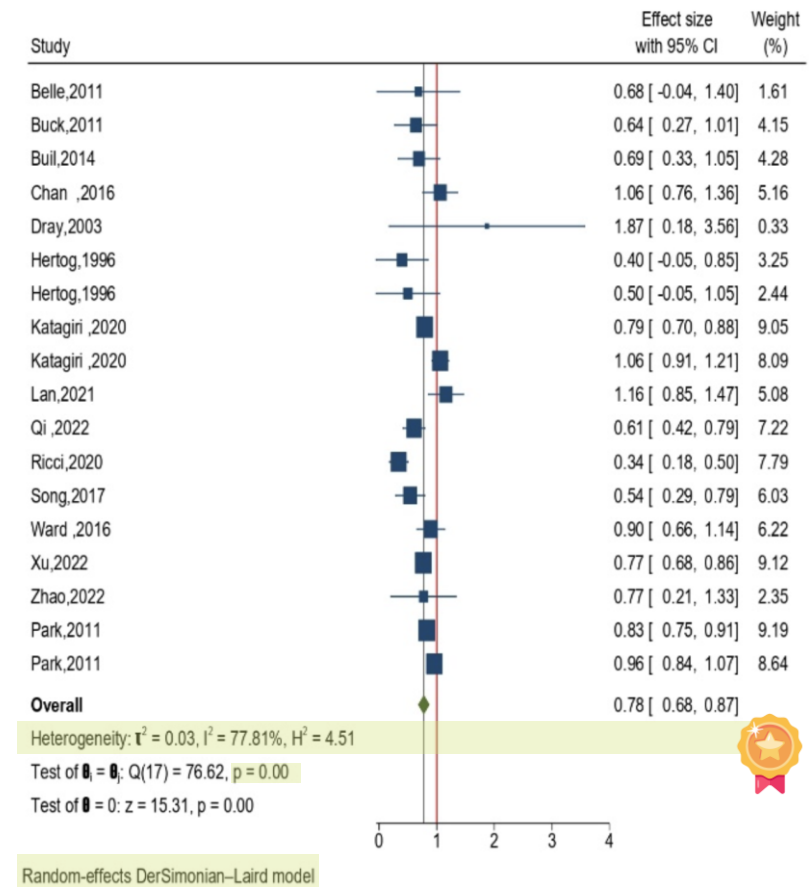
## All-Cause Mortality



## CVD-Related Mortality



## Malignancy-Related Mortality



## Step 2 : 系統性文獻回顧的品質如何?(FAITH)



### H-試驗的結果是否相近-異質性 (Heterogeneity) ?

在理想情況下，各個試驗的結果應相近或具同質性，若具有異質性，作者應評估差異是否顯著 (卡方檢定)。



根據每篇個別研究中不同的 PICO 及研究方法，探討造成異質性的原因。

評讀結果: 是 否 不清楚

Outcome	I <sup>2</sup>	HR (95%CI)	Risk reduction
 All-cause mortality	67.9%	0.77	↓23%
CVD mortality	20%	0.74	↓26%
 Malignancy-related mortality	77.8%	0.78	↓22%

#### I<sup>2</sup> statistic interpretation

- 0–25%: low heterogeneity
- 25–50%: moderate heterogeneity
- 50–75%: **substantial heterogeneity**
- >75%: considerable heterogeneity

# Step 2 : 系統性文獻回顧的品質如何?(FAITH)

## H-試驗的結果是否相近-異質性 (Heterogeneity) ?

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根據每篇個別研究中不同的 PICO 及研究方法，探討造成異質性的原因。



