Supplementary Tables

Supplementary Table S1. PICO Framework for Systematic Review of Diet and Parkinson's Disease

PICO Element	Definition / Criteria
Population (P)	Adults ≥18 years; general population or PD patient cohorts
Intervention / Exposure (I)	Any dietary exposure (food, beverage, nutrient, or dietary pattern) assessed via validated or semi-validated instruments
Comparator (C)	Low/no exposure, lower intake, or standard diet; within-cohort comparisons where available
Outcome (O)	Primary: Incident PD (clinically confirmed or registry-verified) Secondary: Prodromal PD features, motor/non-motor progression, biomarkers of disease
Study Design (S)	Observational (prospective cohort, nested case–control, cross-sectional) or interventional (RCTs)
Timeframe	Studies published 2015–2025
Other Considerations	Studies must provide sufficient methodological detail for verification; dietary instruments validated or reproducible

Supplementary Table 2 (S2). Methodological Features and Quantitative Summary of Included Studies

ID	Author(s), Year	Exposure Assessment Tool	Follow-up Duration	Main Covariates Adjusted	Effect Direction (vs. reference)	Effect Estimate (as reported)	Notes on Validity / Comments
1	Hughes *et al.,* 2017	Validated FFQs administered every 2–4 years (NHS, HPFS, CPS-II)	Up to 25 years	Age, sex, smoking, BMI, total energy, education, alcohol, physical activity	↑ Risk with high low-fat milk intake; neutral for cheese/yogurt	HR ≈ 1.20 (95% CI 1.05–1.37) for highest vs lowest low-fat milk	Large pooled US cohorts; robust outcome validation; residual confounding possible
2	Maraki *et al.,*2019	Culturally adapted 189-item FFQ; MeDi score (0–9)	Cross-sectional	Age, sex, education, comorbidities	↓ Prodromal PD probability with high MeDi score	OR ≈ 0.55 (95% CI 0.32–0.94) per +1 SD score	Clinic/community Greek sample; limited generalizability; validated dietary index
3	Olsson *et al.,*2020	National dietary questionnaires (Swedish cohorts) + registry linkage	Median 15 years	Age, sex, smoking, BMI, education, physical activity	↑ Risk for low-fat milk; null for fermented milk	HR ≈ 1.25 (95% CI 1.03–1.51) for skimmed milk	High-quality registry ascertainment; heterogeneity across cohorts

4	Simon *et al.,* 2015	Self-reported caffeine (cups/day) from baseline forms in trial datasets	Median 3 years	Age, sex, disease duration, dopaminergic medication, baseline UPDRS	↔ No overall progression effect; possible subgroup benefit	β = NS (non-significant difference in UPDRS slope)	Secondary analysis of trial cohorts; short follow-up; exploratory
5	Hong *et al.,* 2020	Pooled extracted measures (FFQs, diet recalls) from prior cohorts	N/A (meta-analysis)	Study-level adjusted estimates (age, sex, smoking)	↓ Risk for incident PD; ↔ progression	Pooled RR = 0.75 (95% CI 0.68–0.82)	Consistent direction across cohorts; variable adjustment; AMSTAR2 = Low–Moderate
6	Tresserra-Rimbau *et al.,* 2023	24-item touchscreen FFQ (UK Biobank); plant-based diet index	Median 12 years	Age, sex, BMI, smoking, physical activity, SES	↓ Risk with higher plant-based score	HR ≈ 0.86 (95% CI 0.76–0.98) per SD increase	Large sample; validated outcome linkage; limited ethnic diversity

Abbreviations: FFQ = food-frequency questionnaire; NHS = Nurses' Health Study; HPFS = Health Professionals Follow-Up Study; CPS-II = Cancer Prevention Study II; MeDi = Mediterranean diet; PD = Parkinson's disease; HR = hazard ratio; OR = odds ratio; RR = relative risk; SES = socioeconomic status; UPDRS = Unified Parkinson's Disease Rating Scale; NS = not significant.

