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Highlights

- Among 48,104 people with MS, 22% have changed their diet in their lifetime.
- Among 25,338, 17% may currently modify their diets.
- Prevalences of diet modification were highest in North America and Oceania.
- Evidence suggest that the prevalence of diet modifications has increased over time.
- Few studies were of low risk of bias leading to very low quality of evidence.

Prevalence of Diet Modification Among People with Multiple Sclerosis: A Systematic Review and Meta-analysis

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Abstract

Background*:* People with multiple sclerosis (MS) report modifying their diet to improve wellbeing; however, the overall prevalence of diet modification in this population is unknown.

Objective*:* To assess the prevalence of diet modification among people with MS.

Methods*:* A systematic literature review was performed July 2024 in four databases (Ovid Medline, Embase, Scopus, and Web of Science Core Collection). Inclusion criteria were: 1) studies including adults with MS and 2) reporting the prevalence of diet modification. Random effects inverse-variance meta-analyses determined the prevalence of current and lifetime diet modification as well as subgroup analyses based on global region, survey date, sample size, and risk of bias (RoB). The protocol was registered August 2024 at PROSPERO (CRD42024573284).

Results*:* Among 39 studies reporting on 43 independent samples with 48,104 participants with MS, 13,808 cases of lifetime diet modification were reported for an overall prevalence (95% CI) of 0.22 (0.17, 0.27). Additionally, among 23 studies reporting on 27 independent samples with 25,338 participants with MS, 4,893 cases of current diet modification were observed for a prevalence (95% CI) of 0.17 (0.11, 0.23). High heterogeneity was present and was explained by age, sex, MS duration, global region, survey year, sample size, and RoB, which was moderate/high for 74% of included samples and drove the very low quality of evidence rating for both outcomes.

Conclusion*:* Diet modification was common among people with MS with the highest prevalences observed in North America, Oceania, and international cohorts, along with an increasing trend over time.

Keywords: multiple sclerosis, diet, prevalence, systematic review, meta-analysis

1. Introduction

People with multiple sclerosis (MS) frequently use alternative and complementary approaches to improve wellness and manage symptoms (Soto-Lara et al., 2023). Among these alternative and complementary approaches, modifications to diet often receive the most interest (Dunn et al., 2015). People with MS greatly desire support and resources for improving their diets (Dean et al., 2022; Russell et al., 2021; Russell et al., 2019; Silveira et al., 2022; Weiss et al., 2023). However, MS neurologists report providing little dietary advice due to inadequate consultation time (Russell et al., 2020a) and that their patients would benefit from including dietitians with specialty training in MS on staff (Wills et al., 2025). As such, people with MS report receiving little dietary advice from their healthcare team (Russell et al., 2019) and the advice some MS clinicians do provide is often contradictory (Wills et al., 2024). Thus, people with MS likely obtain information on diets from online sources (Russell et al., 2021; Russell et al., 2019; Silveira et al., 2022) that may not be evidence-based and often promote restrictive diets (Beckett et al., 2019; Zoszak et al., 2024).

Many of the diets promoted online to people with MS are restrictive (Zoszak et al., 2024) and may increase risk of adverse nutritional outcomes including malnutrition, disordered eating, and micronutrient deficiency. While emerging evidence has linked several specific dietary patterns to favorable MS outcomes (Snetselaar et al., 2023; Solsona et al., 2024), the current state of evidence does not support the use of any specific diet in MS care (Evans et al., 2019; Parks et al., 2020) and most MS-specific organizations recommend general healthy diets for people with MS (Zoszak et al., 2024). Given the potential benefits and risks associated with self-selected diet modifications, it is imperative to fully understand the scope of diet modification within this patient population so that people with MS can be provided guidance and support for

implementing healthy eating behaviors. Members of both the National MS Society Nutrition workgroup (Spain et al., 2023) and the Consortium of MS Centers Dietitians Special Interest Group (Titcomb et al., 2023) have called for the inclusion of dietitians in MS care teams to help people with MS minimize the potential risks and maximize potential benefits of healthy eating.

Despite a lack of dietary recommendations in the standard of care for MS, some surveys suggest that over 50% of people with MS report implementing dietary modifications (Anderson et al., 2022; Nag et al., 2021; Silbermann et al., 2020; Yadav et al., 2006; Yu et al., 2023). However, other surveys report lower prevalences ranging from 10-20% (Marck et al., 2021; Nayak et al., 2003; Skovgaard et al., 2012). As such, the true overall prevalence of diet modification among people with MS remains unclear. Therefore, the objective of the present study is to assess the prevalence of current and lifetime diet modification among the MS population.

2. Methods

2.1. Design

This systematic review and meta-analysis was registered in PROSPERO International Prospective Register of Systematic Reviews (CRD42024573284). The present study followed the Meta-Analysis of Observational Studies in Epidemiology (MOOSE) reporting guidelines for meta-analyses of observational studies (Brooke et al., 2021).

2.2. Literature search strategy

The following databases were searched for eligible citations from inception to July 2024: Ovid (Medline), Embase (Elsevier), Scopus (Elsevier), and Web of Science Core Collection. The

search strategies were developed and executed with oversight from a health sciences librarian with expertise in systematic literature searching. Full search strategies for all databases are included in **Supplemental Appendix 1**. No language limits were applied and articles in languages other than English or Persian were translated with Google Translate. Duplicates were removed with automated methods first in EndNote and then with the Automated Systematic Search Deduplicator (ASySD) web-based program (Hair et al., 2023). Reference lists from retrieved articles meeting inclusion criteria were screened to search for additional relevant studies.

2.3. Eligibility criteria

Both authors independently screened all studies for inclusion based on the following criteria: studies, of any design, including: 1) adults with MS and 2) reporting prevalence of diet modification. Discrepancies were discussed until consensus was reached. Abstracts and unpublished studies were excluded.

2.4. Data extraction

After study selection, both authors extracted the following characteristics: first author's last/family name, year of publication, country, study design, study setting, mean baseline age, percent female of the study sample, MS duration, MS type, EDSS, BMI, sample size, cases, and diet types. Because the included studies used differing terminology, diet modification was ascertained as affirmative responses to any questions regarding "following a diet," "MS diet," "special diet," "nutritional therapy," or "seeing a dietitian or nutritionist." Discrepancies were discussed until consensus was reached. Current diet modification was defined as any study that

reported current diet modification or diet modifications within the previous 12 months. Lifetime diet modification was defined as any other time frame or no specific time frame reported. For studies that reported only current diet modification, these values were also included in the lifetime analysis since current diet modification would be a conservative estimate of lifetime diet modification.

2.5. Missing data

Eight corresponding authors of eligible studies were contacted by email to obtain additional information for any study that met inclusion criteria but did not provide complete data necessary for inclusion in this systematic review; six (75%) provided additional information.

2.6. Risk of bias assessment

Full articles were assessed for methodological quality using the Checklist for Prevalence Studies from JBI (Munn et al., 2015) and the following nine sources of bias were evaluated: 1) was the sample frame appropriate to address the target population?, 2) were study participants recruited in an appropriate way?, 3) was the sample size adequate?, 4) were the study subjects and setting described in detail?, 5) was data analysis conducted with sufficient coverage of the identified sample?, 6) were valid methods used for the identification of the condition?, 7) was the condition measured in a standard, reliable way for all participants?, 8) was there appropriate statistical analysis?, and 9) was the response rate adequate, and if not, was the low response rate managed appropriately? Responses to all questions were “no”, “unclear/not applicable”, or “yes” for 0, 0.5, or 1 points, respectively. Studies with <3 points were considered to have high risk of bias (RoB) and studies with ≥6 points were considered to have low RoB.

