University of Texas Rio Grande Valley

ScholarWorks @ UTRGV

Health & Biomedical Sciences Faculty Publications and Presentations

College of Health Professions

8-2024

Diet modification reduces pain and improves function in adults with osteoarthritis: a systematic review

Karen Stanfar

Corey Hawes
The University of Texas Rio Grande Valley, corey.hawes@utrgv.edu

Mina Ghajar

Laura Byham-Gray

Diane R. Radler

Follow this and additional works at: https://scholarworks.utrgv.edu/hbs_fac

 Part of the Nutrition Commons

Recommended Citation

Stanfar, K., Hawes, C., Ghajar, M., Byham-Gray, L., & Radler, D. R. (2024). Diet modification reduces pain and improves function in adults with osteoarthritis: A systematic review. Journal of Human Nutrition and Dietetics, 37(4), 847–884. https://doi.org/10.1111/jhn.13317

This Article is brought to you for free and open access by the College of Health Professions at ScholarWorks @ UTRGV. It has been accepted for inclusion in Health & Biomedical Sciences Faculty Publications and Presentations by an authorized administrator of ScholarWorks @ UTRGV. For more information, please contact justin.white@utrgv.edu, william.flores01@utrgv.edu.

Check for updates

Received: 18 October 2023 | Accepted: 14 April 2024

DOI: 10.1111/jhn.13317

JHND Journal of Human Nutrition and Dietetics BDA The Association of UK Dietitians

SYSTEMATIC REVIEW

Diet modification reduces pain and improves function in adults with osteoarthritis: a systematic review

Karen Stanfar | **Corey Hawes** | **Mina Ghajar** | **Laura Byham-Gray** | **Diane R. Radler**

Department of Clinical and Preventive Nutrition Sciences, School of Health Professions, Rutgers University, Newark, New Jersey, USA

Correspondence

Karen Stanfar, Department of Clinical and Preventive Nutrition Sciences, School of Health Professions, Rutgers University, Stanley Bergen Building, 65 Bergen St., Rm. 157, Newark, NJ 07107-3001, USA.
Email: kls333@shp.rutgers.edu

Funding information
None

Abstract

Background: The effect of dietary modifications on pain and joint function in adults with osteoarthritis (OA) is an emerging area of study. This systematic review aimed to evaluate if adults with OA who consume diets with a higher proportion of plant phenols and omega-3 fatty acids would have less pain and improved joint function than those with a higher proportion of saturated fatty acids, omega-6 fatty acids and refined carbohydrates.

Methods: Database searches of CINAHL (EBSCO), Clinical Trials (NIH-NLM), Cochrane Library (Wiley), Dissertation & Thesis Global (ProQuest), Embase (Elsevier), Medline (OVID), PubMed (NLM), Scopus (Elsevier), Web of Sciences (Clarivate) for clinical trials identified 7763 articles published between January 2015 and May 2023. After an independent review of the articles, seven randomised clinical trials and one nonrandomised clinical trial were included in the analysis. Because of the heterogeneity of the outcome measures, a meta-analysis was not possible.

Results: Participants who were instructed to consume high-phenol/high-omega-3 fatty acid diets reported significant improvements in pain and physical function scores. The greatest improvement was reported by those who consumed a diet that had the most omega-3 fatty acids.

Conclusion: Because of the high risk of bias, the strength of the evidence is limited. However, there is evidence that counselling adults with OA to replace refined grains and processed foods with whole plant foods, fish and plant oils may have a favourable effect on pain and physical function. Routine follow-up care regarding these diet modifications may be necessary to ensure adherence to this therapy.

KEYWORDS

diet, osteoarthritis, pain, physical function

Key points

- A systematic review of the literature identified eight clinical trials that studied the effects of diet interventions on pain and physical function in adults with osteoarthritis (OA).
- The diet interventions used in the clinical trials were categorised based on their varying levels of fatty acids and polyphenols.
- Instructing adults with OA to consume diets high in omega-3 fatty acids and polyphenols may have a favourable effect on pain and physical function.

This manuscript was prepared as part of the Doctor of Clinical Nutrition degree requirements.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.
© 2024 The Authors. *Journal of Human Nutrition and Dietetics* published by John Wiley & Sons Ltd on behalf of British Dietetic Association.

INTRODUCTION

Osteoarthritis (OA) is the leading cause of disability in ageing adults.[1] Like other chronic diseases observed in ageing populations, its incidence has risen 48% since 1990.[1,2] Hallmarks of the disease are joint pain, stiffness and loss of function.[3] The goals of OA care include pain management, preservation of joint function and the ability to perform activities of daily living (ADLs).[3] OA may progress to its end stage without successful intervention, requiring surgical joint replacement.[4]

The effect of diet modification on joint function and disease progression is an emerging area of study that may offer complementary treatment. Weight loss of 5%–20% has effectively reduced pain and improved function in those who are overweight or obese.[3] A novel focus on nutrient balance beyond energy deficit is developing because of evidence that nutrients affect the articular chondrocyte cell environment.[5,6]

Oxidative stress is a cellular state where free radicals exceed antioxidants. In chondrocytes, oxidative stress may occur in response to diet, initiating inflammation or propagating proinflammatory mediators that stimulate nociceptors and pain neurons.[7] This cytokine response contributes to chondrocyte degradation. Progressive degradation because of chronic oxidative stress within cells leads to structural changes in the joint, the surrounding tissues and joint function.[8] Chronic inflammation of the articular cartilage may also result in chronic nociceptive pain.[8]

Antioxidants interfere in the chondrocyte's reactive oxidative stress pathways, interrupting the cytokine cascade and reducing the inflammatory response. Over time, their actions may balance the synthesis and degradation of cartilage cells.[7] Antioxidants occur in edible plant foods as vitamins, minerals and polyphenols.[9] The concentration of polyphenols is greatest in the plants' seed coat, bran, bark, fruit, kernel and leaf portions. Plant foods with these portions removed during processing have reduced polyphenol content and may be collectively referred to as refined carbohydrates. Valsimou et al. reviewed the effect of isolated and combined polyphenols from plant extracts on the chondrocyte and found biomarkers of decreased cytokine response.[10] They concluded that a synergistic effect of multiple polyphenols effectively reduces oxidative stress in the chondrocytes.[10]

Despite the known protective effect of phenols on the chondrocyte, the impact of phenols on pain and physical function experienced by those with OA is varied.[8,11,12] Systematic reviews conducted by Morales-Ivorra et al., Xu et al. and Zeng et al. showed consistent associations between reduced pain and improved physical function in cohorts whose diets were rich in phenol-containing vegetables, herbs, roots, nuts, seeds and fruits.[13–15] They concluded that diets rich in phenol-containing food compounds are associated with reduced pain and improved joint function.[13–15] Yet, Guan et al. did not find a consistent effect on pain in clinical trials wherein 100 g of freeze-dried strawberries or 200 mL of pomegranate juice was given daily for 12 weeks to adults with OA.[8,11,12]

Fatty acids are another group of nutrients involved in chondrocyte metabolism and homeostasis. Their structural characteristics, such as the degree of saturation and location of any unsaturated bonds, indicate their cellular functions. In vivo and in vitro evidence supports that saturated fats promote inflammatory cytokines (such as interleukin 6 [IL-6]), apoptosis and OA-like symptoms in the chondrocyte.[6] There is also evidence that omega-3 polyunsaturated fats protect the chondrocyte by reducing the secretion of its matrix metalloproteinases (MM3 enzymes) and resolving oxidative stress. Additional evidence indicates that omega-6 fatty acids reduce chondrogenesis and promote degradation.[6] Therefore, balancing the n-6 to n-3 fatty acids ratio may be necessary to achieve chondrocyte homeostasis.[6]

Interventions showing the effect of dietary fat on chondrocytes are limited to human observational studies.[16–18] Miao et al.[16] showed a positive association between inflammation in the rat chondrocyte and dietary stearic acid intake. In the Osteoarthritis Initiative that included 2134 adults with OA, Eaton et al.[17] observed a dose–response association between saturated fat and loss of joint space width in those with knee OA. In the same data set, Lu et al. confirmed a positive association between total fat and saturated fat and loss of joint space width in those with knee OA. Further, they found a negative association between dietary unsaturated fats and joint space loss.[18]

Based on the association of phenols and fatty acids to OA markers, the proportion of phenols and fatty acids in the diet significantly affects the homoeostasis of the chondrocyte. Therefore, varying levels of these foods in diets may affect OA. The present study aimed to evaluate the effect of diet modifications on pain and physical function in adults with OA. We hypothesised that adults with OA who consume diets containing a higher proportion of phenols and omega-3 fatty acids would have less pain and improved joint function than those consuming a higher proportion of total fat, saturated fat, omega-6 fatty acids and refined carbohydrates.

METHODS

The protocol for this systematic review adhered to the guidelines established in the Cochrane Handbook for Systematic Reviews of Intervention[19] and followed the steps of Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 Checklist[20] outlined in Figure 1. It was conditionally registered in the International Prospective Register of Systematic Reviews (PROSPERO) on 24 February 2023, as CRD42023394983 and received final approval on 3 July 2023.

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	3-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	5,8
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Appendix A
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	5
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	5
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	6,7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	6,7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	7
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	8
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	8
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	8
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	8
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	n/a
Reporting bias	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	6
assessment			
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	6
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Appendix C
Study characteristics	17	Cite each included study and present its characteristics.	8-11
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Table 2 Figure 1
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	8-11
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	12
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	n/a
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	n/a
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	n/a
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	12
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	12
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	12-13
	23b	Discuss any limitations of the evidence included in the review.	14
	23c	Discuss any limitations of the review processes used.	14
	23d	Discuss implications of the results for practice, policy, and future research.	13
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	4
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	n/a
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	15
Competing interests	26	Declare any competing interests of review authors.	15
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Tables 1-4 Figures 1-3

FIGURE 1 PRISMA 2020 checklist.[20] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Systematic Reviews 2021;10:89.

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Eligibility criteria

All clinical trials evaluating the effect of diet on pain or physical function in those with OA of any joint were included. Exclusion criteria were studies performed in animals, those younger than 19 years old, those with arthritis not defined as OA, those with acute pain, studies using supplements, non-whole foods, non-specific or 'weight loss diets' and studies that did not evaluate the outcomes of pain or joint mobility or had a duration of fewer than 6 weeks.

Literature searches

The following databases were searched: CINAHL (EBSCO), Clinical Trials (NIH-NLM), Cochrane Library (Wiley), Dissertation & Thesis Global (ProQuest), Embase (Elsevier), Medline (OVID), PubMed (NLM), Scopus (Elsevier), Web of Sciences (Clarivate). An initial search of PubMed, Web of Science and Scopus was conducted, followed by an analysis of keywords in the title and abstract and indexed terms using MESH. A second search using all identified keywords was conducted across all included databases (Appendix A). Inclusion criteria for the literature search were limited to articles in the English language, human studies, all adults and articles found since January 2015. Previous systematic reviews investigating the use of dietary interventions have not revealed clinical trials before 2017. When a search returned a relevant literature review, the reference section was examined to check for applicable studies. All search results were entered into an EndNote Library for citation management. In addition, Google Scholar was searched, and the first 200 results were added to the EndNote Library.

As a result of these searches, 7271 records were identified and moved to the EndNote Library; after all the duplicates were removed, 4465 articles were identified for screening. The first reviewer (K.S.) screened 4116 titles for eligibility using the EndNote search feature. Both reviewers (K.S. and C.H.) screened the remaining 349 titles and abstracts for eligibility using Rayyan software. Of the 4465 articles, 4453 were removed during screening because they did not match the eligibility criteria or were duplicates. Of all titles and abstracts excluded, 35.2% ($n = 1557$) had ineligible populations, 30.8% ($n = 1,373$) had a non-diet intervention, 25.7% ($n = 1150$) had an ineligible study design and 7.5% ($n = 337$) had an ineligible outcome. One study was published in Spanish, and two had a study duration of fewer than 6 weeks (Appendix B). Twelve full-text articles were then reviewed (K.S., C.H.) (Appendix C). Five of the 12 articles were excluded because they were abstracts, the population was not limited to those with OA or there needed to be more information about dietary intervention. An updated search was conducted on 26 May 2023 to detect any new studies published since the original search for our systematic review. After evaluating the results, three were identified for retrieval and one was added for synthesis. The PRISMA flow diagram was updated (Appendix B).

There were eight articles retained for the study. Publication dates ranged from 2015 to 2023. Two studies[21,22] were based on the same participants, but both were retained to provide data about the effect of short- and long-term diet intervention.

Data extraction

Data were extracted from the included articles and tabulated in Excel spreadsheets by the primary investigator (PI) (K.S.). The data extracted included the study author, publication year, design, purpose, population demographics, diet intervention, findings, attrition, adherence, conclusions and comments on additional variables that may confound or validate the results. A second reviewer (C.H.) critically analysed the extracted data for accuracy and presentation.

Risk of bias

Two reviewers (K.S., C.H.) independently assessed the seven randomised clinical trials for risk of bias using Cochrane RoB2 tools available at riskofbias.info.[23] The tool was used to assess if measures were taken to reduce the risk of bias, such as randomisation, allocation concealment, deviations from the assigned interventions, outcome assessment blinding, attrition, reporting or other bias that are present in the study.[19] The reviewers assigned one of three judgments to each article: low risk, unclear or high risk. The reviewers compared their judgments and found agreement. The two reviewers (K.S., C.H.) also used the Cochrane ROBINS1 tool[24] to assess the risk of bias for the one nonrandomised clinical trial that was included. The study was evaluated for bias in randomisation, participant selection, intervention classification, deviations from intended interventions and data reporting. The reviewers agreed on the ROB classification for this study.

