

Diet for COVID-19: real-time meta analysis of 28 studies

@CovidAnalysis, March 2024, Version 32

<https://c19early.org/dtmeta.html>

Abstract

Statistically significant lower risk is seen for ICU admission, hospitalization, progression, recovery, cases, and viral clearance. 24 studies from 23 independent teams in 10 countries show statistically significant improvements.

Meta analysis using the most serious outcome reported shows 50% [41-58%] lower risk. Results are similar for higher quality studies.

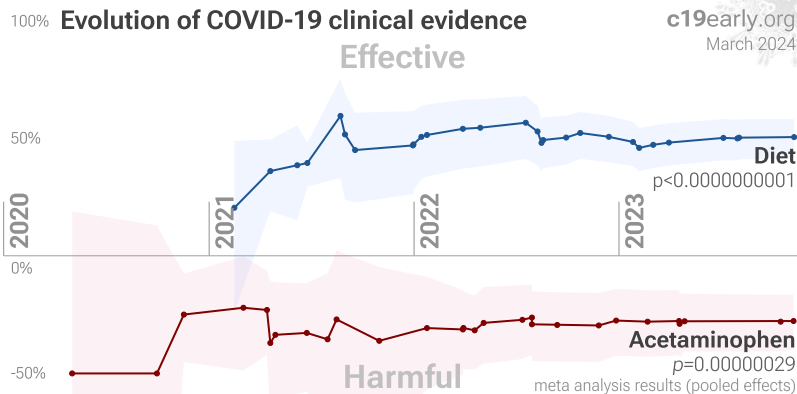
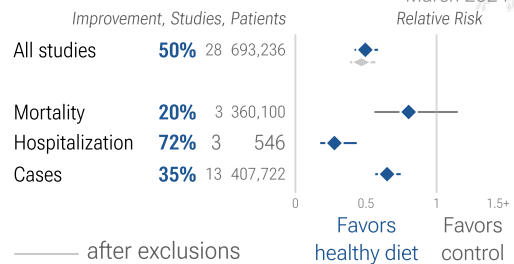
Results are robust — in exclusion sensitivity analysis 26 of 28 studies must be excluded to avoid finding statistically significant efficacy in pooled analysis.

Studies analyze diet quality before infection, and use different definitions of diet quality.

No treatment or intervention is 100% effective. All practical, effective, and safe means should be used based on risk/benefit analysis.

All data to reproduce this paper and sources are in the appendix. Other meta analyses show significant improvements with diet for hospitalization *Rahmati*, severity *Hao*, and cases *Hao, Rahmati*.

Diet for COVID-19



HIGHLIGHTS

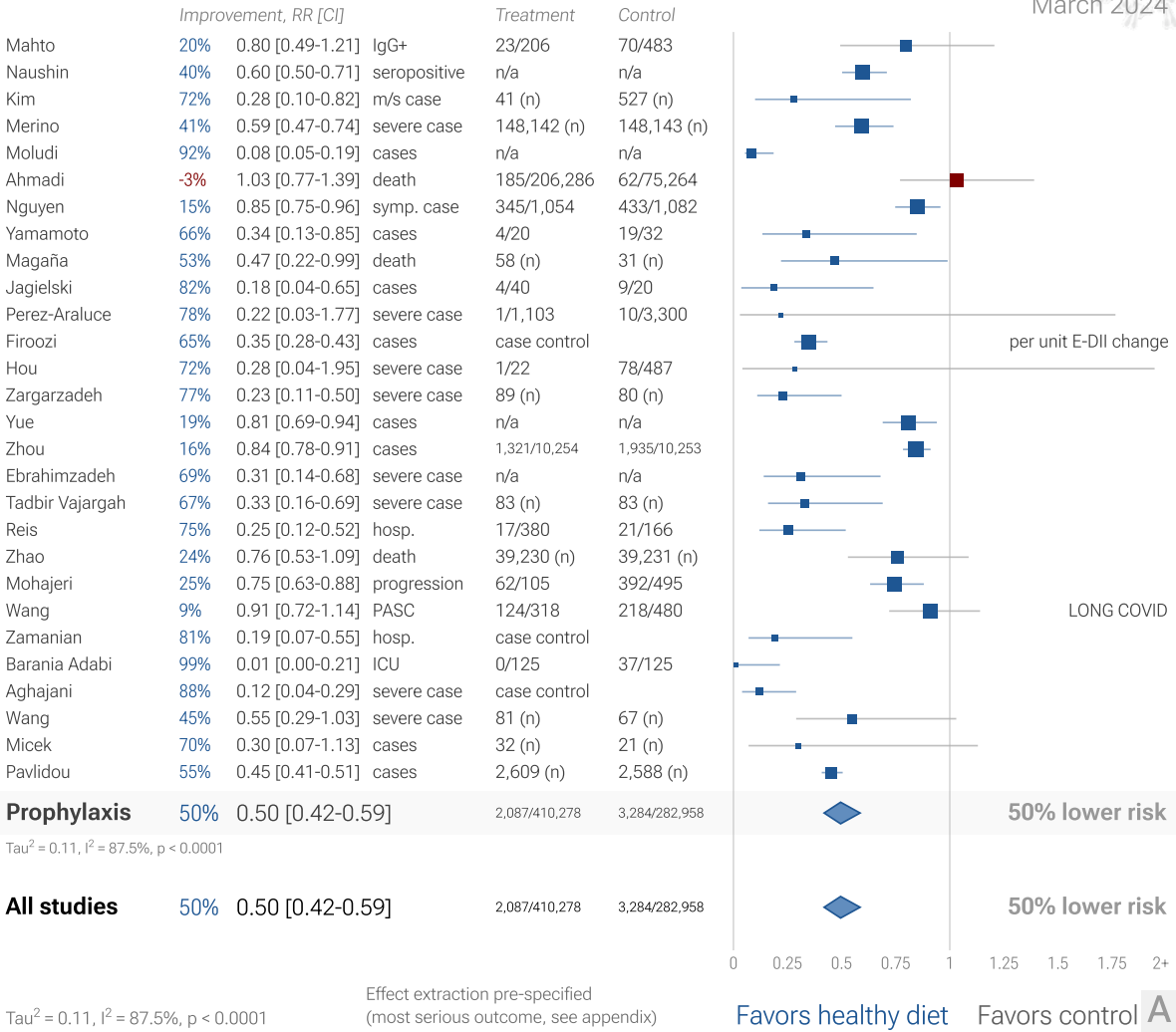
A healthier diet reduces risk for COVID-19 with very high confidence for hospitalization, cases, and in pooled analysis, low confidence for ICU admission, progression, recovery, and viral clearance, and very low confidence for mortality.

Diet was the 22nd treatment shown effective with ≥ 3 clinical studies in June 2021, now known with $p < 0.0000000001$ from 28 studies.

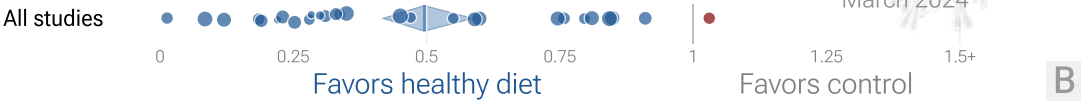
We show traditional outcome specific analyses and combined evidence from all studies.

Real-time updates and corrections, transparent analysis with all results in the same format, consistent protocol for 66 treatments.

28 diet COVID-19 studies



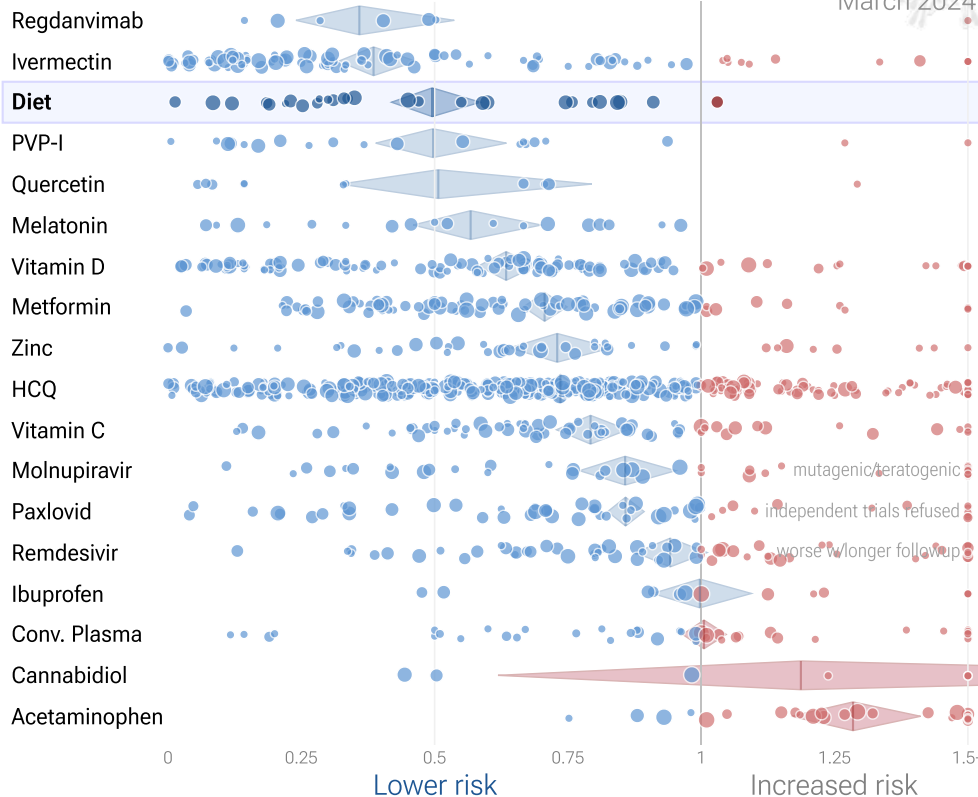
Efficacy in COVID-19 diet studies (pooled effects)



Efficacy in COVID-19 studies (pooled effects)

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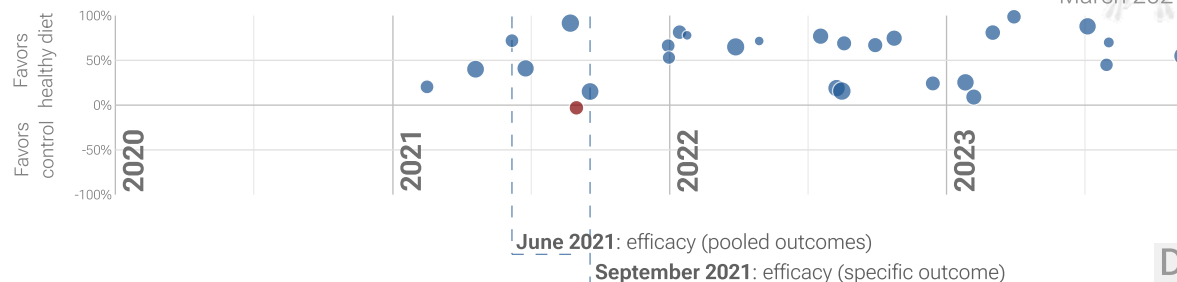


C

Timeline of COVID-19 diet studies (pooled effects)

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D

Figure 1. A. Random effects meta-analysis. This plot shows pooled effects, see the specific outcome analyses for individual outcomes, and the heterogeneity section for discussion. Effect extraction is pre-specified, using the most serious outcome reported. For details of effect extraction see the [appendix](#). **B. Scatter plot showing the most serious outcome in all studies.**

The diamond shows the results of random effects meta-analysis. **C. Results within the context of multiple COVID-19 treatments.** 0.6% of 6,686 proposed treatments show efficacy [c19early.org](#). **D. Timeline of results in diet studies.** The marked dates indicate the time when efficacy was known with a statistically significant improvement of $\geq 10\%$ from ≥ 3 studies for pooled outcomes and one or more specific outcome. Efficacy based on specific outcomes was delayed by 3.4 months, compared to using pooled outcomes.

