

Plant-based diets, pescatarian diets and COVID-19 severity: a population-based case-control study in six countries



Adoption of plant-based and plant-predominant diets rich in vegetables, legumes, and nuts constitutes a simple and achievable lifestyle intervention for ambulatory patients that confers protection against moderate-to-severe COVID-19

Background Facts:

1. Host nutritional status and micronutrient intake affect innate and adaptive immune responses to viral infections.
2. Lifestyle associated comorbidities such as type 2 diabetes, hypertension, obesity, and coronary artery disease are associated with adverse COVID-19 clinical outcomes, including ICU admission and death.
3. Specific dietary patterns that confer either protection against or increased risk of severe COVID-19 have yet to be defined.

Study Title:

Plant-based diets, pescatarian diets and COVID-19 severity: a population-based case-control study in six countries

Hypothesis / Objectives:

To investigate the association between dietary patterns and COVID-19 outcomes and severity.

Study Design:

- Web-based survey of close to 3000 front-line healthcare workers from 6 countries (France, Germany, Italy, Spain, UK, USA) over a 3-month period in 2020 regarding their demographics, dietary patterns, and COVID-19 outcomes.
- Relationship between self-reported dietary patterns (as assessed by a 47-item food frequency questionnaire) and COVID-19 infection, severity, and duration examined using a multivariate logistic regression models.
- Adjusted odds ratios with 95% confidence intervals were reported where the model adjusted for age, sex, race/ethnicity, country, medical specialty of healthcare worker, smoking status, and physical activity.
- One further model adjusted findings according to body mass index (BMI) and the presence of any of the following medical conditions: diabetes, pre-diabetes, high cholesterol, hypertension, coronary heart disease or heart attack, heart failure, cancer, prior lung disease, prior lung infection, overweight, asthma, or autoimmune disease.

Outcome Measures:

COVID-19 severity was dichotomized as moderate-to-severe versus very mild to mild, where the following definitions were used:

- Very mild (asymptomatic or nearly asymptomatic) to Mild (symptoms [fever $<38^{\circ}\text{C}$ (without treatment), with or without cough, no dyspnoea, no gasping, no abnormal imaging findings];
- Moderate (fever, respiratory symptoms, and/or imaging findings of pneumonia) to Severe [any of (a) respiratory distress, respiratory rate ≥ 30 times/min; (b) low oxygen saturation $<93\%$ at rest; (c) partial pressure of oxygen (PaO₂)/fraction of inspired oxygen (FiO₂) ≤ 300 mm Hg] or Critical (respiratory failure needing mechanical assistance, intensive care unit admission, shock, or extra-pulmonary organ failure)
- Duration of COVID-19 illness in days was dichotomized as >14 days versus ≤ 14 days.

Summary of Findings:

- More than 70% of healthcare worker participants were men and close to 95% were physicians.
- Healthcare workers who reported adhering to plant-based or pescatarian diets that were higher in vegetables, legumes and nuts had a 73% (OR 0.27, 95% CI 0.10 to 0.81) lower odds of moderate-to-severe COVID-19.



- Healthcare workers who reported adhering to plant-based or pescatarian diets that were lower in poultry and red and processed meats had a 59% (OR 0.41, 95% CI 0.17 to 0.99) lower odds of moderate-to-severe COVID-19.
- The associations above did not change by further adjusting the multivariate model for BMI or the presence of a medical condition as defined above.
- Compared to healthcare workers who reported adhering to 'plant-based diets', those who reported consuming 'low carbohydrate, high protein diets' had a greater odds of moderate-to-severe COVID-19 (OR 3.86, 95% CI 1.13 to 13.24).
- No associations between COVID-19 infection or duration of symptoms were observed according to dietary self-reported pattern.

Study Limitations:

- Generalizability of study findings may be limited by sex and occupation biases observed in the comparator groups.
- Self-reported data are limited by potential recall bias, inconsistently applied and subjective definitions of dietary pattern, as well as over- and under-estimates of predominant consumption patterns.
- Varying cultural norms may affect self-reported data across geographies
- Potential bias towards milder disease given that those with severe COVID-19 may not have had the opportunity to complete the study questionnaire

- Competing influences of unanticipated or incorrectly assessed confounders could bias validity, generalizability, and accuracy of multivariate models.
- Caloric, macro-, and micronutrient intakes were not reported
- By self-report, the 'low-carb' group was consuming carbohydrates in excess of the range generally considered to be "low carb"
- Plant-based group consumed considerably less alcohol and fewer sugar sweetened beverages than those not following a plant-based diet

Implications for LM Practice:

- Adjustment of food intake patterns to favour consumption of vegetables, legumes, and nuts over poultry, red- and processed meats is a simple and achievable intervention for ambulatory lifestyle medicine practice that confers demonstrable protection against moderate-to-severe COVID-19.
- Data underpinning this intervention are evidence-based and consistent across geographies.

Key Takeaway:

Plant-based diets that are rich in vegetables, legumes, and nuts are healthy and offer protective efficacy against moderate-to-severe COVID-19.

Conclusions:

- Plant-based and plant-predominant diets rich in vegetables, legumes, and nuts confer clinical outcomes benefits in those who develop COVID-19.
- Those consuming dietary patterns including greater amounts or poultry, red and processed meats are at greater risk of moderate-to-severe COVID-19.
- 'Low-carb, high-protein' dietary patterns confer close to a 4-fold increased odds of moderate-to-severe COVID-19 compared to those who consume a more plant-predominant diet.

Associated Indicators

In 2884 front-line healthcare workers from 6 countries:

- Adherence to plant-based or pescatarian diets that were higher in vegetables, legumes, and nuts had a 73% lower odds of moderate-to-severe COVID-19
- Adherence to plant-based or pescatarian diets that were lower in poultry and red and processed meats had a 59% lower odds of moderate-to-severe COVID-19
- Adherence to 'low-carb, high-protein' diets was associated with an almost 4-fold increased odds of moderate-to-severe COVID-19 compared to those who consumed plant-predominant diets

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