Data synthesis

The extracted data were reviewed for homogeneity and the ability to pool the outcome data. A meta-analysis of effect estimates could not be conducted because each study measured varied outcomes. The PI (K.S.) then analysed the extracted data in a narrative format using the Synthesis Without Meta-Analysis (SWIM) reporting guidelines.[25] The PI (K.S.) tabulated the data in four tables. The tables include the study characteristics, the

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

participants' demographic characteristics and the participants' clinical characteristics that may modulate the outcomes, such as body mass index (BMI), analgesic use and dietary supplement use. The tables also include the types, frequencies and duration of the various dietary interventions.

To test the hypothesis, diet interventions were divided into three categories based on the phenol and omega-3 fatty acid content of the diets on which participants were instructed. Diets labelled 'plant-based', 'The Dietary Guidelines for Americans (DGA)', 'anti-inflammatory' and 'Mediterranean' were classified as high phenol/high-omega-3 fatty acid diets. These diets contained whole plant foods such as legumes, nuts, fruits and vegetables; they had fewer than 10% saturated fatty acids, and whole grains replaced refined grains. The fat content of these diets ranged from 20% to 35% fat depending on the use of plant oils. A category of low phenol/low fat was established to describe a diet labelled 'low fat' that limited animal foods and oils to <20% total fat but did not limit refined carbohydrates. The diet labelled 'low carbohydrate' was categorised as low phenol/high fat. It contained a high proportion of animal foods like eggs, meat and high-fat dairy, which limited its phenol and omega-3 fatty acid content and raised the saturated fat content to >20% of calories and total fat content to >50% of calories. The effect of these three diet categories was evaluated using tools validated by the American College of Rheumatology (ACR) for assessing pain and physical function in OA.[3] Outcomes were reported as a change in pain and physical function scores within the intervention groups and tabulated to reflect the differences in outcomes between intervention and control groups.

The four validated tools used to measure the effect were the Arthritis Impact Measurement Score (AIMS2), the Knee Osteoarthritis Outcome Score (KOOS), the Western Ontario and McMaster Arthritis Index (WOMAC) and the Visual Analogue Pain Scale (VAS).

AIMS2 is a questionnaire that evaluates pain, physical function, ability to work, sociability and affect.[26] The WOMAC questionnaire assesses pain, stiffness and physical function in any joint.[27] Pain scores range from 0 to 20, and physical function scores range from 0 to 68, where lower scores indicate less pain and better physical function. A score of two or more for two of the five questions about pain is considered moderate pain. KOOS is derived from WOMAC but is only used for the knee joint.[28] The tool has five domains (pain, quality of life, ADLs, sport and recreation and other symptoms). It is scored by summing the response for each domain and converting it to an interval score of 1–100, where zero indicates severe pain and disability, and 100 indicates the best knee health. Scores from AIMS2, WOMAC and KOOS are often transformed to a normalised scale of one to five, where higher scores indicate severe problems. VAS measures pain on a scale of 0–100 mm, which may also be reported in centimetres, wherein zero indicates no pain, and 100 indicates severe pain.[29] Scores of ≤30 mm indicate mild pain, scores between 45 and 74 mm indicate moderate pain and scores of 75–100 mm indicate severe pain.

RESULTS

Study characteristics

Seven of the eight studies were randomised controlled trials (RCT).[21,22,30–34] One study was a nonrandomised, single-arm study.[30] A total of 778 participants were included in the studies. The mean age of participants ranged between 52 and 72 years. Most participants were female ($n = 673$, 86.5%). Although five studies[30–33,35] included mostly whites (66%–100%), two large studies[21,22] included mostly African Americans (86%). One study did not report race.[34] Common reasons for excluding participants were a history of joint replacement, recent weight loss, reports of following other diets or the presence of non-OA pain. Other reasons were the following comorbidities: rheumatoid arthritis, diabetes mellitus, fibromyalgia, organ failure and cancer. The mean BMI of participants ranges from 29 to 35 mg/kg^2. All participants experienced moderate disability and pain at baseline. Seven of the eight studies[21,22,30–33,35] controlled for pain medications; however, only one[34] controlled for dietary supplement use. Additional study and participant characteristics are outlined in Table 1.

Diet interventions

All studies instructed at least one group of participants to consume a high-phenol/high-omega-3 fatty acid diet.[21,22,30–35] One study[32] instructed a group of participants to consume a low-phenol/low-fat diet, and another[33] study instructed a group to consume a low-phenol/high-fat diet. Although eight diets were categorised as high-phenol/high-omega-3 fatty acid diet, there was variation between them. In all the high-phenol/high-omega-3 fatty acid diets, unrefined plant foods were the largest source of carbohydrates. These unrefined plant foods were whole grains, legumes, fruits, vegetables, seeds and nuts. Animal foods, commercial bakery products and processed grains were limited in the DGA, Mediterranean and anti-inflammatory diets and eliminated in the plant-based diet. There were variations in the use of plant oils. They were eliminated in the plant-based diet, used sparingly in the DGA diet and used liberally in the Mediterranean and anti-inflammatory diet.[21,22,30–35] The diets where plant oils were used liberally contained the greatest number of phenols and omega-3 fatty acids.[30,32,34,35]

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 1 Overall characteristics of clinical trials included in the synthesis.

Reference	Design	Location	Group (*n*)	Mean Age (years)	White, *n* (%)	Female, *n* (%)	Joint	Mean BMI	DSUC	AUC	Inclusion criteria	Exclusion criteria	Attrition (%)	Adherence (%)
Clinton et al. (2015)	RCT	Michigan, USA	PLANT (19)	56.1 ± 8.4	16 (88.9)	15 (78.9)	Any	29.1 ± 6.5	No	Yes	Mild, mod (ACR)	DM. other diet	2	100
			CNTRL (18)	60.0 ± 6.3	18 (100.0)	16 (88.9)	Any	28.4 ± 4.5	No	Yes	Mild, mod (ACR)			
Cooper et al. (2022)	NRCT	Australia	ANTI-INFLAM (28)	66 ± 8	28 (100.0)	25 (82.0)	Knee	30.6 ± 4.6	No	Yes	Mod (ACR)	Other diet, Fibromyalgia WL, CA, other pain	21	96
Dolatkhah et al. (2023)	RCT	Germany	ANTI-INFLAM (30)	52.60 ± 6.74	n/a	30 (100.0)	Knee	34.90 ± 5.48	Yes	Yes	Mild, mod (ACR, rad)	Other diet, DM, CA, RA, PT, other pain	10	91.7
			LOWCAL (30)	54.57 ± 8.16	n/a	30 (100.0)	Knee	34.54 ± 5.58	Yes	Yes	Mild, mod (ACR, rad)			
Dyer et al. (2017)	RCT	England	MED (50)	66 ± 11	n/a	38 (76.0)	Any	n/a	No	Yes	Early (clinician)	Other diet	17	65
			CNTRL (49)	60 ± 12	n/a	44 (90.0)	Any	n/a	No	Yes	Early (clinician)			
Hughes et al. (2018)[a]	RCT	Illinois, USA	DGA (203)	68 ± 6	16 (7.9)	177 (87)	Any	34.7 ± 0.4	No	No	Mild, mod (ACR)	RA, inability to exercise	13.8	n/a
			CNTRL (210)	68 ± 6	17 (8.0)	178 (85)	Any	35.0 ± 0.4	No	No	Mild, mod (ACR)			
Fitzgibbons et al. (2020)[a]	RCT	Illinois, USA	DGA (174)	68 ± 6	16 (7.9)	177 (87)	Any	34.7 ± 0.4	No	No	Mild, mod (ACR)	RA, inability to exercise	13.3	n/a
			CNTRL (182)	68 ± 6	17 (8.0)	178 (85)	Any	35.0 ± 0.4	No	No	Mild, mod (ACR)			
Sadeghi et al. (2022)	RCT	Iran	MED (40)	55.9 ± 9.5	n/a	37 (93)	Knee	<35	No	Yes	Early (ACR)	JR, RA, OF, CA, MI, DM, Stroke, ND, FA, PT, AU, CU, WT	7	>80
			LOWFAT (43)	57.98 ± 10.98	n/a	40 (93)	Knee	<35	No	Yes	Early (ACR)		0	>80

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 1 (Continued)

Reference	Design	Location	Group (*n*)	Mean Age (years)	White, *n* (%)	Female, *n* (%)	Joint	Mean BMI	DSUC	AUC	Inclusion criteria	Exclusion criteria	Attrition (%)	Adherence (%)
			CNTRL (42)	59.1 ± 9.8	n/a	37 (88)	Knee	<35	No	Yes	Early (ACR)			
Strath et al. (2020)	RCT	Alabama, USA	LOWFAT (6)	72.33 ± 6	5 (83.3)	3 (100)	Knee	29.65 ± 4.48	No	Yes	Mild, mod (ACR)	JR, DM, WL, OF	16.7	>83
			LOWCHO (8)	71.00 ± 63.12	7 (87.5)	5 (83)	Knee	35.64 ± 7.35	No	Yes	Mild, mod (ACR)		0	>83
			CNTRL (7)	68.71 ± 67.11	2 (28.6)	4 (57)	Knee	26.9 ± 3.02	No	Yes	Mild, mod (ACR)			

Abbreviations: ACR, American College of Rheumatology criteria; ANTI-INFLAM, anti-inflammatory diet; AU, alcohol use; AUC, analgesic use controlled; CA, cancer; CNTRL, control diet; CU, cigarette use; DGA, Dietary Guidelines for America; DM, diabetes mellitus; DSUC, dietary supplement use controlled; FA, fish allergy; JR, joint replacement; LOWCHO, low carbohydrate diet; MED, Mediterranean diet; MI, myocardial infarction; MOD, moderate; n, number; ND, neurological disease; OF, organ failure; PT, physical therapy; RA, rheumatoid arthritis; RAD, radiograph; WL, recent weight loss.

All interventions were implemented by dietitians or someone trained to perform diet instructions. The implementation method was dietary education and reinforcement through continued communication between the diet instructor and the study participants. The trial durations ranged from 6 weeks to 18 months, with a median duration of 12 weeks.[21,22,30–35]

Adherence to the diet interventions

Adherence was measured through tracking of dietary intake logs that the participants maintained and was highest in the studies of the shortest duration. One hundred per cent adherence was reported by Clinton et al. who used a high-phenol/high-omega-3 fatty acid diet for 6 weeks, and 96% adherence was reported by Cooper et al. who used a high-phenol/high-omega-3 fatty acid diet for 9 weeks.[30,31] The lowest compliance (65%) was reported by Dyer et al. who used a high-phenol/high-omega-3 fatty acid diet for 12 weeks.[35] Fitzgibbons et al. and Hughes et al. measured adherence to the DGA by calculating the Healthy Eating Score (HEI).[21,22,36]

Attrition

The attrition rate ranged from 0% among 43 participants following a low-phenol/low-omega-3 fatty acid diet for 12 weeks[33] to 21% among 28 participants following a high-phenol/high-omega-3 fatty acid diet.[30] The primary reason for attrition across the studies was participant adherence to the diet intervention that fell below the established threshold.

Weight loss

All participants in the control and intervention groups were classified as overweight or obese.[21,22,30–35] Participants lost weight on all diet interventions, including those in the Cooper et al. study that used an energy-controlled diet.[30,34] The range of weight loss was 1.3–8.7 kg.[21,22,30–35] The greatest weight loss was reported in those who followed a low-phenol/high-fat diet for 12 weeks,[33] in which participants lost ≥10% of their body weight; the change in baseline weight to weight at 12 weeks was a reduction from 98.53 ± 18.56 to 89.59 ± 17.86 kg ($p < 0.001$). Dolatkhah et al.[34] compared the weight loss between two groups following a low-calorie diet of which one was high-phenol/high-omega-3 fatty acid diet. They found that although both groups experienced significant weight loss, those following the low-calorie, high-phenol/high-omega-3 fatty acid diet had a greater magnitude of change. Participants following the low-calorie, high-phenol/high-omega-3 fatty acid diet had a mean loss of >6 kg (86.39 ± 12.82 to

1363277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

79.87 ± 12.73 kg, [−6.52 ± 7.44, $p < 0.001$]) compared to those in the same study who followed a low-calorie diet and had a mean loss of 2.2 kg (83.35 ± 13.47 to 81.22 ± 12.57 kg [−2.12 ± 2.10, $p < 0.001$]).[34]

Effect of diet interventions on pain

Participants in all eight studies reported reduced pain after the dietary interventions (Table 2). A significant reduction was achieved in those with over 80% adherence to a high-phenol/high-omega-3 fatty acid diet for 9 weeks or longer.[21,22,30,32,34,35] Hughes et al. demonstrated a 1.5-point reduction (−1.5 ± 0.3, $p < 0.001$) on the WOMAC pain score after 6 months following the diet.[22] Fitzgibbons et al. demonstrated a smaller, yet still significant difference in WOMAC pain score (−0.9 ± 0.3, $p < 0.01$) after following a high-phenol/high-omega-3 fatty acid diet for 18 months.[21] During the 18-month intervention, the lowest pain score was at 6 months when participant adherence was highest.[21]

Of the participants following a high-phenol/high-omega-3 fatty acid diet, those encouraged to consume plant oils, and therefore, the most phenols and omega-3 fatty acids, reported the most improvement in pain scores.[30,32,34,35] The exception was reported by Dyer et al.[35] who found a clinical but not statistically significant decrease in AIMS2 pain score (3.5 ± 2.6 to 3.2 ± 2.5) after 12 weeks of following the diet; however, adherence to the diet was lower (65%) among participants in this study compared to adherence to the diet among participants in studies of Cooper et al. (96% adherence), Sadeghi et al. (>80% adherence) and Dolatkhah et al. (90.1% adherence).[30,32,34,35]

Cooper et al.[30] found the greatest improvement in pain on VAS (−8.9 ± 35.6 mm, 95% confidence interval [CI] [−26.8 to 8.2]) and KOOS pain score (+6.6 ± 12.6 95% CI [0.9–12.4], 61.8 ± 12.0 to 68.4 ± 12.3) in participants following the high-phenol/high-omega-3 fatty acid diet. Sadeghi et al.[32] also found a significant reduction on VAS (6.8 ± 1.8 to 5.4 ± 1.9 cm, $p < 0.001$) in participants who followed the high-phenol/high-omega-3 fatty acid diet. Dolatkhah et al.[34] reported a decrease in both VAS (6.68 ± 1.92 to 4.56 ± 0.81 cm [−2.11 ± 1.86, $p < 0.001$]) and WOMAC pain score (12.00 ± 4.92 to 6.76 ± 3.34 [−5.23 ± 5.48, $p < 0.001$]) in participants who followed a high-phenol/high-omega-3 fatty acid diet.

