Supplementary Online Content

Qian F, Liu G, Hu FB, Bhupathiraju SN, Sun Q. Association between plant-based dietary patterns and risk of type 2 diabetes: a systematic review and meta-analysis. *JAMA Intern Med.* Published online July 22, 2019. doi:10.1001/jamainternmed.2019.2195

This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Search Terms and Number of Records **PubMed**
(((((plant-based) OR plant-based diet) OR vegetarian) OR vegan) AND ((diabetes OR type 2 diabetes OR type II diabetes OR non-insulin dependent diabetes OR NIDDM)))
Records found: 552
EMBASE
('**plant diet**':ti,ab,kw OR '**plant-based diet**':ti,ab,kw OR '**vegetarian diet**':ti,ab,kw OR '**vegan diet**':ti,ab,kw) AND ('**diabetes mellitus**':ti,ab,kw OR '**non insulin dependent diabetes mellitus**':ti,ab,kw OR '**type 2 diabetes**':ti,ab,kw OR '**type ii diabetes)**':ti,ab,kw)
Records found: 134
Web of Science
((plant-based OR plant-based diet OR vegetarian OR vegan) AND (diabetes OR type 2 diabetes OR type II diabetes OR non-insulin dependent diabetes OR NIDDM))
Records found: 514

eTable 2. Inclusion/Exclusion Criteria for Literature Search

Considered items	Inclusion	Exclusion
Study type	Prospective cohort studies, prospective case-cohort studies, or nested prospective case-control studies	Retrospective case-control studies, cross-sectional and ecological studies, literature reviews, commentaries, editorials, letters, case reports, and meeting abstracts
Study population/disease indication	Adults with type II diabetes mellitus or non-insulin dependent diabetes mellitus, through validated self-report, physician diagnosis, or use of diabetes-specific medications	Primary outcome involves conditions that are not type II diabetes (or non-insulin dependent diabetes) including: type I diabetes, children with type II diabetes, gestational diabetes, prediabetes, or impaired glucose tolerance
Exposure	Plant-based dietary patterns, defined by emphasis of plant-based foods and de-emphasis or avoidance of animal foods, assessed using validated dietary assessment methods (i.e. the primary dietary method was compared to another method, e.g. food diary or blood biomarkers)	Unclear definitions of dietary exposure or measurements
Outcomes	Multivariate adjusted effect estimate (odds ratio, relative risk, or hazard ratio)	Crude effect estimates only
Publication date range	Up to September 30th, 2018	
Language restriction	English	Not English
Other	Human studies only	Non-human animal studies, no full text

