Supplementary Information

A global analysis of dairy consumption and incident cardiovascular disease

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Supplementary Methods

Description of meta-analysis methodology

We performed a systematic review and updated meta-analysis including UKB and CKB studies as well as previous prospective cohort studies which explored the relationship of dairy product intake with CVD risk in the general population. This meta-analysis was registered on the international prospective register (PROSPERO: CRD42021283876) and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement.¹ The systematic search of the PubMed, EMBASE databases, and Web of Science was conducted and updated to 12 November 2023. The Supplementary Table 2 shows the search strategy. Besides, reference lists of included studies were also screened to find potentially relevant studies. Inclusion criteria were shown as follows: observational studies with prospective design; assessing the association between dairy products consumption (total dairy, milk, yogurt, cheese, cream, or butter) and incidence of CVD (CHD, stroke, or total CVD); providing risk estimates and 95% CIs for the final models; available description of covariables in the statistical models.

Two reviewers independently extracted the data from the eligible articles, including cohort name, first author, year of publication, location, follow-up duration, number of participants, age range, dairy types, methods for dietary assessment, outcome, approach for outcome ascertainment, number of cases, dairy product intake categories, relative risks (RRs) (95% CIs) and potential confounders in the fully adjusted models. Disagreements were resolved by a third reviewer who checked and consolidated the data. The quality of included studies was assessed by the Newcastle-Ottawa scale.² For each type of dairy product, a meta-analysis was conducted if more than 3 studies were selected. Low-fat dairy included low-fat milk, low-fat yogurt, low-fat cheese and low-fat ice cream. High-fat dairy included high-fat milk, high-fat yogurt, high-fat cheese, and cream or butter, which was

consistent with previous studies³⁻⁵. As the intake of low-fat cheese cannot be ignored in the UKB (Supplementary Fig. 1), we separately analyzed low-fat and high-fat cheese, categorizing them accordingly in analyses of low-fat and high-fat dairy products in meta-analysis. A random-effect model based on the DerSimonian and Laird method⁶ was applied to calculate summary RRs and 95% CIs comparing the highest with the lowest category of intake. If no significant heterogeneity was found, we also conducted a fixed-effect model to calculate summary HRs and 95% CIs comparing the highest with the lowest category. For dose-response meta-analysis, standard serving sizes were applied to each type of dairy product according to the definition in primary studies. In terms of dairy consumption, the median or midpoint of the lower and upper bounds were assigned to each category. If the lower or upper bound was not reported, we estimated it by multiplying the upper bound by 0.5 for the lowest category and the lower bound by 1.75 for the highest category.⁷ When studies only reported RRs and 95% CIs for CHD and stroke but not total CVD, we pooled it by using fixed effect meta-analysis. If studies reported results separately for sex or different cohorts, they were included as separate studies. The extent of heterogeneity was assessed by I^2 (ranging from 0% to 100%, >50%) indicates heterogeneity among studies, >80% indicates severe heterogeneity among studies) and Cochran's Q statistic test (significant at P < 0.10)^{8,9}. Potential publication bias was assessed using Begg's test, Egger's test, and visual funnel plot asymmetry. We assessed the confidence of evidence using the GRADE approach, categorizing it into four levels: very low, low, moderate, and high¹⁰⁻¹². All statistical analyses for the meta-analysis were conducted using Stata version 16.0 (StataCorp). Absolute risk values were calculated with GRADEpro software.



Total cheese intake=0.45 (servings/d)

Supplementary Figure 1. Consumption of different types of dairy products/cheese in the UK Biobank.

(A) Total dairy. (B) Cheese. Source data are provided as a Source Data file.

	СКВ					Uł	KB	
Sustitution	CVD			Sustitut	tion	CVD		
		HR (95% CI)	P value				HR (95% CI)	P value
for red meats	Hel	1.00 (0.98-1.01)	0.605	for red	meats	He I	0.98 (0.95-1.01)	0.135
for fish	e-I	1.02 (1.00-1.04)	0.127	for fish		H•-1	0.99 (0.94-1.03)	0.486
for poultry	⊢ e ⊣I	1.02 (0.98-1.05)	0.305	for pou	ltry	H•	0.98 (0.96-1.00)	0.066
for soybeans	Hel	1.00 (0.98-1.02)	0.721	for legu	mes	H-1	1.00 (0.96-1.04)	0.940
for eggs	Hert	1.11 (1.08-1.13)	<0.001	for egg	5	He-I	0.99 (0.95-1.03)	0.511
	0.80 1.00 1.20				C	0.80 1.00 1.	20	
	IHD					CHD		
		HR (95% CI)	P value				HR (95% CI)	P value
for red meats	-	1.02 (1.00-1.04)	0.081	for red	meats	He I	0.98 (0.95-1.01)	0.226
for fish	Heri	1.04 (1.01-1.07)	0.006	for fish			1.00 (0.95-1.04)	0.840
for poultry	⊢ •1	1.04 (0.99-1.09)	0.098	for pou	ltry	H+	0.98 (0.96-1.01)	0.133
for soybeans	Hert	1.04 (1.01-1.06)	0.007	for legu	mes	⊢ +-1	1.00 (0.96-1.05)	0.862
for eggs	H=	1.13 (1.09-1.16)	<0.001	for egg	5	H - -1	0.99 (0.95-1.04)	0.673
	0.80 1.00 1.20				0	0.80 1.00 1.	20	
	Stroke					Stroke		
		HR (95% CI)	P value				HR (95% CI)	P value
for red meats	H•	0.98 (0.96-1.00)	0.042	for red	meats	Hell	0.99 (0.93-1.05)	0.703
for fish	H	1.00 (0.97-1.02)	0.815	for fish			0.93 (0.85-1.03)	0.154
for poultry	H + + +	1.00 (0.96-1.05)	0.994	for pou	ltry	H•-1	0.99 (0.94-1.04)	0.577
for soybeans	H#H	0.97 (0.95-1.00)	0.024	for legu	mes		0.99 (0.90-1.09)	0.892
for eggs	H++	1.09 (1.06-1.13)	<0.001	for egg	5		0.97 (0.89-1.06)	0.486
	0.80 1.00 1.20				C	0.80 1.00 1.	20	

Supplementary Figure 2. Statistical model-based hazard ratios and 95% confidence intervals for incident cardiovascular disease, coronary heart diseases, stroke associated with replacement of one serving per day of other major protein sources with one serving per day of dairy products in China Kadoorie Biobank and UK Biobank.

Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Multi-variable Cox proportional hazard model was used. The multi-variable model was adjusted for age, sex, study area, survey season, BMI, education, income, physical activity, smoking, alcohol drinking, history of hypertension, diabetes, family history of CVD, aspirin use, vitamins use, minerals use, and intake of red meat, fish, poultry, vegetables, fruits, and eggs in the China Kadoorie Biobank. The multi-variable model was adjusted for age, sex, centers, survey season, BMI, education, household income, physical activity, smoking, alcohol drinking, history of hypertension, diabetes, family history of CVD, aspirin use, vitamins use, minerals use, and intake of red meat, processed red meat, of red meat, processed red meat, oily fish, non-oily fish, poultry, vegetables, fruits, and eggs in the UK Biobank. CHD, coronary heart disease; CI, confidence interval; CKB, China Kadoorie Biobank; CVD, cardiovascular disease; HR, hazard ratio; UKB, UK Biobank. Source data are provided as a Source Data file.