Clinton et al. and Strath et al. reported clinical but not statistically significant reduction in pain after following a high-phenol, high-omega-3 fatty acid diet that contained fewer plant oils and therefore fewer phenols and omega-3 fatty acids. Clinton et al. found a decrease of 2.85 cm on VAS in those who consumed the high phenol/high-omega-3 fatty acid diet compared to a 1.18-cm decrease in the control group who consumed an unrestricted diet for 6 weeks.[31] One group in the Strath et al.'s[33] study reported reduced pain on KOOS after following a high-phenol/high-omega-3 fatty acid diet with >83% adherence for 12 weeks (2.56 ± 0.734 to 2.24 ± 0.729, $p = 0.337$).

The low-phenol/low-fat and low-phenol/high-fat diets also resulted in reduced pain; however, the result was only significant in those following the low-phenol/low-fat diet. Sadeghi et al.[32,33] found reductions in pain reported on VAS (6.8 ± 1.9 to 6.1 ± 2, $p < 0.001$) and WOMAC (13.8 ± 4 to 12.6 ± 4.4, $p < 0.001$) in those following the low-phenol/low-fat diet. KOOS pain reported by participants following the low-phenol/high-fat diet was not statistically significant (2.68 ± 0.360 to 2.20 ± 0.730, $p = 0.058$).[33]

Effect of diet interventions on physical function

All groups demonstrated improvements in physical function after receiving instruction on a high-phenol/high-omega-3 fatty acid diet; however, only the results of five interventions were statistically significant (Table 3). In these studies, participants reported fewer problems performing ADLs on the WOMAC physical function scale or the KOOS ADL score. Hughes et al.[22] and Fitzgibbons et al.[21] reported improved WOMAC physical function scores of −4.7 ± 0. 9, $p < 0.001$ in participants after 6 months (HEI: 67.8 ± 0.8) and −3.5 ± 0.9, $p < 0.001$ after 18 months (HEI: 66.9 ± 0.8). Cooper et al. and Dolatkhah et al. also reported improved physical function after following high-phenol/high-omega-3 fatty acid diets.[30,34] Cooper et al.[30] reported an increased KOOS ADL interval scores (68.2 ± 15.9 to 78.3 ± 14.4 [+10.1 ± 14.3, 95% CI: 3.6–16.6, MDS 8–10]). Dolatkhah et al. reported decreased WOMAC physical function 36.36 ± 10.30 to 29.80 ± 10.71(−6.56 ± 7.46, $p < 0.001$).[34]

Although participants in the Dyer et al. study[35] who also followed the high-phenol, high-omega-3 fatty acid diet reported improved physical function (1.75 ± 1.5 to 1.6 ± 1.4), the change was not statistically significant. This was also true for Strath et al., whose participants followed a high-phenol/low-fat diet.[33]

Clinton et al.[31] did not report a within-group change from baseline to 6 weeks following the high-phenol/high-omega-3 fatty acid diet; however, the physical function score on the 36-question health survey short form[37] increased more in the intervention group (+6.09) than in the control group (+1.02), $p < 0.01$.

Sadeghi et al.[32] compared WOMAC physical function scores in participants with a minimum of 80% adherence to a high-phenol/high-omega-3 fatty acid diet group to a low-phenol/low-fat diet group. Although both WOMAC scores improved, the magnitude of improvement was greater in participants following the high-phenol/high-omega-3 fatty acid diet, which did not limit added plant oils (48.3 ± 11.4 to 42.1 ± 11.9, $p < 0.001$), than in the participants following the low-phenol/low-fat diet (50.2 ± 11.9 to 46.5 ± 12.7, $p < 0.001$).[32]

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 2 The effect of diet modification on pain in adults with osteoarthritis (OA).

Authors	Diet (number)	AIMS2 change within group[a]	KOOS pain change within group	VAS change within group[a]	WOMAC pain change within group[a]	Weight change
Clinton et al.	PLANT (19) ▲Phen ▲Ω3)			−2.85 (n.s.)		(−5.23 pounds, $p < 0.003$)
	CNTRL (18)			−1.18 (n.s.)		(0.89 pounds, $p < 0.003$)
Cooper et al.	ANTI-INF (28) ▲Phen ▲Ω3		+6.6 ± 12.6[b] 95% CI (0.9 to 12.4) 61.8 ± 12.0 to 68.4 ± 12.3	52.6 ± 22.7 to 43.6 ± 27.5 (−8.9 ± 35.6, 95%CI [−26.8 to 8.2])		(−3.0 ± 2.3 kg) 95% CI (−4.1 to −1.8)
Dolatkhah et al.	ANTI-INF (30) ▲Phen ▲Ω3			6.68 ± 1.92 to 4.56 ± 0.81 (−2.11 ± 1.86, $p < 0.001$)	12.00 ± 4.92 to 6.76 ± 3.34 (−5.23 ± 5.48, $p < 0.001$)	86.39 ± 12.82 to 79.87 ± 12.73 (−6.52 ± 7.44, $p < 0.001$)
	LOWCAL (30) ▲Phen ▲Ω3			6.20 ± 2.25 to 5.31 ± 1.84 (−0.88 ± 1.21, $p < 0.001$)	10.10 ± 5.34 to 9.26 ± 4.16 (0.83 ± 4.05, $p < 0.001$)	83.35 ± 13.47 to 81.22 ± 12.57 (−2.12 ± 2.10, $p < 0.001$)
Dyer et al.	MED (50) ▲Phen ▲Ω3	3.5 ± 2.6 to 3.2 ± 2.5 (n.s.)				70.4 ± 13.1 to 68.9 ± 12.6 kg $p = 0.012$
	CNTRL (49)	4.2 ± 2.8 to 3.6 ± 2.7 (n.s.)				71.6 ± 17.4 to 72.4 ± 16.6 $p = 0.012$
Fitzgibbons et al.[c]	DGA (174) ▲Phen ▲Ω3				5.4 ± 0.2 to 4.5 ± 0.3 (−0.9 ± 0.3, $p < 0.01$)	(−1.3 ± 0.3 kg, $p < 0.001$) (−1.4%)
	CNTRL (182)				5.7 ± 0.2 to 4.8 ± 0.3 (−1.0 ± 0.3, $p < 0.01$)	(−0.9 ± 0.3 kg, $p < 0.001$) (−1.0%)
Hughes et al.[c]	DGA (174) ▲Phen ▲Ω3				5.4 ± 0.2 to 4.0 ± 0.3 (−1.5 ± 0.3, $p < 0.001$)	(−2.0 ± 0.3 kg, $p < 0.001$) (−2.2%)
	CNTRL (173)				5.7 ± 0.2 to 5.1 ± 0.3 (−0.6 ± 0.3, $p < 0.05$)	(0.8 ± 0.3 kg, $p < 0.001$) (−0.9%)
Sadeghi et al.	MED (40) ▲Phen ▲Ω3			6.8 ± 1.8 to 5.4 ± 1.9 $p < 0.001$	12.5 ± 3.7 to 10.2 ± 3.9 $p < 0.001$	73.2 ± 11.6 to 70.2 ± 10.5 kg $p < 0.001$
	CNTRL (42)			6.4 ± 1.7 to 5.9 ± 1.8 $p < 0.008$	12.5 ± 3.8 to 11.8 ± 4 $p < 0.01$	68.8 ± 9.6 to 69.2 ± 9.7 kg $p < 0.07$
Strath et al.	LOWFAT (6) ▲Phen ▲Ω3		2.56 ± 0.734 to 2.24 ± 0.729[a] $p = 0.337$			88.02 ± 18.07 to 81.30 to 16.70 kg $p < 0.001$
	CNTRL (7)		3.23 ± 0.542 to 2.78 ± 0.759[a] $p = 0.071$			77.64 ± 7.07 to 75.87 ± 7.55 kg $p < 0.001$

(Continues)

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 2 (Continued)

Authors	Diet (number)	AIMS2 change within group[a]	KOOS pain change within group	VAS change within group[a]	WOMAC pain change within group[a]	Weight change
Strath et al.	LOWCHO (8) ▼Phen ▲ Fat		2.68 ± 0.360 to 2.20 ± 0.730[a] $p = 0.058$			98.53 ± 18.56 to 89.59 to 17.86 kg $p < 0.001$
	CNTRL (7)		3.23 ± 0.542 to 2.78 ± 0.759[a] $p = 0.071$			77.64 ± 7.07 to 75.87 ± 7.55 kg $p < 0.001$
Sadeghi et al.	LOWFAT (43) ▼Phen ▼Fat			6.8 ± 1.9 to 6.1 ± 2 $p < 0.001$	13.8 ± 4 to 12.6 ± 4.4 $p < 0.001$	74.7 ± 11.4 to 71.9 ± 10.5 kg $p < 0.001$
	CNTRL (42)			6.4 ± 1.7 to 5.9 ± 1.8 $p < 0.008$	12.5 ± 3.8 to 11.8 ± 4 $p < 0.01$	68.8 ± 9.6 to 69.2 ± 9.7 kg $p < 0.07$

Abbreviations: AIMS2, Arthritis Impact Measurement Score for pain; ANTI-INF, anti-inflammatory; CNTRL, control group; MED, Mediterranean; DGA, Dietary Guidelines for Americans 2010 Version; KOOS, Knee Osteoarthritis Outcome Score; LOWCAL, low calorie; LOWCHO, low carbohydrate; LOWFAT, low fat; n.s., *p*-value is not significant; PLANT, plant-based; VAS, Visual Analog Pain Scale; WOMAC, Western Ontario and McMaster Arthritis Index; ▲Phen ▲Ω3, high-phenol, high-omega-3 fatty acid diet; ▼Phen ▼Fat, low-phenol, low-fat diet; ▼Phen ▲ Fat, low-phenol, high-fat diet.

[a]A reduced score indicates improvement.

[b]An increased score indicates improvement.

[c]Shared methods and data set at baseline.

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 3 Effect of diet modifications on physical function in adults with osteoarthritis (OA).

Authors	Diet (*n*)	AIMS2 change within group[a]	KOOS QOL change within group	KOOS ADL change within group	WOMAC PF change within group[a]
Clinton et al.	PLANT (19) ▲Phen ▲Ω3	Not available	Not available	Not available	Not available
	CNTRL (18)				
Cooper et al.	ANTI-INF (28) ▲Phen ▲Ω3		42.0 ± 16.4 to 50.8 ± 13.7 (+8.8 ± 14.7 [MDS 8–10] 95% CI (2.1–15.5)][b]	68.2 ± 15.9 to 78.3 ± 14.4 (+10.1 ± 14.3 (MDS 8–10) 95% CI (3.6–16.6][b]	
Dolatkhah et al.	ANTI-INF (30) ▲Phen ▲Ω3				36.36 ± 10.30 to 29.80 ± 10.71 (−6.56 ± 7.46, $p < 0.001$)
	LOWCAL (30)				36.10 ± 13.11 to 35.03 ± 15.19 (−1.06 ± 7.80, $p = 0.460$)
Dyer et al.	MED (50) ▲Phen ▲Ω3	1.75 ± 1.5 to 1.6 ± 1.4 Not significant			
	CNTRL (49)	2.0 ± 1.9 to 1.9 ± 1.9 Not significant			
Hughes et al.[c]	DGA (174) ▲Phen ▲Ω3				17.7 ± 0.9 to 13.0 ± 1.0 (−4.7 ± 0.9, $p < 0.001$)
	CNTRL (173)				17.8 ± 0.9 to 16.3 ± 1.0 (−1.5 ± 0.3, n.s.)
Fitzgibbons et al.[c]	DGA (174) ▲Phen ▲Ω3				−17.7 ± 0.9 to 13.0 ± 1.0 (3.5 ± 0.9, $p < 0.001$)
	CNTRL (182)				17.8 ± 0.9 to 15.2 ± 1.0 (−2.6 ± 0.9, $p < 0.01$)
Sadeghi et al.	MED (43) ▲Phen ▲Ω3				48.3 ± 11.4 to 42.1 ± 11.9, $p < 0.001$
	CNTRL (42)				47.2 ± 11.9 to 44.9 ± 11.8, $p < 0.001$
Strath et al.	LOWFAT (6) ▲Phen ▲Ω3		2.91 ± 0.785 to 2.08 ± 0.954[a] $p = 0.534$		
	CNTRL (7)		3.67 ± 0.718 3.26 ± 0.759[a] $p = 0.047$		
Strath et al.	LOWCHO (8) ▼Phen ▲ Fat		3.28 ± 0.604 to 2.75 ± 0.627,[a] $p = 0.031$		
	CNTRL (7)		3.67 ± 0.718 3.26 ± 0.759,[a] $p = 0.047$		

(Continues)

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 3 (Continued)

Authors	Diet (*n*)	AIMS2 change within group[a]	KOOS QOL change within group	KOOS ADL change within group	WOMAC PF change within group[a]
Sadeghi et al.	LOWFAT (43) ▼Phen ▼Fat		3.28 ± 0.604 to 2.75 ± 0.627, [a] $p = 0.031$		50.2 ± 11.9 to 46.5 ± 12.7, $p < 0.001$
	CNTRL (42)		3.67 ± 0.718 to 3.26 ± 0.759, [a] $p = 0.047$		47.2 ± 11.9 to 44.9 ± 11.8, $p < 0.001$

Abbreviations: AIMS2, Arthritis Impact Measurement Score for physical function; ANTI-INF, anti-inflammatory; CNTRL, control group; DGA, Dietary Guidelines for Americans 2010 Version; KOOS QOL, Knee Osteoarthritis Outcome Score for quality of life; LOWCAL, low calorie; LOWCHO, low carbohydrate; LOWFAT, low fat; MED, Mediterranean; PLANT, plant-based; n.s., *p*-value is not significant; WOMAC, Western Ontario and McMaster Arthritis Index for physical function; ▲Phen ▲Ω3, high-phenol, high-omega-3 fatty acid diet; ▼Phen ▼Fat, low-phenol, low-fat diet; ▼Phen ▲Fat, low-phenol, high-fat diet.