eTable 3. Food Composition of Plant-Based Diets

Reference	Study name (Country)	Comparison	Plant food groups											Animal food groups							
			Whole grains	Fruits	Vegetables	Nuts	Legumes	Vegetable oil	Tea & Coffee	Fruit juices	Refined grains	Potatoes	Sugar-sweetened beverages	Sweets & desserts	Animal Fat	Dairy	Eggs	Fish & seafood	Poultry	Unprocessed red meat	Processed red meat	Miscellaneous animal-based foods
Vang 2008	Adventist Health Study and Adventist Mortality Study (USA)	Long-term vegetarian vs. long-term nonvegetarian	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Excludes	Excludes	Excludes	Excludes	Includes, if not manufactured using red meat, poultry or fish products
Tonstad 2013	Adventist Health Study-2 (USA)	Vegan vs. nonvegetarian	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Excludes	Excludes	Excludes	Excludes	Excludes	Excludes	Excludes	Excludes
Kolovou 2016	ATTICA Cohort Study (Greece)	Factor coefficient for plant-based diet (Factor 2)	Bread, rusk, pasta: 0.554 Cereals: -0.105	0.550	0.655	0.034	0.692	N/A	N/A	N/A	See whole grains	Potatoes, fried: -0.033 Potatoes boiled/baked: 0.329	N/A	0.156	N/A	Dairy (milk, yogurt): 0.106 Feta cheese: 0.126 Hard cheese: -0.010	N/A	Fish, small: 0.156 Fish, big: 0.022	0.144	Beef: -0.022 Pork: -0.059	-0.106	N/A
Satija 2016	Nurses' Health Study (USA)	Extreme deciles of overall plant-based diet index, mean servings/day	1.5 vs. 0.8	1.8 vs. 0.9	3.7 vs. 2.6	0.4 vs. 0.2	0.5 vs. 0.3	0.8 vs. 0.4	3.5 vs. 2.6	0.9 vs. 0.5	1.7 vs. 1.3	0.5 vs. 0.4	0.3 vs. 0.2	1.3 vs. 0.9	0.1 vs. 0.6	1.3 vs. 2.3	0.2 vs. 0.5	0.3 vs. 0.4	0.3 vs. 0.3	0.5 vs. 0.7	0.2 vs. 0.4	0.3 vs. 0.5
Satija 2016	Nurses' Health Study II (USA)	Extreme deciles of overall plant-based diet index, mean servings/day	2.0 vs. 1.1	1.7 vs. 0.9	4.2 vs. 2.6	0.4 vs. 0.2	0.6 vs. 0.3	0.4 vs. 0.2	2.7 vs. 1.8	1.0 vs. 0.5	1.7 vs. 1.4	0.6 vs. 0.5	0.4 vs. 0.5	1.4 vs. 1.1	0.0 vs. 0.3	1.7 vs. 2.8	0.1 vs. 0.3	0.2 vs. 0.3	0.3 vs. 0.4	0.3 vs. 0.4	0.1 vs. 0.1	0.1 vs. 0.4
Satija 2016	Health Professionals Follow-up Study (USA)	Extreme deciles of overall plant-based diet index, mean	2.2 vs. 1.1	2.2 vs. 1.1	4.2 vs. 2.5	0.7 vs. 0.3	0.6 vs. 0.3	0.4 vs. 0.2	2.6 vs. 2.1	1.1 vs. 0.6	1.7 vs. 1.3	0.6 vs. 0.5	0.4 vs. 0.3	1.6 vs. 1.2	0.0 vs. 0.5	1.4 vs. 2.5	0.2 vs. 0.5	0.4 vs. 0.4	0.9 vs. 0.9	0.5 vs. 0.7	0.3 vs. 0.6	0.2 vs. 0.7

		servings/day																			
Chen 2018	Singapore Chinese Health Study (Singapore)	Extreme quintiles of plant-based diet index, mean servings/day	0.78 vs. 0.10	1.91 vs. 0.69	2.01 vs. 1.05	0.32 vs. 0.04	0.71 vs. 0.29	0.89 vs. 0.24	Tea: 0.76 vs. 0.32 Coffee: 1.57 vs. 1.18	0.17 vs. 0.02	2.97 vs. 2.28	N/A	0.13 vs. 0.04	N/A	N/A	0.27 vs. 0.34	0.23 vs. 0.30	0.62 vs. 0.62	0.23 vs. 0.23	0.31 vs. 0.32		N/A
Chen 2018	Rotterdam Study I, II, and III (Netherlands)	Extreme quintiles of plant-based diet index, median grams/day	135.0 vs. 88.3	258.5 vs. 168.0	241.3 vs. 181.6	9.0 vs. 13.5	13.5 vs. 0.0	27.7 vs. 12.0	900.0 vs. 705.4	N/A	61.2 vs. 37.7	126.0 vs. 83.6	59.8 vs. 15.0	Sweets: 71.3 vs. 50.3 Desserts/dairy with sugars: 6.4 vs. 21.4	0.0 vs. 0.7	Low-fat yogurt: 32.1 vs. 82.3 Low-fat milk: 48.0 vs. 111.0 Cheese: 29.9 vs. 32.9	10.7 vs. 14.3	11.0 vs. 21.4	N/A	7.6 vs. 14.3	80.0 vs. 93.2	N/A
Chiu 2018	Tzu Chi Health Study (Taiwan)	Vegetarian diet, full-time	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Includes	Excludes	Includes	Includes	Excludes	Excludes	Excludes	Excludes	Includes, if not manufactured using red meat, poultry or fish products