評讀結果: 是 否 不清楚

### 2.5. Statistical analysis

The I squared ( $I^2$ ) and Cochran's Q tests were used to assess the heterogeneity between the studies and in cases of significant heterogeneity (P-value <0.1 or  $I^2 > 50\%$ ), a random-effect model (DerSimonian and Laird model) was used for analyses; otherwise, a fixed-effect model was adapted [26]. Only the categorical HRs or RRs (for the highest category to the lowest category of fiber intake) of the included studies were pooled as an effect size for assessing the association of dietary fiber intake with mortality, and hazard ratios for continuous fiber intake were removed from the analysis. Meta-analysis was performed for outcomes with at least three observations within the studies. Sub-group analysis was performed for all-cause, CVD, and malignancy-related mortalities (stratified by sex, baseline general health status of study population, dietary assessment, and dietary fiber). Egger's test and funnel plots were used for publication bias assessment for each all-cause, CVD, and malignancy-related mortalities, and trim-fill analysis was performed if publication bias was present. To assess possible causes of heterogeneity among studies, Meta-Regression and sensitivity analysis were performed. STATA (Stata Corporation, College Station, Texas, USA) version 17 was used to analyze the data.

Meta-regression

Sensitivity analysis



# Meta-regression

Supplementary Table 2: Meta-Regression Table for

## All-Cause Mortality

Random-effects meta-regression Method: DerSimonian-Laird						Number of obs = 17	
						Residual heterogeneity:	
						tau2 = .004621	
						I2 (%) = 35.01	
						H2 = 1.54	
						R-squared (%) = 55.48	
						Wald chi2(5) = 12.67	
						Prob > chi2 = 0.0267	
_meta_es	Coefficient	Std. err.	z	P> z	[95% conf. interval]		
Sex	.0464083	.0441201	1.05	0.293	-.0400655	.132882	
MeanAge	-.0030304	.0028408	-1.07	0.286	-.0085982	.0025375	
Population	-.1978936	.0777998	-2.54	0.011	-.3503785	-.0454087	
followTime	-.0151504	.0089317	-1.70	0.090	-.0326562	.0023555	
DietaryAssessment	.0212832	.0476346	0.45	0.655	-.0720789	.1146454	
_cons	1.26983	.198942	6.38	0.000	.879911	1.659749	

Test of residual homogeneity: Q\_res = chi2(11) = 16.93 Prob > Q\_res = 0.1101



Supplementary Table 4: Meta-Regression Table for

## Malignancy-Related Mortality

Fixed-effects meta-regression Method: Inverse-variance						Number of obs = 9	
						Wald chi2(5) = 14.51	
						Prob > chi2 = 0.0127	
_meta_es	Coefficient	Std. err.	z	P> z	[95% conf. interval]		
Sex	-.1000682	.1714284	-0.58	0.559	-.4360618	.2359253	
MeanAge	-.0108196	.0092013	-1.18	0.240	-.0288539	.0072147	
Population	-.6643139	.2477161	-2.68	0.007	-1.149829	-.1787992	
followTime	-.1339029	.0727586	-1.84	0.066	-.2765072	.0087014	
DietaryAssessment	.3663593	.2924824	1.25	0.210	-.2068957	.9396144	
_cons	3.397769	.9474094	3.59	0.000	1.540881	5.254657	



Supplementary Table 3: Meta-Regression Table for

## CVD-Related Mortality

Effect-size label: Effect size						Number of obs = 15	
Effect size: HR						Wald chi2(5) = 2.21	
Std. err.: _meta_se						Prob > chi2 = 0.8190	
Fixed-effects meta-regression Method: Inverse-variance							
_meta_es	Coefficient	Std. err.	z	P> z	[95% conf. interval]		
Sex	-.0338153	.0904337	-0.37	0.708	-.211062	.1434315	
MeanAge	-.001995	.0073267	-0.27	0.785	-.0163552	.0123651	
Population	-.0306205	.1757601	-0.17	0.862	-.3751039	.313863	
followTime	-.0057722	.0170562	-0.34	0.735	-.0392018	.0276574	
DietaryAssessment	.0881768	.0883192	1.00	0.318	-.0849256	.2612792	
_cons	.7493884	.4704909	1.59	0.111	-.1727568	1.671534	



## 研究結果為何？

1. 膳食纖維攝取越高，全因死亡風險越低
2. **不溶性纖維** 比 可溶性纖維 更能降低死亡風險尤其對 **癌症相關死亡** 的保護效果顯著較強
3. 膳食纖維對於已有健康問題的族群，其保護效果更為顯著（例如慢性病患者）

# 問題討論

在衛教一般的民眾，您是否會進一步強調其「來源與品質（全穀、未精緻）」和膳食纖維之關係與重要性？

同意

12票

需更多  
研究

不同意



# THANKS







# 6. 補充資料

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**Table 1**  
Main characteristics of cohort studies examined the association of fiber intake with mortalities.