[a]A reduced score indicates improvement.

[b]An increased score indicates improvement.

[c]Shared methods and data set at baseline.

The improvement in KOSS for quality of life (KOOS QOL) for participants following the low-phenol/high-fat diet was insignificant.

Risk of bias assessment

The risk of bias for the RCTs using the ROB2 tool characterised seven studies as having a high level of bias primarily arising from measuring the outcome (Figure 2). The risk of bias for the NRCT using the ROBINS 1 tool found a low level of bias for participant selection, classification, deviations from intended interventions and reporting; however, the risk of bias was high because of the NRCT study design (Table 4).

DISCUSSION

The results of this systematic review support that adults who consume diets proportionately higher in plant phenols and omega-3 fatty acids have less pain and greater joint function than those who consume diets proportionately higher in refined carbohydrates, saturated fat and total fat.

In eight clinical trials, groups were instructed to replace or eliminate refined grains or refined carbohydrates.[21,22,30–35] Seven of these trials also instructed participants to consume foods containing phenols and omega-3 fatty acids while reducing foods containing saturated fatty acids.[21,22,30–32,34,35] All studies found that participants who replaced refined plant foods with whole or unrefined plant foods reported reduced pain and improved joint function.[21,22,30–35]

Unlike previous cross-sectional studies, the degree to which participants replaced unrefined plant foods and animal foods with high-phenol/high-omega-3 fatty acid diets, whole plant foods were measured in these trials.[15,38] Quantifying the changes provided new information about how shifts in diet patterns can affect OA symptoms. The greatest dietary change was demonstrated by participants who either consumed a low-phenol/high-fat diet containing 20–50 g of carbohydrate[33] or an all-plant food[31] diet. The participants following other diets exhibited only moderate dietary change. Participants who were instructed by Hughes et al. and Fitzgibbons et al.[21,22] to follow high-phenol/high-omega-3 fatty acid diets had a 3%–5% change in HEI; this percentage change was attributed to adding fish, one or two cups of whole fruit, vegetable, or whole grain, or decreasing overall consumption of refined grains, added sugars or saturated fat. Participants instructed by Cooper et al.[30] to follow a high-phenol/high-omega-3 fatty acid diet increased their consumption of vegetables by 1.2 servings, fruits by 0.13 servings and decreased their overall consumption of both refined and whole grains.[30] Overall, groups reporting small increases

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

FIGURE 2 Risk of bias assessment (ROB2) for randomised clinical trials included in the analysis.

TABLE 4 Risk of bias (ROBINS-1) in nonrandomised clinical trial included in the analysis.

Author	D1	D2	D3	D4	D5	Overall
Cooper et al.	Not applicable	Low	Low	Low	Low	High

Notes: Domains: D1, bias arising from the randomisation process; D2, bias arising from selection of participants into the study; D3, bias arising from classifications of interventions; D4, bias arising from deviations from intended interventions; D5, bias arising from data reporting.

in their consumption of fish, fruit, vegetables and whole grains reported significant improvements in pain and physical function.

Because changes in nutrient composition accompany dietary change, quantifying the total nutrient composition of these adjusted diets may support earlier hypotheses that a synergistic effect exists between polyphenols, omega-3 fatty acids and micronutrients with antioxidative properties.[10,15] Only Sadeghi et al. and Dolatkhah et al. provided the micronutrient content of the diets.[32,34]

Sadeghi et al.[32] reported significant differences in nutrient consumption between the control, low-phenol/low-fat diet and the high-phenol/high-omega-3 fatty acid diets. Participants following both diets consumed less saturated fat ($p < 0.001$), more magnesium ($p < 0.09$) and less sodium ($p < 0.07$) than participants following the control diet.[32] Dotalkhana et al.[34] reported that participants who were instructed to follow the high-phenol/high-omega-3 fatty acid diet increased consumption of fibre ($p = 0.033$), manganese (<0.001), beta carotene ($p < 0.001$), vitamin E ($p < 0.011$), magnesium ($p < 0.001$), zinc ($p = 0.001$), vitamin A ($p = 0.038$) and vitamin C ($p = 0.016$). The shift towards more whole plant foods, previously displaced by refined grains and highly processed foods, resulted in added fibre, minerals, phenols and vitamins in the participants' diets. In earlier clinical trials,[8] adding fruit powders and juices alone resulted in fewer nutrients added to the diet than in the studies that adjusted the total diet.

The findings suggest that moderate shifts in nutrient consumption may alleviate patient pain and improve physical function. Regarding pain scores, most groups reported a one-to-two-point or 20% improvement in scores,[21,22,31–33,35] whereas Cooper et al. and Dolatkhah reported more robust improvements using the high-phenol/high-omega-3 fatty acid diet with plant oils.[30,34] However, further interpretation is necessary before the degree to which a patient may benefit from the intervention can be determined, especially for those with more severe OA symptoms.[39–41] Differences in clinical significance may exist among patients because of the severity or stage of their OA, the degree of pain or impairment that they are experiencing and the occupational activities they perceive are necessary for daily living.[42,43] These factors will determine if the improvements are of the magnitude that the patient perceives as beneficial.[42]

Clinical practice

These findings support dietary interventions beyond energy restriction for patients with OA who are willing and aware that the impact may be limited to mild improvements in pain and physical function. The studies in this review demonstrated the effectiveness of using interpersonal communication and written resources to direct dietary change, assist

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

patients with adapting to the patterns and sustain adherence. Low attrition and high adherence rates suggest that the changes were acceptable. Furthermore, these interventions may offer reinforcement to adopt similar dietary guidelines for associated morbidities such as cardiovascular disease.[44]

Diet education and nutrition counselling may also support patient efforts to exercise and lose weight. This is notable because exercise is recommended for everyone with OA,[3] and weight loss is strongly recommended for those who are overweight or obese.[3] Because pain and lack of physical function may deter movement, patient perceptions of improvement may support individuals as they attempt to exercise.

Weight loss of 10%–20% in those who are overweight has been associated with significant improvements in pain, walk tests and physical and knee joint compressive force.[39,40] Losing 20% of the body weight has been noted to result in a 25% reduction in pain and improved function.[39,40] The studies presented in this review found up to a 10% weight loss. Continuing the intervention for longer periods may have resulted in additional losses.

Limitations

The most significant limitations in these findings are the high risk of bias across the studies and the need to address the potentially confounding effects of weight loss and micronutrient intake from diet or supplements. The risk of bias across the studies is due to the inherent challenges of blinding participants to diet interventions and using patient-reported outcome measures. Another limitation is the potential for heterogeneous stages of OA and affected joints across the participants. All participants had medically diagnosed OA using ACR criteria and reported mild-to-moderate symptoms, but few had radiographical evidence of their OA stage. Although the findings from this systematic review support the high-phenol/omega-3 fatty acid diet approach for reducing pain and improving physical function, the evidence cannot be considered strong due to these limitations.

Future research

Additional studies that address these limitations can strengthen and clarify the findings. A crossover design comparing the low-calorie diet of unspecified nutrient content to a low-calorie diet containing specific nutrients would allow blinding and address the confounding variable of weight loss. Confounding could also be reduced by controlling dietary supplement use. Less risk of bias in measuring outcomes could be achieved by using observed tests of physical function. Clarity can be improved if authors include the servings consumed in each food category and the diet's total nutritional composition.

Continued research towards understanding the recommended dietary pattern is worthwhile. A therapeutic diet that contributes to multimodal care of adults with OA may support the reduced use of analgesics for pain management, preserve joint function, prevent disability, improve quality of life and delay or prevent joint replacement surgery.

CONCLUSIONS

Instructing adults with OA to replace refined grains and processed foods with whole plant foods may have a favourable effect on pain and physical function. Follow-up counselling may be necessary to achieve long-term adherence to these diets.

AUTHOR CONTRIBUTIONS

Conceptualisation: Diane R. Radler, Laura Byham-Gray and Karen Stanfar. *Methodology, analysis and original draft preparations*: Karen Stanfar. *Literature search*: Mina Ghajar. *Title and abstract review*: Corey Hawes and Karen Stanfar. *Risk of bias assessments*: Corey Hawes and Karen Stanfar. *Review and editing*: Corey Hawes, Diane R. Radler and Laura Byham-Gray.

ACKNOWLEDGEMENTS

This research did not receive specific grants or funding from public, commercial, or not-for-profit agencies.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

TRANSPARENCY DECLARATION

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported. The reporting conforms with PRISMA20 and SWIM25 guidelines.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in the supplementary material of this article.

ORCID

Karen Stanfar http://orcid.org/0009-0009-1517-6731
Mina Ghajar http://orcid.org/0000-0003-2925-2933

PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/jhn.13317.

REFERENCES

1. Hunter DJ, March L, Chew M. Osteoarthritis in 2020 and beyond: a Lancet Commission. Lancet. 2020;396(10264):1711–2.
2. Abd-Allah F, Abdulle AM, Abera SF, Abu-Raddad LJ, Adetokunboh O, Afshin A, et al. Global, regional, and national

