Dietary Approaches and Health Outcomes: An Evidence Analysis Center Scoping Review

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ABSTRACT

Appropriate diet can prevent, manage, or reverse noncommunicable health conditions such as obesity, cardiovascular disease, and diabetes. Consequently, the public's interest in diet and nutrition has fueled the multi-billion-dollar weight loss industry and elevated its standing on social media and the internet. Although many dietary approaches are popular, their universal effectiveness and risks across overall populations are not clear. The objective of this scoping review was to identify and characterize systematic reviews (SRs) examining diet or fasting (intermittent energy restriction [IER]) interventions among adults who are healthy or may have chronic disease. An in-depth literature search of six databases was conducted for SRs published between January 2010 and February 2020. A total of 22,385 SRs were retrieved, and 1,017 full-text articles were screened for eligibility. Of these, 92 SRs met inclusion criteria. Covered diets were organized into 12 categories: high/restricted carbohydrate (n = 30), Mediterranean, Nordic, and Tibetan (n = 19), restricted or modified fat (n = 17), various vegetarian diets (n = 16), glycemic index (n = 13), high protein (n = 12), IER (n = 11), meal replacements (n = 11), paleolithic (n = 8), Dietary Approaches to Stop Hypretension (DASH; n = 6), Atkins, South Beach, and Zone (n = 5), and eight other brand diets (n = 4). Intermediate outcomes, such as body weight or composition and cardiometabolic, were commonly reported. Abundant evidence was found exploring dietary approaches in the general population. However, heterogeneity of diet definitions, focus on single macronutrients, and infrequent macronutrient subanalyses were observed. Based on this scoping review, the Evidence Analysis Center prioritized the need to collate evidence related to macronutrient modification, specifically restricted carbohydrate diets.

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Supplementary materials: *Supplementary table 1, 2 and references are available at www.jandonline.org*

THE ROLE OF POOR NUTRITION and overnutrition in metabolic risk factors such as hypertension (HTN), dyslipidemia, elevated blood glucose, insulin resistance, and overweight and obesity, is well known.[1] Data from the 2017-2018 National Health and Nutrition Examination Survey indicates three quarters (73.6 %) of American adults were classified as overweight or obese (body mass index [BMI] $\geq$ 25).[2] Obesity is associated with increased risk for coronary heart disease, type 2 diabetes, certain forms of cancer, gallstones, and disability. Appropriate diet in large part can successfully reduce noncommunicable disease morbidity and mortality by preventing, managing, or reversing[3,4] these conditions.

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The public's interest in nutrition is significant. According to the National Center for Health Statistics, in 2015 to 2018, almost one in five (17.6%) US adults said they were *currently* following a "special diet" (predominantly for weight loss) on any given day.[5] In another survey in 2019, the International Food Information Council Foundation found that 23% of American consumers reported actively seeking out foods or following a diet,[6] and over one third (38%) of consumers reported following a specific eating pattern or diet *in the past year*, with "clean" eating followed by intermittent fasting as the most commonly cited. Other popular approaches were gluten-free, low-carbohydrate, ketogenic/high-fat, weight loss, Mediterranean, plant-based, and flexitarian.[6] Although many dietary approaches are very popular, their universal effectiveness and risks across overall populations have not been clear.

In 2019 (pre-COVID-19 pandemic), the US weight and diet industry hit a peak of 78 billion dollars.[7] Despite its substantial earnings, few offerings are evidence-based.[8] Furthermore, the internet has become a prominent source of health and nutrition advice.[9,10] An estimated 85% of individuals use the internet as a source of nutrition and health information, and 80% consider it reliable.[10] Food and nutrition is the second most popular science topic on social media, behind health and medicine.[9]

The US Preventive Services Task Force recommendations have concluded with moderate certainty (Grade B evidence) that people with obesity and those with cardiovascular disease (CVD) risk factors should be referred for intensive behavioral interventions, which included diet.[11] Registered dietitian nutritionists (RDNs) and their international equivalent counterparts are experts in assisting individuals with dietary changes for improving weight status, cardiometabolic risk factors, and overall health.[12]

RDNs need high-quality scientific evidence about different dietary approaches to effectively communicate research findings to the public and incorporate individualized diet strategies and advice for their patients and

Research Snapshot

Research Question: The objective of this scoping review is to identify and characterize studies examining diet or fasting interventions among adults who are healthy or who may have chronic disease.

