



Association of vegetable and fruit intake with risk of dementia: three prospective studies and meta-analysis of cohort studies



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KEY TAKE AWAYS: In the current study, we found that intake of vegetables and fruits is associated with a reduced risk of dementia, and this protective association was likely driven by the combined contributions of specific vegetable and fruit subgroups, particularly green leafy vegetables.

BACKGROUND

Evidence linking total and specific types of vegetable and fruit intake to dementia remains scarce. This study examined associations between total and subgroup intake of vegetables and fruits and dementia risk across three prospective cohorts and a meta-analysis.

METHODS

- Data were drawn from the Health and Retirement Study (HRS), the Framingham Heart Study Offspring cohort (FOS), and Whitehall II study (WHII).
- Average daily intakes of total vegetables and fruits and seven subgroups were assessed using food frequency questionnaires.
- Incident dementia was identified using cohort-specific definitions.
- Cox regression models estimated hazard ratios (HRs) and 95% confidence intervals (CIs).
- We also performed a meta-analysis that incorporating our results and findings from 13 previous cohort studies.

RESULTS

Table 1. Association of intake of vegetables and fruits with risk of dementia

	Tertile1	Tertile2	Tertile3	Per serving increment	P-trend ^a
Total vegetables and fruits					
Health and Retirement Study					
Intake, servings/d, median	1.3 [0.8, 1.7]	3.1 [2.6, 3.7]	6.4 [5.2, 8.4]	3.1 [1.8, 5.3]	
Case/total No.	165/2227	135/2226	145/2297	445/6750	
Model 1	Ref (1.0)	0.68 (0.54, 0.86)	0.63 (0.49, 0.82)	0.95 (0.91, 0.98)	0.005
Model 2	Ref (1.0)	0.72 (0.57, 0.92)	0.73 (0.56, 0.96)	0.97 (0.94, 1.01)	0.154
Framingham Heart Study Offspring Cohort					
Intake, servings/d, median	2.1 [1.6, 2.6]	3.8 [3.4, 4.2]	6.1 [5.3, 7.2]	3.8 [2.6, 5.3]	
Case/total No.	93/999	104/1018	73/1051	270/3068	
Model 1	Ref (1.0)	0.79 (0.60, 1.06)	0.55 (0.39, 0.77)	0.86 (0.80, 0.93)	<0.001
Model 2	Ref (1.0)	0.87 (0.64, 1.17)	0.65 (0.45, 0.94)	0.89 (0.82, 0.96)	0.004
Whitehall II study					
Intake, servings/d, median	2.9 [2.2, 3.5]	4.9 [4.4, 5.4]	7.5 [6.6, 9.1]	5.0 [3.5, 6.6]	
Case/total No.	70/ 2802	73/ 2822	78/ 2897	221/ 8521	
Model 1	Ref (1.0)	0.92 (0.66, 1.28)	0.84 (0.60, 1.19)	1.00 (0.95, 1.05)	0.890
Model 2	Ref (1.0)	0.93 (0.66, 1.32)	0.84 (0.58, 1.20)	1.00 (0.95, 1.05)	0.981
Pooled					
Model 1	Ref (1.0)	0.77 (0.65, 0.91)	0.66 (0.53, 0.82)	0.94 (0.87, 1.02)	0.130
Model 2	Ref (1.0)	0.81 (0.68, 0.95)	0.74 (0.61, 0.89)	0.96 (0.90, 1.02)	0.165
Total vegetables					
Health and Retirement Study					
Intake, servings/d, median	0.7 [0.4, 0.9]	1.8 [1.5, 2.2]	4.2 [3.4, 5.7]	1.9 [1.0, 3.4]	
Case/total No.	178/2217	124/2235	143/2298	445/6750	
Model 1	Ref (1.0)	0.73 (0.58, 0.93)	0.70 (0.54, 0.91)	0.92 (0.87, 0.97)	0.001