Supplementary Figure 3. Flow chart for participated study selection in the meta-analysis.

Crown and Study	Cooco/N		% Waiabt
Group and Study	Cases/N	HR (95% CI)	weight
CHD			
Sabita S. Soedamah-Muthu 2013	323/4255	0.95 (0.81, 1.11)	0.63
Emma Patterson 2013	1392/33 636	0.97 (0.94, 1.00)	6.94
Timothy J. Key 2019	7198/409 885		6.97
Adam M. Bernstein 2012	4030/127 160	0.97 (0.95, 1.01)	6.90
Timo T. Koskinen 2018	472/1981	0.99 (0.93, 1.06)	2.96
Adam M. Bernstein 2010	3162/84 136	1.02 (1.00, 1.05)	8.27
Subgroup, DL (I ² = 59.5%, p = 0.030))	0.99 (0.96, 1.01)	32.67
Stroke			
Tammy Y N Tong 2020	7378/418 329	0.93 (0.90, 0.96)	6.08
Susanna C Larsson 2009	3281/26 556	0.99 (0.97, 1.01)	8.93
Susanna C. Larsson 2012	4089/74 961	0.99 (0.98, 1.01)	9.61
Subgroup, DL (I ² = 83.4%, p = 0.002))	0.97 (0.94, 1.00)	24.62
CVD			
Mahshid Dehohan 2018	5855/136 384	0.91 (0.87, 0.95)	5.09
Pan Zhuang 2022 (UKB)	12 132/183 446	-+- 0.97 (0.94, 0.99)	7.97
Matina Kouvari 2020	277/1885	0.97 (0.95, 0.99)	7.92
Laury Sellem 2021	1952/104 805	0.98 (0.93, 1.04)	3.81
Emily Sonestedt 2011	2520/26 445	• 0.99 (0.97, 1.00)	9.84
Amée M Buziau 2019	835/7679	0.99 (0.94, 1.06)	3.13
Jaike Praacman 2015	1131/4235	1.00 (0.96, 1.05)	4.88
Jing Guo 2022	904/1746	1.23 (0.76, 1.97)	0.07
Subgroup, DL (I ² = 57.4%, p = 0.021))	0.97 (0.95, 0.99)	42.71
Heterogeneity between groups: p = 0).673		
Overall, DL (l ² = 63.0%, p < 0.001)	I	0.98 (0.96, 0.99)	100.00
	5		

Supplementary Figure 4. Association of total dairy product consumption with CVD risk for 1 serving per day increase using random-effects meta-analysis.

Meta-analysis pooling of aggregate data using the random-effects inverse-variance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. UKB, UK Biobank. Source data are provided as a Source Data file.



Supplementary Figure 5. Dose-response of total dairy product consumption with CVD risk. (A) Cardiovascular disease. (B) Coronary heart disease. (C) Stroke. Solid line represents non-linear dose response and dotted lines represent 95% confidence interval. Source data are provided as a Source Data file.

А	Group and Study	Cases/N	HR (95% CI)	% Weight
	Excluding the UKB study			
	Timo T. Koskinen 2018	472/1981	0.74 (0.57, 0.97)	0.68
	Amée M. Buziau 2019	835/7679	0.83 (0.69, 1.00)	1.32
	Tammy V N Tong 2020	7378/418 329	0.83 (0.73, 0.54)	7.45
	Timothy J. Key 2019	7198/409 885	0.89 (0.84, 0.94)	7.33
	Mahshid Dehghan 2018	4623/109 976	0.91 (0.80, 1.03)	2.54
	Susanna C. Larsson 2012	4089/74 961	0.91 (0.81, 1.01)	3.18
	Shupming Zhang 2022	4261/20 499	0.96 (0.83, 1.06)	10.85
	Matina Kouvari 2020	277/1885	· · · 0.97 (0.95, 0.99)	11.63
	Sabita S. Soedamah-Muthu 2013	323/4255	0.97 (0.73, 1.28)	0.61
	Thanasis G. Tektonidis 2015	4289/32 921	0.97 (0.89, 1.06)	4.47
	Ingegerd Johansson 2018 M	0200/40 041 4139/35 892		3.61
	Geertie W. Dalmeijer 2013	2179/33 625	0.98 (0.94, 1.03)	8.88
	Laury Sellem 2021	1952/104 805	1.00 (0.88, 1.13)	2.61
	Susanna C. Larsson 2009	3281/26 556	1.00 (0.92, 1.09)	4.57
	Erika Olsson 2022 (COSM)	5596/43 726		4.82
	Jaike Praagman 2015 Elisea E. Avalos 2012 W	229/1008	1.04 (0.30, 1.21)	0.52
	Louise H. Dekker 2019	1490/78 760	1.09 (0.83, 1.43)	0.65
	Jing Guo 2022	904/1746	1.15 (0.94, 1.41)	1.12
	Elisea E. Avalos 2012 M	222/751	1.21 (0.90, 1.62)	0.57
	Subgroup, DL (I ² = 45.7%, p = 0	.009)	0.96 (0.93, 0.98)	89.89
	The LIKB study			
	Pan Zhuang 2023 (UKB)	12 132/183 446	0.96 (0.93, 1.00)	10.11
	·,			
	Heterogeneity between groups: n =	0.728		
	Overall, DL (I ² = 43.4%, p = 0.01	3)	0.96 (0.94, 0.98)	100.00
		.5	1 2	%
R	Group and Study	Cases/N	HR (95% CI)	Weight
	Excluding the UKB study			
	Timo T. Koskinen 2018	472/1981	0.74 (0.57, 0.97)	1 33
	Emma Patterson 2013	1302/33 636	0.83 (0.53, 0.84)	1.00
	Enina Patterson 2013	1092/00 000	0.83 (0.75, 0.94)	4.09
	Laury Sellem 2021	1219/104 805	0.89 (0.75, 1.05)	3.07
	Timothy J. Key 2019	/198/409 885	0.89 (0.84, 0.94)	13.53
	Thanasis G. Tektonidis 2015	1109/32 921	0.93 (0.81, 1.06)	4.48
	Ingegerd Johansson 2018 W	1193/50 231	0.96 (0.85, 1.08)	5.43
	Shunming Zhang 2022	2409/20 499	0.97 (0.94, 1.01)	18.25
	Sabita S. Soedamah-Muthu 2013	3 323/4255	0.97 (0.73, 1.28)	1.20
	Ingegerd Johansson 2018 M	3102/48 341	0.98 (0.90, 1.06)	9.77
	Geertje W. Dalmeijer 2013	1648/33 625	1.00 (0.95, 1.05)	14.94
	Jaike Praagman 2015	567/4235	1.01 (0.82, 1.24)	2.13
	Jing Guo 2022	332/1746	1.05 (0.75, 1.47)	0.85
	Elisea E. Avalos 2012 W	229/1008	1.06 (0.78, 1.44)	1.03
	Louise H. Dekker 2019	325/78 760	1 10 (0 77 1 58)	0 75
	Elisea E Avalos 2012 M	222/751	1 21 (0 90, 1 62)	1 12
	Subgroup DI $(l^2 = 39.2\% \text{ p} = 0)$	060)		82.58
	Subgroup, DE (1 = 55.276, p = 5.		0.00 (0.01, 0.00)	02.00
	The LIKB study			
	Pan Zhuang 2023 (UKB)	10 088/183 446	0.98 (0.94, 1.02)	17.42
	() - to	- 0.245		
	Heterogeneity between groups: p	0 = 0.315		400.00
	Overall, DL (1" = 36.9%, p = 0.06	(9)	0.96 (0.93, 0.99)	100.00
		.5	1 2	%
\sim	Group and Study	Cases/N	HR (95% CI)	Weight
C				
	Excluding the UKB study			
	Emily Sonestedt 2011	1176/26 445	0.80 (0.68, 0.95)	3.08
	Laury Sellem 2021	878/104 805	0.81 (0.66, 0.98)	2.30
	Tammy Y. N. Tong 2020	7378/418 329	0.89 (0.84, 0.94)	12.80
	Susanna C Larsson 2012	4089/74 961	0.91 (0.81, 1.01)	5.94
	Coartie W. Dalmailer 2012	531/33 625	0.92 (0.83, 1.01)	6.99
	Geerije W. Daimeijei 2013	1193/50 231	0.93 (0.83, 1.03)	6.16
	Ingegerd Johansson 2018 W	4804/80 400	0.05 (0.04, 4.09)	44.40
	Shunming Zhang 2022	1821/20 499	0.95 (0.91, 1.00)	14.40
	Ingegerd Johansson 2018 M	2101/48 341	0.97 (0.88, 1.07)	7.16
	Erika Olsson 2022 (SMC)	4139/35 892	0.98 (0.89, 1.09)	6.69
	Susanna C. Larsson 2009	3281/26 556	1.00 (0.92, 1.09)	8.30
	Thanasis G. Tektonidis 2015	1532/32 921	1.01 (0.90, 1.13)	5.66
	Erika Olsson 2022 (COSM)	5596/43 726	1.03 (0.95, 1.12)	8.72
	Louise H. Dekker 2019	306/78 760	1.08 (0.71, 1.63)	0.57
	Jaike Praanman 2015	564/4235	1.08 (0.87, 1.34)	1.96
	Sumo Fragman 2010 Subarawa DL $t^2 = 40.000$	050)		90.70
	Subgroup, DL (1° = 40.3%, p = 0.	.059)	0.85 (0.92, 0.98)	00.70
	The LIKP study			
	The UKB study	2456/183 446		9.30
	Pan Zhuang 2023 (UKB)	2400 100 440	0.00 (0.00, 1.03)	0.00
	Heterogeneity between groups: p =	0.989		
	Overall, DL (I ² = 35.7%, p = 0.08	3)	0.95 (0.92, 0.98)	100.00