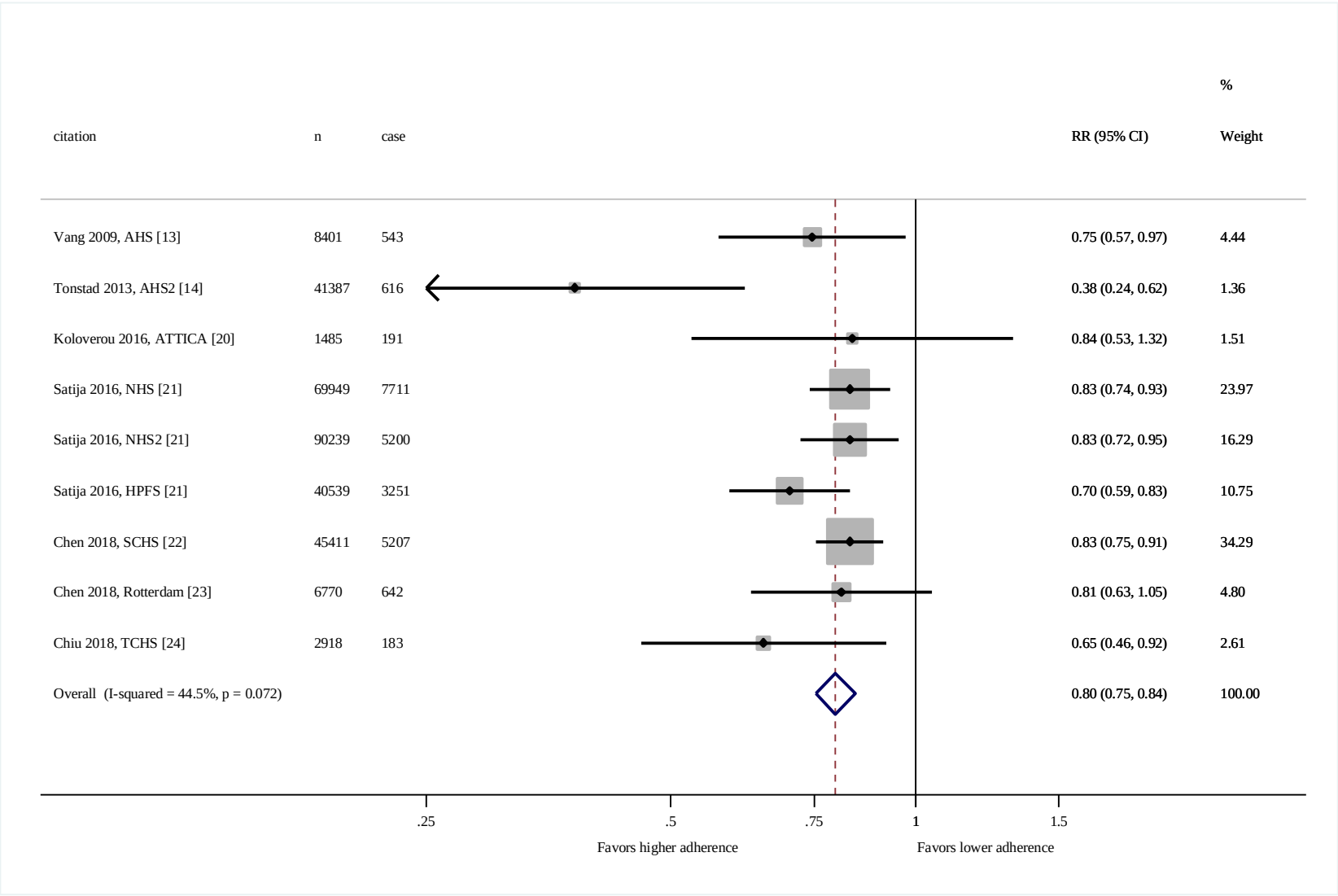
eTable 4. Assessment of Individual Study Bias

