PEN version of the Risk of Bias assessment of Non randomized studies (NRS) – adapted from Cochrane Risk of Bias Assessment Tool for Non-Randomized Studies of Interventions (ROBINS-I) and GRADE Handbook[a]

Note: this tool is intended for assessing risk of bias in cohort studies and prospective NRS (e.g. quasi-experimental studies). Other NRS, such as case-control, cross-sectional and case series, are considered at high risk of bias due to bias inherent in these study designs. Case-control studies are subject to high risk of recall bias (if food intake is recalled and participants know their outcome status), cross-sectional are at high risk of bias due to lack of temporality (lack of knowing whether the exposure or disease came first), and case series are at high risk of bias due to lack of adequate control group.

Domain of Bias	**Criteria for Judging Risk of Bias**
CONFOUNDING – Bias due to confounding of the exposure	*Low risk of bias if:* All known critically important prognostic/risk factors are assessed using reliable and valid measures, and then adjusted/controlled for in statistical analysis (common examples include: age, sex, severity of pre-existing disease, presence of comorbidities, adiposity, socioeconomic status, family history, lifestyle factors (e.g. smoking, physical activity, other nutrition risk factors)).
	High risk of bias if: Not all known critically important prognostic/risk factors are assessed, accurately measured, and adjusted/controlled for in statistical analysis.
	Unclear: Insufficient information about critically important prognostic/risk factors, their measurements, and/or adjustments to permit judgment. If adjustment/control of confounding is not stated, assume confounding was not adjusted/controlled for, and assess as High risk of bias. There will be very few instances of Unclear.
SELECTION OF PARTICIPANTS – Bias in selection into the study related to exposure or outcome	*Low risk of bias if:* Selection of exposed and unexposed or less exposed groups (or higher and lower intakes) are from the same population.
	High risk of bias if: Groups are selected from different populations so that selection into the study was related to the exposure or outcome. This is not about generalizability beyond the study, it is about whether there is an important difference between the groups included in the study.
	Unclear: Insufficient information about group selection to permit judgment
MEASUREMENT OF EXPOSURE – Bias in measurement of exposure status	*Low risk of bias if:* Exposure is well measured or assessed such as an appropriate biological marker or a measure of dietary intake (obtained from validated food frequency questionnaires, multiple 24-hour recalls, food records or through a structured interview). Information on exposure was collected at the time of the exposure.
	High risk of bias if: - Exposure is not well measured or assessed such as dietary intake obtained from non-validated food frequency questionnaires, single 24-hour recalls, or single food records. - If different co-interventions were implemented depending on whether the participant was receiving or not receiving the intervention
	Unclear: Insufficient information about measurement of exposure to permit

	judgment
MISSING DATA – Bias due to incomplete outcome data	*Low risk of bias if:* Data are reasonably complete for groups or proportions and reasons for missing participants is similar across groups
	High risk of bias if: Missing outcome data are not addressed in the analysis or proportions of missing participants differ substantially between groups.
	Unclear: Insufficient information about completeness of group follow-up to permit judgment
MEASUREMENT OF OUTCOMES - Bias in measuring outcomes	*Low risk of bias if:* Measurement of outcome was objective (e.g. record linkage) or outcome was assessed by blind outcome assessors and therefore minimal risk that knowledge of the intervention/exposure/disease group could affect the assessment
	High risk of bias if: Measurement of outcomes was subjective (e.g. self-report) or different methods of outcome assessment were used in exposed and unexposed groups
	Unclear: Insufficient information about measurement of both exposure and outcome to permit judgment
OTHER BIAS (optional) – Bias due to problems not covered elsewhere in the table.	*Low risk of bias if:* There is no change from the intended analysis. *Low risk of bias if:* There is no indication of selection of reported analyses.
	High risk of bias if: Multiple measurements were made, but only one or a subset of these measurements is/are reported. *High risk of bias if:* Analytic methods performed differed from those that were pre-specified (e.g. unadjusted and adjusted models; use of final value vs change from baseline; a continuously scaled outcome converted to categorical data with different cut-points; different sets of covariates used for adjustment; different analytic strategies for dealing with missing data). *High risk of bias if:* Reported results differ from the primary study objective
	Unclear: Insufficient information on whether there is a departure from the intended exposure or selective reporting of results

[a] Cochrane Risk of Bias Assessment Tool for Non-Randomized Studies of Interventions (ACROBAT-NRSI). Version 1.0.0, 24 September 2014. Available from: https://sites.google.com/site/riskofbiastool/home

GRADE Handbook (Table 5.5: Study limitations in observational studies (2015). Available from: http://www.guidelinedevelopment.org/handbook/#h.m9385o5z3li7