Supplementary Figure 6. Association of fermented dairy consumption with cardiovascular disease, coronary heart disease, and stroke risk for high compared with low intake using random-effects meta-analysis.

(A) Cardiovascular disease. (B) Coronary heart disease. (C) Stroke. Meta-analysis pooling of aggregate data using the random-effects inverse-variance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. M, men; W, women; UKB, UK Biobank. Source data are provided as a Source Data file.

А	Group and Study	Cases/N	HR (95% CI)	% Weight
	Excluding the UKB study			
	PC Elwood 2004	493/2403	• 0.71 (0.40, 1.26)	0.75
	Jing Guo 2022	332/1746	0.72 (0.50, 1.03)	1.79
	Ingegerd Johansson 2018 W	1193/50 231	0.92 (0.77, 1.10)	5.71
	Sabita S. Soedamah-Muthu 2013	323/4255	0.93 (0.71, 1.23)	2.91
	Helle K. M. Bergholdt 2015	1091/70 709	0.96 (0.86, 1.07)	10.18
	Timothy J. Key 2019	7198/409 885	0.97 (0.88, 1.06)	11.69
	Shunming Zhang 2022	2409/20 499	+ 1.00 (0.98, 1.02)	18.78
	Jaike Praagman 2015	567/4235	1.03 (0.82, 1.29)	3.99
	Elisea E. Avalos 2012 M	222/751	1.04 (0.82, 1.31)	3.85
	Laury Sellem 2021	1219/104 805	1.10 (0.93, 1.30)	6.23
	Emma Patterson 2013	1392/33 636	1.14 (0.95, 1.36)	5.66
	Timo T. Koskinen 2018	472/1981	1.16 (0.96, 1.40)	5.27
	Ingegerd Johansson 2018 M	1193/48 341	+ 1.23 (1.10, 1.37)	10,14
	Flisea E. Avalos 2012 W	229/1008	1,23 (0.94, 1.62)	2.97
	Subgroup, DL $(l^2 = 53.4\%, p = 0.0)$	9)	1.03 (0.98, 1.09)	89.92
)		
	The UKB study Pan Zhuang 2023 (UKB)	10 088/183 446	0.99 (0.89, 1.11)	10.08
	Heterogeneity between groups: p = 0 Overall, DL (l ² = 49.9%, p = 0.014)	.512	1.03 (0.98, 1.08)	100.00
			I I .5 1 2	0/
В	Group and Study	Cases/N	HR (95% CI)	% Weight
	Excluding the UKB study			
	Laury Sellem 2021	1219/104 805	0.87 (0.74, 1.02)	13.24
	Emma Patterson 2013	1392/33 636	0.89 (0.75, 1.05)	12.63
	Timethy I. Key 2010	7109/400 995	0.00 (0.84, 0.07)	21.64
	Timothy J. Key 2019	/ 190/409 000	0.90 (0.04, 0.97)	21.04
	Jing Guo 2022	332/1746	• 0.95 (0.58, 1.56)	2.58
	Jaike Praagman 2015	567/4235	1.11 (0.91, 1.35)	10.60
	Elisea E. Avalos 2012 M	222/751	1.20 (0.85, 1.68)	4.89
	Cabite C. Coodemah Muthu 2012	202//055	1.02 (0.02, 1.62)	6.60
	Sabila 5. Soedaman-Multitu 2015	52514255	· 1.20 (0.00, 1.00)	0.02
	Elisea E. Avalos 2012 W	229/1008	• 1.32 (0.90, 1.92)	4.11
	Subgroup, DL (l ² = 50.0%, p = 0.051)		0.99 (0.89, 1.10)	76.30
	The UKB study			00.70
	Pan Zhuang 2023 (UKB)	10 088/183 446	1.03 (0.56, 1.06)	23.70
	Heterogeneity between groups: p = 0.	497		
	Overall, DL (I ² = 60.7%, p = 0.009)		0.99 (0.91, 1.08)	100.00
		.5		%
С	Group and Study	Cases/N	HR (95% CI)	Weight
	Excluding the UKB study			
	Elisea E. Avalos 2012 W	229/1008	0.71 (0.43, 1.20)	0.96
	Emma Patterson 2013	1392/33 636	0.74 (0.60, 0.91)	5.23
	Sabita S. Soedamah-Muthu 2013	323/4255	0.82 (0.61, 1.09)	2.86
	Timothy J. Key 2019	7198/409 885	0.88 (0.80, 0.96)	18.03
	Emily Sonestedt 2011	1344/26 445	0.88 (0.74, 1.04)	7.38
	Jing Guo 2022	904/1746	0.92 (0.66, 1.29)	2.18
	Ingegerd Johansson 2018 W	1193/50 231	0.92 (0.78, 1.09)	7.59
	Laury Sellem 2021	1219/104 805	0.96 (0.81, 1.15)	7.03
	Jaike Praagman 2015	567/4235	1.01 (0.79. 1.30)	3.79
	Timo T. Koskinen 2018	472/1981	1.03 (0.78. 1.36)	3.10
	Ingegerd Johansson 2018 M	3102/48 341	1.03 (0 93 1 15)	14.94
	Louise H. Dekker 2019	325/78 774	110 (0 77 1 58)	1.91
	Elisea E. Avalos 2012 M	222/751	1 23 (0 70 2 18)	0.79
	Subgroup, DL ($I^2 = 17.8\%$, p = 0.20	54)	0.92 (0.87, 0.98)	75.80
	The UKB study			
	Pan Zhuang 2023 (UKB)	27 190/418 895	0.88 (0.82, 0.94)	24.20
	Heterogeneity between arouns: $p = 0$.285		
	Overall, DL (l ² = 18.6%, p = 0.251)		0.91 (0.87, 0.96)	100.00
			I I .5 1 2	