Study	Criteria	Yes	No	Other (cannot determine, not reported, not applicable)
Vang 2008	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		
	3. Was the participation rate of eligible persons at least 50%?		X	
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
	5. Was a sample size justification, power description, or variance and effect estimates provided?	X		
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	X		
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	10. Was the exposure(s) assessed more than once over time?		X	
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?		X	
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?			X
	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?		X	
	Total	9		
Tonstad 2013	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		
	3. Was the participation rate of eligible persons at least 50%?	X		
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
	5. Was a sample size justification, power description, or variance and effect estimates provided?		X	
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?		X	
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	10. Was the exposure(s) assessed more than once over time?		X	
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?			X
	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	X		
	Total	10		
Koloverou 2016	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		

	3. Was the participation rate of eligible persons at least 50%?	X		
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
	5. Was a sample size justification, power description, or variance and effect estimates provided?	X		
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	X		
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	10. Was the exposure(s) assessed more than once over time?		X	
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?	X		
	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	X		
	Total	13		
Satija 2016 (NHS)	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		
	3. Was the participation rate of eligible persons at least 50%?	X		
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
	5. Was a sample size justification, power description, or variance and effect estimates provided?		X	
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	X		
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	10. Was the exposure(s) assessed more than once over time?	X		
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?	X		
	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	X		
	Total	13		
Satija 2016 (NHSII)	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		
	3. Was the participation rate of eligible persons at least 50%?	X		
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
	5. Was a sample size justification, power description, or variance and effect estimates provided?		X	
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	X		

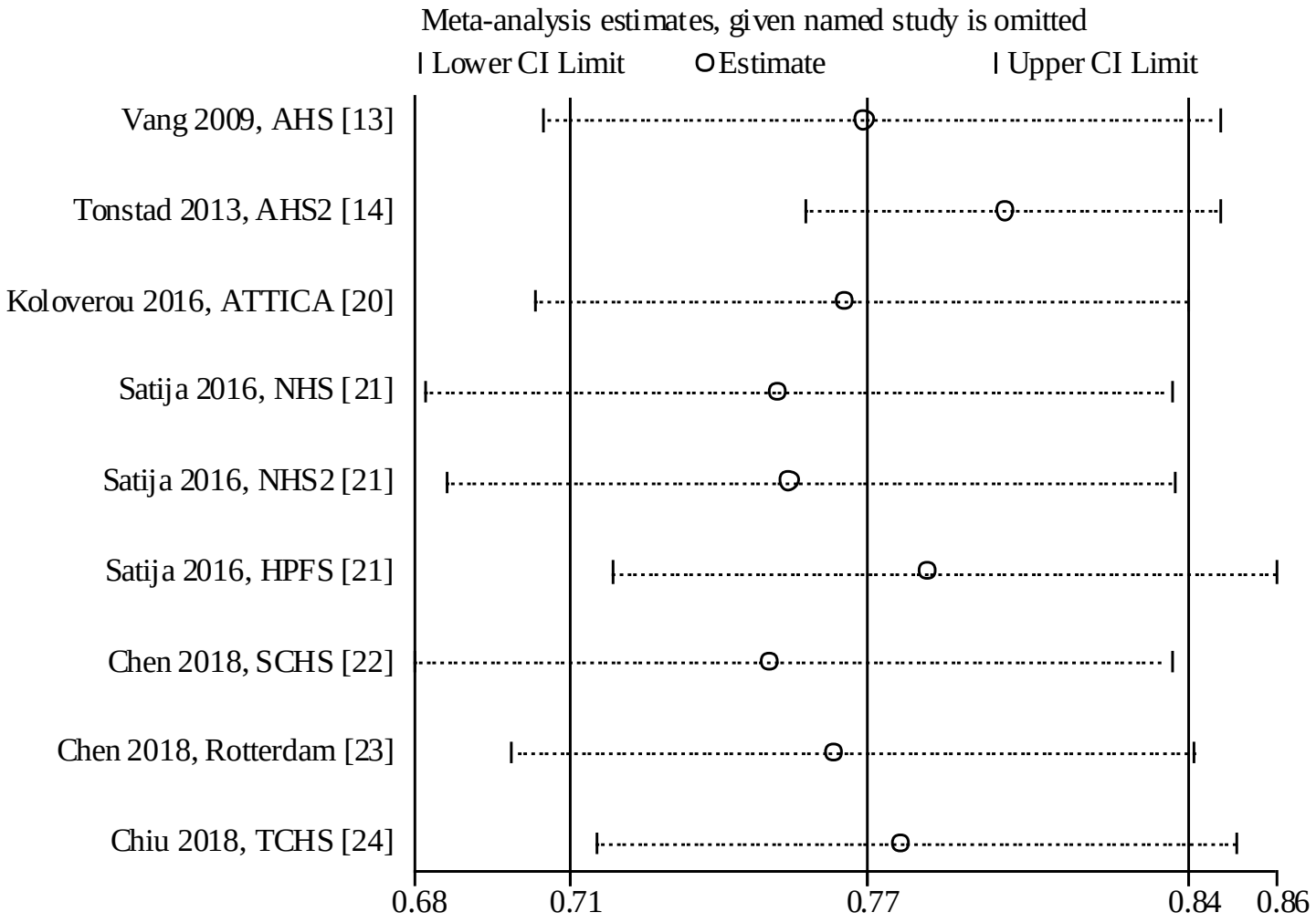
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	10. Was the exposure(s) assessed more than once over time?	X		
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?	X		
	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	X		
	Total	13		
Satija 2016 (HPFS)	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		
	3. Was the participation rate of eligible persons at least 50%?	X		
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
	5. Was a sample size justification, power description, or variance and effect estimates provided?		X	
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	X		
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	10. Was the exposure(s) assessed more than once over time?	X		
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?	X		
	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	X		
	Total	13		
Chen 2018 (SCHS)	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		
	3. Was the participation rate of eligible persons at least 50%?	X		
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?			
	5. Was a sample size justification, power description, or variance and effect estimates provided?		X	
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	X		
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?			
	10. Was the exposure(s) assessed more than once over time?		X	
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?	X		