Introduction

Analysis. We analyze all significant studies reporting COVID-19 outcomes as a function of diet quality and providing adjusted results. Search methods, inclusion criteria, effect extraction criteria (more serious outcomes have priority), all individual study data, PRISMA answers, and statistical methods are detailed in Appendix 1. We present random effects meta-analysis results for all studies, individual outcomes, and higher quality studies.

Results

Table 1 summarizes the results for all studies, after exclusions, and for specific outcomes. Figure 2, 3, 4, 5, 6, 7, 8, and 9 show forest plots for random effects meta-analysis of all studies with pooled effects, mortality results, ICU admission, hospitalization, progression, recovery, cases, and viral clearance.

	<i>Improvement</i>	<i>Studies</i>	<i>Patients</i>	<i>Authors</i>
All studies	50% [41-58%] ****	28	693,236	358
After exclusions	53% [43-61%] ****	24	691,433	340
Mortality	20% [-15-44%]	3	360,100	20
Hospitalization	72% [57-82%] ****	3	546	19
Cases	35% [25-43%] ****	13	407,722	132

Table 1. Random effects meta-analysis for all studies, after exclusions, and for specific outcomes. Results show the percentage improvement with higher quality diets and the 95% confidence interval. **** $p < 0.0001$.

28 diet COVID-19 studies

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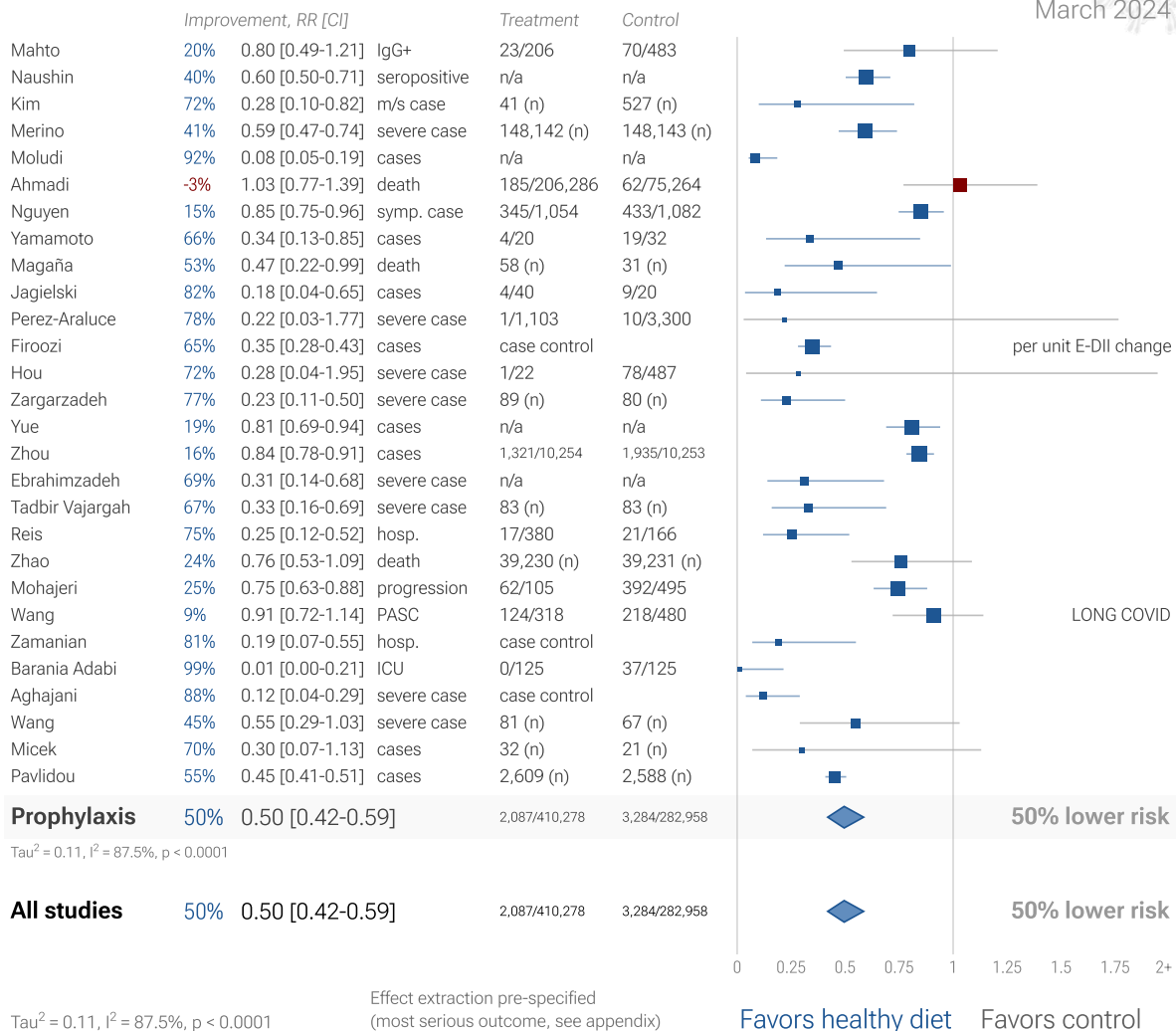


Figure 2. Random effects meta-analysis for all studies with pooled effects. This plot shows pooled effects, see the specific outcome analyses for individual outcomes, and the heterogeneity section for discussion. Effect extraction is pre-specified, using the most serious outcome reported. For details of effect extraction see the appendix.

3 diet COVID-19 mortality results

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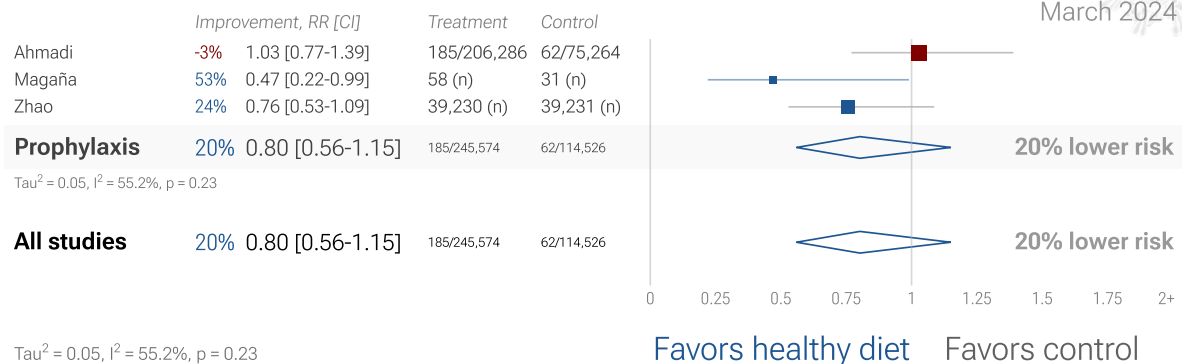


Figure 3. Random effects meta-analysis for mortality results.

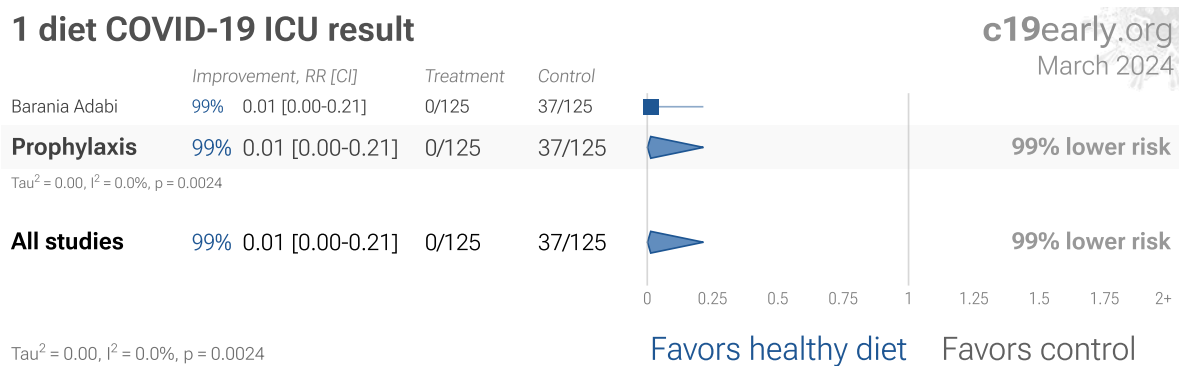


Figure 4. Random effects meta-analysis for ICU admission.

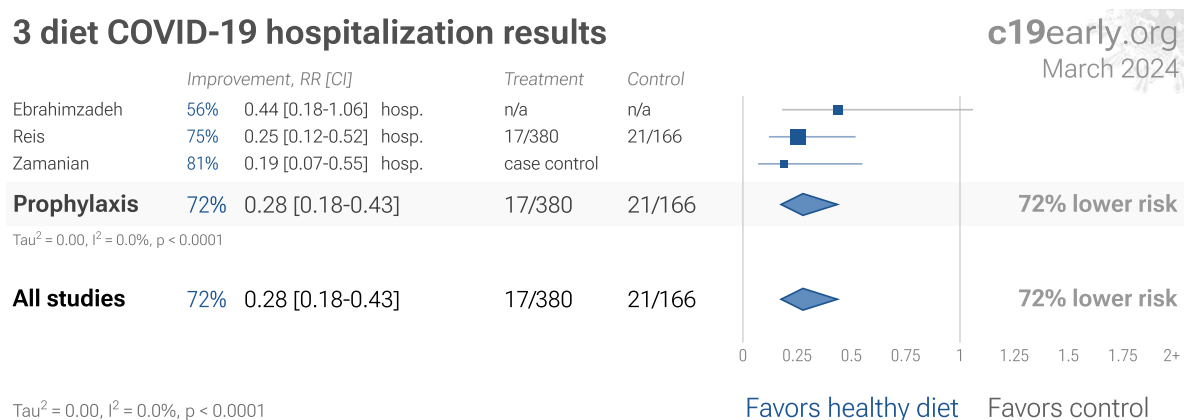


Figure 5. Random effects meta-analysis for hospitalization.

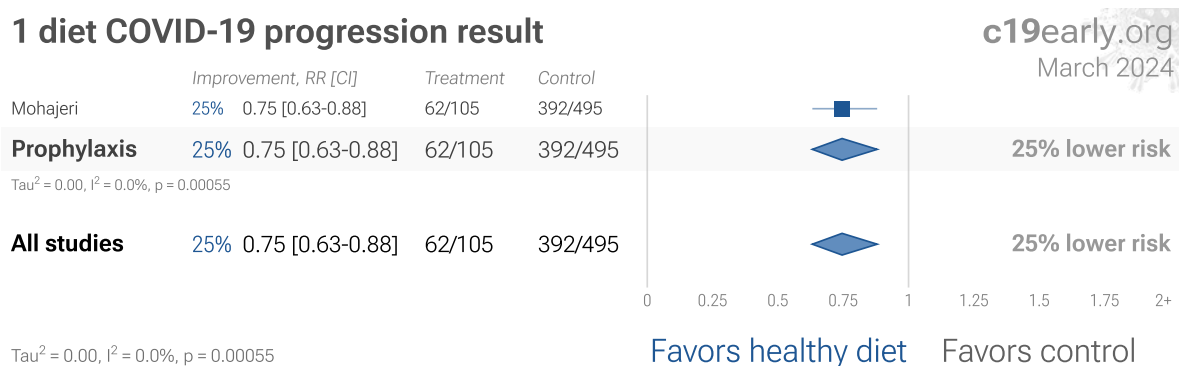


Figure 6. Random effects meta-analysis for progression.