2.7. Statistical analysis

Random effects proportional meta-analyses were used to determine the pooled prevalence of current and lifetime diet modification reported by people with MS in the primary analysis. Additional random effects proportional subgroup analyses were performed to assess the pooled prevalence of diet modification stratified by global region, decade of study publication, sample size, and RoB. Meta-regression was used to compare prevalences between subgroups, assess moderating effects of demographic variables (age, sex, MS type, and MS duration), and assess trends over time based on the year the sample was surveyed. All meta-analyses used the inverse variance method with Freeman-Tukey double arcsine transformations. For studies with multiple reports of the prevalence of diet modification from the same sample, the most recent survey was included in analyses to avoid multiplicity bias.

In the primary analyses, potential small study effects were explored by visual inspection of funnel plots and publication bias was assessed with Begg's test. The leave-one-out method was used to further explore single study influences on estimates. Since I^2 are inaccurate estimates of heterogeneity for meta-analyses of prevalence, prediction intervals were calculated for primary analyses to assess heterogeneity as recommended (Borges Migliavaca et al., 2022). The trim-and-fill method was used in secondary analyses to adjust for publication bias in the primary analyses. Additional secondary analyses were conducted for lifetime prevalence of all specific diets that were reported. Sensitivity analyses of the primary analyses were conducted using alternative transformations including arcsine, logit, log, and none to assess consistency in estimates as recommended (Schwarzer et al., 2019).

All analyses were conducted using RStudio software (Version 2023.06.0) with the *meta* (Version 7.0-0) and *metafor* (Version 4.6-0) packages and p-value ≤0.05 was considered statistically significant.

2.8. Quality of evidence assessment

The overall quality of evidence for prevalence estimates was assessed using the Grading of Recommendation, Assessment, Development, and Evaluation (GRADE) approach for prognosis (Iorio et al., 2015), which is also recommended for prevalence studies (Borges Migliavaca et al., 2020), and comprised of the following items: 1) RoB, 2) inconsistency, 3) indirectness, 4) imprecision, and 5) publication bias (Iorio et al., 2015).

3. Results

3.1. Systematic review

Of the 1,906 articles originally identified by the literature search, 1,306 were screened and 97 were assessed for eligibility (**Figure 1**). An additional five articles were identified through citation searching and were included for a total of 46 articles reporting on the prevalence of diet modification among people with MS. Descriptive characteristics of included studies are reported in **Table 1** and excluded studies are reported in **Supplemental Appendix 2**. Included studies were published between 1994 and 2024, and 15 were conducted in the United States (Anderson et al., 2022; Berkman et al., 1999; Brenton and Goldman, 2016; Fawcett et al., 1994; Fawcett et al., 1996; Goodman and Gulick, 2008; Marrie et al., 2003; Masullo et al., 2015; Nayak et al., 2003; Russell et al., 2020b; Schwartz et al., 1999; Silbermann et al., 2020; Stuifbergen and Harrison, 2003; Sung et al., 2013; Yadav et al., 2006); 7 in Germany (Apel et al., 2006; Apel et

al., 2005; Gotta et al., 2018; Kochs et al., 2014; Rommer et al., 2018; Schwarz et al., 2008; Winterholler et al., 1997); 3 each in Australia (Leong et al., 2009; Marck et al., 2021; Russell et al., 2018) and Denmark (Lynning et al., 2017; Skovgaard et al., 2013a, b); 2 each in Morrocco (Lotfi et al., 2024a; Lotfi et al., 2024b) and Poland (Fryze et al., 2006; Podlecka-Pietowska et al., 2022); 1 each in Belgium (Huybregts et al., 2018), Canada (Venasse et al., 2021), Italy (Pucci et al., 2004), Netherlands (van der Ploeg et al., 1994), Saudia Arabia (Shariff et al., 2019), Spain (Sastre-Garriga et al., 2003), Sweden (Chruzander et al., 2015), and Turkey (Gedizlioğlu et al., 2015). In addition, one study reported separate independent surveys in Denmark, Finland, Iceland, Norway, and Sweden (Skovgaard et al., 2012), and one study reported a combined prevalence in the United States and Canada (Fitzgerald et al., 2018). Furthermore, four studies reported on international samples (Grace-Farfaglia, 2021; Nag et al., 2021; Simpson-Yap et al., 2021; Yu et al., 2023) for a total of 50 samples.

3.2. Risk of bias

Of the 50 samples, 13 were judged to be low, 26 moderate, and 11 were high RoB. Median total score was 4.5 of 9. Most (68%) were judged to be low RoB for standardized measurement of the condition, 58% for description of participants and study setting, 46% for appropriate statistical analysis, 44% for adequate sample size, 38% for appropriate sample frames, 38% for sufficient coverage of the identified sample, 24% for valid methods to identify the condition, 18% for appropriate sampling, and 16% for adequate response rate or appropriate management (**Table 2**). Of the 50 samples, seven reported duplicate or updated findings and were excluded from meta-analyses.

3.3. Prevalence of lifetime diet modification

Among 43 independent samples with 48,104 participants with MS, 13,808 cases of lifetime diet modification were reported for an overall pooled prevalence of 0.22 (0.17, 0.27 [95% CI]) with a prediction interval of 0.00 to 0.64 (**Figure 2**). Global region-specific subgroup meta-analysis prevalences (95% CIs) of lifetime diet modification were 0.48 (0.27, 0.69) for international samples, 0.34 (0.17, 0.52) for Oceania, 0.28 (0.19, 0.38) for North America, 0.13 (0.09, 0.18) for Europe, and 0.10 (0.02, 0.24) for other regions ($p<0.001$; **Figure 3**). Meta-regression indicated that global region ($p<0.001$) accounted for 28.6% of heterogeneity with prevalences in international samples ($p<0.01$), North America ($p<0.01$), and Oceania ($p<0.05$) significantly higher compared to Europe. No differences were observed in subgroup meta-analyses or meta-regression stratified by sample size, sampling decade, or RoB (**Supplemental Figures 1-3)**. However, other demographic variables accounted for heterogeneity in lifetime diet modification prevalence including age (43.9%), sex (9.71%), and MS duration (18.9%) such that increasing mean age, % female, and mean MS duration of studies were associated with higher prevalence estimates (**Supplemental Figure 4**). Across studies, 42 specific diets were reported with the highest lifetime prevalences (95% CIs) reported for anti-inflammatory 0.24 (0.06, 0.49), Overcoming MS (OMS) 0.20 (0.00, 0.58), low-fat 0.14 (0.05, 0.27), and general healthy 0.12 (0.01, 0.31) diets **Supplemental Table 1**). Prevalences for 'MS diets' (i.e. diets specifically promoted for MS) were lower with the highest lifetime prevalences (95% CIs) reported for MS diet 0.11 (0.00, 0.41), Swank 0.06 (0.03, 0.10), and Wahls 0.02 (0.01, 0.04). The prevalence using a dietitian was 0.14 (0.07, 0.23).