Supplementary Figure 7. Association of milk, yogurt, cheese consumption with coronary heart disease risk for high compared with low intake using random-effects meta-analysis.

(A) Milk. (B) Yogurt. (C) Cheese. Meta-analysis pooling of aggregate data using the random-effects inverse-variance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. M, men; W, women; UKB, UK Biobank. Source data are provided as a Source Data file.

A	Group and Study	Cases/N	HR (95% CI)	% Weight
	Excluding the UKB study			
	PC Elwood 2004	493/2403	• 0.66 (0.24, 1.81)	0.34
	Tammy Y.N. Tong 2020	7378/418 329	0.90 (0.84, 0.98)	17.13
	Jaike Praagman 2015	564/4235	0.91 (0.72, 1.15)	5.10
	Emily Sonestedt 2011	1176/26 445	• 0.91 (0.75, 1.09)	7.13
	Ingegerd Johansson 2018 W	1553/50 231	1.03 (0.88, 1.20)	9.14
	Erika Olsson 2022 (COSM)	5596/43 726	1.05 (0.97, 1.15)	16.12
	Susanna C Larsson 2009	3281/26 556	1.08 (1.00, 1.17)	16.60
	Erika Olsson 2022 (SMC)	4139/35 892	1.09 (0.88, 1.36)	5.71
	Ingegerd Johansson 2018 M	2101/48 341	1.10 (0.97, 1.26)	11.13
	Laury Sellem 2021	878/104 805	1.13 (0.92, 1.38)	6.35
	Subgroup, DL (I ² = 50.4%, p = 0	0.034)		94.74
	Pan Zhuang 2023 (UKB)	2456/183 446	0.99 (0.79, 1.25)	5.26
	Heterogeneity between groups:	p = 0.824		400.00
				100.00
_				%
В	Group and Study	Cases/N	HR (95% CI)	Weight
	Excluding the UKB study			
	Tammy Y.N. Tong 2020	7378/418 329	0.88 (0.81, 0.94)	27.18
	Laury Sellem 2021	878/104 805	0.92 (0.76, 1.12)	13.78
	Jaike Praaoman 2015	564/4235	110(090.134)	13 37
	Susanna C. Larsson 2009	3281/26 556	1.10 (0.98, 1.25)	21.22
	Subgroup, DL (l ² = 74.6%, p = 0	0.008)	0.99 (0.86, 1.13)	75.55
	The UKB study			
	Pan Zhuang 2023 (UKB)	2456/183 446	0.94 (0.85, 1.03)	24.45
	Heterogeneity between groups:	p = 0.560		
	Overall DI $(l^2 = 66.2\% \text{ p} = 0.0\%)$	10)	0.97 (0.88, 1.07)	100.00
	Overall, DE (1 - 00.2%, p - 0.0			100.00
		.5	1 2	%
С	Group and Study	Cases/N	HR (95% CI)	Weight
	Excluding the UKB study			
	Tammy Y.N. Tong 2020	7378/418 329		27.29
	Susanna C. Larsson 2012	4089/74 961	0.91 (0.81, 1.01)	15.47
	Susanna C. Larsson 2009	3281/26 556	0.91 (0.80, 1.02)	12.76
	Jaike Praagman 2015	564/4235	0.96 (0.75, 1.22)	3.18
	Emily Sonestedt 2011	1176/26 445	0.96 (0.80, 1.15)	5.72
	Ingegerd Johansson 2018 W	1553/50 231	0.98 (0.85, 1.14)	8.74
	Laury Sellem 2021	878/104 805	0.99 (0.80, 1.22)	4.23
	Ingegerd Johansson 2018 M	2101/48 341	• 1.03 (0.90, 1.17)	10.94
	Louise H. Dekker 2019	306/78 774	1.08 (0.71, 1.63)	1.09
	Subgroup, DL ($l^2 = 0.0\%$, p = 0.1	803)	0.94 (0.90, 0.98)	89.42
	The UKB study Pan Zhuang 2023 (UKB)	6933/418 895	0.97 (0.85, 1.11)	10.58
	Heterogeneity between groups:	p = 0.642		
	Overall, DL (l ² = 0.0%, p = 0.85	3)	0.94 (0.90, 0.98)	100.00
		.5	1 2	

Supplementary Figure 8. Association of milk, yogurt, cheese consumption with stroke risk for high compared with low intake using random-effects meta-analysis.

(A) Milk. (B) Yogurt. (C) Cheese. Meta-analysis pooling of aggregate data using the random-effects inverse-variance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. M, men; W, women; UKB, UK Biobank. Source data are provided as a Source Data file.