1 diet COVID-19 recovery result

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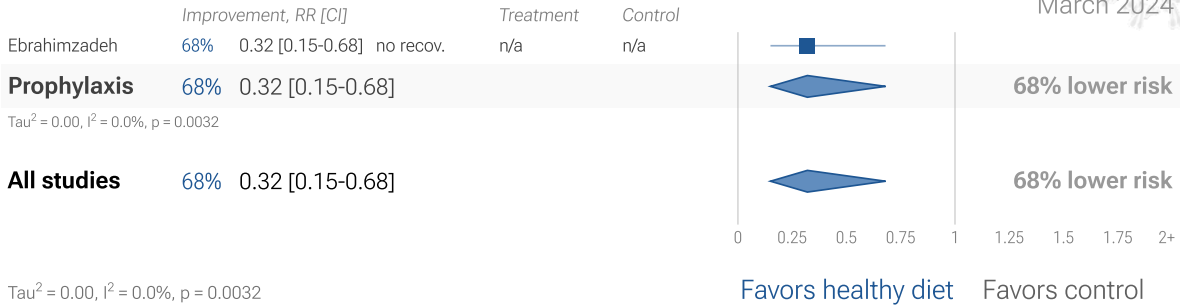


Figure 7. Random effects meta-analysis for recovery.

13 diet COVID-19 case results

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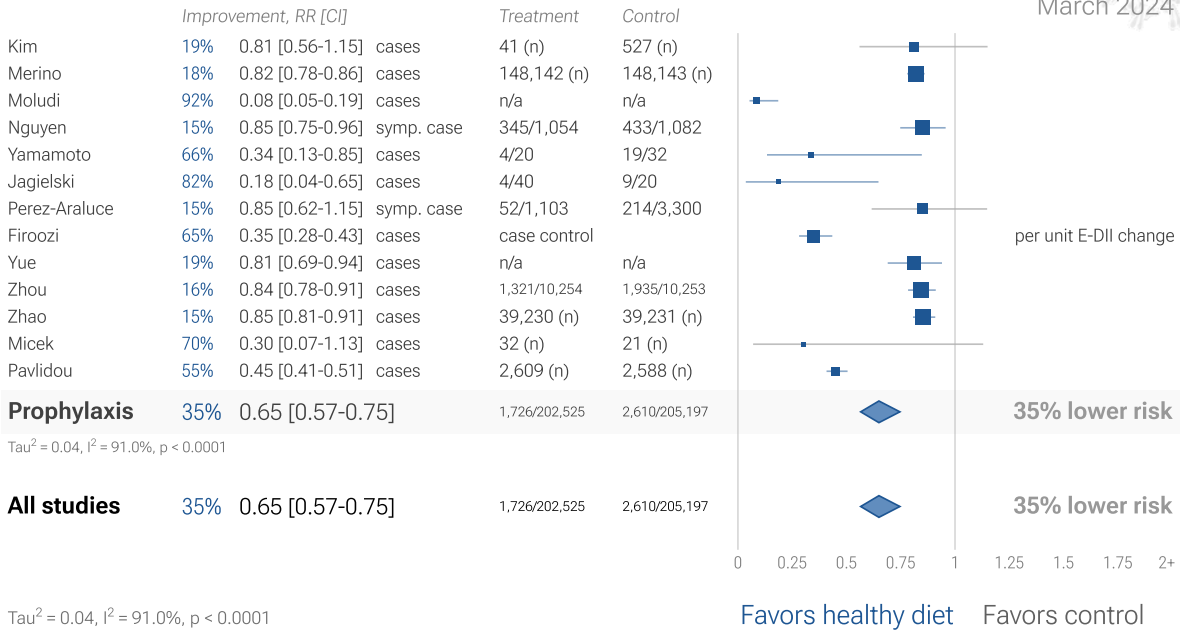


Figure 8. Random effects meta-analysis for cases.

1 diet COVID-19 viral clearance result

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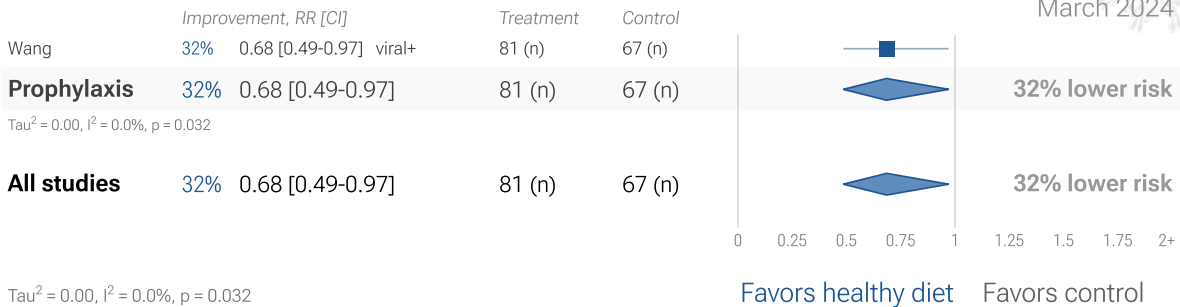


Figure 9. Random effects meta-analysis for viral clearance.

Exclusions

To avoid bias in the selection of studies, we analyze all non-retracted studies. Here we show the results after excluding studies with major issues likely to alter results, non-standard studies, and studies where very minimal detail is currently available. Our bias evaluation is based on analysis of each study and identifying when there is a significant chance that limitations will substantially change the outcome of the study. We believe this can be more valuable than checklist-based approaches such as Cochrane GRADE, which may underemphasize serious issues not captured in the checklists, overemphasize issues unlikely to alter outcomes in specific cases (for example, lack of blinding for an objective mortality outcome, or certain specifics of randomization with a very large effect size), and can be easily influenced by potential bias.

The studies excluded are as below. Figure 10 shows a forest plot for random effects meta-analysis of all studies after exclusions.

Hou, unadjusted results with no group details. Excluded results: severe case, moderate/severe case.

Magaña, unadjusted results with no group details.

Mahto, unadjusted results with no group details.

Mohajeri, unadjusted results with no group details.

Yamamoto, unadjusted results with no group details.

24 diet COVID-19 studies after exclusions

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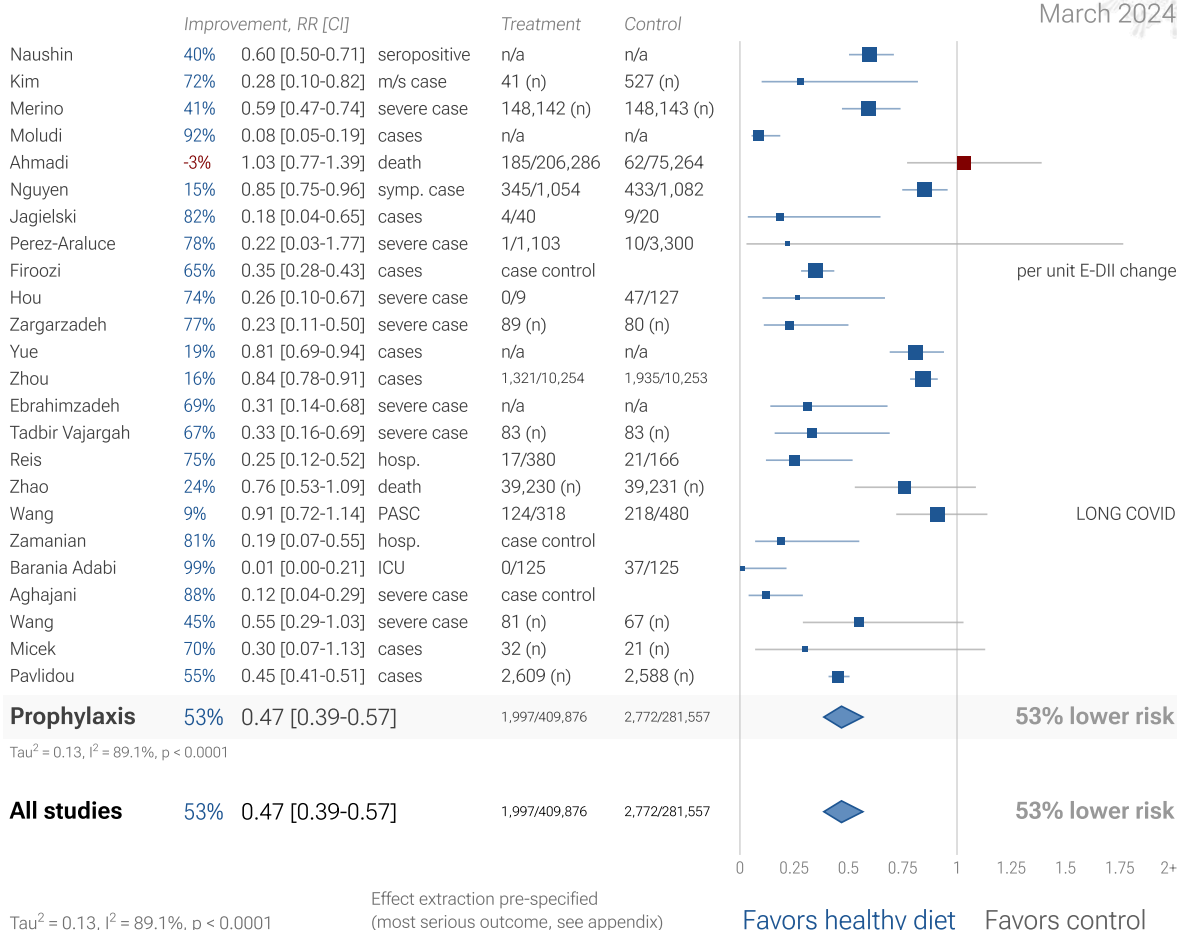


Figure 10. Random effects meta-analysis for all studies after exclusions. This plot shows pooled effects, see the specific outcome analyses for individual outcomes, and the heterogeneity section for discussion. Effect extraction is pre-specified, using the most serious outcome reported. For details of effect extraction see the appendix.