3.4. Prevalence of current diet modification

Among 27 independent samples with 25,338 participants with MS, 4,893 cases of current diet modification were reported for an overall pooled prevalence of 0.17 (0.11, 0.23 [95% CI]) with a prediction interval of 0.00 to 0.56 (**Figure 4**). Global region-specific subgroup meta-analysis prevalences (95% CIs) of current diet modification were 0.44 (0.26, 0.63) for international samples, 0.34 (0.17, 0.52) for Oceania, 0.19 (0.11, 0.27) for North America, 0.08 (0.05, 0.14) for Europe, and 0.05 (0.03, 0.08) for other regions ($p<0.001$; **Figure 5**). Meta-regression indicated that global region accounted for 51.5% of heterogeneity with prevalences in international samples ($p<0.001$), Oceania ($p<0.01$), and North America ($p<0.05$) significantly higher compared to Europe. RoB-specific subgroup meta-analysis prevalences (95% CIs) of current diet modification were 0.06 (0.03, 0.09) for high RoB, 0.10 (0.06, 0.16) for low RoB, and 0.23 (0.15, 0.33) for moderate RoB studies ($p<0.001$; **Figure 6**). Meta-regression indicated that RoB ($p=0.04$) accounted for 14.9% of heterogeneity but there were no differences between specific groups. Sample size-specific subgroup meta-analysis prevalences (95% CIs) of current diet modification were 0.09 (0.04, 0.17) for inadequate and 0.21 (0.14, 0.29) for adequate sample size studies ($p=0.03$; **Figure 7**). Meta-regression indicated that sample size ($p=0.05$) accounted for 12.9% of heterogeneity with prevalences in adequate sample size studies significantly higher than in inadequate sample size studies ($p<0.05$). In addition, no demographic variables accounted for heterogeneity of current diet modification prevalence estimates (**Supplemental Figure 5**). No differences were observed in subgroup meta-analysis or meta-regression based on sampling decade (**Supplemental Figure 6)**. However, a significant increasing trend in prevalence, accounting for 9.9% of heterogeneity, was observed in meta-regression analysis by the year the sample was surveyed ($p=0.05$; **Figure 8B**).

3.5. Funnel plots and publication bias

Visual inspection of funnel plots revealed significant heterogeneity in prevalence estimates across studies for both current and lifetime diet modification; however, Begg's tests were not significant for publication bias (**Supplemental Figure 7**). Similarly, the trim-and-fill method did not adjust estimated prevalences for current diet modification but did trim two studies from the left side of the funnel plot and filled them to the right side, which increased estimated prevalence (95% CI) for lifetime diet modification to 0.23 (0.18, 0.29). Prevalence estimates derived from leave-one-out analyses did not appreciably differ for lifetime diet modification (range 0.21 to 0.22; **Supplemental Table 2**) or current diet modification (range 0.15 to 0.18; **Supplemental Table 3**).

3.6. Sensitivity analyses

Alternative transformation methods yielded similar estimates for the prevalence of lifetime and current diet modification, albeit the logit and log transformations yielded prevalences that were lower than the Freeman-Tukey double arcsine transformation used in the primary analysis by 1-3% (**Supplemental Table 4**).

3.7. Quality of evidence

The overall GRADE quality of evidence from the primary analyses is considered very low quality for both current and lifetime diet modification (**Supplemental Table 5**). These ratings were driven by very serious RoB, serious inconsistency, and serious indirectness.

4. Discussion

Among 45 studies reporting on 49 independent samples of people with MS, overall pooled prevalences were 23% for lifetime and 19% for current diet modification. However, due to very serious RoB, serious inconsistency, and serious indirectness, the overall GRADE quality of evidence is considered very low, which necessitates caution in interpreting results.

In the present study, the observed pooled prevalences were lower than values reported in several frequently cited surveys that indicate approximately half of people with MS report diet modification (Fitzgerald et al., 2018; Nag et al., 2021; Silbermann et al., 2020; Simpson-Yap et al., 2021; Yadav et al., 2006; Yu et al., 2023). As noted in meta-regression analyses, a significant portion of heterogeneity in the overall estimates could be explained by spaciotemporal factors including global region and survey year. The highest prevalences of lifetime diet modification were observed in Oceania (all studies conducted in Australia), North America, and international samples. Notably, the international samples were primarily comprised of participants from North America (Grace-Farfaglia, 2021; Nag et al., 2021) and Oceania (Yu et al., 2023), further supporting the observation that these two global regions have the highest prevalences of diet modification.

While the present study cannot assess the impact of MS diet advocates on the prevalence of diet modification among people with MS, it is noteworthy that well-known MS diet advocates are located in the global regions with high diet modification prevalences (e.g., Dr. George Jelinek in Oceania and Drs. Roy Swank and Terry Wahls in North America). Several studies reported on the prevalence of following the specific diets promoted by these three MS diet advocates (OMS, Swank, and Wahls diets, respectively) with the OMS diet having the highest prevalence at 20% of respondents. However, this estimate is likely high as one of the included studies used to derive

this estimate is from Dr. Jelinek's HOLISM study which recruited participants who were already familiar with the OMS diet (Yu et al., 2023).

Diet modification is an important component of self-management to people with MS (Dunn et al., 2015). While preliminary trials (Snetselaar et al., 2023) and observational studies (Solsona et al., 2024) suggest benefits of some specific dietary patterns for MS symptoms, little real-world evidence exists supporting these preliminary observations. One short-term prospective cohort study recorded dietary intake among 163 individuals with MS and observed that plant-based diets and vegetable intake were associated with reduced burden of nine pre-defined symptoms including fatigue and walking difficulty (Skovgaard et al., 2023). The findings from the present study suggest that there is adequate prevalence of diet modification among people with MS in North America and Oceania for large MS centers to quickly generate data on the impact of diet and nutrition on MS symptoms and disease progression. These efforts would help add clarity to the field and ultimately help provide MS healthcare providers and people with MS the support and resources for changing their diets that they desire (Dean et al., 2022; Russell et al., 2021; Russell et al., 2019; Silveira et al., 2022; Weiss et al., 2023).

The strengths of this study include the large sample size, consistency across meta-analytical methods, identification of heterogeneity via prediction intervals, exploration of heterogeneity, use of JBI RoB assessment, and use of GRADE quality of evidence analysis. However, this study also has several limitations. First, of the 50 samples included, only 26% were considered low RoB. Many of the included studies lacked power and utilized variable methods of collecting information on the prevalence of diet modification. Second, high heterogeneity was noted in prediction intervals and funnel plots and was not explained by publication bias. This heterogeneity was largely explainable by the global region in which the study was conducted

and, to a lesser extent, the year the survey was conducted, the sample size, and RoB. Third, due to the presence of high heterogeneity, random effects models were used for all analyses. This method weighs studies with differing sample sizes more similarly (Borenstein et al., 2010), which may cause underestimation of the prevalence of diet modification as the present study observed that studies with inadequate sample size (<400 participants) had lower pooled estimates compared to studies with adequate sample size. Accordingly, the trim-and-fill method increased the estimate for lifetime diet modification from 0.22 to 0.23. Due to the presence of significant heterogeneity, the random effects model is appropriate for the present analysis.