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet (British edition). 2017;390(10100):1211–59.
3. Kolasinski SL, Neogi T, Hochberg MC, Oatis C, Guyatt G, Block J, et al. 2019 American College of Rheumatology/Arthritis Foundation Guideline for the Management of Osteoarthritis of the Hand, Hip, and Knee. Arthritis care & research (2010). 2020;72(2):149–62.
4. Huynh C, Puyraimond-Zemmour D, Maillefert JF, Conaghan PG, Davis AM, Gunther KP, et al. Factors associated with the orthopaedic surgeon's decision to recommend total joint replacement in hip and knee osteoarthritis: an international cross-sectional study of 1905 patients. Osteoarthritis Cartilage. 2018;26(10):1311–8.
5. Durazzo A, Lucarini M, Souto EB, Cicala C, Caiazzo E, Izzo AA, et al. Polyphenols: a concise overview on the chemistry, occurrence, and human health. Phytother Res. 2019;33(9): 2221–43.
6. Harasymowicz NS, Dicks A, Wu CL, Guilak F. Physiologic and pathologic effects of dietary free fatty acids on cells of the joint. Ann NY Acad Sci. 2019;1440(1):36–53.
7. Kaushik AS, Strath LJ, Sorge RE. Dietary interventions for treatment of chronic pain: oxidative stress and inflammation. Pain Ther. 2020;9(2):487–98.
8. Guan VX, Mobasheri A, Probst YC. A systematic review of osteoarthritis prevention and management with dietary phytochemicals from foods. Maturitas. 2019;122:35–43.
9. Neveu V, Perez-Jimenez J, Vos F, Crespy V, du Chaffaut L, Mennen L, et al. Phenol-explorer: an online comprehensive database on polyphenol contents in foods. Database. 2010;2010: bap024.
10. Valsamidou E, Gioxari A, Amerikanou C, Zoumpoulakis P, Skarpas G, Kaliora AC. Dietary interventions with polyphenols in osteoarthritis: a systematic review directed from the preclinical data to randomized clinical studies. Nutrients. 2021;13(5):1420.
11. Schell J, Scofield R, Barrett J, Kurien B, Betts N, Lyons T, et al. Strawberries improve pain and inflammation in obese adults with radiographic evidence of knee osteoarthritis. Nutrients. 2017; 9(9):949.
12. Ghoochani N, Karandish M, Mowla K, Haghighizadeh MH, Jalali MT. The effect of pomegranate juice on clinical signs, matrix metalloproteinases and antioxidant status in patients with knee osteoarthritis. J Sci Food Agric. 2016;96(13):4377–81.
13. Zeng J, Franklin DK, Das A, Hirani V. The effects of dietary patterns and food groups on symptomatic osteoarthritis: systematic review. Nutr Diet. 2023;80(1):21–43.
14. Xu C, Wang S, Ti W, Yang J, Yasen Y, Memetsidiq M, et al. Role of dietary patterns and factors in determining the risk of knee osteoarthritis: a meta-analysis. Mod Rheumatol. 2022;32(4):815–21.
15. Morales-Ivorra I, Romera-Baures M, Roman-Viñas B, Serra-Majem L. Osteoarthritis and the mediterranean diet: a systematic review. Nutrients. 2018;10(8):1030.
16. Miao H, Chen L, Hao L, Zhang X, Chen Y, Ruan Z, et al. Stearic acid induces proinflammatory cytokine production partly through activation of lactate-HIF1α pathway in chondrocytes. Sci Rep. 2015;5:13092.
17. Eaton CB, Driban JB, Yang S, Lu B. Dietary fat intake and knee osteoarthritis progression: data from the osteoarthritis initiative. Osteoarthritis Cartilage. 2014;22:S207.
18. Lu B, Driban JB, Xu C, Lapane KL, McAlindon TE, Eaton CB. Dietary fat intake and radiographic progression of knee osteoarthritis: data from the osteoarthritis initiative. Arthritis Care Res. 2017;69(3):368–75.
19. Higgins JPT. Cochrane Handbook for Systematic Reviews of Interventions. Version 6 ed. Hoboken, NJ: Wiley-Blackwell; 2019.
20. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Int J Surg. 2021;88:105906.
21. Fitzgibbon ML, Tussing-Humphreys L, Schiffer L, Smith-Ray R, Marquez DX, DeMott AD, et al. Fit and strong! plus: twelve and eighteen month follow-up results for a comparative effectiveness trial among overweight/obese older adults with osteoarthritis. Prev Med. 2020;141:106267.
22. Hughes SL, Tussing-Humphreys L, Schiffer L, Smith-Ray R, Marquez DX, DeMott AD, et al. Fit amp; strong! plus trial outcomes for obese older adults with osteoarthritis. Gerontologist. 2020;60(3):558–70.
23. Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ (Online). 2019; August 29:366l4898–36.
24. Sterne JAC, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ (Online). 2016; October 12:355i4919–35.
25. Campbell M, McKenzie JE, Sowden A, Katikireddi SV, Brennan SE, Ellis S, et al. Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline. BMJ (Online). 2020;368:368l6890–36.
26. Meenan RF, Mason JH, Anderson JJ, Guccione AA, Kazis LE. AIMS2. The content and properties of a revised and expanded arthritis impact measurement scales health status questionnaire. Arthritis Rheum. 1992;35(1):1–10.
27. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. J Rheumatol. 1988;15(12): 1833–40.
28. Roos EM, Lohmander LS. The Knee injury and Osteoarthritis Outcome Score (KOOS): from joint injury to osteoarthritis. Health Qual Life Outcomes. 2003;1:64.
29. Delgado DA, Lambert BS, Boutris N, McCulloch PC, Robbins AB, Moreno MR, et al. Validation of digital visual analog scale pain scoring with a traditional paper-based visual analog scale in adults. JAAOS: Global Res Rev. 2018;2(3):e088.
30. Cooper I, Brukner P, Devlin BL, Reddy AJ, Fulton M, Kemp JL, et al. An anti-inflammatory diet intervention for knee osteoarthritis: a feasibility study. BMC Musculoskelet Disord. 2022;23(1):47.
31. Clinton CM, O'Brien S, Law J, Renier CM, Wendt MR. Whole-foods, plant-based diet alleviates the symptoms of osteoarthritis. Arthritis. 2015;2015:1–9.
32. Sadeghi A, Zarrinjooiee G, Mousavi SN, Abdollahi Sabet S, Jalili N. Effects of a mediterranean diet compared with the low-fat diet on patients with knee osteoarthritis: a randomized feeding trial. Int J Clin Pract. 2022;2022:1–7.
33. Strath LJ, Jones CD, Philip George A, Lukens SL, Morrison SA, Soleymani T, et al. The effect of low-carbohydrate and low-fat diets on pain in individuals with knee osteoarthritis. Pain Med. 2020;21(1):150–60.
34. Dolatkhah N, Toopchizadeh V, Barmaki S, Salekzamani Y, Najjari A, Farshbaf-Khalili A, et al. The effect of an anti-inflammatory in comparison with a low caloric diet on physical and mental health in overweight and obese women with knee osteoarthritis: a randomized clinical trial. Eur J Nutr. 2023;62(2):659–72.
35. Dyer J, Davison G, Marcora SM, Mauger AR. Effect of a Mediterranean type diet on inflammatory and cartilage degradation biomarkers in patients with osteoarthritis. J Nutr Health Aging. 2016;21(5):562–6.
36. Center for Nutrition Policy and Promotion. Healthy Eating Index 2015 [updated April 27, 2022]. Available from: https://www.fns.usda.gov/healthy-eating-index-hei.
37. Lins L, Carvalho FM. SF-36 total score as a single measure of health-related quality of life: scoping review. SAGE Open Med. 2016;4:205031211667172.

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

38. Veronese N, Stubbs B, Noale M, Solmi M, Luchini C, Maggi S. Adherence to the Mediterranean diet is associated with better quality of life: data from the Osteoarthritis Initiative. Am J Clin Nutr. 2016;104(5):1403–9.
39. Messier SP, Resnik AE, Beavers DP, Mihalko SL, Miller GD, Nicklas BJ, et al. Intentional weight loss in overweight and obese patients with knee osteoarthritis: is more better? Arthritis Care Res. 2018;70(11):1569–75.
40. Messier SP, Beavers DP, Queen K, Mihalko SL, Miller GD, Losina E, et al. Effect of diet and exercise on knee pain in patients with osteoarthritis and overweight or obesity: a randomized clinical trial. JAMA. 2022;328(22):2242–51.
41. Dougados M, Leclaire P, van der Heijde D, Bloch DA, Bellamy N, Altman RD. A report of the Osteoarthritis Research Society International Standing Committee for Clinical Trials Response Criteria Initiative. Osteoarthritis Cartilage. 2000;8(6):395–403.
42. Fitzgerald GK, Hinman RS, Zeni J, Risberg MA, Snyder-Mackler L, Bennell KL. OARSI Clinical Trials Recommendations: design and conduct of clinical trials of rehabilitation interventions for osteoarthritis. Osteoarthritis Cartilage. 2015;23(5):803–14.
43. Katz NP, Paillard FC, Ekman E. Determining the clinical importance of treatment benefits for interventions for painful orthopedic conditions. J Orthop Surg Res. 2015;10(1):24.
44. Van Horn L, Carson JAS, Appel LJ, Burke LE, Economos C, Karmally W, et al. Recommended dietary pattern to achieve adherence to the American Heart Association/American College of Cardiology (AHA/ACC) guidelines: a scientific statement from the American Heart Association. Circulation. 2016;134(22):e505–29.

How to cite this article: Stanfar K, Hawes C, Ghajar M, Byham-Gray L, Radler DR. Diet modification reduces pain and improves function in adults with osteoarthritis: a systematic review. J Hum Nutr Diet. 2024;37:847–84. https://doi.org/10.1111/jhn.13317

APPENDIX A
SEARCH STRATEGY WITH KEYWORDS AND MeSH TERMS

CINAHL

Osteoarthritis OR "Spine Osteoarthritis" OR "Knee Osteoarthritis" OR "Hip Osteoarthritis" OR "Degenerative arthritis" OR "Degenerative arthritides" OR "Joint diseases" OR "Degenerative joint disease" OR Arthritis OR "Knee Joint" OR "Knee pain" OR "Patellofemoral Pain Syndrome" OR "Hip pain" OR "Neck pain" OR "Wrist pain" OR "Hand pain" OR "Musculoskeletal pain" OR "Chronic pain" OR "Shoulder pain" OR "Neck pain" OR "Low back pain" OR "Back pain"

AND

Beverages OR "Green tea" OR Tea OR "Fermented foods" OR "Cultured food" OR "Soy food" OR Isoflavonoid OR Food OR Diet OR "Western diet" OR "Paleolithic diet" OR "Paleo diet" OR High-fat diet OR "Ketogenic diet" OR "Keto diet" OR Gluten-free diet OR Carbohydrate-restricted diet OR Low-Carbohydrate diet OR Low-Carb diet OR "Mediterranean diet" OR Protein-restricted diet OR Fat-restricted diet OR "Vegetarian diet" OR "High-Protein Low-Carbohydrate diet" OR "High-Protein Low-Carb diet" OR "High-Protein diet" OR "Vegan diet" OR Plant-based OR Vegetarianism OR "DASH diet" OR "Dietary Approaches To Stop Hypertension" OR "Anti-inflammatory diet" OR "Low-inflammatory diet" OR "Low-caloric diet" OR "Low-calorie diet" OR Phenols OR Phenolic OR Polyphenols OR Phytochemicals OR Dietary-Phytochemicals OR "Omega-3 fatty acids" OR Carotenoids OR Added-sugar OR High-sugar OR "Dietary fat" OR "Saturated fat" OR "High-saturated fat" OR Nutrition OR "Nutritional status" OR "Nutrition therapy" OR "Diet therapy" OR "Dietary restriction" OR "Dietary modification" OR "Diet modification" OR "Nutritional intervention" OR "Dietary interventions" OR "Nutritive Value" OR "Nutrition value" OR "Nutritional value" OR "Feeding behavior" OR "Feeding behaviour" OR "Food habit" OR "Eating habit" OR "Eating behavior" OR "Eating behaviour" OR "Dietary habit" OR "Dietary behavior" OR "Dietary behaviour" OR "Eating pattern" OR "Dietary pattern" OR "Diet pattern" OR "Healthy diet" OR "Healthy eating" OR "Healthy nutrition"

AND

"Ambulation difficulty" OR "Mobility limitation" OR "Ambulatory difficulty" OR "Walking difficulty" OR "Activities of daily living" OR "Daily living activity" OR "Daily living activities" OR "Daily activity" OR "Daily Activities" OR "Physical function" OR "Pain management" OR "Managing pain" OR "Pain Perception" OR "Pain Threshold" OR "Pain Measurement" OR "Measuring pain" OR " Pain assessment" OR" Pain scale" OR " Pain intensity" OR " Pain severity" OR " Pain severities" OR " Pain relief" OR "Pain control" OR " Pain reduction" OR Analgesia OR " Quality of life" OR " Life quality" OR " Life Style" OR Lifestyle OR "Range of motion" OR "Joint flexibility" OR "Treatment Outcome"

Clinical Trials

12/5/22

Advanced Search Feature

Osteoarthritis

AND

Nutrition OR food OR diet OR dietary

Cochrane Library

Title-Abstract-Keyword

Osteoarthritis OR "Spine Osteoarthritis" OR "Knee Osteoarthritis" OR "Hip Osteoarthritis" OR "Degenerative arthritis" OR "Degenerative arthritides" OR "Joint diseases" OR "Degenerative joint disease" OR Arthritis OR "Knee Joint" OR "Knee pain" OR "Patellofemoral Pain Syndrome" OR "Hip pain" OR "Neck pain" OR "Wrist pain" OR "Hand pain" OR "Musculoskeletal pain" OR "Chronic pain" OR "Shoulder pain" OR "Neck pain" OR "Low back pain" OR "Back pain"

AND

1363277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Title-Abstract-Keyword

Beverages OR "Green tea" OR Tea OR "Fermented foods" OR "Cultured food" OR "Soy food" OR Isoflavonoid OR Food OR Diet OR "Western diet" OR "Paleolithic diet" OR "Paleo diet" OR High-fat diet OR "Ketogenic diet" OR "Keto diet" OR Gluten-free diet OR Carbohydrate-restricted diet OR Low-Carbohydrate diet OR Low-Carb diet OR "Mediterranean diet" OR Protein-restricted diet OR Fat-restricted diet OR "Vegetarian diet" OR "High-Protein Low-Carbohydrate diet" OR "High-Protein Low-Carb diet" OR "High-Protein diet" OR "Vegan diet" OR Plant-based OR Vegetarianism OR "DASH diet" OR "Dietary Approaches To Stop Hypertension" OR "Anti-inflammatory diet" OR "Low-inflammatory diet" OR "Low-caloric diet" OR "Low-calorie diet" OR Phenols OR Phenolic OR Polyphenols OR Phytochemicals OR Dietary-Phytochemicals OR "Omega-3 fatty acids" OR Carotenoids OR Added-sugar OR High-sugar OR "Dietary fat" OR "Saturated fat" OR "High-saturated fat" OR Nutrition OR "Nutritional status" OR "Nutrition therapy" OR "Diet therapy" OR "Dietary restriction" OR "Dietary modification" OR "Diet modification" OR "Nutritional intervention" OR "Dietary interventions" OR "Nutritive Value" OR "Nutrition value" OR "Nutritional value" OR "Feeding behavior" OR "Feeding behaviour" OR "Food habit" OR "Eating habit" OR "Eating behavior" OR "Eating behaviour" OR "Dietary habit" OR "Dietary behavior" OR "Dietary behaviour" OR "Eating pattern" OR "Dietary pattern" OR "Diet pattern" OR "Healthy diet" OR "Healthy eating" OR "Healthy nutrition"

AND

Title-Abstract-Keyword

"Ambulation difficulty" OR "Mobility limitation" OR "Ambulatory difficulty" OR "Walking difficulty" OR "Activities of daily living" OR "Daily living activity" OR "Daily living activities" OR "Daily activity" OR "Daily Activities" OR "Physical function" OR "Pain management" OR "Managing pain" OR "Pain Perception" OR "Pain Threshold" OR "Pain Measurement" OR "Measuring pain" OR " Pain assessment" OR "Pain scale" OR "Pain intensity" OR "Pain severity" OR "Pain severities" OR "Pain relief" OR "Pain control" OR "Pain reduction" OR Analgesia OR "Quality of life" OR "Life quality" OR "Life Style" OR Lifestyle OR "Range of motion" OR "Joint flexibility" OR "Treatment Outcome"

Dissertation @ Theses Global

Anywhere Except Full Text – NOFT

Osteoarthritis OR "Spine Osteoarthritis" OR "Knee Osteoarthritis" OR "Hip Osteoarthritis" OR "Degenerative arthritis" OR "Degenerative arthritides" OR "Joint diseases" OR "Degenerative joint disease" OR Arthritis OR "Knee Joint" OR "Knee pain" OR "Patellofemoral Pain Syndrome" OR "Hip pain" OR "Neck pain" OR "Wrist pain" OR "Hand pain" OR "Musculoskeletal pain" OR "Chronic pain" OR "Shoulder pain" OR "Low back pain" OR "Back pain"