Group and Study	Cases/N	HR (95% CI)	/° Weiaht
Excluding the UKB study	Cuccom		
Jing Guo 2022	332/1746 -	0.82 (0.59, 1.1	6) 1.56
Emily Sonestedt 2011	1344/26 445	0.84 (0.71, 1.0	0) 5.34
Sabita S. Soedamah-Muthu 2	2013 323/4255	0.87 (0.67, 1.1	4) 2.45
Timo T. Koskinen 2018	472/1981	0.89 (0.74, 1.0	8) 4.51
Adam M. Bernstein 2010	3162/84 136	0.90 (0.80, 1.0	1) 9.70
Bernhard Haring 2014	1147/12 066	0.91 (0.74, 1.1	2) 3.84
Emma Patterson 2013	1392/33 636	0.97 (0.88, 1.0	7) 12.43
Laury Sellem 2021	1219/104 805	——— — 1.01 (0.85, 1.1	9) 5.50
Geertje W. Dalmeijer 2013	1648/33 625	1.01 (0.96, 1.0	6) 22.94
Elisea E. Avalos 2012 M	222/751	1.08 (0.78, 1.4	9) 1.69
Jaike Praagman 2015	567/4235	1.14 (0.93, 1.4	0) 3.93
Elisea E. Avalos 2012 W	229/1008	• 1.48 (1.02, 2.1	6) 1.28
Subgroup, DL (I ² = 35.9%, p	= 0.103)	0.97 (0.91, 1.0	2) 75.18
The UKB study			
Pan Zhuang 2023 (UKB)	28 076/42 9240	0.97 (0.93, 1.0	1) 24.82
Heterogeneity between grou	os: p = 0.960		
Overall, DL (l ² = 31.0%, p =	0.135)	0.97 (0.93, 1.0	1)100.00
	I		
	.5	1 2	%
Group and Study	Cases/N	HR (95% CI)	Weight
Excluding the UKB study			
Emily Sonestedt 2011	1176/26 445	0.76 (0.63, 0.91)	8.86
Susanna C. Larsson 2012	4089/74 961		13.85
Adam M. Bernstein 2012 W/	2633/84 010		11 35
Leury Collers 2021	2000/04 010		0.20
Laury Sellem 2021	878/104 805	0.94 (0.78, 1.15)	8.38
Geertje W. Dalmeijer 2013	531/33 625	0.94 (0.85, 1.03)	13.87
Adam M. Bernstein 2012 M	1397/43 150	0.94 (0.78, 1.12)	9.01
Susanna C. Larsson 2009	3281/26 556	• 1.04 (0.92, 1.18)	12.13
Jaike Praagman 2015	564/4235	1.05 (0.85, 1.30)	7.60
Subgroup, DL (l²= 32.7%, p	= 0.167)	0.93 (0.87, 0.99)	85.05
The UKB study			
Pan Zhuang 2023 (UKB)	7162/429 240		14.95
Heterogeneity between grou	ps: p = 0.000		
Overall, DL (l ² = 68.5%, p = 0	0.001)	0.90 (0.84, 0.98)	100.00
	5		

Supplementary Figure 9. Association of low-fat dairy consumption with coronary heart disease and stroke risk for high compared with low intake using random-effects meta-analysis.

(A) Coronary heart disease. (B) Stroke. Meta-analysis pooling of aggregate data using the random-effects inversevariance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. M, men; W, women; UKB, UK Biobank. Source data are provided as a Source Data file.

Group and Study	Cases/N	HR (95%)	CI) W	Veigh
Excluding the UKB study	1		,	-
Laury Sellem 2021	1219/104 805	0.86 (0.73,	1.02)	4.03
Jing Guo 2022	332/1746	0.93 (0.65,	1.32)	0.93
Emily Sonestedt 2011	1344/26 445	0.94 (0.79,	1.11)	3.91
Geertje W. Dalmeijer 2013	1648/33 625	0.97 (0.92,	1.02) 2	29.03
Emma Patterson 2012	1392/33 636	0.98 (0.89 ,	1.07) 1	11.97
Elisea E. Avalos 2012 M	222/751	0.99 (0.68,	1.49)	0.76
Jaike Praagman 2015	567/4235	1.01 (0.80,	1.27)	2.16
Elisea E. Avalos 2012 W	229/1008	1.01 (0.77,	1.34)	1.52
Sabita S. Soedamah-Muth	u 2013 323/4255	1.02 (0.80,	1.27)	2.16
Timo T. Koskinen 2018	472/1981	1.07 (0.87,	1.32)	2.64
Adam M. Bernstein 2010	3162/84 136	1.09 (0.71,	1.38)	1.06
Bernhard Haring 2014	1147/12 066	1.14 (0.93,	1.39)	2.83
Mohammad Talaei 2019	564/5432		1.91)	0.88
Subgroup, DL ($I^2 = 0.0\%$,	p = 0.716)	0.98 (0.94,	1.02) 6	63.88
The UKB study				
Pan Zhuang 2023 (UKB)	28 076/429 240	0.92 (0.88,	0.96) 3	36.12
Overall, DL (l ² = 8.6%, p =	= 0.358)	0.96 (0.93,	0.99) 10	00.00
	.5	1 I 1 2		0/
Group and Study	.5 Cases/N	HR (95% CI)) We	% eight
Group and Study Excluding the UKB study	.5 Cases/N	HR (95% CI)) We	% eight
Group and Study Excluding the UKB study Jaike Praagman 2015	5 Cases/N 564/4235	HR (95% CI)) We	% eight 5.49
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M	.5 Cases/N 564/4235	HR (95% CI)) We	% eight 5.49 7.07
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010	HR (95% CI)	.04) (.06) (.03) 1	% eight 5.49 7.07
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4090/74 061	1 2 HR (95% CI) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.90 (0.79, 1) We .04) { .06) 1 .03) 1	% eight 5.49 7.07 1.77
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4089/74 961	1 2 HR (95% CI) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.94 (0.83, 1) We .04) { .06) 7 .03) 1 .07) 12	% eight 5.49 7.07 1.77 2.37
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4089/74 961 141/5432	1 2 HR (95% Cl) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.94 (0.83, 1 0.95 (0.38, 2) We .04) { .06) 7 .03) 1 .07) 1 .38) (% eight 5.49 7.07 1.77 2.37 0.41
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019 Geertje W. Dalmeijer 2013	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4089/74 961 141/5432 531/33 625	1 2 HR (95% CI) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.94 (0.83, 1 0.95 (0.38, 2 0.99 (0.91, 1)) We .06) 1 .03) 1 .07) 1 .38) (.09) 1	% eight 5.49 7.07 1.77 2.37 0.41 7.22
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019 Geertje W. Dalmeijer 2013 Laury Sellem 2021	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4089/74 961 141/5432 531/33 625 878/104 805	1 2 HR (95% CI) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.94 (0.83, 1 0.95 (0.38, 2 0.99 (0.91, 1 1.00 (0.81, 1) We .04) { .06) 1 .03) 1 .07) 1 .38) (.09) 1 .23) (% eight 5.49 7.07 1.77 2.37 0.41 7.22 6.28
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019 Geertje W. Dalmeijer 2013 Laury Sellem 2021 Susanna C. Larsson 2009	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4089/74 961 141/5432 531/33 625 878/104 805 3281/26 556	HR (95% C) HR (95% C) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.90 (0.79, 1 0.94 (0.83, 1 0.95 (0.38, 2 0.99 (0.91, 1 1.00 (0.81, 1 1.13 (1.00, 1) We .04) { .06) 7 .03) 1 .07) 1 .38) (.09) 1 .23) (.27) 1	% eight 5.49 7.07 1.77 2.37 0.41 7.22 6.28 3.24
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019 Geertje W. Dalmeijer 2013 Laury Sellem 2021 Susanna C. Larsson 2009 Emily Sonestedt 2011	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4089/74 961 141/5432 531/33 625 878/104 805 3281/26 556 1176/26 445	HR (95% CI) • • • • • • • • • • • • • • • • • • •) We .04) { .06) 1 .03) 1 .07) 1 .38) (.09) 1 .23) (.27) 1 .40) 1	% eight 5.49 7.07 1.77 2.37 0.41 7.22 6.28 3.24 7.65
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019 Geertje W. Dalmeijer 2013 Laury Sellem 2021 Susanna C. Larsson 2009 Emily Sonestedt 2011 Subgroup, DL (f ² = 45.0%,	.5 Cases/N 564/4235 1397/43 150 2633/84 010 4089/74 961 141/5432 531/33 625 878/104 805 3281/26 556 1176/26 445 p = 0.069)	1 2 HR (95% Cl) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.90 (0.79, 1 0.94 (0.83, 1 0.95 (0.38, 2 0.99 (0.91, 1 1.00 (0.81, 1 1.13 (1.00, 1 1.17 (0.97, 1 0.98 (0.91, 1	We .04) 4 .06) 1 .03) 1 .07) 1 .38) (.09) 1 .23) (.27) 1 .40) 5 .06) 8	% eight 5.49 7.07 1.77 2.37 0.41 7.22 6.28 3.24 7.65 1.50
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019 Geertje W. Dalmeijer 2013 Laury Sellem 2021 Susanna C. Larsson 2009 Emily Sonestedt 2011 Subgroup, DL (I ² = 45.0%, The UKB study	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4089/74 961 141/5432 531/33 625 878/104 805 3281/26 556 1176/26 445 p = 0.069)	1 2 HR (95% CI) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.94 (0.83, 1 0.94 (0.83, 1 0.95 (0.38, 2 0.99 (0.91, 1 1.00 (0.81, 1 1.13 (1.00, 1 1.17 (0.97, 1 0.98 (0.91, 1)	We .04) 4 .06) 1 .03) 1 .07) 1 .38) (.09) 1 .23) (.27) 1 .40) 5 .06) 8	% eight 5.49 7.07 1.77 2.37 0.41 7.22 6.28 3.24 7.65 1.50
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019 Geertje W. Dalmeijer 2013 Laury Sellem 2021 Susanna C. Larsson 2009 Emily Sonestedt 2011 Subgroup, DL (I ² = 45.0%, The UKB study Pan Zhuang 2023 (UKB)	.5 Cases/N 564/4235 1397/43 150 2633/84 010 4089/74 961 141/5432 531/33 625 878/104 805 3281/26 556 1176/26 445 p = 0.069) 7162/429 240	1 2 HR (95% Cl) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.90 (0.79, 1 0.94 (0.83, 1 0.95 (0.38, 2 0.99 (0.91, 1 1.00 (0.81, 1 1.13 (1.00, 1 1.17 (0.97, 1 0.98 (0.91, 1 0.97 (0.89, 1 0.97 (0.89, 1	We .04) 4 .06) 1 .03) 1 .07) 1 .38) (.09) 1 .23) (.27) 1 .40) 5 .06) 8 .05) 1	% eigh 5.49 7.07 1.77 2.37 0.41 7.22 6.28 3.24 7.65 1.50 8.50
Group and Study Excluding the UKB study Jaike Praagman 2015 Adam M. Bernstein 2012 M Adam M. Bernstein 2012 W Susanna C. Larsson 2012 Mohammad Talaei 2019 Geertje W. Dalmeijer 2013 Laury Sellem 2021 Susanna C. Larsson 2009 Emily Sonestedt 2011 Subgroup, DL (I ² = 45.0%, The UKB study Pan Zhuang 2023 (UKB)	.5 Cases/N 564/4235 1397/43 150 / 2633/84 010 4089/74 961 141/5432 531/33 625 878/104 805 3281/26 556 1176/26 445 p = 0.069) 7162/429 240 ups: p = 0.788	HR (95% C) 0.83 (0.66, 1 0.87 (0.72, 1 0.90 (0.79, 1 0.94 (0.83, 1 0.95 (0.38, 2 0.99 (0.91, 1 1.00 (0.81, 1 1.13 (1.00, 1 1.17 (0.97, 1 0.98 (0.91, 1 0.97 (0.89, 1	.04) 4 .06) 1 .03) 1 .07) 1 .38) (.09) 1 .23) (.27) 1 .40) 5 .06) 8 .05) 1	% eigh 5.49 7.07 1.77 2.37 0.41 7.22 6.28 3.24 7.65 1.50 8.50