The present study observed that 22% of people with MS have tried diet modification in their lifetime and that 17% may be currently modifying their diet. This may be particularly common in Oceania and North America where prevalences increased to 34% and 28% for lifetime diet modification, respectively. The influence of such high prevalences in Oceania and North America on patient outcomes remains unknown and future studies are urgently needed to understand how diet impacts symptoms and course of the disease. Given the lack of MS-specific dietary guidelines, many people with MS likely utilize online sources that may not be evidence-based. As such, MS healthcare providers should be prepared to guide discussions about evidence-based nutrition with their patients. Barring the discovery of a specific MS:nutrition interaction, MS healthcare providers are encouraged to promote general healthy diets such as the Dietary Guidelines for Americans as a foundation for individualized healthy diets.

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Table 1. Characteristics of included studies.[a,b]

Reference	Country/ Region (code)	Study design	Sample Size	Cases (lifetime / current)	Age, years mean ± SD	Sex (% f)	MS type (% RMS)	MS duration, years mean ± SD	Disability	Outcome ascertainment method	Included in meta-analysis? (Y/N)
Anderson 2022	United States (USA)	Cross-sectional	114	65 / NA	57	80	72	15.7 ± 9.8		Survey and interview	Y
Apel 2005	Germany (DEU)	Cross-sectional	154	7 / 7	42.5 ± 12.0	75.3	68.8	6.8 ± 6.4	EDSS 3.3 ± 2.2	Semi-structured interview	N *Updated data reported in Rommer
Apel 2006	Germany (DEU)	Cross-sectional	254	12 / 12	44.0 ± 11.6	73.6	56.3	8.1 ± 7.0	EDSS 4.0 ± 2.2	Semi-structured interview	N *Updated data reported in Rommer 2018
Berkman 1999	United States (USA)	Cross-sectional	238	24 / NA	47.8 ± 10.9	80.3		11.8 ± 9.4	Self-report 47.3% Mild 40.9% Moderate 11.8% Severe	Mailed survey	Y
Brenton 2016	United States (USA)	Cross-section	199	34 / 34	50.5	70	71.4	12		Mailed survey	Y
Chruzander 2015	Sweden (SWE)	Longitudinal	121	10 / NA	49 ± 11	69	45	18 ± 11	EDSS 34% Mild 20% Moderate 46% Severe	Interview	Y

Fawcett 1994	United States (USA)	Cross-sectional	16	5 / NA	44.4 ± 9.5	75		8.19		Mailed survey	Y
Fawcett 1996	United States (USA)	Cross-sectional	16	7 / NA	44.4	75		13.7		Mailed survey	Y
Fitzgerald 2018	United States (USA) & Canada (CAN)	Cross-sectional	6,989	3,120 / 642	59.1 ± 10.3	79.7	52.7	19.7 ± 9.9	PDDS 3 (1-4)	NARCOMS survey	Y
Fryze 2006	Poland (POL)	Cross-sectional	210	32 / NA	44.26 ± 11.14	64.8		8.76 ± 8.5	55% Walk alone 25% Walk with help 17% Wheelchair 3% Bedbound	Survey	Y
Gedizlioğlu 2015	Turkey (TUR)	Cross-sectional	101	25 / NA	38.9 ± 8	65.3	90	7.0 ± 4.8	EDSS 2.8 ± 1.3	Survey	Y
Goodman 2008	United States (USA)	Cross-sectional	123	20 / NA	46.7	90.2		9.5	PDDS 68.3% 0-3 31.7% 4+	Survey	Y
Gotta 2018	Germany (DEU)	Cross-sectional	343	67 / NA	45.0 ± 11.9	77.3	46.1	12.0 ± 9.6	EDSS 3.69 ± 2.01	Online survey	Y
Grace-Farfaglia 2021	International (INT)	Longitudinal	476	126 / 126	47.18 ± 9.53	65.97	50	10.54	EDSS 4.95 ± 2.03	Survey	Y
Huybregts 2018	Belgium (BEL)	Retrospective	99	2 / NA		57.6	37.4		60% Severe disability 31% Moderate disability 9% Mild disability	Survey	Y

Kochs 2014	Germany (DEU)	Cross-sectional	119	2 / 2	48.2 ± 11.2	73.1	56.3	13.1 ± 6.3	EDSS 4.1 ± 2.2	Semi-structured interview	N *Updated data reported in Rommer 2018
Leong 2009	Australia (AUS)	Cross-sectional	416	126 / 126		70	54.8	0-9.9 44% 10-10.9 34% 20-29.9 15% 30+ 7%	Qualitative Disease Severity Rating Scale 39% None/mild 32% Moderate 29% Severe	Mailed survey	Y
Lofti 2024a	Morocco (MAR)	Cross-sectional	98	4 / 4	34.49 ± 10.49	68				Online survey	N *Updated data reported in Lotfi 2024b
Lofti 2024b	Morocco (MAR)	Cross-sectional	170	8 / 8	34.51 ± 10.06	67.6	80	10.9 ± 11.6		Online survey	Y
Lynning 2017	Denmark (DNK)	Cross-sectional	420	45 / 45		68.1	50			Online survey	Y
Marck 2021	Australia (AUS)	Cross-sectional	1490	316 / 316		79.5	61.9		MS Steps 47.5% 0-2 34.7% 3-5 17.9% 6+	AMSLS survey	Y
Marrie 2003	United States (USA)	Cross-sectional	20,778	4934 / NA	46.9 ± 10.7	72.2		17.6		NARCOMS survey	Y

Masullo 2014	United States (USA)	Cross-sectional	35	8 / 8	18-39 28.6% 40-59 42.9% 60-85 28.6%	91.4	82.9	9.7 ± 7.2	MS Severity 17.1% None/minimal 31.4% Mild 20.0% Moderate 22.9% Walk with support 8.6% Walker	Online survey	Y
Nag 2021	International (INT)	Cross-sectional	1108	643 / NA	52.6	78.1	67.7	13	PDDS 43.7% Mild 39.5% Moderate 16.8% Severe	iConquerMS survey	Y
Nayak 2003	United States (USA)	Cross-sectional	3140	472 / 472	18-24 1.0% 25-34 12.1% 35-49 49.5% 50-62 28.8% 62+ 7.2%	75.9	43.4			Mailed survey	Y
Podlecka-Pietowska 2022	Poland (POL)	Cross-sectional	75	34 / NA	44.6 ± 12.5	62.7	62.7	12.0 ± 14.4		Survey	Y
Pucci 2004	Italy (ITA)	Cross-sectional	109	13 / NA	39.4	74.3	63.3	7.8	EDSS 3.4	Semi-structured	Y

										interview	
Rommer 2018	Germany (DEU)	Cross-sectional	254	33 / 12	44.0 ± 11.6	73.6	56.3	8.1 ± 7.0	EDSS 4.0 ± 2.2	Semi-structured interview	Y
Russell 2019	Australia (AUS)	Cross-sectional	11	6 / 6	47 ± 13	82	82	0.75 ± 0.42		Semi-structured interview	Y
Russell 2020	United States (USA)	Cross-sectional	470	46 / NA	37.5 ± 12.6	73.2				Structured interview	Y
Sastre-Garriga 2003	Spain (ESP)	Cross-sectional	193	11 / 11	41.7	67.7	64.7	11.4	EDSS 4	Survey	Y
Schwartz 1999	United States (USA)	Cross-sectional	569	51 / 51		72				Mailed survey	Y
Schwarz 2008	Germany (DEU)	Cross-sectional	1573	649 / 487	48.5 ± 11.7	74	43	13.9 ± 9.5	9% No symptoms 34% Symptoms without impairment 19% Some disability 6% Need help to walk 31% Wheelchair 1% Bedridden	Mailed survey	Y
Shariff 2019	Saudia Arabia (SAU)	Cross-sectional	133	8 / 8	32.3 ± 7.6	63.2	82.7	>10 45.9 % 5-10 33.8 %	EDSS 38.3% <2.5 51.1% 2.5-4.5 10.5% >4.5	Survey	Y