AND

Anywhere Except Full Text – NOFT

Beverages OR "Green tea" OR Tea OR "Fermented foods" OR "Cultured food" OR "Soy food" OR Isoflavonoid OR Food OR Diet OR "Western diet" OR "Paleolithic diet" OR "Paleo diet" OR High-fat diet OR "Ketogenic diet" OR "Keto diet" OR Gluten-free diet OR Carbohydrate-restricted diet OR Low-Carbohydrate diet OR Low-Carb diet OR "Mediterranean diet" OR Protein-restricted diet OR Fat-restricted diet OR "Vegetarian diet" OR "High-Protein Low-Carbohydrate diet" OR "High-Protein Low-Carb diet" OR "High-Protein diet" OR "Vegan diet" OR Plant-based OR Vegetarianism OR "DASH diet" OR "Dietary Approaches To Stop Hypertension" OR "Anti-inflammatory diet" OR "Low-inflammatory diet" OR "Low-caloric diet" OR "Low-calorie diet" OR Phenols OR Phenolic OR Polyphenols OR Phytochemicals OR Dietary-Phytochemicals OR "Omega-3 fatty acids" OR Carotenoids OR Added-sugar OR High-sugar OR "Dietary fat" OR "Saturated fat" OR "High-saturated fat" OR Nutrition OR "Nutritional status" OR "Nutrition therapy" OR "Diet therapy" OR "Dietary restriction" OR "Dietary modification" OR "Diet modification" OR "Nutritional intervention" OR "Dietary interventions" OR "Nutritive Value" OR "Nutrition value" OR "Nutritional value" OR "Feeding behavior" OR "Feeding behaviour" OR "Food habit" OR "Eating habit" OR "Eating behavior" OR "Eating behaviour" OR "Dietary habit" OR "Dietary behavior" OR "Dietary behaviour" OR "Eating pattern" OR "Dietary pattern" OR "Diet pattern" OR "Healthy diet" OR "Healthy eating" OR "Healthy nutrition"

AND

Anywhere Except Full Text – NOFT

"Ambulation difficulty" OR "Mobility limitation" OR "Ambulatory difficulty" OR "Walking difficulty" OR "Activities of daily living" OR "Daily living activity" OR "Daily living activities" OR "Daily activity" OR "Daily Activities" OR "Physical function" OR "Pain management" OR "Managing pain" OR "Pain Perception" OR "Pain Threshold" OR "Pain Measurement" OR "Measuring pain" OR "Pain assessment" OR "Pain scale" OR "Pain intensity" OR "Pain severity" OR "Pain severities" OR "Pain relief" OR "Pain control" OR "Pain reduction" OR Analgesia OR "Quality of life" OR "Life quality" OR "Life Style" OR Lifestyle OR "Range of motion" OR "Joint flexibility" OR "Treatment Outcome"

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Embase

Embase Session Results No. Query Results
12/7/2022
759 #150 #25 AND #114 AND #146 AND [humans]/lim AND [english]/lim AND [2015–2023]/py AND ([adult]/lim OR [middle aged]/lim OR [aged]/lim OR [very elderly]/lim)
1206 #149 #25 AND #114 AND #146 AND [humans]/lim AND [english]/lim AND [2015–2023]/py
2304 #148 #25 AND #114 AND #146 AND [humans]/lim AND [english]/lim
2541 #147 #25 AND #114 AND #146
2063329 #146 #115 OR #116 OR #117 OR #118 OR #119 OR #120 OR #121 OR #122 OR #123 OR #124 OR #125 OR #126 OR #127 OR #128 OR #129 OR #130 OR #131 OR #132 OR #133 OR #134 OR #135 OR #136 OR #137 OR #138 OR #139 OR #140 OR #141 OR #142 OR #143 OR #144 OR #145
939207 #145 'treatment outcome'/de
300 #144 'joint flexibility'
19601 #143 'joint mobility'/de
57472 #142 'range of motion'/de
20378 #141 'life style'
130235 #140 'lifestyle'/de
20803 #139 'life quality'
582498 #138 'quality of life'/de
9893 #137 'pain reduction'
26332 #136 'pain control'
56594 #135 'pain relief'
13757 #134 'pain severity'/de
26340 #133 'pain intensity'/de
12251 #132 'pain scale'
95378 #131 'pain assessment'/de
773 #130 'measuring pain'
10618 #129 'pain measurement'/de
20236 #128 'pain threshold'/de
9828 #127 'pain perception'
1773 #126 'managing pain'
66437 #125 'pain management'
148150 #124 'analgesia'/de
139 #123 'physical function'/de

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

#122 'daily activit*'	32527
#121 'daily living activit*'	2707
#120 'activiti* of daily living'	47636
#119 'daily life activity'/de	108591
#118 'ambulatory difficult*'	62
#117 'mobility limitation'	941
#116 'ambulation difficult*'	60
#115 'walking difficulty'/de	15370
#114 #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61 OR #62 OR #63 OR #64 OR #65 OR #66 OR #67 OR #68 OR #69 OR #70 OR #71 OR #72 OR #73 OR #74 OR #75 OR #76 OR #77 OR #78 OR #79 OR #80 OR #81 OR #82 OR #83 OR #84 OR #85 OR #86 OR #87 OR #88 OR #89 OR #90 OR #91 OR #92 OR #93 OR #94 OR #95 OR #96 OR #97 OR #98 OR #99 OR #100 OR #101 OR #102 OR #103 OR #104 OR #105 OR #106 OR #107 OR #108 OR #109 OR #110 OR #111 OR #112 OR #113	1121876
#113 'healthy nutrition'	1435
#112 'healthy eating'/de	30
#111 'healthy diet'/de	6055
#110 'diet* pattern'	11482

(Continues)

#109 'dietary pattern'/de	5912
#108 'eating pattern'	1186
#107 'diet* behaviour'	1118
#106 'diet* behavior'	2048
#105 'diet* habit'	1112
#104 'dietary habit'/de	39
#103 'eating behaviour'	3717
#102 'eating behavior'	8837
#101 'eating habit'/de	14345
#100 'food habit'	352
#99 'feeding behaviour'	3096
#98 'feeding behavior'/de	96739
#97 'nutrition* value'	27778
#96 'nutritive value'	3233
#95 'nutritional value'/de	23940
#94 'diet* intervention'	11228

(Continues)

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

#93 'nutrition* intervention'	8064
#92 'diet* modification'	3926
#91 'dietary modification'/de	16
#90 'diet* restriction'	100892
#89 'diet restriction'/de	98364
#88 'nutrition therapy'	3898
#87 'diet therapy'/de	66398
#86 'nutrition* status'	95543
#85 'nutritional status'/de	79290
#84 'nutrition'/de	124390
#83 'high saturated fat'	772
#82 'saturated fat'	9862
#81 'saturated fatty acid'/de	19733
#80 'dietary fat'	12440
#79 'fat intake'/de	53145
#78 'high sugar'	3616
#77 'high-sucrose diet'/de	674
#76 'added sugar'	1747
#75 'carotenoid'/de	27251
#74 'omega 3 fatty acid'/de	37007
#73 'dietary phytochemical'	207
#72 'phytochemical'/de	13945
#71 'polyphenol'/de	26458
#70 'phenolic'	69972
#69 'phenol'/de	31749
#68 'low calori* diet'	11354
#67 'low calorie diet'/de	10261
#66 'low-inflammatory diet'	9
#65 'anti-inflammatory diet'	324
#64 'antiinflammatory diet'	40
#63 'antiinflammatory diet'/de	22
#62 'dietary approaches to stop hypertension'	1335

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

#61 'dash diet'/de	1152
#60 'vegetarianism'	748
#59 'vegetarian diet'/de	5013
#58 'plant-based diet'	1070
#57 'vegan diet'/de	975
#56 'high-protein diet'	2813
#55 'protein diet'/de	7225
#54 'high-protein low-carb* diet'	201
#53 'high-protein low-carbohydrate diet'/de	83
#52 'vegetarian diet'/de	5013
#51 'fat-restricted diet'	121
#50 'low fat diet'/de	11638
#49 'protein-restricted diet'	645
#48 'protein restriction'/de	8820
#47 'mediterranean diet'/de	11131
#46 'low-carb diet'	118
#45 'carbohydrate-restricted diet'	177
#44 'low carbohydrate diet'/de	4097
#43 'gluten free diet'/de	10521
#42 'keto diet'	41
#41 'ketogenic diet'/de	7371
#40 'high-fat diet'	52995
#39 'lipid diet'/de	60730
#38 'paleo diet'	59
#37 'paleolithic diet'/de	331
#36 'western diet'/de	4984
#35 'diet'/de	260067
#34 'food'/de	80966
#33 'isoflavonoid'/de	1643
#32 'soy food'/de	1060
#31 'cultured food'	9
#30 'fermented food'	1442

(Continues)

(Continues)

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

#29 'fermented product'/de	3456
#28 'tea'/de	23087
#27 'green tea'	13100
#26 'beverage'/de	21082
#25 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24	572653
#24 'backache'/de	65915
#23 'back pain'	108365
#22 'low back pain'/de	68685
#21 'shoulder pain'/de	20029
#20 'chronic pain'/de	73162
#19 'musculoskeletal pain'/de	14129
#18 'hand pain'/de	2962
#17 'wrist pain'/de	2425
#16 'neck pain'/de	29331
#15 'hip pain'/de	10044
#14 'patellofemoral pain syndrome'/de	1737
#13 'knee pain'/de	20983
#12 'knee joint'	33189
#11 'arthritis'/de	82151
#10 'degenerative joint disease'	3933
#9 'joint diseases'	14881
#8 'arthropathy'/de	31087
#7 'degenerative arthritides'	15
#6 'degenerative arthritis'	1807
#5 'hip osteoarthritis'/de	14088
#4 'knee osteoarthritis'/de	42615
#3 'spondylosis'/de	6010
#2 'spine osteoarthritis'	134
#1 'osteoarthritis'	180559

Medline

Ovid MEDLINE(R) ALL < 1946 to November 22, 2022>		
1	Osteoarthritis/	42329

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

2	Osteoarthritis.mp.	106540
3	Osteoarthritis, Spine/	205
4	(Spine adj2 Osteoarthritis).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	271
5	Osteoarthritis, Knee/	25866
6	(Knee adj2 Osteoarthritis).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	30561
7	Osteoarthritis, Hip/	9588
8	(Hip adj2 Osteoarthritis).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	10907
9	(Degenerative adj2 arthritis).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1547
10	(Degenerative adj2 arthritides).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	10
11	Joint Diseases/	25372
12	(Joint adj2 diseases).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	28411
13	(Degenerative adj2 joint adj2 disease).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	3017
14	Arthritis/	36868
15	Knee Joint/	63197
16	(Knee adj2 Joint).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	75784
17	(Knee adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	11051
18	Patellofemoral Pain Syndrome/	1117
19	(Patellofemoral adj2 Pain adj2 Syndrome).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word,	1517

(Continues)

(Continues)

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

	protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	
20	(Hip adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	5390
21	Neck Pain/	8237
22	(Neck adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	16063
23	(Wrist adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2062
24	(Hand adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1292
25	Musculoskeletal Pain/	4359
26	(Musculoskeletal adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	10638
27	Chronic Pain/	21076
28	(Chronic adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	72867
29	Shoulder Pain/	5710
30	(Shoulder adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	11750
31	Low Back Pain/	25802
32	(Low adj2 back adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	40913
33	Back Pain/	18726
34	(Back adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	72100
35	Beverages/	16652
36	Tea/	12331
37	(Green adj1 tea).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	10112

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

38	Fermented Foods/	1055
39	(Fermented adj2 foods).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2808
40	(Cultured adj2 food).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	49
41	Soy Foods/	1936
42	(Soy adj2 food).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	416
43	Isoflavones/or Isoflavonoid.mp.	11273
44	Food/	37117
45	Diet/	181282
46	Diet, Western/	1379
47	(Western adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	4443
48	Diet, Paleolithic/	147
49	(Paleolithic adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	224
50	(Paleo adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	33
51	Diet, High-Fat/	21456
52	(High adj1 fat adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	41424
53	Diet, Ketogenic/	2151
54	(Ketogenic adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	4149
55	(Keto adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	27
56	Diet, Gluten-Free/	2908
57	(Gluten adj1 free adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary	6430

(Continues)

(Continues)

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

	concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	
58	Diet, Carbohydrate-Restricted/	2033
59	(Carbohydrate adj1 restricted adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2114
60	(Low adj1 Carbohydrate adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1463
61	(Low adj1 Carb adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	62
62	Diet, Mediterranean/	4897
63	(Mediterranean adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	7870
64	Diet, Protein-Restricted/	3224
65	(Protein adj1 restricted adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	3531
66	Diet, Fat-Restricted/	3979
67	(Fat adj1 restricted adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	4045
68	Diet, Vegetarian/	3661
69	(Vegetarian adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	4276
70	Diet, High-Protein Low-Carbohydrate/	89
71	(High adj1 Protein adj1 Low adj1 Carbohydrate adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	233
72	(High adj1 Protein adj1 Low adj1 Carb adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2
73	Diet, High-Protein/	355
74	(High adj1 Protein adj1 diet).mp. [mp=title, book title, abstract,	2457