Key Findings: A total of 92 systematic reviews examining 12 different diet categories met our inclusion criteria. The most commonly researched approaches were macronutrient restriction or modification, regional dietary patterns, vegetarian and intermittent fasting. Body weight and cardiometabolic outcomes were frequently reported. While abundant evidence exists, variation in diet definitions and comparator diets; inconsistent energy restriction; focus on single macronutrients; and lack of macronutrient sub-analyses were observed.

clients. A thorough and critical review from the perspective of a nutrition professional is needed, to summarize the current state of evidence for various dietary approaches and their effect on health outcomes in the general population. The objective of this Evidence Analysis Center scoping review is to identify and characterize studies examining diet or fasting (intermittent energy restriction [IER]) interventions among adults who are healthy or who may have chronic disease. Understanding the landscape of these interventions in the literature will help to inform the scope and the development of future systematic reviews (SRs) in this area.

METHODS

This scoping review is based on the protocol developed by Arksey and O'Malley[13] and updated by Levac et al[14] and the Joanna Briggs Institute.[15] The review protocol adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis[16] checklist for scoping reviews, and has been registered on Open Science Framework.[17]

Eligibility Criteria

Detailed description of the inclusion and exclusion criteria can be found in Table 1. SRs (with or without meta-analysis) of randomized controlled trials (RCTs), controlled clinical trials, or cohort studies of adults (≥18 years) undergoing a specified diet, dietary pattern, or fasting regimen were eligible for inclusion. Participants included healthy individuals of any weight status and those who were at risk of chronic disease or had comorbidities. Additionally, SRs were required to meet methodological rigor, having searched at least two databases and completed a risk of bias assessment of included studies.

Search Strategy

Search strategies were developed by an information specialist for Ovid MEDLINE, MEDLINE (EBSCO), CINAHL, Cochrane Database of Systematic Reviews, Embase, and PsychINFO. Results were limited by English language and publication year January 2010 through February 2020. Results were deduplicated in EndNote software. A sample of the search strategy for one database is available in Supplemental Table 1.

Study Selection and Data Extraction

Database search results were uploaded onto Rayyan, a title/abstract screening software.[18] Two reviewers conducted the two-step screening process. One reviewer excluded all non-SRs and those not focused on adults and nonhuman animal studies. After this step, all remaining titles/abstracts were independently reviewed by two reviewers, and discrepancies in decisions were settled through discussions and consensus or by a third reviewer. All articles included in this phase were exported onto Microsoft Excel template designed by the reviewers. After full-text review by two reviewers, all studies meeting inclusion criteria were moved into the data extraction phase. Reason for exclusion was provided for each study not meeting the inclusion criteria. Extracted data included publication information, study population, study purpose, focused diet, diet definitions, comparison diets, length of study, health outcomes, and certainty of evidence (eg, Grading of Recommendations Assessment, Development and Evaluation [GRADE] method), if reported.

Synthesis of Results

Results were synthesized according to the type of dietary intervention or diet focused on in the included SRs. These findings were presented visually, using bubble charts and heat maps.

Consultation/Content Advisors

This scoping review included two content advisors who are experts in the field of diets or dietary patterns and its impact on health outcomes. These content advisors guided the scoping review process, as well as reviewed and provided feedback on the search plan and findings.

RESULTS

The databases and hand searches identified 22,385 individual articles, and 1,017 full texts were screened for eligibility. Of these, 137 articles met the primary inclusion criteria. After applying secondary inclusion criteria (methodological rigor), a total of 92 SRs were retained, which included three umbrella reviews.[19-21] The most common reason for exclusion was body weight/BMI criteria. See Figure 1 for study selection and exclusions.

Population Characteristics

All SRs included both sexes, except for one study, which included women only.[22] A total of 23 SRs were interested in only studies of overweight or obese subjects, generally defined by BMI. All other SRs either did not specify weight status or they included any weight categories.