								<5 18.8 %			
Silbermann 2020	United States (USA)	Cross-sectional	1014	711 / 424	18-30 3.8 % 31-40 15.7% 41-50 21.2% 51-60 26.8% 61-70 21.6% 70+ 7.6 %	75.5	67.9	14.2 ± 10.4	Disability Status 66.9% None/moderate 26.0% Need walking support 5.1% Unable to walk	Survey	Y
Simpson-Yap 2021	International (INT)	Cross-sectional	952	465 / NA	50.9 ± 10.4	82.9	70.2	16.5 (10.5 – 24.6)	P-MSSS 65.8% Normal/ Mild 23.3% Moderate 10.6% Severe	HOLISM survey	N *Updated data reported in Yu 2023
Skovgaard 2012	Denmark (DNK)	Cross-sectional	1865	181 / 181	<40 18.8% 41-60 56.1% >60 25.1%	72.1				Online survey	Y
	Finland (FIN)	Cross-sectional	551	57 / 57	<40 18.7% 41-60	75.0				Online survey	Y

					58.6% >60 22.7%						
	Iceland (ISL)	Cross-sectional	236	17 / 17	<40 26.2% 41-60 57.8% >60 16.0%	77.2				Online survey	Y
	Norway (NOR)	Cross-sectional	516	40 / 40	<40 14.7% 41-60 58.9% >60 26.4%	71.0				Online survey	Y
	Sweden (SWE)	Cross-sectional	627	49 / 49	<40 12.9% 41-60 59.5% >60 27.6%	76.2				Online survey	Y
Skovgaard 2013a	Denmark (DNK)	Cross-sectional	1865	181 / 181	<40 18.8% 41-60 56.1% >60 25.1%	72.1		<2 yrs 4.3% 2-10 yrs 39.9% >10 yrs 52.4%		Online survey	N *Same data reported in Skovgaard 2012
Skovgaard 2013b	Denmark (DNK)	Cross-sectional	1865	181 / 181	<40 18.8%	72.1		<2 yrs 4.3%		Online survey	N *Same data report

					41-60 56.1% >60 25.1%			2-10 yrs 39.9% >10 yrs 52.4%			ed in Skovgaard 2012
Stuifbergen 2003	United States (USA)	Cross-sectional	621	119 / 54	50.56 ± 10.26)	82.8	40.3	13.3	Incapacity Status Scale Score 18.3	Survey	Y
Sung 2013	United States (USA)	Cross-sectional	215	85 / NA	47.38 ± 10.19	86		11.52 ± 9.69		Survey	Y
Van Der Ploeg 1994	Netherlands (NLD)	Cross-sectional	88	11 / 0	49	76.1				Survey	Y
Venasse 2021	Canada (CAN)	Cross-sectional	60	10 / 10	49.1 ± 10.3	80.0	66.7	14.5 ± 9.7	PDDS 2.5 (0 – 5.0)	Survey	Y
Winterholler 1997	Germany (DEU)	Cross-sectional	129	21 / NA	38.3	65.9		7.9		Survey	Y
Yadav 2006	United States (USA)	Cross-sectional	1913	1129 / 709	51.6 ± 11.7	77	49	19.5 ± 12.3	Disease severity 30% None/mild 57% Moderate 13% Severe	Mailed survey	Y
Yu 2023	International (INT)	Cross-sectional	671	402 / 321	53.3 ± 10.2	80.8	73.0	15.5 ± 6.9	P-MSSS 67.1% Normal/ mild 23.1% Moderate 9.8% Severe	HOLISM survey	Y

[a] Abbreviations: EDSS, Expanded Disability Status Scale; HOLISM, Health Outcomes and Lifestyle In a Sample of people with Multiple Sclerosis; NARCOMS, North American Research Committee on Multiple Sclerosis; PDDS, Patient-Determined Disease Steps; P-MSSS, Patient-derived Multiple Sclerosis Severity Score.

[b] Data shown as mean ± standard deviation, median (IQR), or percent.

Table 2. Risk of bias assessment of included studies as determined by JBI Checklist for Prevalence Studies.[a]

Study	Was the sample frame appropriate to address the target population?	Were study participants recruited in an appropriate way?	Was the sample size adequate?	Were the study subjects and setting described in detail?	Was data analysis conducted with sufficient coverage of the identified sample?	Were valid methods used for the identification of the condition?	Was the condition measured in a standard, reliable way for all participants?	Was there appropriate statistical analysis?	Was the response rate adequate, and if not, was the low response rate managed appropriately?	Overall RoB score (category) [b]
Anderson 2022	0	0	0	0	0.5	0	0.5	0	0.5	1.5 (high)
Apel 2005	0	0	0	0	0	0	1	0.5	0.5	2 (high)
Apel 2006	0.5	0	0	1	0.5	0	1	0.5	0.5	4 (moderate)
Berkman 1999	1	1	0	1	0.5	0	0.5	0	0	4 (moderate)
Brenton 2016	0.5	0.5	0	0	0.5	0	1	1	1	4.5 (moderate)
Chruzander 2015	1	1	0	1	1	0	1	0	0	5 (moderate)
Fawcett 1994	0.5	0	0	1	0	0	1	0	0	2.5 (high)
Fawcett 1996	0	0	0	1	0	0.5	1	0	0	2.5 (high)
Fitzgerald 2018	1	0.5	1	1	1	0	1	1	0.5	7 (low)
Fryze 2006	0	0	0	1	0.5	0	1	0	0.5	3 (moderate)
Gedizlioğlu 2015	0	0	0	1	0.5	0	0.5	0	0.5	2.5 (high)