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

	original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	
75	Diet, Vegan/	387
76	(Vegan adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	778
77	(Plant adj1 based).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	8560
78	Vegetarianism.mp.	578
79	Dietary Approaches To Stop Hypertension/	366
80	(DASH adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	742
81	(anti adj1 inflammatory adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	254
82	(Low adj1 inflammatory adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	7
83	(Low adj1 caloric adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	140
84	Caloric Restriction/	7065
85	(Low adj1 calorie adj1 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1697
86	Phenols/	56308
87	Phenolic.mp.	57587
88	Polyphenols/	14805
89	Phytochemicals/	9706
90	(Dietary adj2 Phytochemicals).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	575
91	Fatty Acids, Omega-3/	15618
92	(Omega-3 adj1 fatty adj1 acids).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary	8467

(Continues)

(Continues)

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

	concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	
93	Carotenoids/	20941
94	(Added adj2 sugar).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1564
95	(High adj2 sugar).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	3992
96	Dietary Fats/	49375
97	(Dietary adj1 fat).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	10429
98	(Saturated adj1 fat).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	8541
99	(High adj1 saturated adj1 fat).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	541
100	Nutrition.mp.	268748
101	Nutritional Status/	52421
102	(Nutritional adj2 status).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	74932
103	Nutrition Therapy/	3116
104	(Nutrition adj2 therapy).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	5863
105	Diet Therapy/	10914
106	(Diet adj2 therapy).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	67219
107	(Dietary adj2 restrict*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	9400
108	(Dietary adj2 modification).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2403

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

109	(Diet adj2 modif*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	6691
110	(Nutrition* adj2 intervention).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	6161
111	(Diet* adj2 interventions).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	5230
112	Nutritive Value/	15733
113	(Nutritive adj1 Value).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	17200
114	(Nutrition* adj2 value).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	8065
115	Feeding Behavior/	91435
116	(Feeding adj1 behavior).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	95830
117	(Feeding adj1 behaviour).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2707
118	(food adj2 habit).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	272
119	(Eating adj2 habit).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	470
120	(Eating adj2 behavior).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	6862
121	(Eating adj2 behaviour).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol	2581

(Continues)

(Continues)

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

	supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	
122	(Diet* adj2 habit).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	778
123	(Diet* adj2 behaviour).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1195
124	(Eating adj2 pattern).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	988
125	(Diet* adj2 pattern).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	6381
126	Diet, Healthy/	6562
127	(Healthy adj2 diet).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	12460
128	(Healthy adj2 eating).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	10102
129	(Healthy adj2 nutrition).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1237
130	Mobility Limitation/	5219
131	(Ambulation adj2 difficult*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	164
132	(Ambulatory adj2 difficult*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	61
133	(Walking adj2 difficult*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2451
134	Activities of Daily Living/	71579

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

135	(Daily adj2 living adj2 activit*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	88579
136	(Daily adj2 activit*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	112603
137	(Physical* adj2 function*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	41915
138	Pain Management/	39976
139	(Pain adj1 management).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	62842
140	(Managing adj2 pain).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2769
141	Pain Perception/	3129
142	(Pain adj2 Perception).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	10779
143	Pain Threshold/	14073
144	(Pain adj2 Threshold).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	18415
145	Pain Measurement/	94013
146	(Pain adj2 Measur*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	102598
147	(Pain adj2 assess*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	21995
148	(Pain adj2 scale).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	18981
149	(Pain adj2 intensity).mp. [mp=title, book title, abstract, original	27217

(Continues)

(Continues)

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

	title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	
150	(Pain adj2 severit*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	9577
151	(Pain adj2 relief).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	40626
152	(Pain adj2 control*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	23990
153	(Pain adj2 reduc*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	36101
154	Analgesia/	21633
155	Quality of Life/	254525
156	(Life adj2 quality).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	432574
157	Life Style/	62741
158	Lifestyle.mp.	118804
159	Range of Motion, Articular/	58554
160	(Range adj2 motion).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	81584
161	(Joint adj2 flexibility).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	284
162	Treatment Outcome/	1126913
163	(Treatment adj2 Outcome).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1157583
164	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34	383691
165	35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83 or 84 or	899336

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

	85 or 86 or 87 or 88 or 89 or 90 or 91 or 92 or 93 or 94 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103 or 104 or 105 or 106 or 107 or 108 or 109 or 110 or 111 or 112 or 113 or 114 or 115 or 116 or 117 or 118 or 119 or 120 or 121 or 122 or 123 or 124 or 125 or 126 or 127 or 128 or 129	
166	130 or 131 or 132 or 133 or 134 or 135 or 136 or 137 or 138 or 139 or 140 or 141 or 142 or 143 or 144 or 145 or 146 or 147 or 148 or 149 or 150 or 151 or 152 or 153 or 154 or 155 or 156 or 157 or 158 or 159 or 160 or 161 or 162 or 163	1998233
167	164 and 165 and 166	1261
168	limit 167 to (english language and humans and "all adult (19 plus years)" and last 8 years)	390

PubMed

(Osteoarthritis OR "Osteoarthritis"[Mesh] OR "Osteoarthritis, Spine"[Mesh] OR "Spine Osteoarthritis" OR "Osteoarthritis, Knee"[Mesh] OR "Knee Osteoarthritis" OR "Osteoarthritis, Hip"[Mesh] OR "Hip Osteoarthritis" OR "Degenerative arthritis" OR "Degenerative arthritides" OR "Joint Diseases"[Mesh] OR "Joint diseases" OR "Degenerative joint disease" OR Arthritis OR "Arthritis"[Mesh] OR "Knee Joint" OR "Knee Joint"[Mesh] OR "Knee pain" OR "Patellofemoral Pain Syndrome"[Mesh] OR "Hip pain" OR "Neck pain" OR "Neck Pain"[Mesh] OR "Wrist pain" OR "Hand pain" OR "Musculoskeletal Pain"[Mesh] OR "Musculoskeletal pain" OR "Chronic Pain"[Mesh] OR "Chronic pain" OR "Shoulder Pain"[Mesh] OR "Shoulder pain" OR "Neck Pain"[Mesh] OR "Neck pain" OR "Low Back Pain"[Mesh] OR "Low back pain" OR "Back Pain"[Mesh] OR "Back pain") AND (Beverages OR "Green tea" OR "Tea"[Mesh] OR Tea OR "Beverages"[Mesh] OR "Fermented foods" OR "Fermented Foods"[Mesh] OR "Cultured food" OR "Soy food" OR "Soy Foods"[Mesh] OR Isoflavonoid OR Food OR "Food"[Mesh] OR Diet OR "Diet"[Mesh] OR "Diet, Western"[Mesh] OR "Western diet" OR "Diet, Paleolithic"[Mesh] OR "Paleolithic diet" OR "Paleo diet" OR "Diet, High-Fat"[Mesh] OR High-fat diet OR "Diet, Ketogenic"[Mesh] OR "Ketogenic diet" OR "Keto diet" OR "Diet, Gluten-Free"[Mesh] OR Gluten-free diet OR "Diet, Carbohydrate-Restricted"[Mesh] OR Carbohydrate-restricted diet OR Low-Carbohydrate diet OR Low-Carb diet OR "Diet, Mediterranean"[Mesh] OR "Mediterranean diet" OR "Diet, Protein-Restricted"[Mesh] OR Protein-restricted diet OR "Diet, Fat-Restricted"[Mesh] OR Fat-restricted diet OR "Diet, Vegetarian"[Mesh] OR "Vegetarian diet" OR "Diet, High-Protein Low-Carbohydrate"[Mesh] OR High-Protein Low-Carbohydrate diet OR High-Protein Low-Carb diet OR "Diet, High-Protein"[Mesh] OR High-Protein diet OR "Diet, Vegan"[Mesh] OR "Vegan diet" OR Plant-based OR Vegetarianism OR "DASH diet" OR "Dietary Approaches To Stop Hypertension"[Mesh] OR Anti-inflammatory diet OR Low-inflammatory diet OR Low-caloric diet OR Low-calorie diet OR Phenols OR "Phenols"[Mesh] OR Phenolic OR Polyphenols OR "Polyphenols"[Mesh] OR Phytochemicals OR "Phytochemicals"[Mesh] OR Dietary-Phytochemicals OR Omega-3 fatty acids OR "Fatty Acids, Omega-3"[Mesh] OR Carotenoids OR "Carotenoids"[Mesh] OR Added-sugar OR High-sugar OR "Dietary fat" OR "Dietary Fats"[Mesh] OR "Saturated fat" OR High-saturated fat OR Nutrition OR "Diet, Food, and Nutrition"[Mesh] OR "Nutritional Status"[Mesh] OR "Nutritional status" OR "Nutrition Therapy"[Mesh] OR "Nutrition therapy" OR "Diet Therapy"[Mesh] OR "Diet therapy" OR "Dietary restriction" OR "Dietary modification" OR "Diet modification" OR "Nutritional intervention" OR "Dietary interventions" OR "Nutritive Value"[Mesh] OR "Nutritive Value" OR "Nutrition value" OR "Nutritional value" OR "Feeding behavior" OR "Feeding behaviour" OR "Feeding Behavior"[Mesh] OR "Food habit" OR "Eating habit" OR "Eating behavior" OR "Eating behaviour" OR "Dietary habit" OR "Dietary behavior" OR "Dietary behaviour" OR "Eating pattern" OR "Dietary pattern" OR "Diet pattern" OR "Healthy diet" OR "Diet, Healthy"[Mesh] OR "Healthy eating" OR "Healthy nutrition") AND ("Ambulation difficulty" OR "Mobility Limitation"[Mesh] OR "Mobility limitation" OR "Ambulatory difficulty" OR "Walking difficulty" OR "Activities of daily living" OR "Activities of Daily Living"[Mesh] OR "Daily living activity" OR "Daily living activities" OR "Daily activity" OR "Daily Activities" OR "Physical function" OR "Pain Management"[Mesh] OR "Pain management" OR "Managing pain" OR "Pain Perception"[Mesh] OR "Pain Perception" OR "Pain Threshold"[Mesh] OR "Pain Threshold" OR "Pain Measurement"[Mesh] OR "Pain Measurement" OR "Measuring pain" OR " Pain assessment" OR" Pain scale" OR " Pain intensity" OR " Pain severity" OR " Pain severities" OR " Pain relief" OR "Pain control" OR " Pain reduction" OR Analgesia OR "Analgesia"[Mesh] OR " Quality of life" OR "Quality of Life"[Mesh] OR " Life quality" OR " Life Style" OR Lifestyle OR "Life Style"[Mesh] OR " Range of motion" OR "Range of Motion, Articular"[Mesh] OR "Joint flexibility" OR "Treatment Outcome"[Mesh] OR "Treatment Outcome")

Scopus

Title-Abstract-Keyword

Osteoarthritis OR "Spine Osteoarthritis" OR "Knee Osteoarthritis" OR "Hip Osteoarthritis" OR

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

"Degenerative arthritis" OR "Degenerative arthritides" OR "Joint diseases" OR "Degenerative joint disease" OR Arthritis OR "Knee Joint" OR "Knee pain" OR "Patellofemoral Pain Syndrome" OR "Hip pain" OR "Neck pain" OR "Wrist pain" OR "Hand pain" OR "Musculoskeletal pain" OR "Chronic pain" OR "Shoulder pain" OR "Neck pain" OR "Low back pain" OR "Back pain"

AND

Title-Abstract-Keyword

Beverages OR "Green tea" OR Tea OR "Fermented foods" OR "Cultured food" OR "Soy food" OR Isoflavonoid OR Food OR Diet OR "Western diet" OR "Paleolithic diet" OR "Paleo diet" OR High-fat diet OR "Ketogenic diet" OR "Keto diet" OR Gluten-free diet OR Carbohydrate-restricted diet OR Low-Carbohydrate diet OR Low-Carb diet OR "Mediterranean diet" OR Protein-restricted diet OR Fat-restricted diet OR "Vegetarian diet" OR "High-Protein Low-Carbohydrate diet" OR "High-Protein Low-Carb diet" OR "High-Protein diet" OR "Vegan diet" OR Plant-based OR Vegetarianism OR "DASH diet" OR "Dietary Approaches To Stop Hypertension" OR "Anti-inflammatory diet" OR "Low-inflammatory diet" OR "Low-caloric diet" OR "Low-calorie diet" OR Phenols OR Phenolic OR Polyphenols OR Phytochemicals OR Dietary-Phytochemicals OR "Omega-3 fatty acids" OR Carotenoids OR Added-sugar OR High-sugar OR "Dietary fat" OR "Saturated fat" OR "High-saturated fat" OR Nutrition OR "Nutritional status" OR "Nutrition therapy" OR "Diet therapy" OR "Dietary restriction" OR "Dietary modification" OR "Diet modification" OR "Nutritional intervention" OR "Dietary interventions" OR "Nutritive Value" OR "Nutrition value" OR "Nutritional value" OR "Feeding behavior" OR "Feeding behaviour" OR "Food habit" OR "Eating habit" OR "Eating behavior" OR "Eating behaviour" OR "Dietary habit" OR "Dietary behavior" OR "Dietary behaviour" OR "Eating pattern" OR "Dietary pattern" OR "Diet pattern" OR "Healthy diet" OR "Healthy eating" OR "Healthy nutrition"

AND

Title-Abstract-Keyword

"Ambulation difficulty" OR "Mobility limitation" OR "Ambulatory difficulty" OR "Walking difficulty" OR "Activities of daily living" OR "Daily living activity" OR "Daily living activities" OR "Daily activity" OR "Daily Activities" OR "Physical function" OR "Pain management" OR "Managing pain" OR "Pain Perception" OR "Pain Threshold" OR "Pain Measurement" OR "Measuring pain" OR " Pain assessment" OR" Pain scale" OR " Pain intensity" OR " Pain severity" OR " Pain severities" OR " Pain relief" OR "Pain control" OR " Pain reduction" OR Analgesia OR " Quality of life" OR " Life quality" OR " Life Style" OR Lifestyle OR "Range of motion" OR "Joint flexibility" OR "Treatment Outcome"

