

Associations between dietary patterns and cognitive performance in an aging population

Catherine Bigras^{1,2,3}, Danielle Laurin^{1,3}, Clémence Desjardins^{1,2}, Xavier Trudel^{3,4}, Sophie Desroches^{2,5}, Jean-Philippe Drouin-Chartier^{1,2}

1- Faculty of pharmacy, Laval University; 2- Centre NUTRISS (Nutrition, santé et société), Institut sur la nutrition et les aliments fonctionnels (INAF), Laval University; 3- Centre d'excellence sur le vieillissement de Québec, Centre de recherche du CHU de Québec and CIUSSS-CN; 4- Department of social and preventive medicine, Laval University; 5- School of Nutrition, Laval University.



Introduction

- The rising prevalence of major neurocognitive disorders (NCD), including dementia, is a growing public health concern.¹
- Mild NCD (mNCD) or mild cognitive impairment (MCI) often represents an intermediate stage between normal aging and dementia.²
- Diet is increasingly recognized as a modifiable factor influencing cognitive health, but no strong recommendations currently exist.
- Several dietary patterns have been linked to better cognitive outcomes.³
- However, few studies have directly compared their relative beneficial or detrimental associations.

Objective

- To examine and compare the associations between adherence to different dietary patterns and the prevalence of cognitive impairment in an aging population.

Methods

We conducted a cross-sectional analysis using data from the second follow-up of the PROspective Québec (PROQ) Study on Work and Health⁴, including 4113 adults aged 44-89 years without major NCD.

Diet was assessed using a validated food frequency questionnaire.⁵ Adherence to 5 different dietary patterns was evaluated:

- Alternative Healthy Eating Index (AHEI-2010)⁶;
- Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND)⁷;
- Healthy Eating Food Index (HEFI-2019)⁸;
- healthful Plant-based Diet Index (hPDI)⁹;
- unhealthful Plant-based Diet Index (uPDI)⁹.

Global cognitive function was assessed using the *Montreal Cognitive Assessment* (MoCA).¹⁰ Scores were standardized for age, sex, and education.¹¹

Participants were categorized into 4 groups:

- No cognitive impairment ($z \geq -1.0$);
- Below-norm performance ($-1.3 \leq z < -1.0$);
- Milder presentation of Mild Cognitive Impairment (mMCI) ($-1.65 \leq z < -1.3$);
- More severe MCI (msMCI) ($z < -1.65$).

Prevalence ratios (PRs) with 95% confidence intervals (CIs) were estimated using Poisson regression models with robust standard errors.

Table 1. Participant characteristics

Participant characteristics	No cognitive impairment (n = 2949)	Below-norm performance (n = 370)	Milder MCI (n = 288)	More severe MCI (n = 506)
Age, y	63.1 (6.6)	62.6 (7.1)	63.5 (6.7)	63.7 (6.9)
Female sex	1480 (50.2%)	173 (46.8%)	135 (46.9%)	246 (48.6%)
Education level at baseline ^a				
High school or less	697 (23.7%)	90 (24.5%)	55 (19.2%)	155 (30.7%)
College	814 (27.7%)	124 (33.8%)	78 (27.2%)	157 (31.1%)
University	1425 (48.5%)	153 (41.7%)	154 (53.7%)	193 (38.2%)
Physical activity				
Insufficiently active	1128 (38.3%)	148 (40.0%)	114 (39.6%)	119 (39.3%)
Active or moderately active	1821 (61.8%)	222 (60.0%)	174 (60.4%)	307 (60.7%)
Body mass index, kg/m ²				
Normal <25	1050 (35.6%)	125 (33.8%)	94 (32.6%)	177 (35.0%)
Overweight (25-29.9)	1229 (41.7%)	168 (45.4%)	127 (44.1%)	212 (41.9%)
Obese (≥30)	670 (22.7%)	77 (20.8%)	67 (23.3%)	117 (23.1%)
Daily energy intake, kcal	2115 (664)	2196 (693)	2091 (638)	2148 (687)
Alcohol intake, g	14.2 (16.0)	14.2 (16.4)	14.2 (16.4)	13.3 (15.7)
Smoking status				
Never smoking regularly	1287 (43.6%)	177 (47.8%)	119 (41.3%)	224 (44.3%)
Former regular smoker	1504 (51.0%)	175 (47.3%)	155 (53.8%)	253 (50.0%)
Current occasional and regular smoker	158 (5.4%)	18 (4.9%)	14 (4.9%)	29 (5.7%)
History of Cardiovascular disease	411 (14 %)	57 (15.4%)	49 (17.0%)	72 (14.2%)
History of diabetes	279 (9.4%)	44 (11.9%)	31 (10.8%)	64 (12.7%)
AHEI-2010 score (/100)	55.7 (12.4)	54.1 (13.3)	55.7 (12.7)	54.7 (12.8)
MIND score (/14)	6.7 (1.8)	6.5 (1.9)	6.8 (1.9)	6.5 (1.9)
HEFI-2019 score (/80)	51.1 (8.9)	50.6 (9.0)	51.6 (9.0)	50.5 (9.5)
hPDI score (/85)	50.2 (7.4)	49.6 (7.6)	50.8 (7.4)	49.6 (7.0)
uPDI score (/85)	51.0 (7.5)	52.0 (7.8)	51.1 (7.7)	51.4 (7.8)
Crude MoCA score ^b (/30)	27.2 (1.5)	24.7 (0.7)	23.9 (0.7)	22.1 (1.3)