Goodman 2008	0	0	0	1	0.5	0	1	0	1	3.5 (moderate)
Gotta 2018	1	0	0.5	1	1	1	0.5	0	0.5	5.5 (moderate)
Grace-Farfaglia 2021	0	0	1	1	0.5	0	0.5	1	0	4 (moderate)
Huybregts 2018	0	0.5	0	1	0.5	0	0.5	0	1	3.5 (moderate)
Kochs 2014	0	0	0	0	0	0	1	0.5	0	1.5 (high)
Leong 2009	1	0	1	0.5	0.5	0.5	1	0.5	0	5 (moderate)
Lofti 2024a	0	0	0	0	0.5	0	1	0	0.5	2 (high)
Lofti 2024b	0	0.5	0	1	0.5	0.5	1	0	0.5	4 (moderate)
Lynning 2017	0	0.5	1	0.5	0.5	0	1	1	1	5.5 (moderate)
Marck 2021	1	0.5	1	1	1	0	1	0	0.5	6 (low)
Marrie 2003	1	0.5	1	1	1	0	1	0	1	6.5 (low)
Masullo 2014	0.5	0	0	1	0	1	1	1	0	4.5 (moderate)
Nag 2021	0.5	0.5	1	1	1	0	1	0	0	5 (moderate)
Nayak 2003	1	0.5	1	1	0.5	0	0	0.5	0	4.5 (moderate)
Podlecka-Pietowska 2022	0	0	0	0.5	0	0	0.5	0	0.5	1.5 (high)
Pucci 2004	0	0	0	0	0.5	0	0.5	1	0.5	2.5 (high)
Rommer 2018	0.5	0.5	0	0	0.5	0.5	0.5	1	1	4.5 (moderate)
Russell 2019	0	0.5	0	1	0	0.5	0.5	0	0.5	3 (moderate)

Russell 2020		0	0	1	1	1	0	1	1	0.5	5.5 (moderate)
Sastre-Garriga 2003		0	0	0	0	1	0	1	0	0	2 (high)
Schwartz 1999		0	0.5	1	0	0.5	0	1	1	0	4 (moderate)
Schwarz 2008		1	0.5	1	1	0.5	1	1	0.5	0	6.5 (low)
Shariff 2019		0	0	0.5	1	0.5	0	0.5	1	1	4.5 (moderate)
Silberman n 2020		1	0	1	1	0.5	0	0	1	0	4.5 (moderate)
Simpson-Yap 2021		0	0	1	1	1	0	1	1	0.5	5.5 (moderate)
Skovgaard 2012	DNK	1	1	1	0	1	1	1	1	0.5	7.5 (low)
	FIN	1	1	1	0	1	1	1	1	0.5	7.5 (low)
	ISL	1	0.5	0.5	0	1	1	1	1	0.5	6.5 (low)
	NOR	1	1	1	0	1	1	1	1	0.5	7.5 (low)
	SWE	1	1	1	0	1	1	1	1	0.5	7.5 (low)
Skovgaard 2013a		1	1	1	0	1	1	1	1	0.5	7.5 (low)
Skovgaard 2013b		1	1	1	0	1	1	1	1	0.5	7.5 (low)
Stuifbergen 2003		1	0	1	1	0.5	0	0.5	1	1	6 (low)
Sung 2013		0.5	0.5	0	1	0.5	0	0.5	0.5	0.5	4 (moderate)
Van Der Ploeg 1994		0.5	1	0	0.5	0.5	1	1	1	0.5	6 (low)
Venasse 2021		0.5	0	0	1	1	1	1	0	0.5	5 (moderate)
Winterholler 1997		0	0	0	0.5	0.5	0	0	1	0.5	2.5 (high)

Yadav 2006	1	0	1	1	1	0.5	1	0	0	5.5 (moderate)
Yu 2023	0	0	1	1	1	0	1	1	0.5	5.5 (moderate)

[a] Low risk, 1; unclear/moderate, 0.5; high risk, 0.
[b] Overall risk categorized as 0-2.5, high; 3-5.5, moderate; 6-9, low.

Figure Legends

Figure 1. PRISMA flow diagram of study selection.

Figure 1.

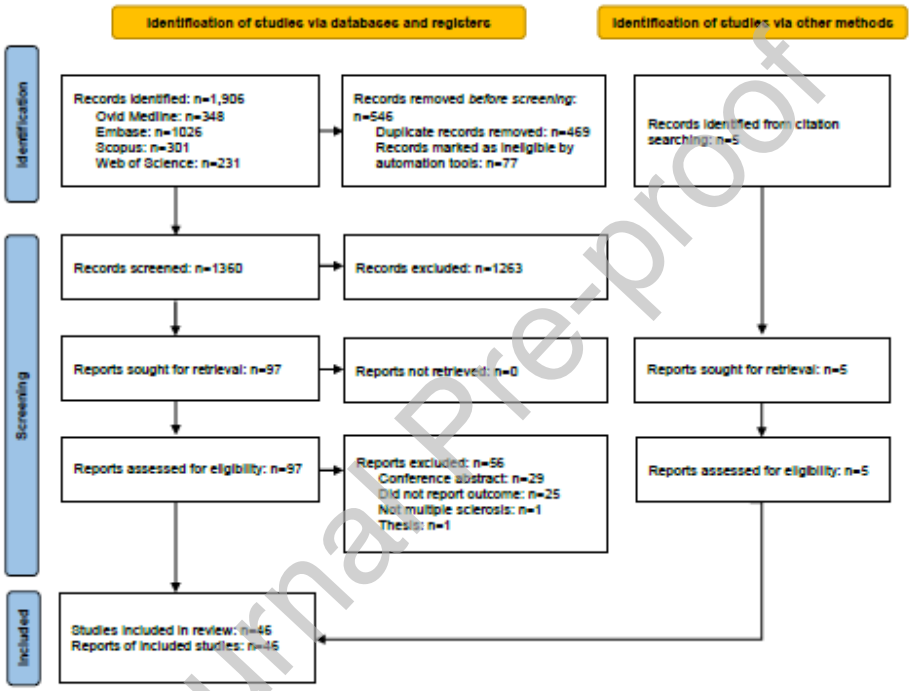


Figure 2. Lifetime diet modification prevalence.

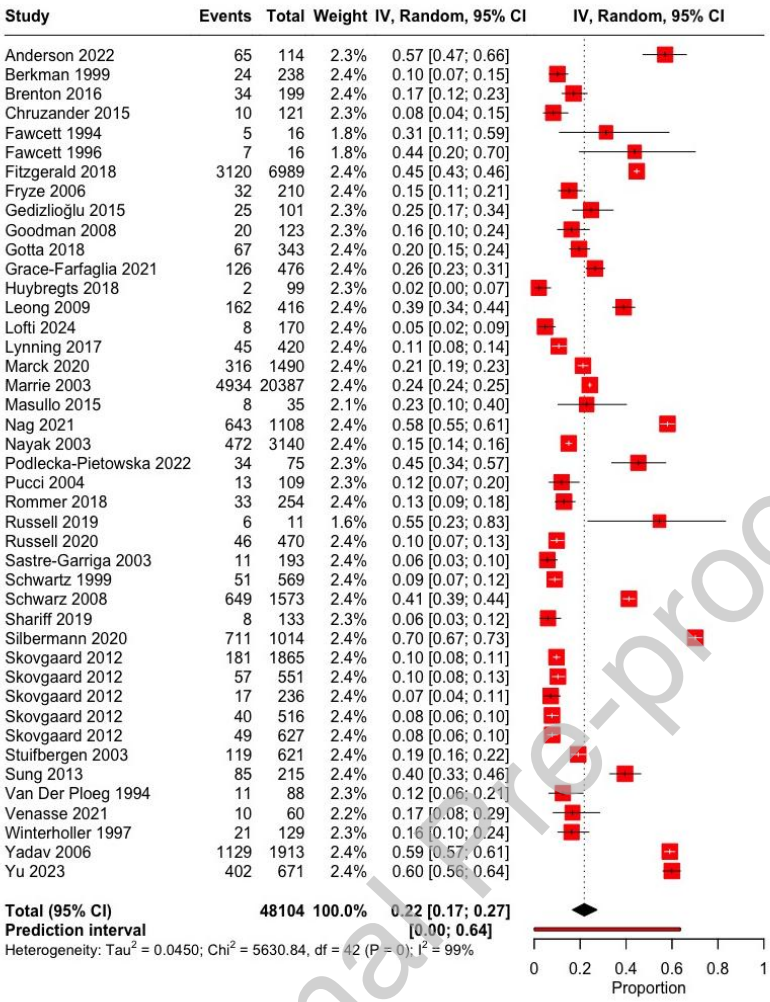


Figure 3. Lifetime diet modification prevalence stratified by global region.