	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	X		
	Total	12		
Chen 2018 (Rotterdam)	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		
	3. Was the participation rate of eligible persons at least 50%?	X		
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
	5. Was a sample size justification, power description, or variance and effect estimates provided?		X	
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	X		
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	10. Was the exposure(s) assessed more than once over time?		X	
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?	X		
	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	X		
	Total	12		
Chiu 2018	1. Was the research question or objective in this paper clearly stated?	X		
	2. Was the study population clearly specified and defined?	X		
	3. Was the participation rate of eligible persons at least 50%?	X		
	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	X		
	5. Was a sample size justification, power description, or variance and effect estimates provided?		X	
	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	X		
	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	X		
	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	X		
	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?		X	
	10. Was the exposure(s) assessed more than once over time?	X		
	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	X		
	12. Were the outcome assessors blinded to the exposure status of participants?	X		
	13. Was loss to follow-up after baseline 20% or less?	X		
	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	X		
	Total	12		

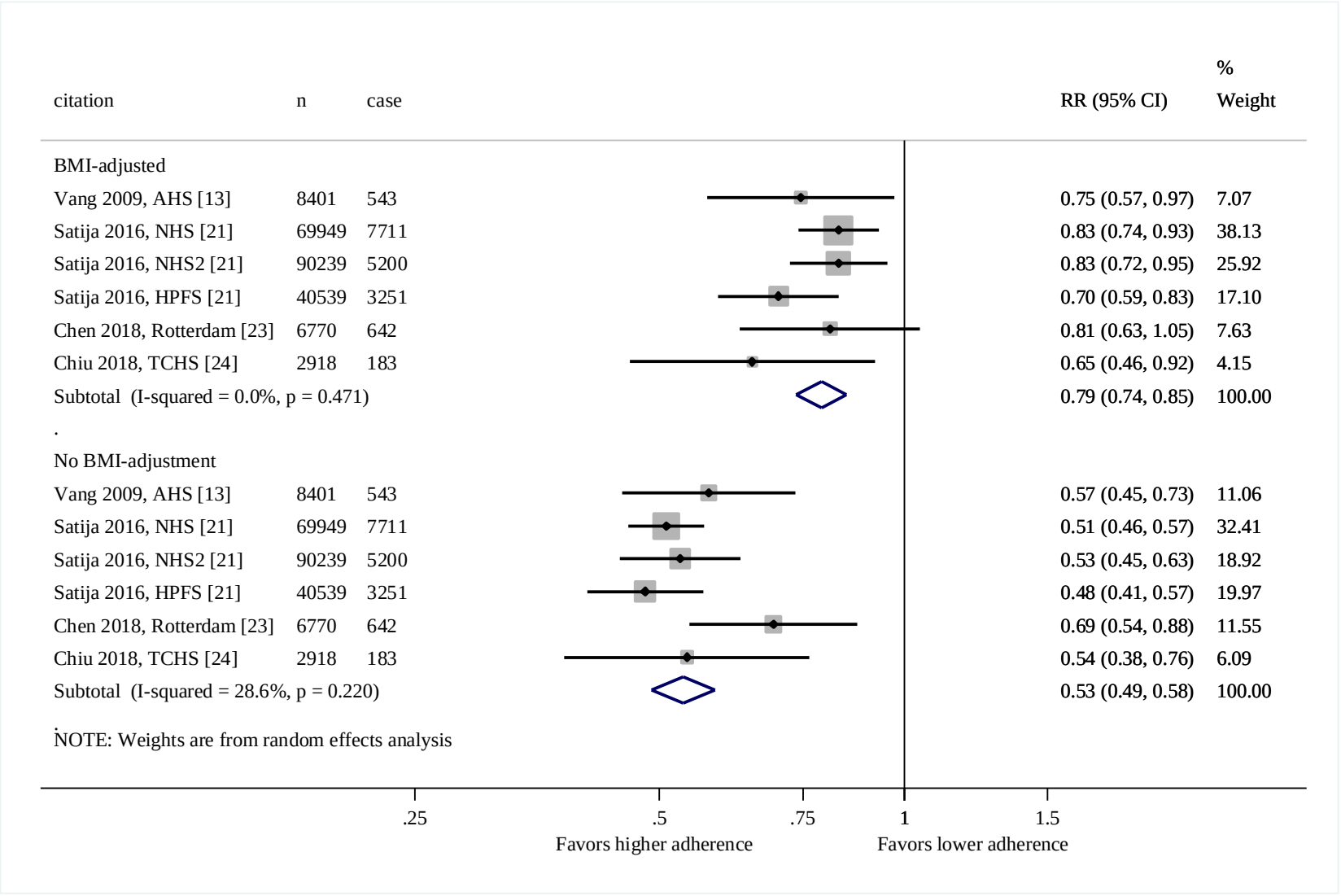


eFigure 1. Forest Plot of Prospective Studies Examining the Association Between Plant-Based Dietary Patterns and Risk of Type 2 Diabetes