Conclusion

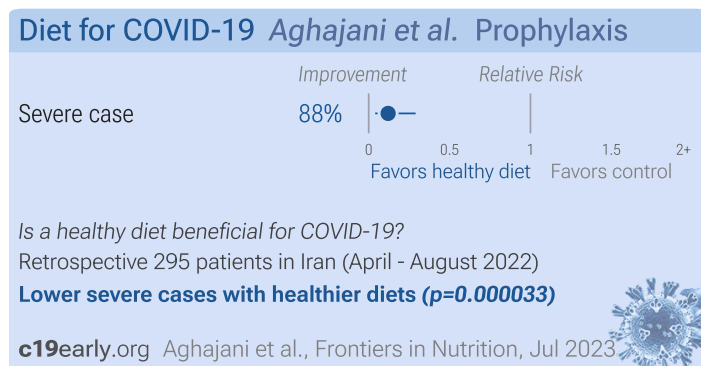
People with healthier diets have reduced risk for COVID-19. Statistically significant lower risk is seen for ICU admission, hospitalization, progression, recovery, cases, and viral clearance. 24 studies from 23 independent teams in 10 countries show statistically significant improvements. Meta analysis using the most serious outcome reported shows 50% [41-58%] lower risk. Results are similar for higher quality studies. Results are robust — in exclusion sensitivity analysis 26 of 28 studies must be excluded to avoid finding statistically significant efficacy in pooled analysis.

Studies analyze diet quality before infection, and use different definitions of diet quality.

Other meta analyses show significant improvements with diet for hospitalization ^{Rahmati}, severity ^{Hao}, and cases ^{Hao, Rahmati}.

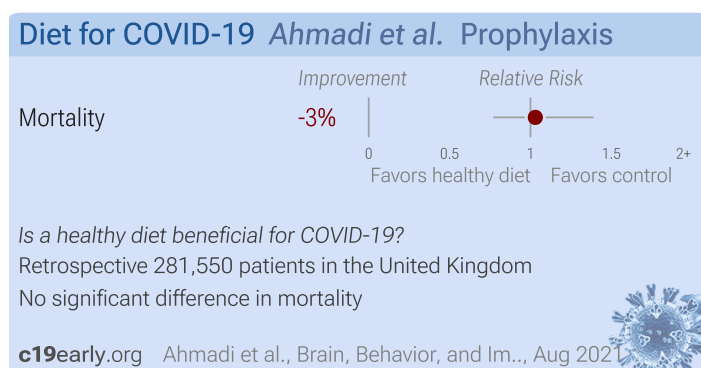
Study Notes

Aghajani



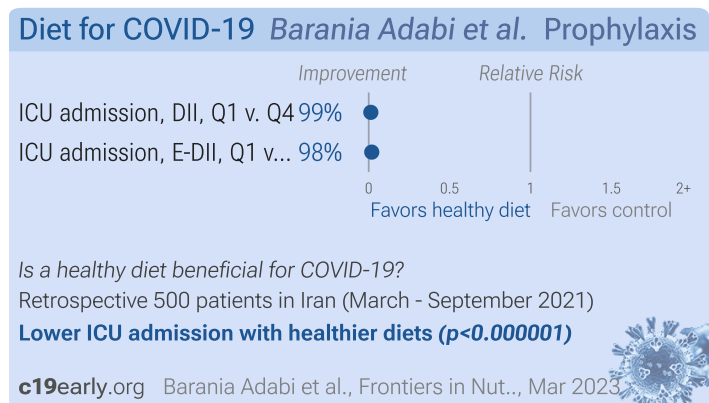
Aghajani: Case control study of 295 COVID-19 patients in Iran, showing lower risk of severe cases with higher dietary antioxidant quality scores, and with higher intake of vitamin D.

Ahmadi



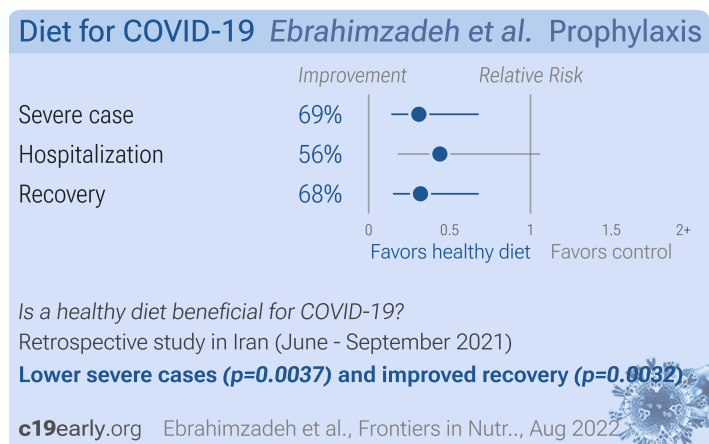
Ahmadi: Retrospective 468,569 adults in the UK, showing significantly lower COVID-19 mortality with physical activity.

Barania Adabi



Barania Adabi: Retrospective 500 COVID-19 patients, showing dietary inflammatory index (DII) and energy-adjusted dietary inflammatory index (E-DII) associated with COVID-19 severity.

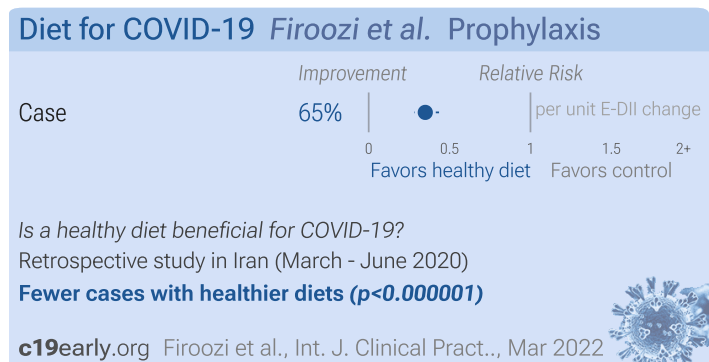
Ebrahimzadeh



Ebrahimzadeh: Retrospective 250 recovered COVID-19 patients, showing lower risk of severe cases and shorter recovery and hospitalization times with a healthy diet.

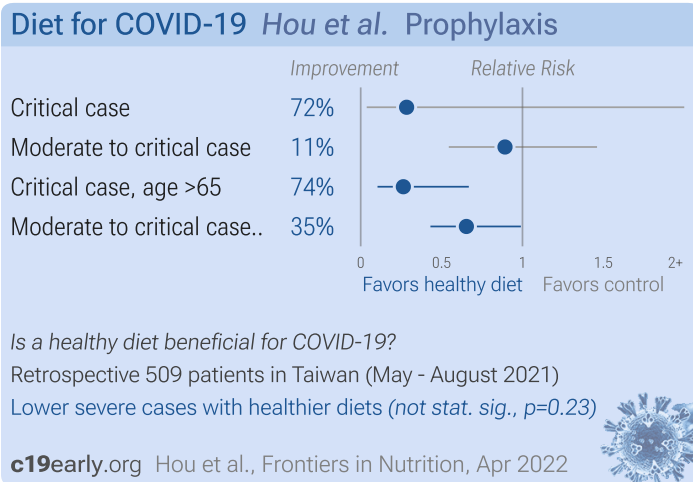
Notably, all individual symptoms show lower incidence with a healthy diet with the exception of fever and chills. Fever and chills help the immune system fight infections (shivering helps to raise the body temperature).

Firoozi



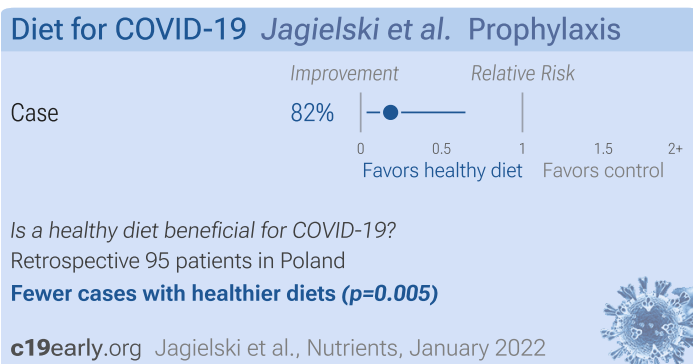
Firoozi: Retrospective 133 COVID-19 patients and 322 controls, showing higher risk of COVID-19 for diets that have a higher inflammatory index (E-DII).

Hou



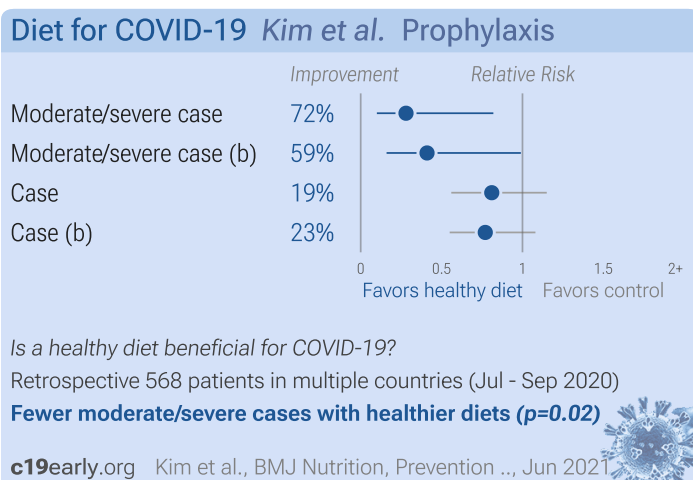
Hou: Retrospective 509 COVID-19 patients in Taiwan, showing higher risk of critical COVID-19 cases with non-vegetarian diets.

Jagielski



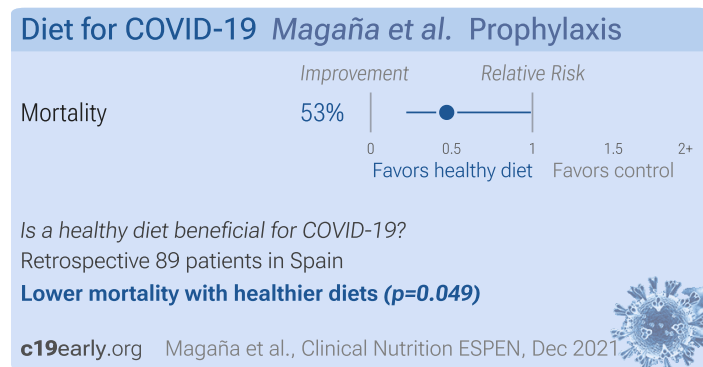
Jagielski: Retrospective 95 people in Poland, showing significantly lower risk of COVID-19 with higher consumption of fruits, vegetables, and nuts. Diets with higher consumption of fruits, vegetables, and nuts had a significantly lower dietary inflammatory index.

Kim



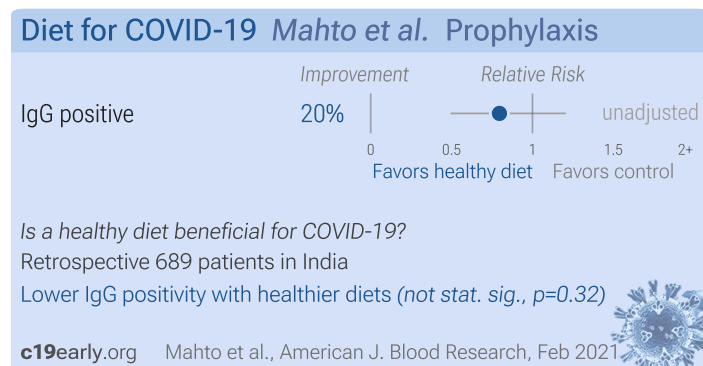
Kim: Retrospective healthcare workers in six countries with exposure to COVID-19 patients, showing lower risk of moderate/severe COVID-19 with plant-based diets.