Data presented as mean ± SD or n (%)

^a18 missing data

^bUnstandardized MoCA score, with one point added to participants with 12 years or less of education

Results

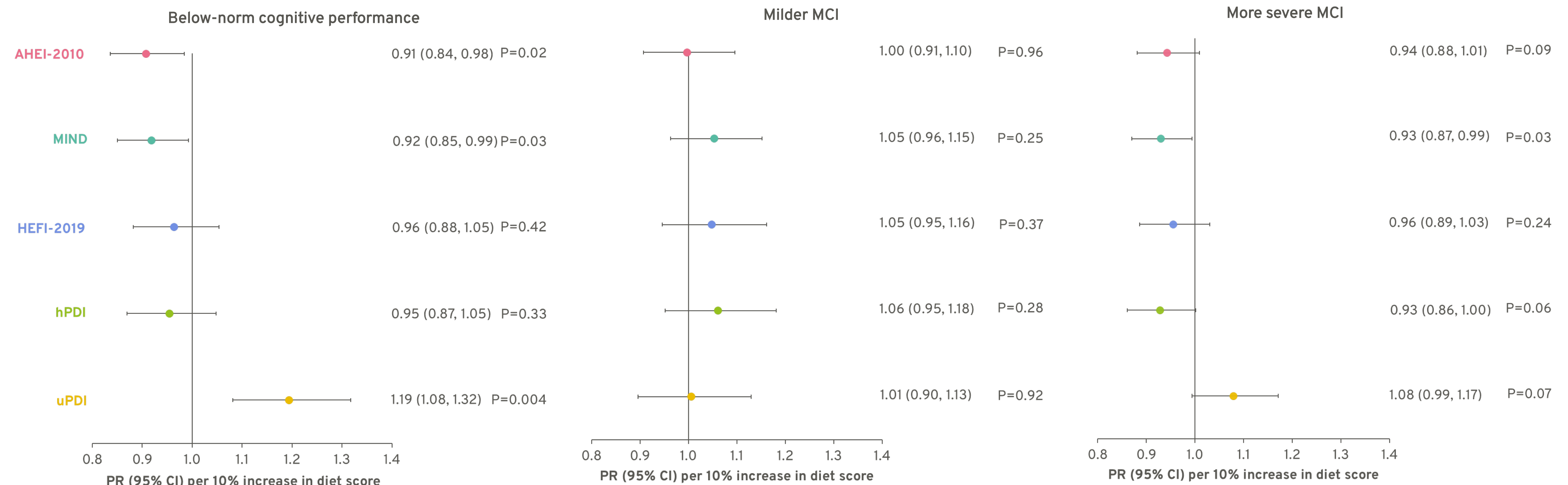


Figure 1. Associations between dietary pattern adherence and prevalence of below-norm cognitive performance, milder and more severe MCI. Prevalence ratios (PRs) and 95% confidence intervals (CIs) per 10% increase in diet score for each cognitive performance category, using no cognitive impairment as the reference group. Adjusted for physical activity, tobacco use, alcohol consumption, total energy intake, BMI, history of cardiovascular disease, history of diabetes.