Model 2	Ref (1.0)	0.77 (0.60, 0.97)	0.78 (0.60, 1.02)	0.94 (0.89, 0.99)	0.029
Framingham Heart Study Offspring Cohort					
Intake, servings/d, median	1.8 [1.4, 2.2]	3.1 [2.9, 3.5]	5.1 [4.4, 6.1]	3.2 [2.2, 4.4]	
Case/total No.	102/1013	102/1005	66/1050	270/3068	
Model 1	Ref (1.0)	0.73 (0.54, 0.98)	0.42 (0.28, 0.63)	0.83 (0.74, 0.93)	0.001
Model 2	Ref (1.0)	0.79 (0.58, 1.09)	0.50 (0.33, 0.76)	0.86 (0.76, 0.97)	0.012
Whitehall II study					
Intake, servings/d, median	1.6 [1.2, 2.0]	2.7 [2.5, 3.0]	4.3 [3.8, 5.2]	2.8 [1.9, 3.8]	
Case/total No.	64/ 2805	76/ 2762	81/ 2954	221/ 8521	
Model 1	Ref (1.0)	1.13 (0.81, 1.59)	1.03 (0.72, 1.47)	0.97 (0.89, 1.05)	0.427
Model 2	Ref (1.0)	1.21 (0.86, 1.72)	1.06 (0.73, 1.53)	0.97 (0.89, 1.06)	0.476
Pooled					
Model 1	Ref (1.0)	0.83 (0.64, 1.08)	0.68 (0.42, 1.11)	0.91 (0.85, 0.98)	0.017
Model 2	Ref (1.0)	0.89 (0.68, 1.16)	0.75 (0.50, 1.12)	0.94 (0.90, 0.98)	0.003
Total fruits					
Health and Retirement Study					
Intake, servings/d, median	0.3 [0.2, 0.5]	1.1 [0.9, 1.3]	2.4 [1.9, 3.3]	1.1 [0.5, 1.9]	
Case/total No.	148/2211	146/2241	151/2298	445/6750	
Model 1	Ref (1.0)	0.85 (0.67, 1.08)	0.81 (0.62, 1.04)	1.01 (0.94, 1.08)	0.862
Model 2	Ref (1.0)	0.90 (0.71, 1.14)	0.87 (0.67, 1.13)	1.03 (0.96, 1.11)	0.426
Framingham Heart Study Offspring Cohort					
Intake, servings/d, median	0.5 [0.3, 0.6]	1.2 [1.1, 1.3]	2.1 [1.8, 2.8]	1.2 [0.7, 1.8]	
Case/total No.	79/984	89/1008	102/1076	270/3068	
Model 1	Ref (1.0)	1.01 (0.74, 1.39)	1.15 (0.81, 1.64)	1.01 (0.85, 1.21)	0.897
Model 2	Ref (1.0)	1.01 (0.73, 1.39)	1.15 (0.79, 1.65)	1.01 (0.85, 1.21)	0.878
Whitehall II study					
Intake, servings/d, median	0.9 [0.5, 1.2]	2.0 [1.7, 2.2]	3.5 [3.0, 4.5]	2.0 [1.2, 3.1]	
Case/total No.	70/ 2809	66/ 2747	85/ 2965	221/ 8521	
Model 1	Ref (1.0)	0.88 (0.62, 1.23)	0.95 (0.67, 1.33)	1.04 (0.96, 1.12)	0.325
Model 2	Ref (1.0)	0.86 (0.61, 1.21)	0.92 (0.65, 1.32)	1.03 (0.95, 1.12)	0.466
Pooled					
Model 1	Ref (1.0)	0.90 (0.76, 1.06)	0.93 (0.76, 1.15)	1.02 (0.97, 1.07)	0.383
Model 2	Ref (1.0)	0.92 (0.78, 1.08)	0.95 (0.79, 1.14)	1.03 (0.98, 1.08)	0.294

Model1 was adjusted for age, age squared, sex, education level, household income , and total energy intake. Model 2 were additionally adjusted for current smoking status, alcohol consumption more than once per week, vigorous exercise, body mass index, depressive symptoms, hypertension, diabetes, stroke, cardiovascular diseases, the modified MIND score, regular use of vitamin/mineral supplements, and mutually adjusted for total vegetable intake and total fruit intake where applicable.

- Over 201,156 person-years, 949 participants developed incident all-cause dementia. The higher intake of total vegetables and fruits was associated with a lower risk of dementia (**Table 1**).
- The results for specific vegetable and fruit subgroups varied across the three cohorts. n the pooled analyses, a significant linear association was observed for green leafy vegetable intake and dementia (**Figure 1**).