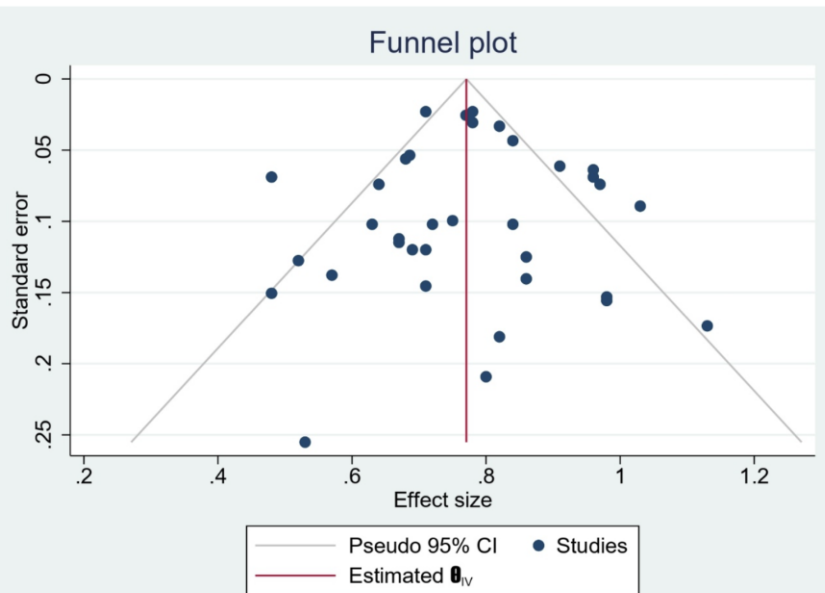
No	First Author/year	Study type	Country	Cohort name	F/U (Year)	Age range/mean age (at base line)	Sample size (n) Men (%)	Population	Outcomes (Causes and Number of death)	Dietary assessment method	Fiber types	Dietary fiber categories (g/day)	Quality score
1	Akbaraly/2011	Cohort	United kingdom	Whitehall II cohort study	18	39–63 Mean = 49.5	7319/(69.7 % men)	Nationally representative	All cause = 534 Cancer = 259 CVD = 141 (CHD = 74/stroke = 28) Non-cancer non-CVD = 127 Missing deaths = 7	Semi-quantitative FFQ	Total fiber	with each increase of 1 SD of component score.	Good
2	Baer/2010	Prospective Cohort	United States	the Nurses' Health Study (NHS)	18	30–55 Mean = 52.5	50112/(0 % Men)	Female nurses, No CVD - No cancer (Healthy)	All cause = 4893 CVD = 1026 Smoking related cancer = 931 Cancers not related to Smoking = 1430 All other causes = 1506	Semi-quantitative FFQ	Cereal fiber, (energy adjusted)	Per 4 g, energy adjusted	Good
3	Bazzano/2003	Prospective Cohort	United States	(NHANES 1) survey 1	19	25–74	9776/(38.3 % Men)	Civilian – No CVD (Healthy)	All cause = 2632 (Q4 = 740) CVD = 1198 (Q4 = 344) Stroke = 233 (Q4 = 67) CHD = 668 (Q4 = 192)	Standardized protocol used (24-h dietary recall)	Total fiber Soluble fiber	4 Quartile - Total fiber Q 1 (<7.7) Q2 (7.7–11) Q3 (11.1–15.9) Q4 (>15.9) 4 Quartile - soluble fiber Q1 (<1.3) Q2 (1.3–2.3) Q3 (2.4–4) Q4 (>4)	Good
4	Belle/2011	Prospective Cohort	United States	Health, Eating, Activity, and Lifestyle (HEAL) study	6.7	>18 Mean = 55.3	688/(0 % Men)	Women with breast cancer stage 0–3A survivors	All cause = 106 Breast cancer = 83	FFQ	Total fiber	4 Quartiles/Q1 (<8.8) Q2 (8.8–12.8) Q3 (12.8–18.3) Q4 (>18.3)	Good
5	Buck/2011	Prospective Cohort	Germany	two German study regions (Hamburg and Rhein-Neckar-Karlsruhe (RNK))	6.4	50–74	2653/(0 % Men)	Postmenopausal women with diagnosed breast cancer	All cause = 321 Breast cancer = 235	FFQ	Total fiber	5 Quintiles/Q1 (13.3) Q2 (16.9), Q3 (19.9), Q4 (23.2), Q5 (28.9)	Good
6	Buil-Cosiales/2014	Prospective Cohort	Spain	Prevencio'n con Dieta Mediterranea (PREDIMED) trial,	5.9	55–75 m/60–75 f/	7216/(43 % Men)	No CVD + T2DM or 3 CVD risk factor	All cause = 425 Cancer = 169 No cancer no CVD death = 153 CVD = 103	Validated FFQ	Total fiber	5 Quintile (medians) Q1 = 17, Q2 = 21, Q3 = 24, Q4 = 28, Q5 = 35	Good