Supplementary Figure 10. Association of high-fat dairy consumption with coronary heart disease and stroke risk for high compared with low intake using random-effects meta-analysis.

(A) Coronary heart disease. (B) Stroke. Meta-analysis pooling of aggregate data using the random-effects inversevariance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. M, men; W, women; UKB, UK Biobank. Source data are provided as a Source Data file.

A	Group and Study Cases/N	HR (95% CI)	% Weight
	Excluding the CKB study and the UKB study		
	Adam M. Bernstein 2012 693/127 160	0.93 (0.73, 1.19)	15.42
	Tammy Y.N. Tong 2020 1430/418 329	0.96 (0.87, 1.07)	23.04
	Susanna C. Larsson 2012 583/74 961	1.03 (0.75, 1.42)	11.99
	Susanna C. Larsson 2009 579/26 556	1.33 (0.97, 1.82)	12.17
	Subgroup, DL (I ² = 25.6%, p = 0.258)	1.00 (0.89, 1.14)	62.62
	The CKB study and the UKB study		
	Pan Zhuang 2023 (CKB) 7915/487 212 -	0.76 (0.69, 0.83)	23.56
	Pan Zhuang 2023 (UKB) 398/183 446	0.91 (0.69, 1.20)	13.83
	Subgroup, DL (l ² = 31.7%, p = 0.226)	0.79 (0.68, 0.92)	37.38
	Heterogeneity between groups: p = 0.016		
	Overall, DL (l ² = 75.2%, p = 0.001)	0.94 (0.81, 1.09)	100.00
	.5 1	2	
В	Group and Study Cases/N	HR (95% CI)	% Weight
_	Excluding the UKB study		
	Adam M. Bernstein 2012 693/127 160	0.88 (0.62, 1.24)	17.47
	Susanna C. Larsson 2012 583/74 961	0.96 (0.74, 1.25)	25.63
	Susanna C. Larsson 2009 579/26 556	1.03 (0.78, 1.38)	22.98
	Subgroup, DL (l ² = 0.0%, p = 0.789)	0.96 (0.81, 1.14)	66.07
	The UKB study		
	Pan Zhuang 2023 (UKB) 1102/429 240	0.73 (0.59, 0.89)	33.93
	Heterogeneity between groups: p = 0.039		
	Overall, DL (l ² = 36.7%, p = 0.192)	0.88 (0.74, 1.04)	100.00
		1 2	
С	Group and Study Cases/N	HR (95% CI)	% Weight
	Excluding the UKB study		
	Adam M. Bernstein 2012 693/127160	0.98 (0.69, 1.37)	19.56
	Susanna C. Larsson 2012 583/74961	0.99 (0.72, 1.37)	21.16
	Susanna C. Larsson 2009 579/26556	- 1.35 (1.04, 1.75)	26.67
	Subgroup, DL (I ² = 35.6%, p = 0.212)	1.12 (0.90, 1.39)	67.38
	The UKB study		
	Pan Zhuang 2023 (UKB) 1102/429240	0.91 (0.74, 1.11)	32.62
	Heterogeneity between groups: p = 0.170		
	Overall, DL (l ² = 48.0%, p = 0.123)	1.04 (0.86, 1.26)	100.00
		2	

Supplementary Figure 11. Association of total, low-fat, high-fat dairy consumption with hemorrhagic stroke risk for high compared with low intake using random-effects meta-analysis. (A) Total dairy. (B) Low-fat dairy. (C) High-fat dairy. Meta-analysis pooling of aggregate data using the random-effects

inverse-variance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. M, men; W, women; UKB, UK Biobank. Source data are provided as a Source Data file.