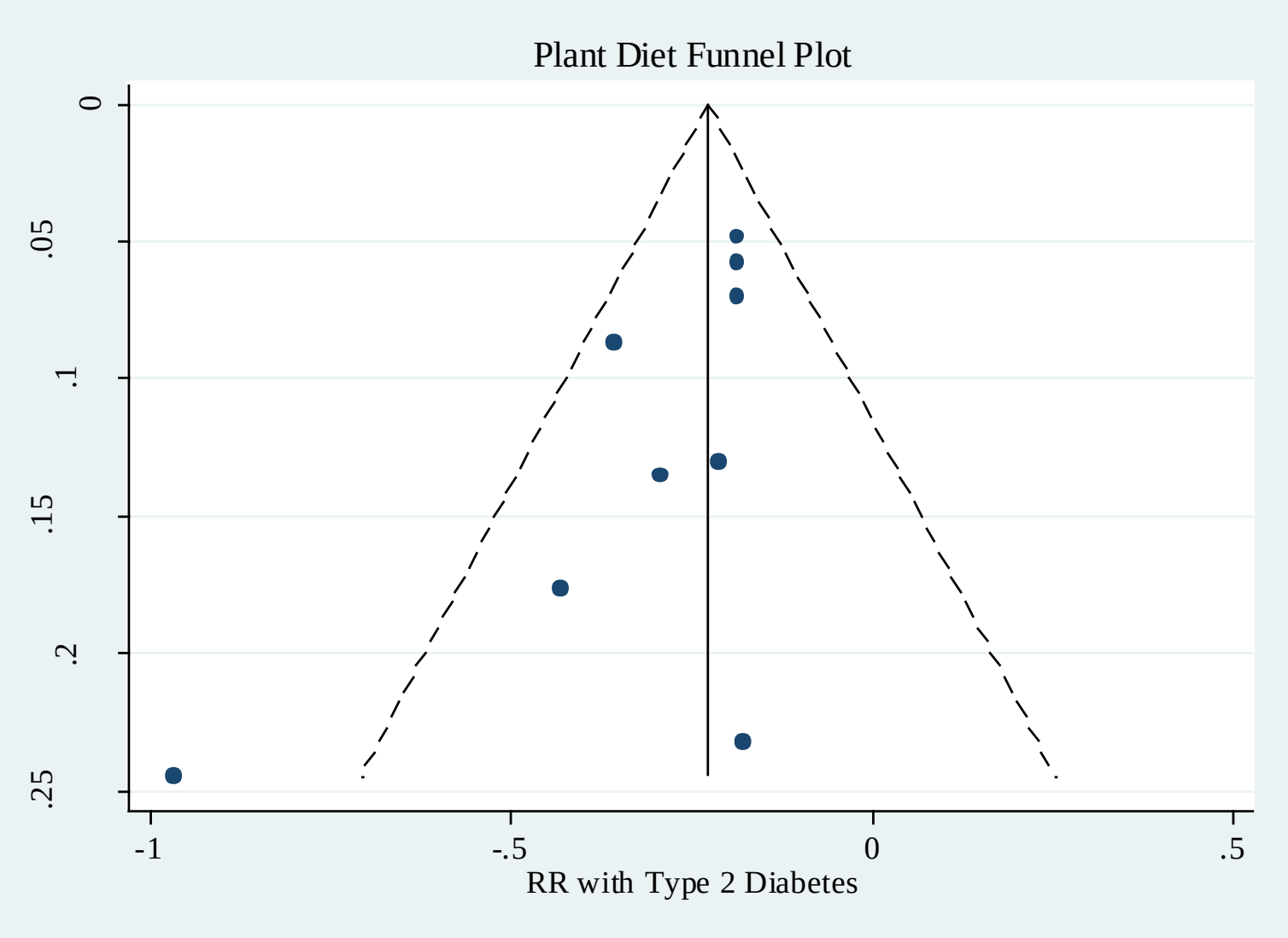
Pooled estimate was calculated using inverse-variance fixed-effects meta-analysis.