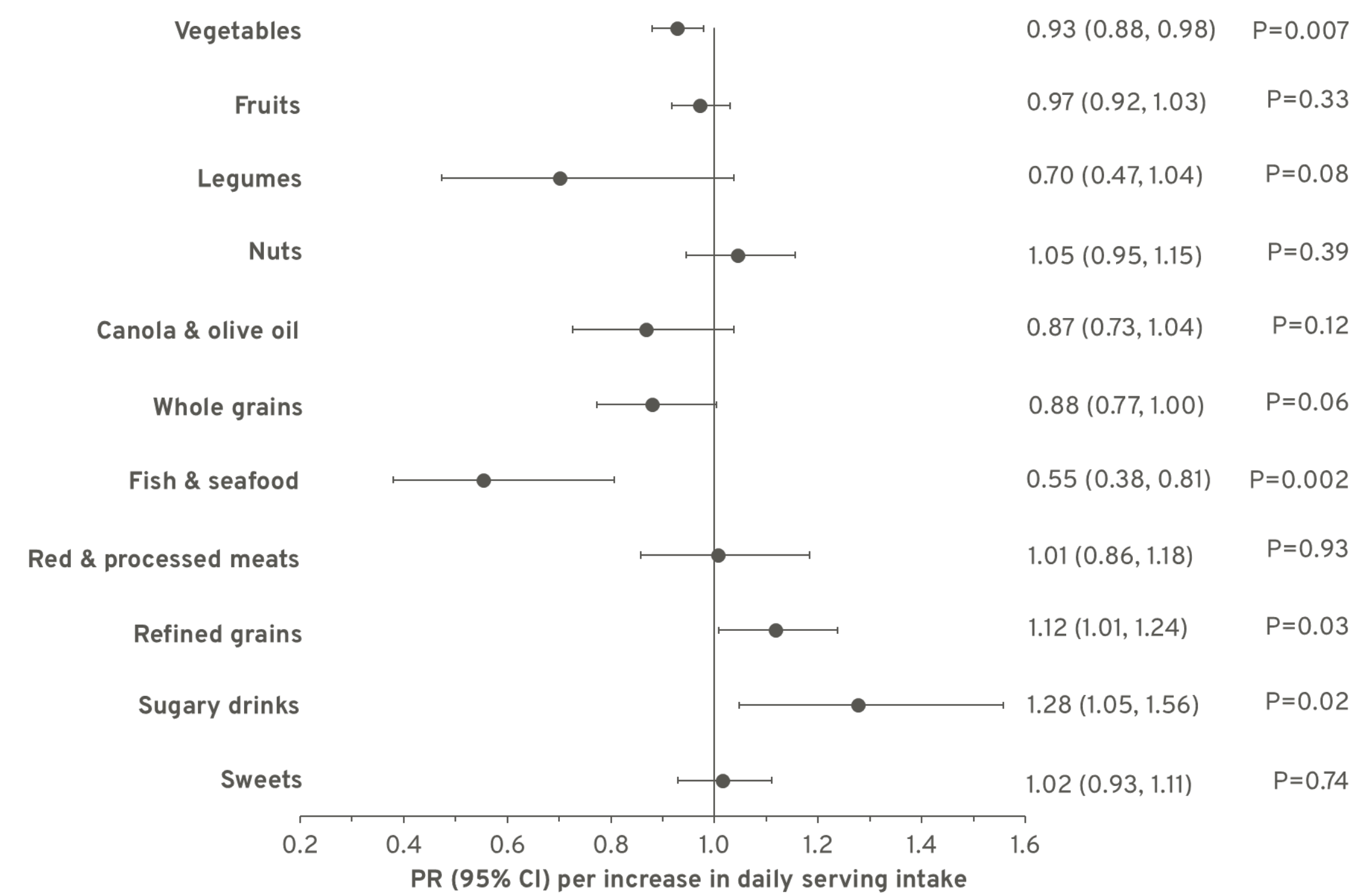


Figure 2. Associations between intake of specific food groups and prevalence of below-norm cognitive performance.

Prevalence ratios (PRs) and 95% confidence intervals (CIs) comparing below-norm cognitive performance to normal cognition. Adjusted for physical activity, tobacco use, alcohol consumption, total energy intake, BMI, history of cardiovascular disease, history of diabetes.

Discussion

- Higher adherence to the AHEI-2010 and MIND dietary patterns was associated with a lower prevalence of below-norm cognitive performance in aging adults.
- In contrast, greater adherence to the uPDI was linked to a higher prevalence of below-norm cognitive performance.
- Similar trends were observed for msMCI, with the MIND being the only significantly associated pattern.
- No significant associations were found for mMCI in the cohort.
- Differences across dietary scores may reflect the specific food groups emphasized:
 - Protective: higher intake of fish & seafood, vegetables, legumes and whole grains
 - Adverse: higher intake of refined grains and sugary drinks
- Differences may also be explained by variability in scoring methodologies (e.g. scores attributed based on cohort specific distributions vs. predetermined thresholds).

Conclusion

- Greater adherence to healthy dietary patterns such as the AHEI-2010 and MIND diets was linked to better cognitive performance in aging adults.
- In contrast, greater adherence to an unhealthy dietary pattern, the uPDI, was linked to poorer performance.
- The MIND diet showed the most consistent association, particularly for more pronounced cognitive impairment.
- These findings suggest that dietary patterns emphasizing fish, vegetables, legumes and whole grains, and limiting refined grains and sugary drinks may help protect cognitive health with aging.

References

- Livingston, G. *et al. The Lancet.* (2024)
- Anderson, N. D. *CNS Spectrums.* (2019).
- Scarmeas, N. *et al. The Lancet Neurology.* (2018).
- Trudel, X. *et al. International Journal of Epidemiology.* (2018).
- Labonté, M.-È. *et al. Eur J Clin Nutr.* (2012).
- Chiuve, S. E. *et al. The Journal of Nutrition.* (2012).
- Morris, M. C. *et al. Alzheimer's & Dementia.* (2015).
- Brassard, D. *et al. Appl. Physiol. Nutr. Metab.* (2022).
- Satija, A. *et al. PLoS Med.* (2016).
- Nasreddine, Z. S. *et al. Journal of the American Geriatrics Society.* (2005).
- Larouche, E. *et al. Arch Clin Neuropsychol.* (2016).