Supplementary Figure 12. Association of fermented dairy, milk, cheese consumption with hemorrhagic stroke risk for high compared with low intake using random-effects meta-analysis. (A) Fermented dairy. (B) Milk. (C) Cheese. Meta-analysis pooling of aggregate data using the random-effects inverse-

variance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. M, men; W, women; UKB, UK Biobank. Source data are provided as a Source Data file.

Group and Study Cases/N

HR (95% CI) Weight

	Evoluting the CKP study a						
	Excluding the CKB study a					0.67 (0.41.1.00)	1.09
	Tammy X N Tong 2020	97/2001				0.87 (0.41, 1.09)	21.90
	Adam M Bernstein 2012	3337/127 160				0.90 (0.81, 0.91)	15.81
	Susanna C. Larsson 2012	3159/74 961			_	0.91 (0.79, 1.05)	12.52
	Susanna C. Larsson 2009	2702/26 556		Τ.		1.14 (0.99, 1.32)	12.38
	Subgroup, DL (l ² = 72.8%, p	o = 0.005)		$\langle \cdot \rangle$	>	0.92 (0.83, 1.03)	63.97
	The CKB study and the UK	B study		Ý			
	Pan Zhuang 2023 (UKB)	1629/183 446				0.86 (0.75, 0.99)	12.82
	Pan Zhuang 2023 (CKB) 32	222/487 212		-		0.96 (0.92, 0.99)	23.21
	Subgroup, DL (I ² = 55.7%, p	o = 0.133)		\diamond	>	0.93 (0.84, 1.03)	36.03
	Heterogeneity between group	ps: p = 0.933					
	Overall, DL (l ² = 72.7%, p =	0.001)		\diamond		0.92 (0.86, 0.99)	100.00
			.5		1	2	
в	Group and Study	Cases/N				HR (95% CI)	% Weight
_	Excluding the UKB study						
	Susanna C. Larsson 2012	3159/74 961	-			0.87 (0.78, 0.98)	25.63
	Adam M. Bernstein 2012	3337/127 160				0.94 (0.81, 1.10)	22.86
	Susanna C. Larsson 2009	2702/26 556			_	1.04 (0.92, 1.18)	24.92
	Subgroup, DL (I ² = 53.4%, p	= 0.117)		\Leftrightarrow		0.95 (0.85, 1.06)	73.41
	The UKB study						
	Pan Zhuang 2023 (UKB)	4951/429 240		-		0.75 (0.67, 0.82)	26.59
	Heterogeneity between group	os: p = 0.002					
	Overall, DL (l ² = 83.3%, p <	0.001)	<			0.89 (0.77, 1.03)	100.00
		l .5		1		2	
С	Group and Study	Cases/N				HR (95% CI)	% Weight
	Excluding the UKB study						
	Adam M. Bernstein 2012	3337/127 160		•		0.87 (0.75, 1.02)	19.50
	Susanna C. Larsson 2012	3159/74 961				0.97 (0.84, 1.12)	21.47
	Susanna C. Larsson 2009	2702/26 556			_	1.08 (0.95, 1.23)	24.92
	Subgroup, DL (I ² = 55.5%, p	o = 0.106)		$\langle \rangle$		0.97 (0.86, 1.10)	65.89
	The UKB study						
	Pan Zhuang 2023 (UKB)	4951/429 240				0.98 (0.88, 1.08)	34.11
	Heterogeneity between grou	ps: p = 0.990					
	Overall, DL (l ² = 33.4%, p =	0.212)		\diamond		0.98 (0.90, 1.06)	100.00

Supplementary Figure 13. Association of total, low-fat, high-fat dairy consumption with ischemic stroke risk for high compared with low intake using random-effects meta-analysis. (A) Total dairy. (B) Low-fat dairy. (C) High-fat dairy. Meta-analysis pooling of aggregate data using the random-effects

inverse-variance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. UKB, UK Biobank. Source data are provided as a Source Data file.

A	Group and Study	Cases/N	HR (95%	Cl) Weigh
	Excluding the UKB study			
	Tammy Y.N. Tong 2020	4281/418 329	0.87 (0.81	, 0.93) 14.7
	Shunming Zhang 2022	1821/20 499	0.96 (0.91	, 1.00) 18.0
	Susanna C Larsson 2009	2702/26 556	0.98 (0.91	, 1.06) 14.24
	Susanna C. Larsson 2012	3159/74 961	0.99 (0.91	, 1.07) 13.0
	Erika Olsson 2022 (SMC)	3208/35 892	1.00 (0.89	, 1.13) 8.9
	Thanasis G. Tektonidis 2015	1270/32 921	1.03 (0.91	, 1.17) 8.3
	Erika Olsson 2022 (COSM)	4365/43 726	1.06 (0.97	, 1.17) 11.5
	Subgroup, DL (I ² = 57.0%, p = 0	0.030)	0.97 (0.93	, 1.02) 88.9
	The UKB study			
	Pan Zhuang 2023 (UKB)	1629/183 446	0.88 (0.79	, 0.97) 11.09
	Heterogeneity between groups:	p = 0.056		
	Overall, DL (l ² = 59.8%, p = 0.0	115)	0.96 (0.92	, 1.01) 100.00
		.5	1 2	
В	Group and Study	Cases/N	HR (95%	CI) Weigh
	Excluding the UKB study			
	PC Elwood 2004	185/2403	0.66 (0.24	, 1.81) 0.4
	Tammy Y.N. Tong 2020	4281/418 329	0.82 (0.74	, 0.91) 18.39
	Shunming Zhang 2022	1821/20 499	0.99 (0.97	, 1.00) 30.47
	Erika Olsson 2022 (COSM)	4365/43 726	1.00 (0.91	, 1.11) 18.99
	Susanna C Larsson 2009	2702/26 556	1.06 (0.97	, 1.16) 20.48
	Erika Olsson 2022 (SMC)	3208/35 892	1.10 (0.85	, 1.41) 6.0
	Subgroup, DL ($I^2 = 68.7\%$, p = 0	0.007)	0.97 (0.90	, 1.05) 94.82
	The UKB study			
	Pan Zhuang 2023 (UKB)	1629/183 446	0.98 (0.74	, 1.29) 5.11
	Heterogeneity between groups:	p = 0.963		
	Overall, DL (l ² = 62.5%, p = 0.0	14)	0.97 (0.91	. 1.04) 100.00
			,5 1 1 2	ģ
С	Group and Study	Cases/N	HR (95% (CI) Weigh
	Excluding the UKB study			
	Susanna C. Larsson 2009	2702/26 556	0.88 (0.77,	1.01) 22.39
	Tammy Y.N. Tong 2020	4281/418 329	0.90 (0.81,	1.00) 37.12
	Susanna C. Larsson 2012	3159/74 961	0.95 (0.84,	1.08) 26.09
	Substantia DL $(l^2 = 0.0\%)$ = = 0	605)		0.07) 95.6(
	Subgroup, DE (1 - 0.0%, p - 0.		0.91 (0.80,	0.37) 03.00
	The UKB study			
	Pan Zhuang 2023 (UKB)	4788/418 895	0.91 (0.77,	1.08) 14.40
	Heterogeneity between groups:	p = 0.996		
	Overall, DL (I ² = 0.0%, p = 0.86	i/)	0.91 (0.85,	u.97) 100.00
		І .5	1 2	