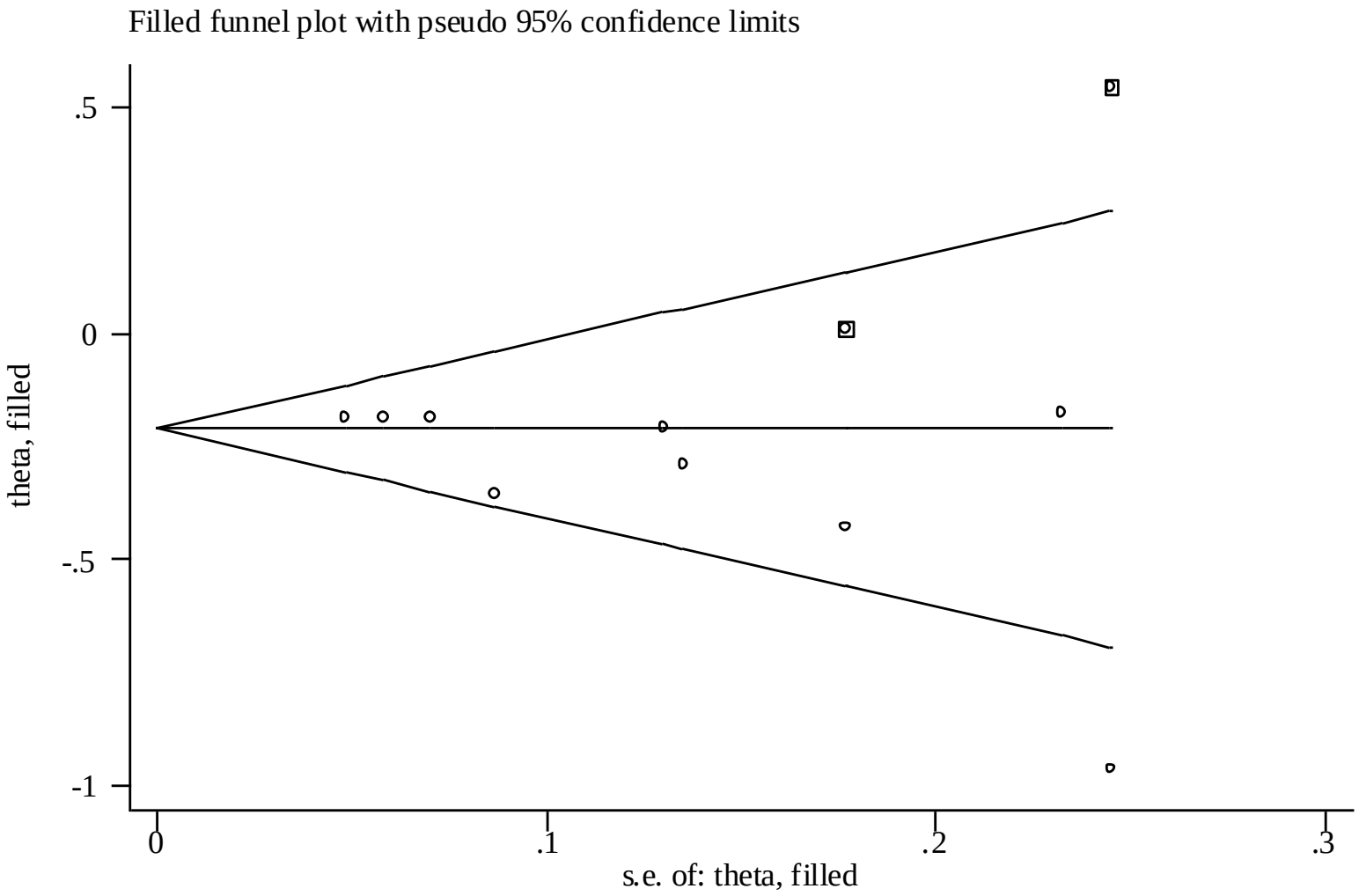
eFigure 2. Changes to the Overall Association Between Plant-Based Dietary Patterns and Risk of Type 2 Diabetes When Removing One Study at a time, Calculated Using Random-Effects Meta-Analysis



eFigure 3. Forest Plot of Prospective Studies Examining the Association Between Plant-Based Dietary Patterns and Risk of Type 2 Diabetes, With and Without Adjustments for Body Mass Index (BMI)
Calculated using random-effects meta-analysis.



eFigure 4. Funnel Plot of Prospective Studies Examining the Association Between Plant-Based Dietary Patterns and Risk of Type 2 Diabetes



eFigure 5. Fill and Trim Analysis to Account for Potential Publication Bias
Funnel plot was updated with two additional studies (circles with squares around them) that was filled in by the *metatrim* module in Stata.