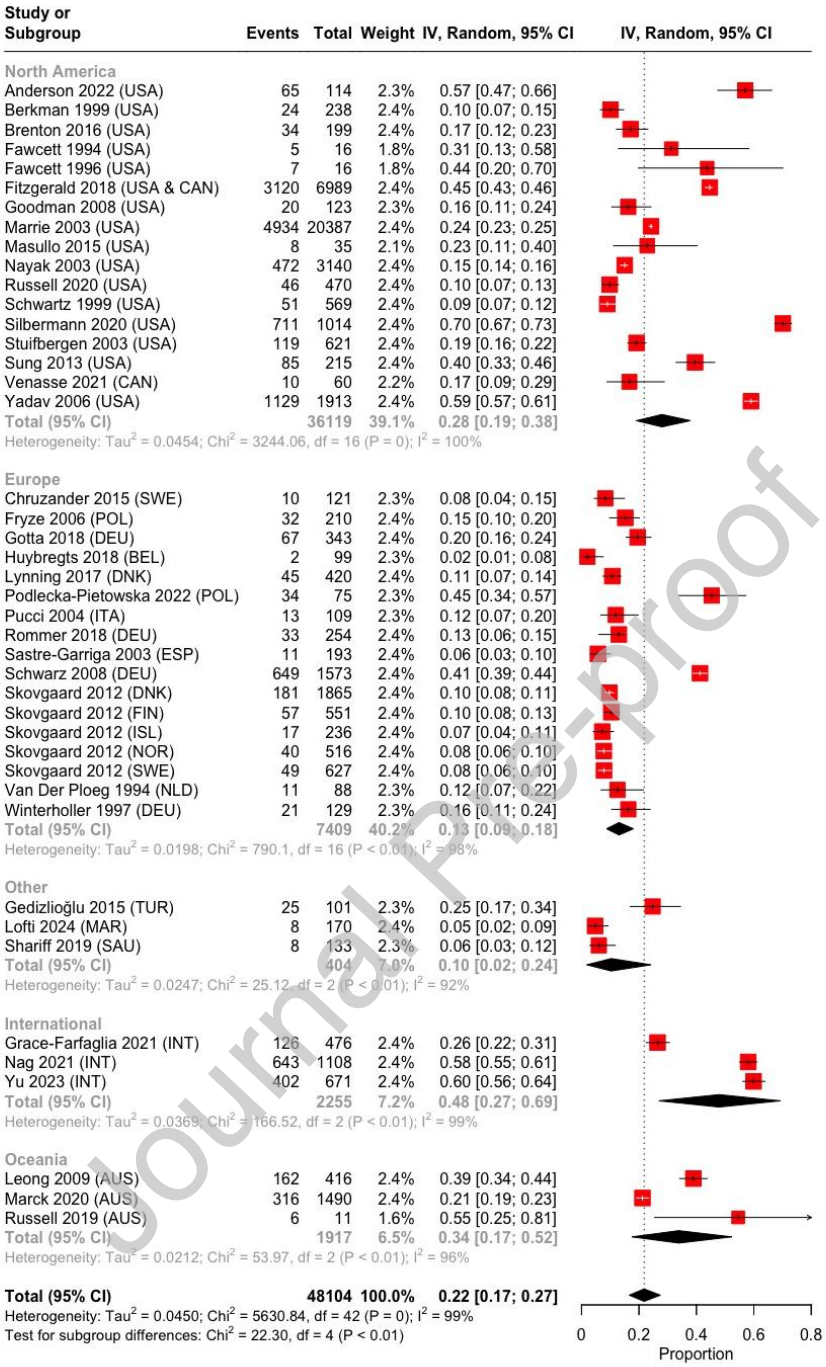


Figure 4. Prevalence of current diet modification.

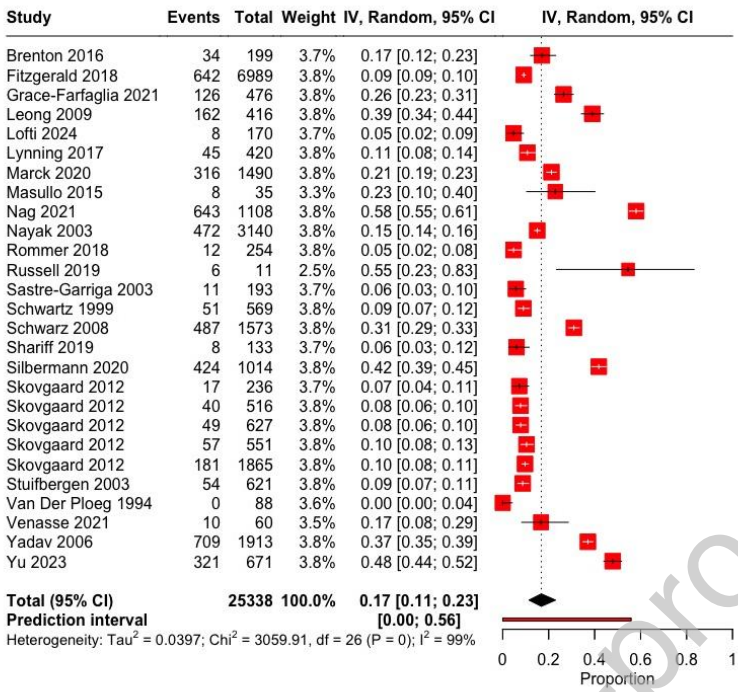


Figure 5. Current diet modification prevalence stratified by global region.