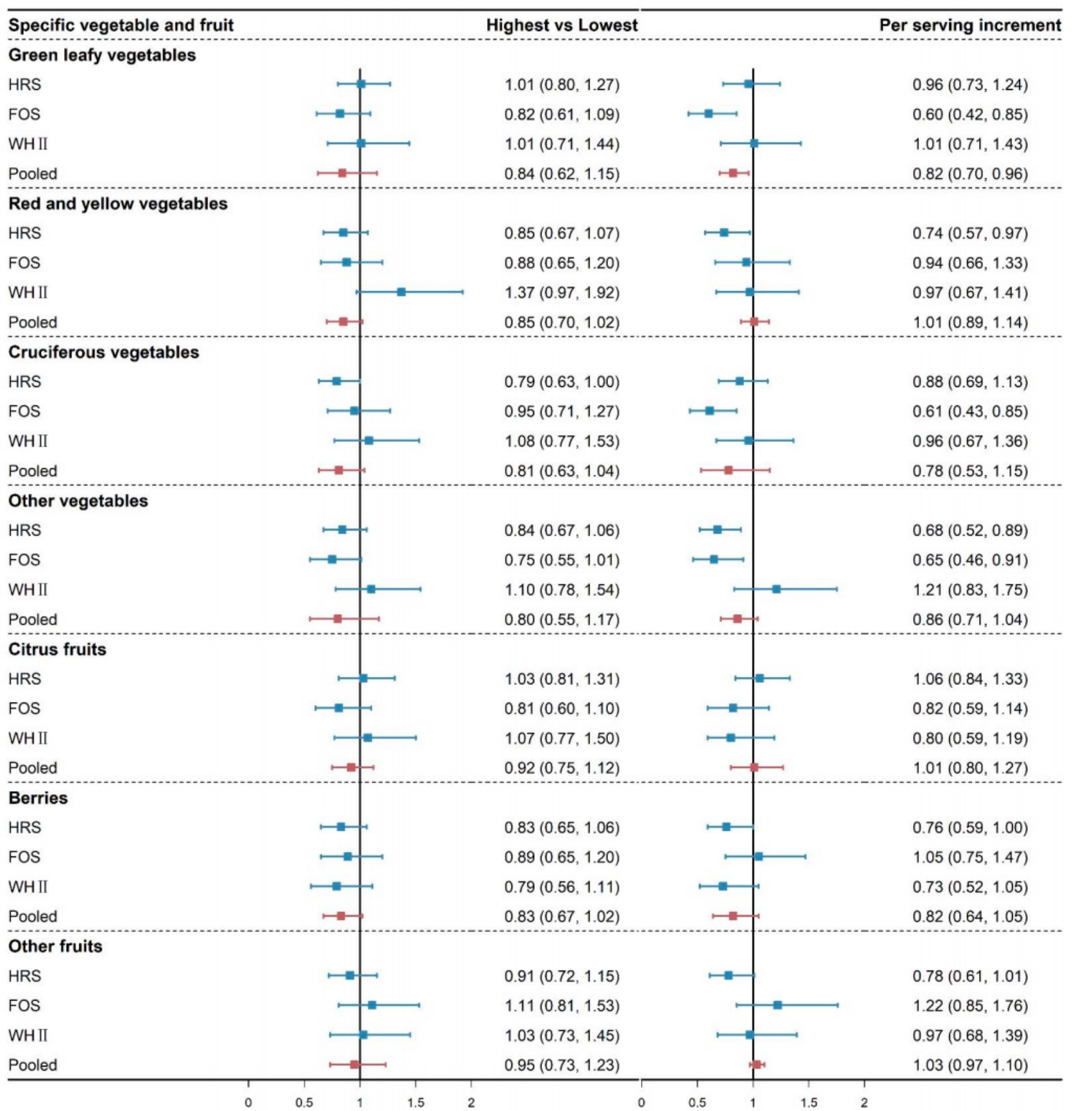


Figure 1. Association of intake of specific subgroups of vegetables and fruits with risk of dementia

- The meta-analysis found that higher total vegetables and fruits intake was associated with a reduced risk of dementia, with a pooled HR of 0.80 (95% CI: 0.71, 0.91, I² = 62.4%). Specifically, higher intake of vegetables was associated with a 13% lower risk of dementia, while higher intake of fruits was related to a 10% lower risk (**Figure 2**). No significant publication bias was detected in the analysis.