46	Rebello/2014	Prospective cohort	Singapore and China	The Singapore Chinese Health Study cohort	15	45–74	53469 (43.9 % Men)	no (cancer, heart attack or angina, stroke, or diabetes.) Healthy	IHD = 1660 (m = 1022/f = 638)	semi-quantitative FFQ	Total fiber	5 Quintiles/men/Q1 = 7.83, Q2 = 10.40, Q3 = 12.13, Q4 = 14.18, Q5 = 17.77 5 Quintiles/Female/ Q1 = 8.50, Q2 = 10.46, Q3 = 12.15, Q4 = 14.18, Q5 = 17.81	Good
<b>非差異性分類偏差 ( non-differential misclassification )</b>													
47	Ricci/2020	Prospective cohort	United States	NHANES surveys (1999–2014)	5.7	>18	2371 (46.86 % Men)	Cancer survivors	All cause = 532 Cancer = 180	24-h dietary recall	Total fiber	Tertile	Good
48	Ricci/2020	Prospective cohort	United States	NHANES surveys (1999–2014)	5.6	Median = 69	2473 (55.7 % men)	Nationally representative	All cause = 761 CVD = 199 CHD = 229	24 h dietary recall interview	Total fiber	T1= (<11·93 g),T2&T3 (18·9–52·39)	Good
49	Rimm/1996	Prospective cohort	United States	The Health Professionals Follow-up Study (HPFS)	6	40–75	43757 (100%Men)	Healthy male health professional, No CVD No DM		Dietary Questionnaire	Energy adjusted total fiber	5 Quintile/median Q1 (12.4) Q2 (16.6), Q3 (19.6), Q4 (23.0), Q5 (28.9)	Good
50	Schoenaker/2012	Prospective cohort	Europe	The EURODIAB Prospective Complications Study (PCS)	7.4	15–60 Mean = 32.07	2108 (51 %Men)	Individuals with type 1 diabetes mellitus free of CVD at baseline	All cause = 46	3 days dietary record	Total fiber Soluble fiber Insoluble fiber	Tertiles/mean/T1 = 13.4 T2 = 18.6 T3 = 25.2	Good
51	Skiba/2019	Prospective cohort	United States	Women's Health Initiative (WHI) study.	15.4	Mean = 63.2	160195 (0 % Men)	Post menopausal women without history of colorectal cancer	All cause = 35746 Colorectal cancer = 841	Questionnaire	Prebiotic supplement fiber type (soluble, insoluble)	Probiotic supplement yes or no	Good
52	Song/2017	Prospective cohort	United States	(NHS) and (HPFS)	8	30–75 Mean = 68.6	1575 (38.9 % Men)	Health care professionals with stage I-III colorectal cancer	All cause = 773 Colorectal cancer = 174	FFQ	Total fiber Cereal fiber Vegetables fiber Fruits fiber	4 Quartiles/median Q1 (14.4) Q2 (18.2), Q3 (22.2), Q4 (28.9)	Good