Supplementary Figure 14. Association of fermented dairy, milk, cheese consumption with ischemic stroke risk for high compared with low intake using random-effects meta-analysis. (A) Fermented dairy. (B) Milk. (C) Cheese. Meta-analysis pooling of aggregate data using the random-effects inverse-

variance model with DerSimonian-Laird estimate of tau². Data are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Squares represent study-specific HRs. Horizontal lines denote 95% CIs. Gray square areas are proportional to the individual study weight for the overall meta-analysis. The red dotted line represents risk ratio of pooled meta-analysis. The blue hollow diamonds represent the results of the meta-analysis for each group, with the center indicating the risk ratio and the width representing the 95% CI. I² refers to the proportion of heterogeneity among studies. M, men; W, women; UKB, UK Biobank. Source data are provided as a Source Data file.



Supplementary Figure 15. Funnel plot for assessment of publication bias for the association between total dairy and subtypes of dairy consumption and risk of cardiovascular disease.

(A) Total dairy. (B) High-fat dairy. (C) Low-fat-dairy. (D) Milk. (E) yogurt. (F) Cheese. (G) Fermented dairy. Begg's Test and Egger's test was used for assessment of publication bias. The blue dots represent each study included in the analysis. Source data are provided as a Source Data file.



Supplementary Figure 16. Funnel plot for assessment of publication bias for the association between total dairy and subtypes of dairy consumption and risk of coronary heart disease.

(A) Total dairy. (B) High-fat dairy. (C) Low-fat-dairy. (D) Milk. (E) Yogurt. (F) Cheese. (G) Fermented dairy. Begg's Test and Egger's test was used for assessment of publication bias. The blue dots represent each study included in the analysis. Source data are provided as a Source Data file.



Supplementary Figure 17. Funnel plot for assessment of publication bias for the association between total dairy and subtypes of dairy consumption and risk of stroke.

(A) Total dairy. (B) High-fat dairy. (C) Low-fat-dairy. (D) Milk. (E) yogurt. (F) Cheese. (G) Fermented dairy. Begg's Test and Egger's test was used for assessment of publication bias. The blue dots represent each study included in the analysis. Source data are provided as a Source Data file.



Supplementary Figure 18. Funnel plot for assessment of publication bias for the association between total dairy and subtypes of dairy consumption and risk of hemorrhagic stroke.

(A) Total dairy. (B) High-fat dairy. (C) Low-fat-dairy. (D) Milk. (E) Cheese. (F) Fermented dairy. Begg's Test and Egger's test was used for assessment of publication bias. The blue dots represent each study included in the analysis. Source data are provided as a Source Data file.



Supplementary Figure 19. Funnel plot for assessment of publication bias for the association between total dairy and subtypes of dairy consumption and risk of ischemic stroke.

(A) Total dairy. (B) High-fat dairy. (C) Low-fat-dairy. (D) Milk. (E) Cheese. (F) Fermented dairy. Begg's Test and Egger's test was used for assessment of publication bias. The blue dots represent each study included in the analysis. Source data are provided as a Source Data file.



Supplementary Figure 20. Forest plot of influence analysis for the association between total dairy product consumption and risk of cardiovascular disease, coronary heart disease, and stroke.

(A) Cardiovascular disease. (B) coronary heart disease. (C) Stroke. Each dot and horizontal line represent the pooled RR (95% CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.

Α



Supplementary Figure 21. Forest plot of influence analysis for the association between milk consumption and risk of cardiovascular disease, coronary heart disease, and stroke.

(A) Cardiovascular disease. (B) coronary heart disease. (C) Stroke. Each dot horizontal line represent the pooled RR (95%

CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.



Supplementary Figure 22. Forest plot of influence analysis for the association between yogurt consumption and risk of cardiovascular disease, coronary heart disease, and stroke.

(A) Cardiovascular disease. (B) coronary heart disease. (C) Stroke. Each dot horizontal line represent the pooled RR (95%

CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.

Α





Supplementary Figure 23. Forest plot of influence analysis for the association between cheese consumption and risk of cardiovascular disease, coronary heart disease, and stroke.

(A) Cardiovascular disease. (B) coronary heart disease. (C) Stroke. Each dot horizontal line represent the pooled RR (95%

CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.



Supplementary Figure 24. Forest plot of influence analysis for the association between low-fat dairy products consumption and risk of cardiovascular disease, coronary heart disease, and stroke.

(A) Cardiovascular disease. (B) coronary heart disease. (C) Stroke. Each dot horizontal line represent the pooled RR (95%

CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.



Meta-analysis estimates, given named study is omitted



Supplementary Figure 25. Forest plot of influence analysis for the association between high-fat dairy products consumption and risk of cardiovascular disease, coronary heart disease, and stroke.

(A) Cardiovascular disease. (B) coronary heart disease. (C) Stroke. Each dot horizontal line represent the pooled RR (95%

CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.

Α





Supplementary Figure 26. Forest plot of influence analysis for the association between fermented dairy products consumption and risk of cardiovascular disease, coronary heart disease, and stroke.

(A) Cardiovascular disease. (B) coronary heart disease. (C) Stroke. Each dot horizontal line represent the pooled RR (95%

CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.



Supplementary Figure 27. Forest plot of influence analysis for the association between total, high-fat, and low-fat dairy consumption and risk of hemorrhagic stroke.

(A) Total dairy. (B) High-fat dairy. (C) Low-fat dairy. Each dot horizontal line represent the pooled RR (95% CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.



Supplementary Figure 28. Forest plot of influence analysis for the association between fermented dairy, milk, and cheese consumption and risk of hemorrhagic stroke.

(A) Fermented dairy. (B) Milk. (C) Cheese. Each dot horizontal line represent the pooled RR (95% CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.



Supplementary Figure 29. Forest plot of influence analysis for the association between total dairy, high-fat dairy, and low-fat dairy consumption and risk of ischemic stroke.

(A) Total dairy. (B) High-fat dairy. (C) Low-fat dairy. Each dot horizontal line represent the pooled RR (95% CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.



Supplementary Figure 30. Forest plot of influence analysis for the association between fermented dairy, milk, and cheese consumption and risk of ischemic stroke.

(A) Fermented dairy. (B) Milk. (C) Cheese. Each dot horizontal line represent the pooled RR (95% CI) following the exclusion of the study listed on the left using random-effects meta-analysis. Source data are provided as a Source Data file.



Supplementary Figure 31. Flow chart for participants.

(A) China Kadoorie Biobank. (B) UK Biobank.

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