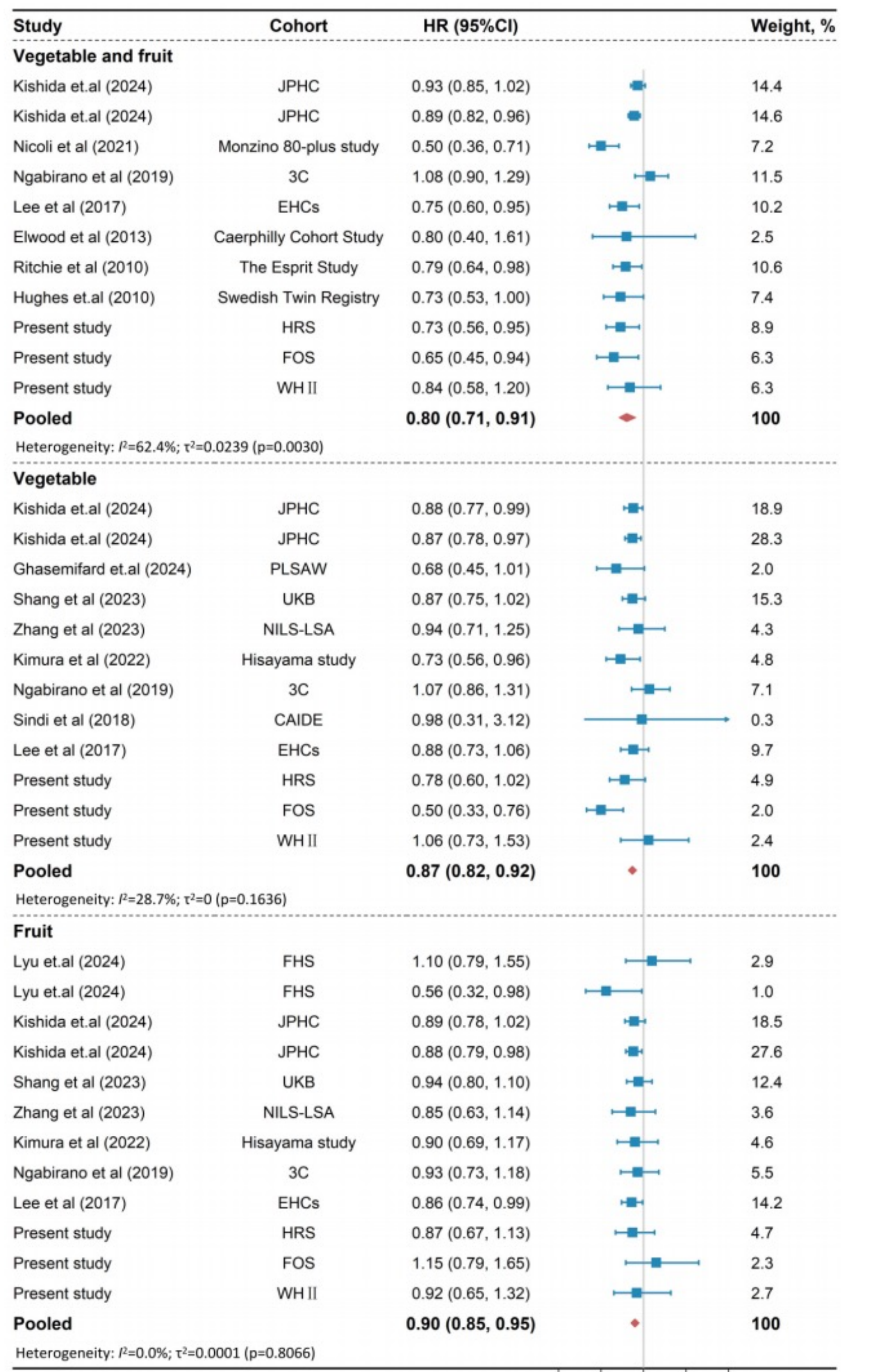


Figure 2. Meta-analysis for the association of intake of vegetables and fruits with risk of dementia

CONCLUSIONS

- Our study supports an inverse association of vegetable and fruit intake with dementia risk. Further studies on specific subgroups are warranted.