(continued on next page)

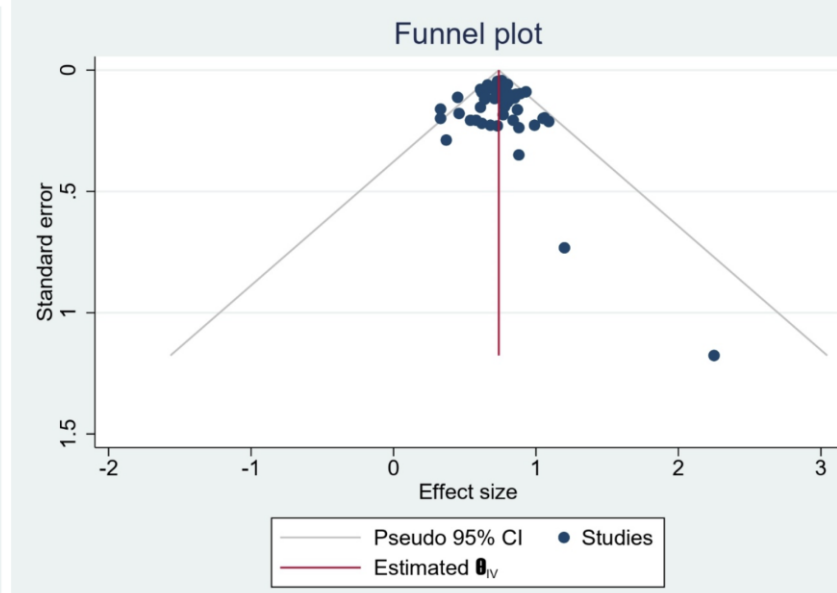
# Publication bias

- Based on **Egger's test**, **no publication bias** was seen across studies assessing all-cause and CVD and malignancy-related mortalities
- Three studies were imputed in **all-cause mortality** records in which the HR changed from **HR:0.77 95%CI (0.73,82) to HR:80 95%CI (0.75,84)** indicating that the findings of the analyses were not substantially affected by publication bias

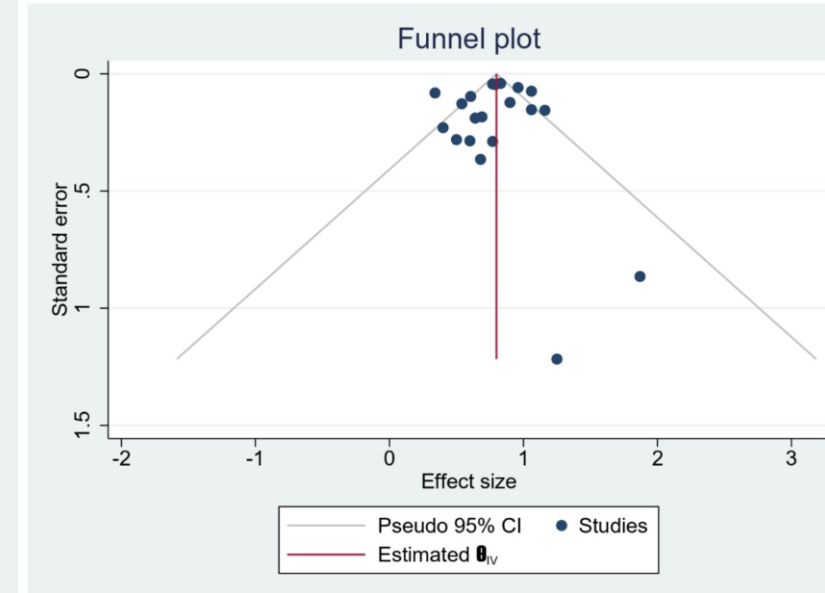
## All-Cause Mortality



## CVD-Related Mortality



## Malignancy-Related Mortality



Supplementary Figure 2-A: Funnel plot for graphical diagnostics of small-study effects (All-cause Mortality)

Supplementary Figure 2-B: Funnel plot for graphical diagnostics of small-study effects (CVD-related Mortality)

Supplementary Figure 2-C: Funnel plot for graphical diagnostics of small-study effects (Cancer-related Mortality)