Supplementary Table 3 (S3). Compact Study-Level Extraction Table

ID	Year	Design	Approx N	Exposure contrast	Outcome definition	Main adjusted covariates	Effect (author reported)
1	2017	Prospective pooled cohorts	>100,000	Highest vs lowest low-fat milk intake	Incident PD (physician/registry confirmed)	Age, sex, smoking, BMI, total energy, education	Low-fat milk ↑ PD risk (modest; HR ~1.2 in primary models)
2	2019	Cross-sectional / prodromal	~500	High vs low MeDi score	Prodromal PD probability (MDS prodromal criteria)	Age, sex, education, comorbidities	Higher MeDi → lower prodromal probability (OR <1)
3	2020	Prospective cohort(s)	national datasets	High vs low fermented milk / low-fat milk	Incident PD	Age, sex, smoking, BMI, socioeconomic status	Low-fat milk modestly ↑; fermented milk neutral
4	2015	Clinical cohort	~400 PD patients	High vs low caffeine intake	Motor progression (UPDRS slopes)	Age, sex, disease duration, medication	No consistent benefit after full adjustment (exploratory subgroup signals)
5	2020	Meta-analysis	pooled cohorts	High vs low caffeine	Incident PD & progression	study-level covariate adjustments	Strong inverse association for incident PD; progression mixed
6	2023	Prospective	~150,000	Highest vs	Incident PD (hospital /	Age, sex, smoking,	Higher plant-based

		cohort (UKB)	subset	lowest plant-based diet index	death registries)	BMI, SES, activity	index → modestly lower PD incidence

Supplementary Table 4 (S4). GRADE. Certainty of Evidence by Exposure

Exposure	Direction of association	Overall GRADE certainty	Rationale (brief)
Caffeine / coffee	Protective	Moderate	Multiple prospective cohorts and a meta-analysis show consistent inverse association; downgraded one level for possible residual confounding and publication bias.
Dairy (milk)	Harmful (modest)	Low–Moderate	Several large prospective cohorts show a modest positive association, but heterogeneity between cohorts and potential residual confounding (e.g., pesticide exposure, dairy processing) reduce certainty.
Mediterranean / plant-based diets	Protective (suggestive)	Low	Evidence limited to cross-sectional prodromal analysis and one UK Biobank prospective study; imprecision and possible confounding lower certainty.
Other exposures (alcohol, fats, micronutrients)	Inconclusive / mixed	Very low	Inconsistent findings, measurement heterogeneity, limited recent verified studies.

Supplementary Table 5 (S5). Risk-of-bias assessment of included studies using the modified Newcastle–Ottawa Scale (NOS)

Study ID	Selection (max 4)	Comparability (max 2)	Outcome (max 3)	Total NOS score (max 9)	NOS interpretation (conservative)
Hughes 2017 (pooled prospective cohorts)	4 (large, representative cohorts; exposure assessed using validated FFQs)	2 (adjusted for major confounders including age, smoking, BMI, and total energy intake; sensitivity analyses performed)	3 (incident PD confirmed via medical records and registries; long follow-up duration)	9/9	High methodological quality; low risk of bias for prospective pooled cohort analyses
Maraki 2019 (prodromal / cross-sectional)	2 (well-characterized clinical/community sample but not a population-based random sample)	1 (adjusted for age and sex; limited adjustment for additional confounders)	0* (cross-sectional assessment of prodromal probability; no prospective PD incidence)	3/9	Moderate methodological limitations due to cross-sectional design; moderate risk of bias
Olsson 2020 (Swedish multi-cohort prospective study)	4 (national population-based cohorts; exposure assessed via FFQ and registry linkage)	2 (models adjusted for major confounders; subgroup and sensitivity analyses conducted)	3 (incident PD identified through national registries; large sample size with variable follow-up)	9/9	High methodological quality; low risk of bias for prospective cohort analyses
Simon 2015 (clinical cohort / secondary	2 (PD patient sample derived from clinical trials and specialty clinics;	1 (adjusted for basic covariates; residual	0* (short follow-up and heterogeneous secondary trial data;	3/9	Moderate–high risk of bias due to selection limitations and

analyses)	limited population representativeness)	confounding likely)	progression rather than incidence outcome)		residual confounding
Hong 2020 (meta-analysis)	Not applicable	Not applicable	Not applicable	Not scored	Meta-analysis assessed separately using AMSTAR-2 and ROBIS; NOS not applicable
Tresserra-Rimbau 2023 (UK Biobank prospective cohort)	4 (large population-based cohort; dietary exposure assessed using baseline touchscreen FFQ)	2 (models adjusted for age, sex, smoking, BMI, socioeconomic status; sensitivity analyses performed)	2 (PD ascertainment via hospital admission and death registries; outcome rare and detection may vary)	8/9	High methodological quality; low to moderate risk of bias

*Outcome domain scored conservatively as 0 for cross-sectional or non-incident PD outcomes, consistent with adapted NOS criteria.

NOS scores were assigned conservatively using a modified Newcastle–Ottawa Scale adapted for observational nutrition studies. Cross-sectional and clinical progression studies were evaluated using adapted criteria, and outcome stars were not awarded for non-incident PD endpoints. Meta-analyses were not assessed using NOS and were evaluated separately using AMSTAR-2 and ROBIS.