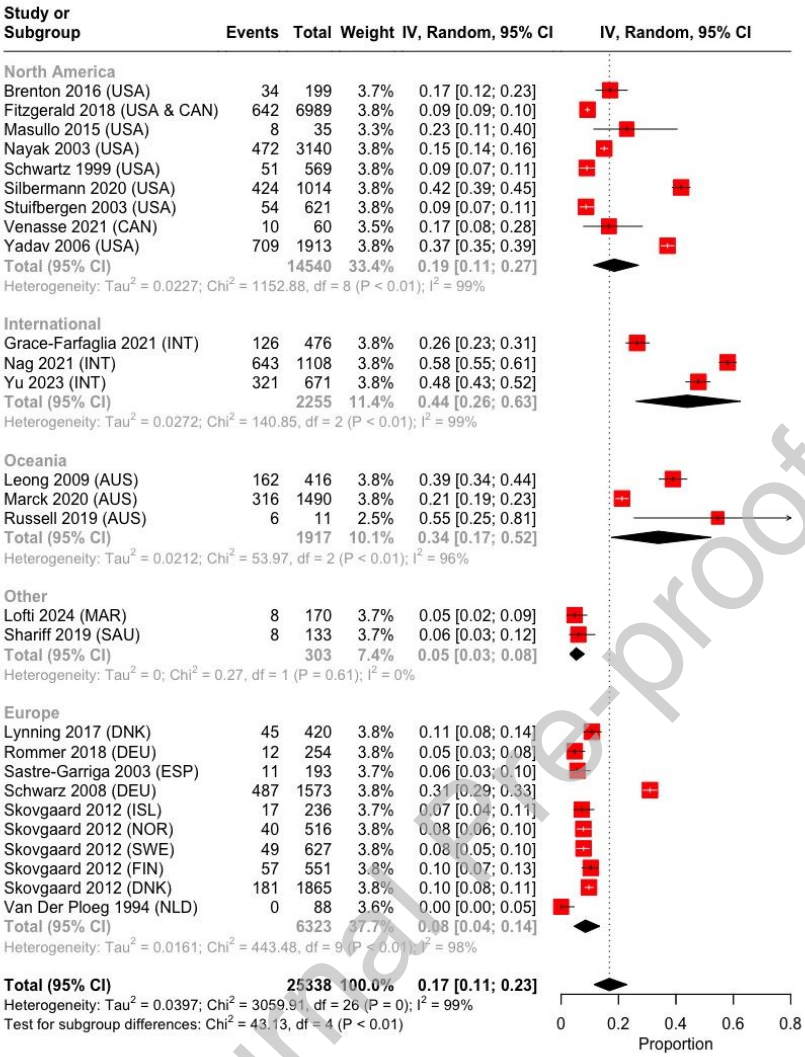


Figure 6. Current diet modification prevalence stratified by risk of bias.

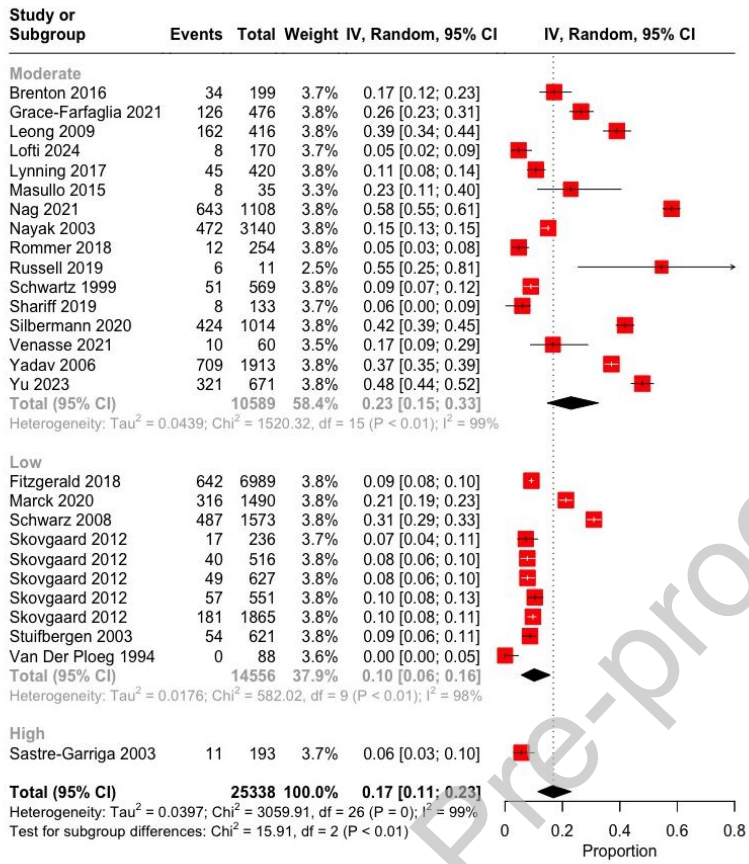


Figure 7. Current diet modification prevalence stratified by sample size.

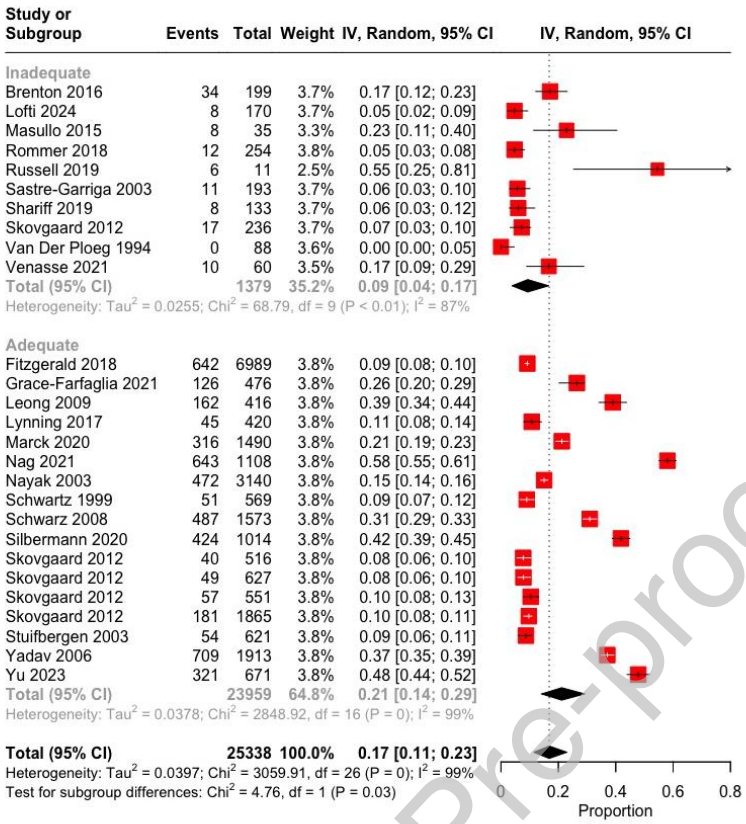
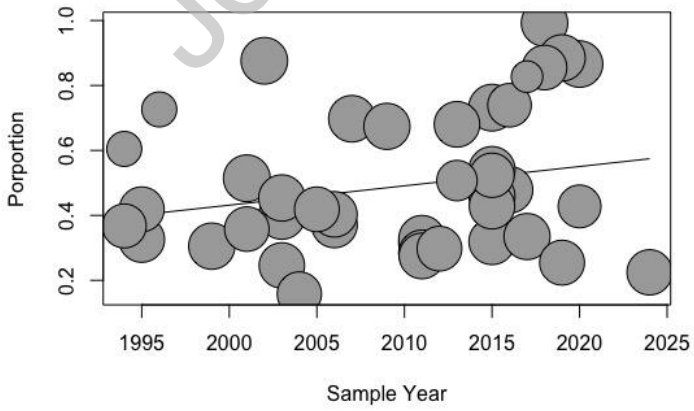


Figure 8. Bubble plots for the association of sample year with prevalence of A) lifetime (estimate 0.01; 95% CI -0.00 to 0.01) and B) current (estimate 0.01; 95% CI 0.00 to 0.02) diet modification.

A.



B.