Magaña



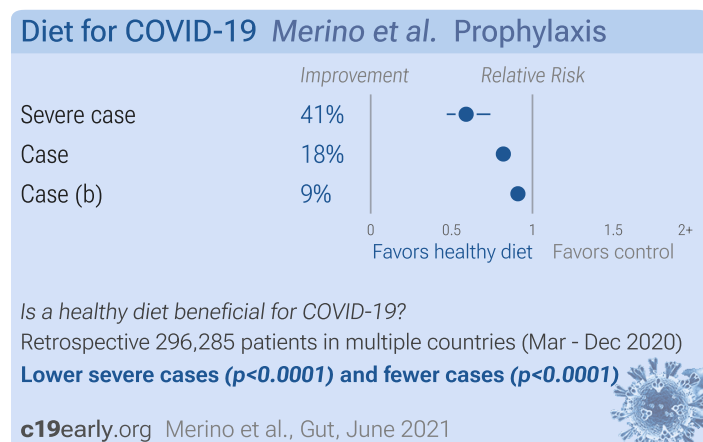
Magaña: Retrospective 89 COVID-19 patients in Spain, showing lower mortality with adherence to the Mediterranean diet.

Mahto



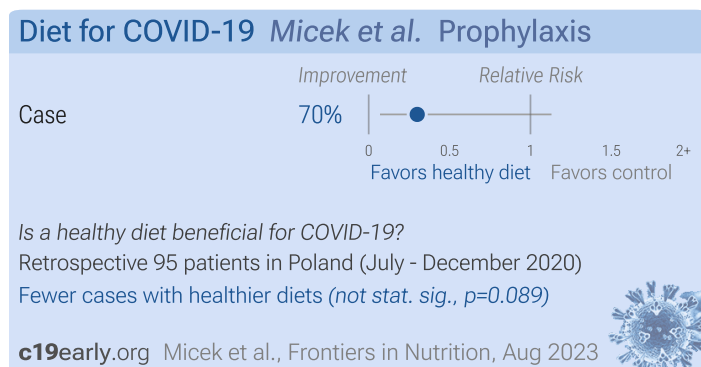
Mahto: Retrospective 689 healthcare workers in India, showing non-statistically significant lower risk of IgG positivity with a vegetarian diet in unadjusted results.

Merino



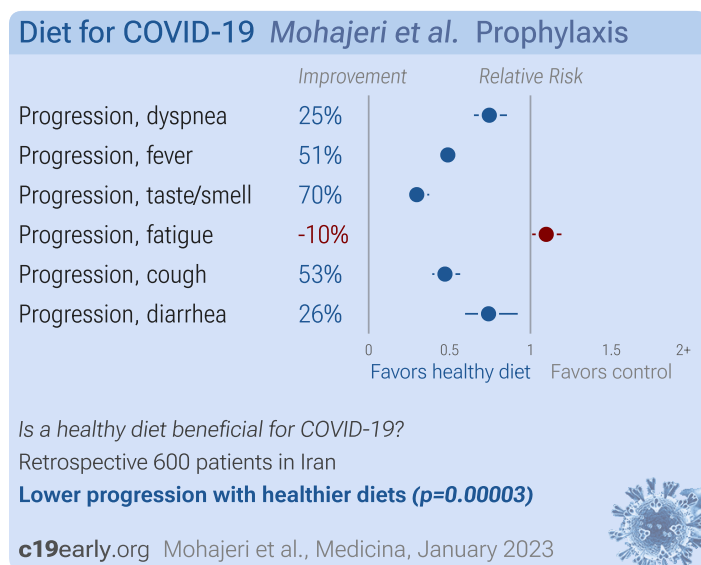
Merino: Retrospective 592,571 participants in the UK and USA with 31,815 COVID-19 cases, showing lower risk or COVID-19 cases and severity for higher healthful plant-based diet scores. Notably, the association was less evident with higher levels of physical activity.

Micek



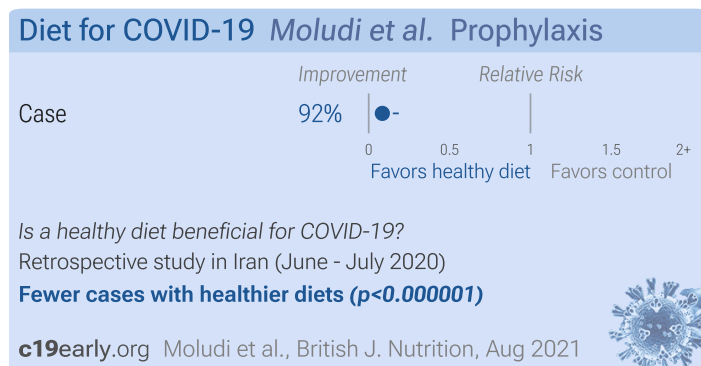
Micek: Dietary analysis of 95 adults in Poland, showing lower risk of COVID-19 with higher intake of polyphenols, lignans, and phytosterols. Results were statistically significant for total phytosterols, secoisolariciresinol, β -sitosterol, matairesinol, and stigmaterol. Authors suggest that beneficial effects on gut microbiota and immune function may contribute to the lower risk.

Mohajeri



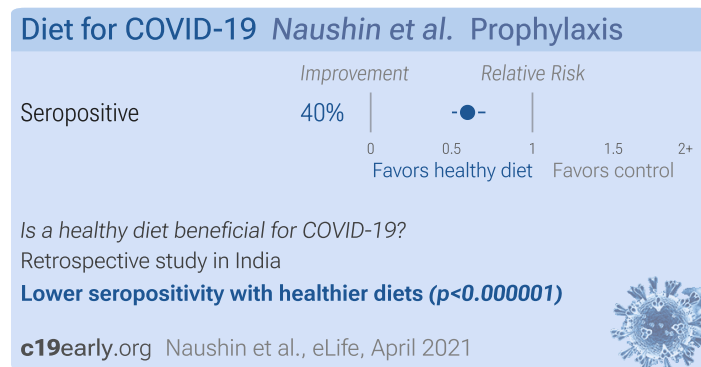
Mohajeri: Retrospective 600 COVID-19 patients in Iran with moderate/severe CT scans, showing lower prevalence of dyspnea, fever, taste/smell abnormalities, and cough with high adherence to the Mediterranean diet in unadjusted results.

Moludi



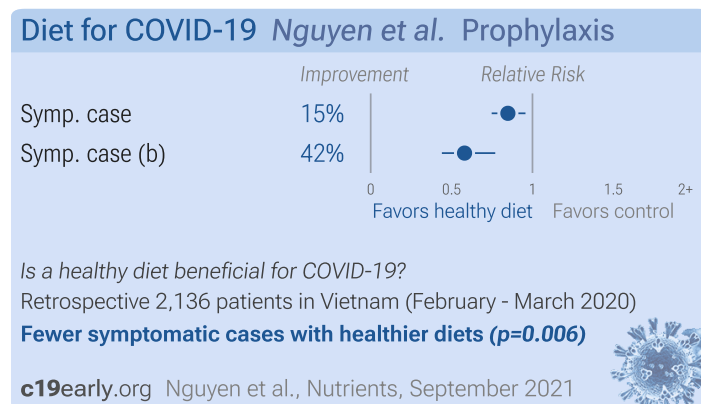
Moludi: Retrospective 60 COVID-19 hospitalized patients and 60 controls in Iran, showing pro-inflammatory diets associated with COVID-19 cases and severity. IR.KUMS.REC.1399-444, IR.TBZMED.REC.1399-225.

Naushin



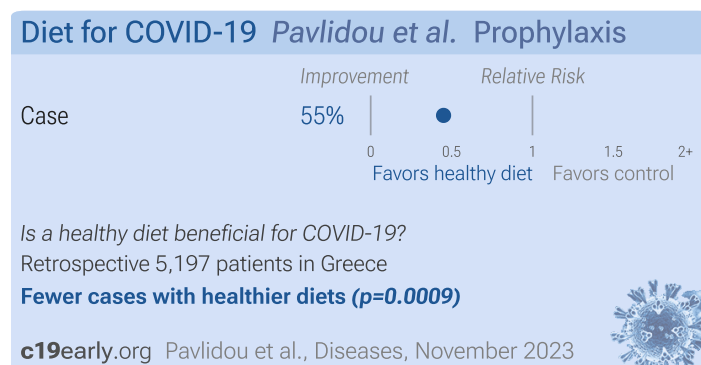
Naushin: Retrospective 10,427 volunteers in India, 1,058 anti-nucleocapsid antibody positive, showing lower risk of seropositivity with a vegetarian diet.

Nguyen



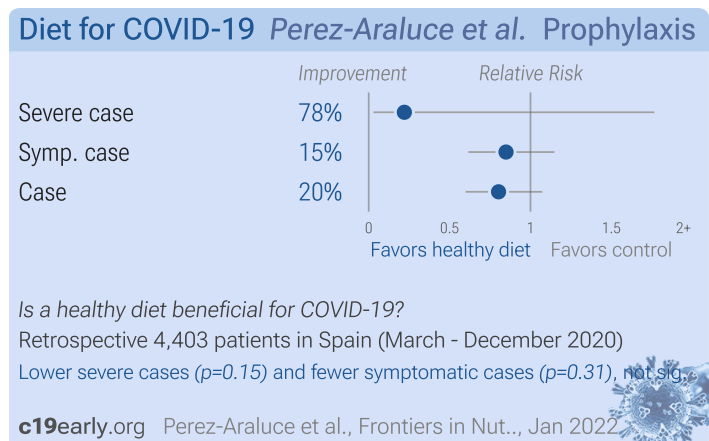
Nguyen: Analysis of 3,947 participants in Vietnam, showing significantly lower risk of COVID-19-like symptoms with physical activity and with a healthy diet. The combination of being physically active and eating healthy reduced risk further compared to either alone. The analyzed period was Feb 14 to Mar 2, 2020, which may have been before testing was widely available.

Pavlidou



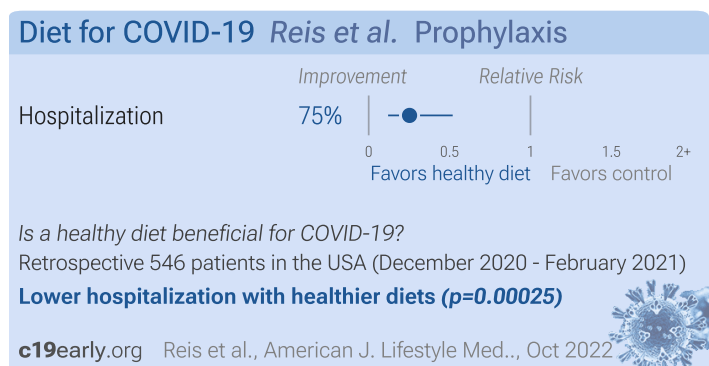
Pavlidou: Retrospective 5,197 Greek adults over 65. After adjustment for confounders, COVID-19 infection was independently associated with poor sleep, low physical activity, low Mediterranean diet adherence, living in urban areas, smoking, obesity, depression, anxiety, stress, and poor health-related quality of life.