Web of Science

Topic:

Osteoarthritis OR "Spine Osteoarthritis" OR "Knee Osteoarthritis" OR "Hip Osteoarthritis" OR "Degenerative arthritis" OR "Degenerative arthritides" OR "Joint diseases" OR "Degenerative joint disease" OR Arthritis OR "Knee Joint" OR "Knee pain" OR "Patellofemoral Pain Syndrome" OR "Hip pain" OR "Neck pain" OR "Wrist pain" OR "Hand pain" OR "Musculoskeletal pain" OR "Chronic pain" OR "Shoulder pain" OR "Neck pain" OR "Low back pain" OR "Back pain"

AND

Topic:

Beverages OR "Green tea" OR Tea OR "Fermented foods" OR "Cultured food" OR "Soy food" OR Isoflavonoid OR Food OR Diet OR "Western diet" OR "Paleolithic diet" OR "Paleo diet" OR High-fat diet OR "Ketogenic diet" OR "Keto diet" OR Gluten-free diet OR Carbohydrate-restricted diet OR Low-Carbohydrate diet OR Low-Carb diet OR "Mediterranean diet" OR Protein-restricted diet OR Fat-restricted diet OR "Vegetarian diet" OR "High-Protein Low-Carbohydrate diet" OR "High-Protein Low-Carb diet" OR "High-Protein diet" OR "Vegan diet" OR Plant-based OR Vegetarianism OR "DASH diet" OR "Dietary Approaches To Stop Hypertension" OR "Anti-inflammatory diet" OR "Low-inflammatory diet" OR "Low-caloric diet" OR "Low-calorie diet" OR Phenols OR Phenolic OR Polyphenols OR Phytochemicals OR Dietary-Phytochemicals OR "Omega-3 fatty acids" OR Carotenoids OR Added-sugar OR High-sugar OR "Dietary fat" OR "Saturated fat" OR "High-saturated fat" OR Nutrition OR "Nutritional status" OR "Nutrition therapy" OR "Diet therapy" OR "Dietary restriction" OR "Dietary modification" OR "Diet modification" OR "Nutritional intervention" OR "Dietary interventions" OR "Nutritive Value" OR "Nutrition value" OR "Nutritional value" OR "Feeding behavior" OR "Feeding behaviour" OR "Food habit" OR "Eating habit" OR "Eating behavior" OR "Eating behaviour" OR "Dietary habit" OR "Dietary behavior" OR "Dietary behaviour" OR "Eating pattern" OR "Dietary pattern" OR "Diet pattern" OR "Healthy diet" OR "Healthy eating" OR "Healthy nutrition"

AND

Topic:

"Ambulation difficulty" OR "Mobility limitation" OR "Ambulatory difficulty" OR "Walking difficulty" OR "Activities of daily living" OR "Daily living activity" OR "Daily living activities" OR "Daily activity" OR "Daily Activities" OR "Physical function" OR "Pain management" OR "Managing pain" OR "Pain Perception" OR "Pain Threshold" OR "Pain Measurement" OR "Measuring pain" OR " Pain assessment" OR" Pain scale" OR " Pain intensity" OR " Pain severity" OR " Pain severities" OR " Pain relief" OR "Pain control" OR " Pain reduction" OR Analgesia

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

OR " Quality of life" OR " Life quality" OR " Life Style" OR Lifestyle OR "Range of motion" OR "Joint flexibility" OR "Treatment Outcome"

Google Scholar

Osteoarthritis AND (diet OR dietary OR food OR nutrition) AND ("Ambulation difficulty" OR "Mobility limitation" OR "Ambulatory difficulty" OR "Walking difficulty" OR "Daily activity" OR "Daily Activities" OR "Physical function" OR "Pain management" OR "Managing pain" OR "Pain Perception" OR "Pain Threshold" OR "Pain Measurement" OR "Pain assessment" OR "Pain scale" OR "Pain intensity" OR "Pain severity" OR "Pain relief" OR "Pain control" OR "Pain reduction" OR Analgesia OR "Quality of life" OR "Life quality" OR Lifestyle OR "Range of motion" OR "Joint flexibility" OR "Treatment Outcome")

APPENDIX B

Figure B1

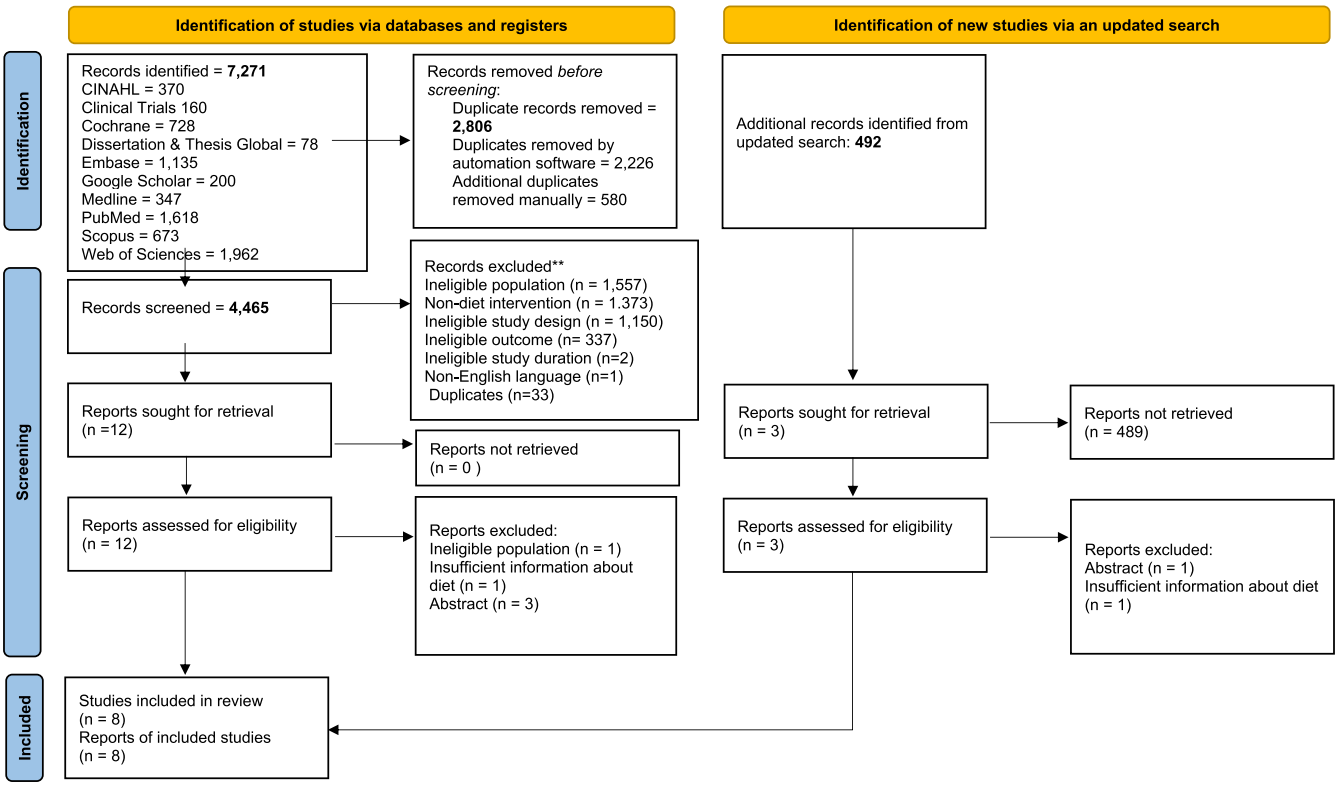

FIGURE B1 PRISMA 2020 flow diagram for new systematic reviews, which included searches of databases, registers and other sources**.** Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic Reviews* 2021;10:89.

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

APPENDIX C

Table C1

TABLE C1 Full-text articles reviewed with inclusion decisions.

Author/year	Title	English	OA	Diet	Duration	Pain measured	Physical function measured	CH include	Exclude with reason	KS include	Exclude with reason
Cooper et al. (2020)	An anti-inflammatory diet intervention for knee osteoarthritis: a feasibility study	Y	Y	Anti-inflammatory	9 weeks	VAS	KOOS	Y		Y	
Clinton et al. (2022)	Whole-foods, plant-based diet alleviates the symptoms of osteoarthritis	Y	Y	Plant-based	6 weeks	VAS	PGIC	Y		Y	
Da Silva et al. (2020)	Four-year follow-up of a 2-day educational programme about OA in Brazil	Y	Y	Nutrition lecture. Did not specify diet type.	4 years	WOMAC	WOMAC	N	Abstract Insufficient information about diet	N	Abstract Insufficient information about diet
deRezende et al. (2016)	One-year results of an educational programme on osteoarthritis: a prospective randomised controlled trial in Brazil	Y	Y	Nutrition lecture. Did not specify diet type.	12 months	VAS WOMAC	WOMAC	N	Insufficient information about diet	N	Insufficient information about diet
Dolatkhah et al. (2023)	The effect of an anti-inflammatory in comparison with a low-caloric diet on physical and mental health in overweight and obese women with knee osteoarthritis: a randomised clinical trial	Y	Y	Anti-inflammatory	2 months	VAS	WOMAC	Y		Y	
Dyer et al. (2017)	Effect of a Mediterranean-type diet on inflammatory and cartilage degradation biomarkers in patients with osteoarthritis	Y	Y	Mediterranean	4 months	AIMS2	AIMS2	Y		Y	
Hughes et al. (2020)	Fit and strong plus trial outcomes for obese older adults with osteoarthritis	Y	Y	Healthy eating index/DGA	6 months	WOMAC	WOMAC	Y		Y	
Fitzgibbons et al. (2020)	Fit and strong plus: 12- and 18-month follow-up results for a comparative effectiveness trial among overweight/obese older adults with osteoarthritis	Y	Y	Healthy eating index/DGA	18 months	WOMAC	WOMAC	Y		Y	

13652 7x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE C1 (Continued)

Author/year	Title	English	OA	Diet	Duration	Pain measured	Physical function measured	CH include	Exclude with reason	KS include	Exclude with reason
Messier et al. (2020)	Effect of diet and exercise on knee pain in adults with overweight or obesity	Y	Y	Low calorie	18 months	WOMAC	WOMAC	Y	Insufficient information about diet	N	Insufficient information about diet
Ocampos et al. (2019)	Comparison between a holistic programme and an educational programme in OA treatment	Y	Y	Nutrition lecture. Did not specify diet type	12 months	VAS WOMAC	WOMAC	N	Abstract Insufficient information about diet	N	Abstract Insufficient information about diet
Rezenda et al. (2020)	During 2 years, what is the difference between an exclusive 2-day education programme on OA and a programme that adds multimodal attention for 6 months in the treatment of OA?	Y	Y	Nutrition lecture. Did not specify diet type	24 months	WOMAC	WOMAC	N	Abstract Insufficient information about diet	N	Abstract Insufficient information about diet
Sadeghi et al. (2020)	Effects of a Mediterranean diet compared with the low-fat diet on patients with knee osteoarthritis: a randomised feeding trail	Y	Y	Mediterranean	12 weeks	WOMAC	WOMAC	Y		Y	
Saich et al. (2023)	Metabolomic approach in osteoarthritic patients after itis diet intervention	Y	Y	Metabolomic	4 weeks	VAS	WOMAC	N	Abstract	N	Abstract
Sala-Climent et al. (2023)	Clinical changes in knee osteoarthritis patients exposed to an anti-inflammatory diet	Y	Y	Anti-inflammatory	4 weeks	VAS	WOMAC	N	Abstract	N	Abstract
Strath et al. (2020)	The effect of low-carbohydrate and low-fat diets on pain in individuals with knee osteoarthritis	Y	Y	Low carbohydrate, low fat	12 weeks	BPI	KOOS	Y		Y	
Towery et al.	Chronic musculoskeletal pain and function improve with a plant-based diet	Y	N	Plant-based	18 weeks	NPRS	PGIC	N	Not OA	N	Not OA

Abbreviations: AIMS2, Arthritis Impact Measurement Score; BPI, Brief Pain Inventory; CH, initials of first screener; DGA, Dietary Guidelines for Americans; KOOS, Knee Osteoarthritis Outcome Score; KS, initial of second screener; N, no; NPRS, Numerical Pain Rating Scale; PGIC, Patient Global Impression of Change Scale; VAS, Visual Analogue Scale; WOMAC, Western Ontario and McMaster Universities Arthritis Index; Y, yes.

13652277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

AUTHOR BIOGRAPHIES

Karen Stanfar is a clinical dietitian at Metro Health Medical Center in Ohio and a doctor of clinical nutrition program student at Rutgers University. She focuses on nutrition and disability.

Corey Hawes is a clinical assistant professor at the University of Texas Rio Grande Valley with interests in body composition, paediatric nutrition and oncology nutrition. He has published and has been a part of systematic reviews specific to nutrition outcomes in nutrition therapy.

Mina Ghajar is a research and education librarian at Rutgers University, George F. Smith Library of the Health Sciences. She has collaborated with faculty and researchers on many systematic reviews.

Laura Byham-Gray is a professor and vice chair of research at Rutgers University with interests in comparative effectiveness research and chronic disease management. She has been a contributor for several published systematic reviews or meta-analyses specific to nutrition therapy and patient outcomes.

Diane R. Radler is a professor in the Department of Clinical and Preventive Nutrition Sciences (DCPNS) at Rutgers University School of Health Professions. Her research interests include nutrition and oral health, clinical nutrition, weight management and dietary intake assessment methods.

1365277x, 2024, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/jhn.13317 by The University Of Texas Rio Grande Valley, Wiley Online Library on [09/08/2024]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License