Perez-Araluce



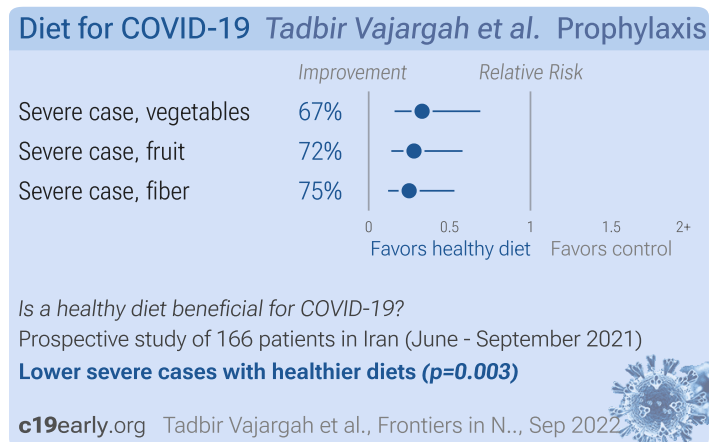
Perez-Araluce: Retrospective 5,194 participants in Spain with 382 COVID-19 cases, showing lower risk of COVID-19 with high adherence to a Mediterranean diet, with statistical significance only when excluding healthcare professionals.

Reis



Reis: Retrospective 546 COVID+ patients in the USA, showing lower risk of hospitalization with higher consumption of vegetables.

Tadbir Vajargah

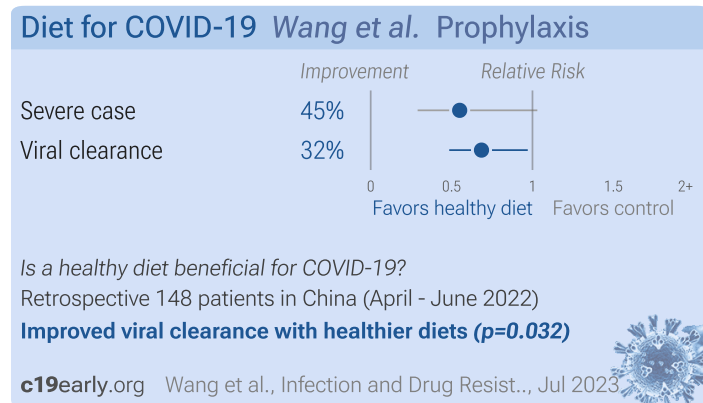


Tadbir Vajargah: Retrospective 250 hospitalized patients in Iran, showing higher consumption of fruits, vegetables, and fiber associated with lower COVID-19 severity.

Tomasa-Irriguible

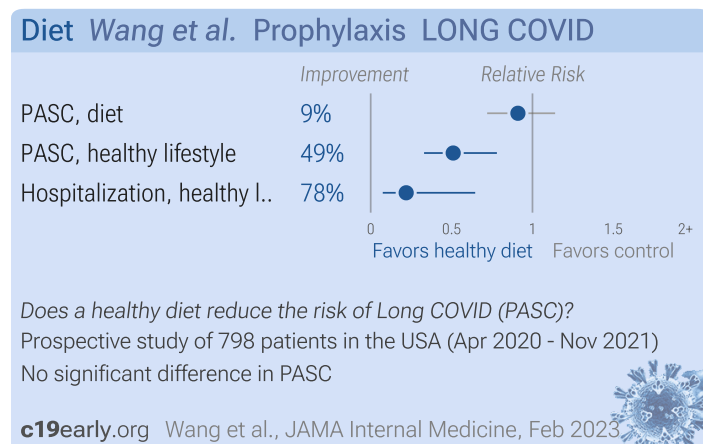
Tomasa-Irriguible: Estimated 300 patient diet early treatment RCT with results expected soon (estimated completion over 3 months ago).

Wang



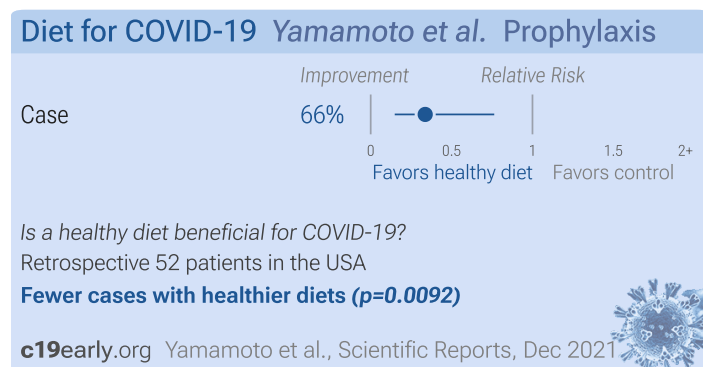
Wang: Retrospective 148 hospitalized COVID-19 patients in China, showing lower severity and faster viral clearance with improved nutrition.

Wang



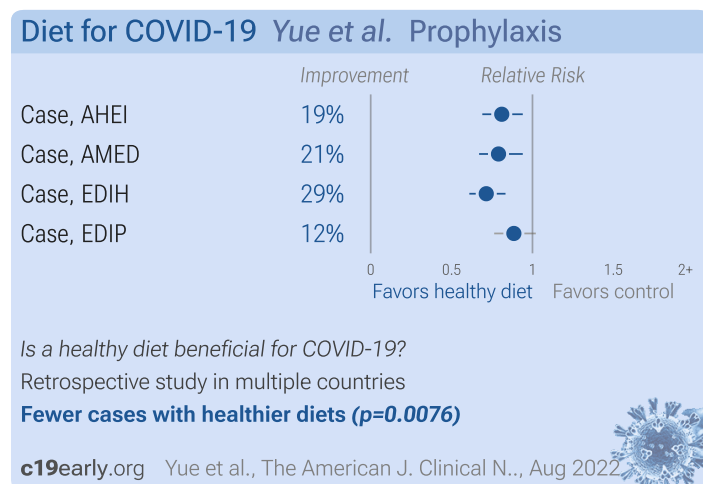
Wang (B): Prospective analysis of 32,249 women from the Nurses' Health Study II in the USA, showing lower risk of PASC with a healthy lifestyle, and in a dose-dependent manner. Participants with 5 or 6 healthy lifestyle factors had significantly lower COVID-19 hospitalization and PASC. BMI and sleep were independently associated with risk of PASC.

Yamamoto



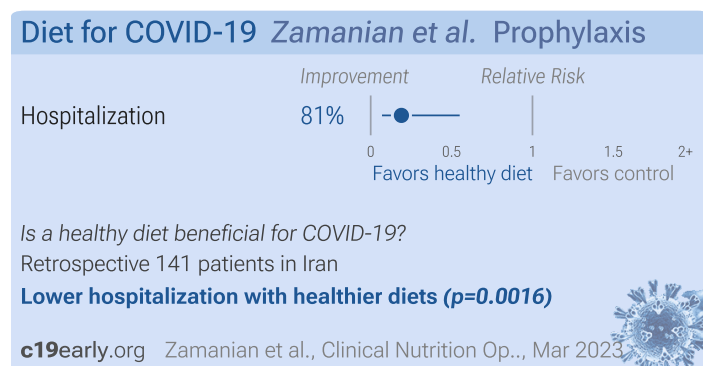
Yamamoto: Retrospective 84 flight attendants, 52 reporting COVID-19 status and diet quality, showing higher risk of COVID-19 with lower self-reported diet quality.

Yue



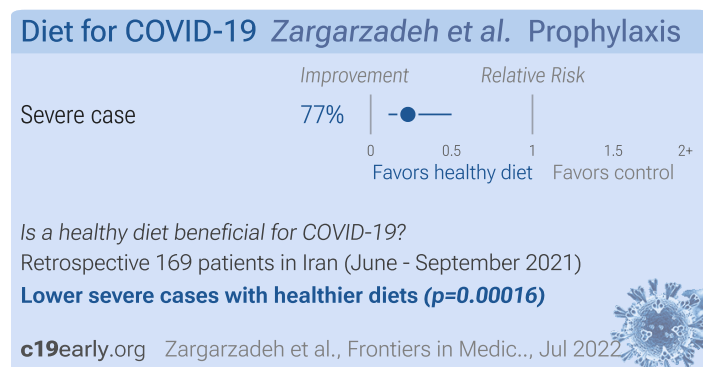
Yue: Analysis of 42,935 participants showing lower risk of COVID-19 with healthier diets. Risk of severe cases was also lower with healthier diets, while not reaching statistical significance. Severity results are only provided with diet indices as a continuous variable.

Zamanian



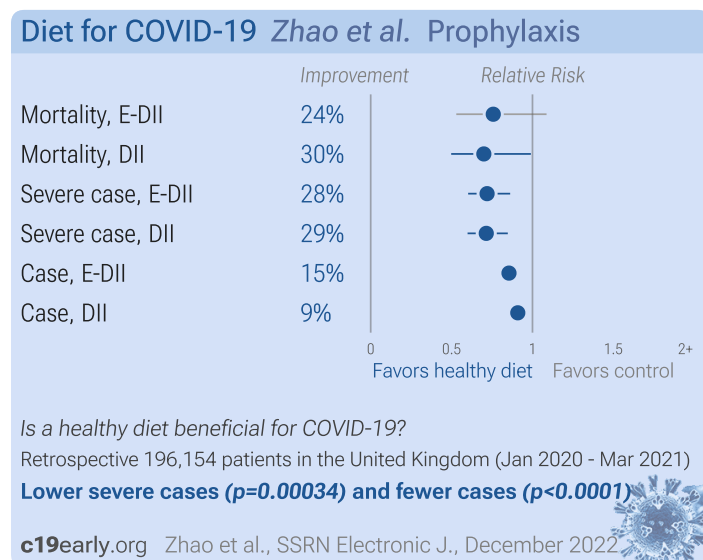
Zamanian: Case control study with 53 inpatients and 88 outpatients in Iran, showing lower risk of hospitalization with increased adherence to the DASH (Dietary Approach to Stop Hypertension) diet. Increased intake of fruits, vegetables and low-fat dairy products, and lower intake of sodium and processed/red meat were significantly associated with reduced risk of hospitalization due to COVID-19.

Zargarzadeh



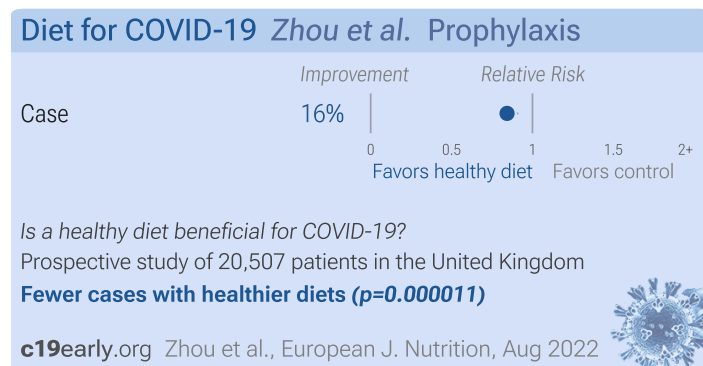
Zargarzadeh: Retrospective 250 COVID-19 patients in Iran, showing lower risk of severe disease with greater adherence to a Mediterranean diet.

Zhao



Zhao: UK Biobank retrospective 196,154 participants with 11,288 COVID-19 cases, showing lower COVID-19 mortality, severity, and incidence for lower dietary inflammatory scores.

Zhou



Zhou: Prospective study of 41,012 UK Biobank participants, showing higher risk of COVID-19 cases with ultra-processed food consumption.

Appendix 1. Methods and Data

We perform ongoing searches of PubMed, medRxiv, Europe PMC, ClinicalTrials.gov, The Cochrane Library, Google Scholar, Research Square, ScienceDirect, Oxford University Press, the reference lists of other studies and meta-analyses, and submissions to the site c19early.org. Search terms are diet AND COVID-19. Automated searches are performed twice daily, with all matches reviewed for inclusion. All studies regarding the use of diet for COVID-19 that report a comparison with a control group are included in the main analysis. Sensitivity analysis is performed, excluding studies with major issues, epidemiological studies, and studies with minimal available information. This is a living analysis and is updated regularly.

We extracted effect sizes and associated data from all studies. If studies report multiple kinds of effects then the most serious outcome is used in pooled analysis, while other outcomes are included in the outcome specific analyses. For example, if effects for mortality and cases are both reported, the effect for mortality is used, this may be different to the effect that a study focused on. If symptomatic results are reported at multiple times, we used the latest time, for example if mortality results are provided at 14 days and 28 days, the results at 28 days have preference. Mortality alone is preferred over combined outcomes. Outcomes with zero events in both arms are not used, the next most serious outcome with one or more events is used. For example, in low-risk populations with no mortality, a reduction in mortality with treatment is not possible, however a reduction in hospitalization, for example, is still valuable. Clinical outcomes are considered more important than viral test status. When basically all patients recover in both treatment and control groups, preference for viral clearance and recovery is given to results mid-recovery where available. After most or all patients have recovered there is little or no room for an effective treatment to do better, however faster recovery is valuable. If only individual symptom data is available, the most serious symptom has priority, for example difficulty breathing or low SpO₂ is more important than cough. When results provide an odds ratio, we compute the relative risk when possible, or convert to a relative risk according to [Zhang](#). Reported confidence intervals and *p*-values were used when available, using adjusted values when provided. If multiple types of adjustments are reported propensity score matching and multivariable regression has preference over propensity score matching or weighting, which has preference over multivariable regression. Adjusted results have preference over unadjusted results for a more serious outcome when the adjustments significantly alter results. When needed, conversion between reported *p*-values and confidence intervals followed [Altman, Altman \(B\)](#), and Fisher's exact test was used to calculate *p*-values for event data. If continuity correction for zero values is required, we use the reciprocal of the opposite arm with the sum of the correction factors equal to 1 [Sweeting](#). Results are expressed with RR < 1.0 favoring treatment, and using the risk of a negative outcome when applicable (for example, the risk of death rather than the risk of survival). If studies only report relative continuous values such as relative times, the ratio of the time for the treatment group versus the time for the control group is used. Calculations are done in Python (3.12.2) with [scipy](#) (1.12.0), [pythonmeta](#) (1.26), [numpy](#) (1.26.4), [statsmodels](#) (0.14.1), and [plotly](#) (5.19.0).

Forest plots are computed using [PythonMeta](#) [Deng](#) with the DerSimonian and Laird random effects model (the fixed effect assumption is not plausible in this case) and inverse variance weighting. Results are presented with 95% confidence intervals. Heterogeneity among studies was assessed using the I^2 statistic. Mixed-effects meta-regression results are computed with R (4.1.2) using the [metafor](#) (3.0-2) and [rms](#) (6.2-0) packages, and using the most serious sufficiently powered outcome. For all statistical tests, a *p*-value less than 0.05 was considered statistically significant. [Grobid](#) 0.8.0 is used to parse PDF documents.

We have classified studies as early treatment if most patients are not already at a severe stage at the time of treatment (for example based on oxygen status or lung involvement), and treatment started within 5 days of the onset of symptoms. If studies contain a mix of early treatment and late treatment patients, we consider the treatment time of patients contributing most to the events (for example, consider a study where most patients are treated early but late treatment patients are included, and all mortality events were observed with late treatment patients). We note that a shorter time may be preferable. Antivirals are typically only considered effective when used within a shorter timeframe, for example 0-36 or 0-48 hours for oseltamivir, with longer delays not being effective [McLean, Treanor](#).

We received no funding, this research is done in our spare time. We have no affiliations with any pharmaceutical companies or political parties.

A summary of study results is below. Please submit updates and corrections at <https://c19early.org/dtmeta.html>.

Early treatment

Effect extraction follows pre-specified rules as detailed above and gives priority to more serious outcomes. For pooled analyses, the first (most serious) outcome is used, which may differ from the effect a paper focuses on. Other outcomes are used in outcome specific analyses.

<i>Tomas-Irriguible</i> , 11/30/2023, Double Blind Randomized Controlled Trial, placebo-controlled, Spain, trial NCT04751669 (history) (CoVIT).	Estimated 300 patient RCT with results unknown and over 3 months late.
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Prophylaxis

Effect extraction follows pre-specified rules as detailed above and gives priority to more serious outcomes. For pooled analyses, the first (most serious) outcome is used, which may differ from the effect a paper focuses on. Other outcomes are used in outcome specific analyses.

<i>Aghajani</i> , 7/6/2023, retrospective, Iran, peer-reviewed, 4 authors, study period April 2022 - August 2022.	risk of severe case, 88.0% lower, OR 0.12, $p < 0.001$, higher quality diet 96, lower quality diet 85, adjusted per study, case control OR, DAQS tertile 3 vs. tertile 1, multivariable, model 3.
<i>Ahmadi</i> , 8/31/2021, retrospective, United Kingdom, peer-reviewed, 5 authors.	risk of death, 3.0% higher, RR 1.03, $p = 0.85$, adjusted per study, good vs. poor, model 2, multivariable.
<i>Barania Adabi</i> , 3/31/2023, retrospective, Iran, peer-reviewed, survey, mean age 40.3, 5 authors, study period March 2021 - September 2021.	risk of ICU admission, 98.7% lower, RR 0.01, $p < 0.001$, higher quality diet 0 of 125 (0.0%), lower quality diet 37 of 125 (29.6%), NNT 3.4, relative risk is not 0 because of continuity correction due to zero events (with reciprocal of the contrasting arm), DII, quartile I vs. quartile IV.
	risk of ICU admission, 98.1% lower, RR 0.02, $p < 0.001$, higher quality diet 0 of 125 (0.0%), lower quality diet 26 of 125 (20.8%), NNT 4.8, relative risk is not 0 because of continuity correction due to zero events (with reciprocal of the contrasting arm), E-DII, quartile I vs. quartile IV.
<i>Ebrahimzadeh</i> , 8/19/2022, retrospective, Iran, peer-reviewed, survey, 3 authors, study period June 2021 - September 2021.	risk of severe case, 69.0% lower, OR 0.31, $p = 0.004$, healthy diet, T3 vs. T1, model 3, RR approximated with OR.
	risk of hospitalization, 56.0% lower, OR 0.44, $p = 0.07$, hospitalization time, healthy diet, T3 vs. T1, model 3, RR approximated with OR.
	risk of no recovery, 68.0% lower, OR 0.32, $p = 0.003$, recovery duration, healthy diet, T3 vs. T1, model 3, RR approximated with OR.
<i>Firoozi</i> , 3/29/2022, retrospective, Iran, peer-reviewed, survey, 8 authors, study period March 2020 - June 2020.	risk of case, 65.0% lower, OR 0.35, $p < 0.001$, adjusted per study, inverted to make $OR < 1$ favor higher quality diet, case control OR, multivariable, per unit E-DII change.
<i>Hou</i> , 4/29/2022, retrospective, Taiwan, peer-reviewed, survey, 3 authors, study period May 2021 - August 2021.	risk of critical case, 71.6% lower, RR 0.28, $p = 0.23$, higher quality diet 1 of 22 (4.5%), lower quality diet 78 of 487 (16.0%), NNT 8.7, excluded in exclusion analyses: unadjusted results with no group details.

	<p>risk of moderate to critical case, 10.8% lower, RR 0.89, $p = 0.66$, higher quality diet 11 of 22 (50.0%), lower quality diet 273 of 487 (56.1%), NNT 17, excluded in exclusion analyses: unadjusted results with no group details.</p>
	<p>risk of critical case, 73.6% lower, RR 0.26, $p = 0.005$, higher quality diet 0 of 9 (0.0%), lower quality diet 47 of 127 (37.0%), NNT 2.7, adjusted per study, inverted to make $RR < 1$ favor higher quality diet, odds ratio converted to relative risk, multivariable, age >65.</p>
	<p>risk of moderate to critical case, 34.7% lower, RR 0.65, $p = 0.04$, higher quality diet 5 of 9 (55.6%), lower quality diet 108 of 127 (85.0%), NNT 3.4, age >65, excluded in exclusion analyses: unadjusted results with no group details.</p>
<i>Jagielski</i> , 1/14/2022, retrospective, Poland, peer-reviewed, 7 authors.	<p>risk of case, 81.5% lower, RR 0.18, $p = 0.005$, higher quality diet 4 of 40 (10.0%), lower quality diet 9 of 20 (45.0%), NNT 2.9, adjusted per study, inverted to make $RR < 1$ favor higher quality diet, odds ratio converted to relative risk, model 2, $FV \geq 500g$ and nuts $\geq 10g$ vs. $FV < 500g$ and nuts $< 10g$, multivariable.</p>
<i>Kim</i> , 6/7/2021, retrospective, multiple countries, peer-reviewed, survey, 8 authors, study period 17 July, 2020 - 25 September, 2020.	<p>risk of moderate/severe case, 72.0% lower, OR 0.28, $p = 0.02$, higher quality diet 41, lower quality diet 527, adjusted per study, plant-based diets, multivariable, RR approximated with OR.</p>
	<p>risk of moderate/severe case, 59.0% lower, OR 0.41, $p = 0.05$, higher quality diet 46, lower quality diet 522, adjusted per study, plant-based or pescatarian diets, multivariable, RR approximated with OR.</p>
	<p>risk of case, 19.0% lower, OR 0.81, $p = 0.24$, higher quality diet 41, lower quality diet 527, adjusted per study, plant-based diets, multivariable, RR approximated with OR.</p>
	<p>risk of case, 23.0% lower, OR 0.77, $p = 0.14$, higher quality diet 46, lower quality diet 522, adjusted per study, plant-based or pescatarian diets, multivariable, RR approximated with OR.</p>
<i>Magaña</i> , 12/31/2021, retrospective, Spain, peer-reviewed, 6 authors, excluded in exclusion analyses: unadjusted results with no group details.	<p>risk of death, 53.0% lower, HR 0.47, $p = 0.049$, higher quality diet 58, lower quality diet 31.</p>
<i>Mahto</i> , 2/15/2021, retrospective, India, peer-reviewed, 6 authors, excluded in exclusion analyses: unadjusted results with no group details.	<p>risk of IgG positive, 20.4% lower, RR 0.80, $p = 0.32$, higher quality diet 23 of 206 (11.2%), lower quality diet 70 of 483 (14.5%), NNT 30, unadjusted, inverted to make $RR < 1$ favor higher quality diet, odds ratio converted to relative risk.</p>
<i>Merino</i> , 6/25/2021, retrospective, multiple countries, peer-reviewed, survey, 30 authors, study period 24 March, 2020 - 2 December, 2020.	<p>risk of severe case, 41.0% lower, HR 0.59, $p < 0.001$, higher quality diet 148,142, lower quality diet 148,143, adjusted per study, model 3, high vs. low hPDI, multivariable, Cox proportional hazards.</p>
	<p>risk of case, 18.0% lower, HR 0.82, $p < 0.001$, higher quality diet 148,142, lower quality diet 148,143, adjusted per study, model 3, high vs. low hPDI, PCR+, multivariable, Cox proportional hazards.</p>

	<p>risk of case, 9.0% lower, HR 0.91, $p < 0.001$, higher quality diet 148,142, lower quality diet 148,143, adjusted per study, model 3, high vs. low hPDI, multivariable, Cox proportional hazards.</p>
<p><i>Micek</i>, 8/3/2023, retrospective, Poland, peer-reviewed, survey, 8 authors, study period July 2020 - December 2020.</p>	<p>risk of case, 70.0% lower, OR 0.30, $p = 0.09$, higher quality diet 32, lower quality diet 21, adjusted per study, total polyphenols, T3 vs. T1, multivariable, RR approximated with OR.</p>
<p><i>Mohajeri</i>, 1/26/2023, retrospective, Iran, peer-reviewed, survey, 3 authors, excluded in exclusion analyses: unadjusted results with no group details.</p>	<p>risk of progression, 25.4% lower, RR 0.75, $p < 0.001$, higher quality diet 62 of 105 (59.0%), lower quality diet 392 of 495 (79.2%), NNT 5.0, dyspnea.</p>
	<p>risk of progression, 51.1% lower, RR 0.49, $p < 0.001$, higher quality diet 50 of 105 (47.6%), lower quality diet 482 of 495 (97.4%), NNT 2.0, fever.</p>
	<p>risk of progression, 70.3% lower, RR 0.30, $p < 0.001$, higher quality diet 23 of 105 (21.9%), lower quality diet 365 of 495 (73.7%), NNT 1.9, taste/smell.</p>
	<p>risk of progression, 9.7% higher, RR 1.10, $p = 0.03$, higher quality diet 98 of 105 (93.3%), lower quality diet 421 of 495 (85.1%), fatigue.</p>
	<p>risk of progression, 52.9% lower, RR 0.47, $p < 0.001$, higher quality diet 38 of 105 (36.2%), lower quality diet 380 of 495 (76.8%), NNT 2.5, cough.</p>
	<p>risk of progression, 25.9% lower, RR 0.74, $p = 0.007$, higher quality diet 44 of 105 (41.9%), lower quality diet 280 of 495 (56.6%), NNT 6.8, diarrhea.</p>
<p><i>Moludi</i>, 8/23/2021, retrospective, Iran, peer-reviewed, 7 authors, study period June 2020 - July 2020.</p>	<p>risk of case, 91.6% lower, OR 0.08, $p < 0.001$, inverted to make OR<1 favor higher quality diet, case control OR, model 3, E-DII tertile 1 vs. tertile 3.</p>
<p><i>Naushin</i>, 4/20/2021, retrospective, India, peer-reviewed, survey, 136 authors.</p>	<p>risk of seropositive, 40.1% lower, OR 0.60, $p < 0.001$, inverted to make OR<1 favor higher quality diet, RR approximated with OR.</p>
<p><i>Nguyen</i>, 9/18/2021, retrospective, Vietnam, peer-reviewed, survey, 17 authors, study period 14 February, 2020 - 2 March, 2020.</p>	<p>risk of symptomatic case, 15.2% lower, RR 0.85, $p = 0.006$, higher quality diet 345 of 1,054 (32.7%), lower quality diet 433 of 1,082 (40.0%), NNT 14, adjusted per study, odds ratio converted to relative risk, high vs. low HES, COVID-19-like symptoms, multivariable.</p>
<p><i>Pavlidou</i>, 11/9/2023, retrospective, Greece, peer-reviewed, 14 authors.</p>	<p>risk of case, 55.0% lower, OR 0.45, $p < 0.001$, higher quality diet 2,609, lower quality diet 2,588, adjusted per study, inverted to make OR<1 favor higher quality diet, moderate/high vs. very low/low Mediterranean diet adherence, multivariable, RR approximated with OR.</p>
<p><i>Perez-Araluce</i>, 1/24/2022, retrospective, Spain, peer-reviewed, survey, 4 authors, study period March 2020 - December 2020.</p>	<p>risk of severe case, 77.9% lower, RR 0.22, $p = 0.15$, higher quality diet 1 of 1,103 (0.1%), lower quality diet 10 of 3,300 (0.3%), NNT 471, odds ratio converted to relative risk, high vs. low adherence.</p>

	<p>risk of symptomatic case, 15.1% lower, RR 0.85, $p = 0.31$, higher quality diet 52 of 1,103 (4.7%), lower quality diet 214 of 3,300 (6.5%), odds ratio converted to relative risk, high vs. low adherence.</p>
	<p>risk of case, 19.7% lower, RR 0.80, $p = 0.14$, higher quality diet 58 of 1,103 (5.3%), lower quality diet 248 of 3,300 (7.5%), odds ratio converted to relative risk, high vs. low adherence.</p>
<p><i>Reis</i>, 10/24/2022, retrospective, USA, peer-reviewed, survey, 6 authors, study period December 2020 - February 2021.</p>	<p>risk of hospitalization, 74.8% lower, RR 0.25, $p < 0.001$, higher quality diet 17 of 380 (4.5%), lower quality diet 21 of 166 (12.7%), adjusted per study, inverted to make RR<1 favor higher quality diet, odds ratio converted to relative risk, 3+ vegetable servings/day vs. <3, multivariable.</p>
<p><i>Tadbir Vajargah</i>, 9/29/2022, prospective, Iran, peer-reviewed, survey, mean age 44.2, 11 authors, study period June 2021 - September 2021.</p>	<p>risk of severe case, 67.0% lower, OR 0.33, $p = 0.003$, higher quality diet 83, lower quality diet 83, vegetables, highest vs. lowest tertile, RR approximated with OR.</p>
	<p>risk of severe case, 72.0% lower, OR 0.28, $p < 0.001$, higher quality diet 83, lower quality diet 83, fruit, highest vs. lowest tertile, RR approximated with OR.</p>
	<p>risk of severe case, 75.0% lower, OR 0.25, $p < 0.001$, higher quality diet 83, lower quality diet 83, fiber, highest vs. lowest tertile, RR approximated with OR.</p>
<p><i>Wang</i>, 7/31/2023, retrospective, China, peer-reviewed, 9 authors, study period April 2022 - June 2022.</p>	<p>risk of severe case, 45.0% lower, OR 0.55, $p = 0.06$, higher quality diet 81, lower quality diet 67, adjusted per study, MNA-SF >11 vs. ≤11, multivariable, RR approximated with OR.</p>
	<p>risk of no viral clearance, 31.5% lower, HR 0.68, $p = 0.03$, higher quality diet 81, lower quality diet 67, inverted to make HR<1 favor higher quality diet, MNA-SF >11 vs. ≤11, Cox proportional hazards.</p>
<p><i>Wang (B)</i>, 2/6/2023, prospective, USA, peer-reviewed, survey, mean age 64.7, 8 authors, study period April 2020 - November 2021.</p>	<p>risk of PASC, 9.0% lower, RR 0.91, $p = 0.43$, higher quality diet 124 of 318 (39.0%), lower quality diet 218 of 480 (45.4%), NNT 16, adjusted per study, Q5 vs. Q1, multivariable, model 2.</p>
	<p>risk of PASC, 49.0% lower, RR 0.51, $p = 0.002$, higher quality diet 188, lower quality diet 66, 5 or 6 healthy lifestyle factors vs. 0.</p>
<p><i>Yamamoto</i>, 12/30/2021, retrospective, USA, peer-reviewed, survey, mean age 35.0, 3 authors, excluded in exclusion analyses: unadjusted results with no group details.</p>	<p>risk of case, 66.3% lower, RR 0.34, $p = 0.009$, higher quality diet 4 of 20 (20.0%), lower quality diet 19 of 32 (59.4%), NNT 2.5, good, very good, excellent vs. fair, poor.</p>
<p><i>Yue</i>, 8/9/2022, retrospective, multiple countries, peer-reviewed, survey, 11 authors.</p>	<p>risk of case, 19.0% lower, OR 0.81, $p = 0.008$, Q4 vs. Q1, model 3 + IPW, AHEI, RR approximated with OR.</p>
	<p>risk of case, 21.0% lower, OR 0.79, $p = 0.006$, Q4 vs. Q1, model 3 + IPW, AMED, RR approximated with OR.</p>
	<p>risk of case, 28.6% lower, OR 0.71, $p < 0.001$, inverted to make OR<1 favor higher quality diet, Q1 vs. Q4, model 3 + IPW, EDIH,</p>

	RR approximated with OR.
	risk of case, 11.5% lower, OR 0.88, $p = 0.10$, inverted to make $OR < 1$ favor higher quality diet, Q1 vs. Q4, model 3 + IPW, EDIP, RR approximated with OR.
<i>Zamanian</i> , 3/3/2023, retrospective, Iran, peer-reviewed, mean age 46.2, 10 authors.	risk of hospitalization, 81.0% lower, OR 0.19, $p = 0.002$, higher quality diet 41, lower quality diet 53, adjusted per study, case control OR, DASH ≥ 27 vs. ≤ 22 , multivariable, model 3.
<i>Zargarzadeh</i> , 7/19/2022, retrospective, Iran, peer-reviewed, mean age 44.1, 11 authors, study period June 2021 - September 2021.	risk of severe case, 77.0% lower, OR 0.23, $p < 0.001$, higher quality diet 89, lower quality diet 80, adjusted per study, top tertile vs. lowest tertile, MD score, model 3, multivariable, RR approximated with OR.
<i>Zhao</i> , 12/14/2022, retrospective, United Kingdom, peer-reviewed, survey, 9 authors, study period January 2020 - March 2021.	risk of death, 24.2% lower, RR 0.76, $p = 0.13$, higher quality diet 39,230, lower quality diet 39,231, adjusted per study, inverted to make $RR < 1$ favor higher quality diet, E-DII, quintile 1 vs. quintile 5, multivariable, model 4.
	risk of death, 30.1% lower, RR 0.70, $p = 0.04$, higher quality diet 39,230, lower quality diet 39,231, adjusted per study, inverted to make $RR < 1$ favor higher quality diet, DII, quintile 1 vs. quintile 5, multivariable, model 4.
	risk of severe case, 28.1% lower, RR 0.72, $p < 0.001$, higher quality diet 39,230, lower quality diet 39,231, adjusted per study, inverted to make $RR < 1$ favor higher quality diet, E-DII, quintile 1 vs. quintile 5, multivariable, model 4.
	risk of severe case, 28.6% lower, RR 0.71, $p < 0.001$, higher quality diet 39,230, lower quality diet 39,231, adjusted per study, inverted to make $RR < 1$ favor higher quality diet, DII, quintile 1 vs. quintile 5, multivariable, model 4.
	risk of case, 14.5% lower, RR 0.85, $p < 0.001$, higher quality diet 39,230, lower quality diet 39,231, adjusted per study, inverted to make $RR < 1$ favor higher quality diet, E-DII, quintile 1 vs. quintile 5, multivariable, model 4.
	risk of case, 9.1% lower, RR 0.91, $p = 0.002$, higher quality diet 39,230, lower quality diet 39,231, adjusted per study, inverted to make $RR < 1$ favor higher quality diet, DII, quintile 1 vs. quintile 5, multivariable, model 4.
<i>Zhou</i> , 8/16/2022, prospective, United Kingdom, peer-reviewed, 6 authors.	risk of case, 15.7% lower, RR 0.84, $p < 0.001$, higher quality diet 1,321 of 10,254 (12.9%), lower quality diet 1,935 of 10,253 (18.9%), inverted to make $RR < 1$ favor higher quality diet, odds ratio converted to relative risk, Q4 vs. Q1, model 3 (before healthy diet score adjustment).

Supplementary Data

Supplementary Data

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