Comorbidities

Almost half (47%; n = 43) of the included SRs either did not specify or were open to any populations with comorbid conditions. Seven SRs specified generally healthy populations, five without comorbidities[23-27] and two with comorbidities.[28,29] Of those focused on populations with specific diseases or conditions, almost one third of SRs (n = 30) were interested in those with glucose metabolism disorders such as type 2 diabetes, impaired fasting glucose/prediabetes, impaired glucose tolerance, or insulin resistance. Other populations of interest were metabolic syndrome (MetSyn),[30,31] nonalcoholic fatty liver disease,[32-34] existing coronary artery disease or CVD,[35,36] HTN/pre-HTN,[37] polycystic ovary syndrome,[22] smokers,[38] obstructive sleep apnea,[39] or multiple noncommunicable diseases.[40]

Table 1. Eligibility criteria for scoping review: Dietary approaches and health outcomes

Criteria	Inclusion criteria	Exclusion criteria
Objective	To determine the availability of literature examining the effect of diet or fasting (IER[a]) on BW[b] status and other health outcomes.	Diet or fasting was not an intervention or the effect of diet or fasting alone could not be separated from other intervention components (eg, weight loss medications, exercise regimen). BW or BMI[c] change was not reported.
Population	Adults (18 years and older) General population (healthy or ill)	Nonadults <18 years (adolescents, children, infants) Animal studies Institutionalized individuals (ie, inmates, patient of mental disease institution) Athletes/elite athletes Pregnant, postpartum, or lactating women
Health status	All weight categories With or without chronic disease(s) or co-morbid condition(s) (eg, MetSyn, IGT,[d] IFG,[e] DM,[f] HTN,[g] CVD,[h] NAFLD,[i] or NASH[j])	Chronic disease, condition or health status that is not generalizable: • HIV[k]/AIDS[l] • Kidney disease • Other liver disease • Bladder disease • Gastrointestinal disorders/disease • COPD[m] • Heart failure • Cancer, cancer survivors • Critically ill or poor prognosis • Cachexia, sarcopenia • Gestational diabetes • Spinal cord injury • Burn injury • Pressure injury, wounds, or ulceration • Mental disorders • Eating disorders, disordered eating • Neuro (-cognitive, -degenerative, or -developmental) disorders/disease • Inborn errors of metabolism and other genetic disorders • Post-surgical, including post-bariatric surgery • Malnourished individuals (ie, unintended weight loss)
Setting	Outpatient or ambulatory care, outpatient rehabilitation	Inpatient or acute care, inpatient rehab
Study design and intervention duration	Systematic reviews (with or without meta-analyses) of RCTs,[n] controlled clinical trials, or cohort studies.	Observational studies (case control, cross-sectional, before–after studies), ecological studies, single case-study, case report, case series, noncomparative.

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Table 1. Eligibility criteria for scoping review: Dietary approaches and health outcomes (*continued*)

Criteria	Inclusion criteria	Exclusion criteria
		Letters to the editor/commentary, poster session, abstract, study protocol.
Intervention	A diet or dietary pattern (with or without caloric restriction) or fasting regimen is specified and must be described or defined, if not commonly known (eg, DASH[o] diet and Paleolithic diet is commonly known) weight loss diet >1,000 kcals must provide name of diet or specify macronutrients) Diet interventions may include: • Whole or liquid foods, including MRs[p] (eg, SlimFast, OPTIFAST) and prepackaged meals • Commercial or brand name diets and diet programs (eg, WW, Jenny Craig, Atkins, Zone, South Beach) • Dietary patterns (eg, Mediterranean, vegetarian, Nordic) • Macronutrient modifications (eg, low CHO,[r] high protein, ketogenic) Fasting intervention (IER)[s] may include various alternate-day, periodic or time-restricted fasting regimens.	Diet or fasting regimen was not an intervention. Weight loss diets that specify calorie level only (ie, 1,200 or 1,500 kcals) without describing macronutrients or specify name of diet). Effects of diet or fasting regimen alone could not be separated from other lifestyle interventions (eg, weight loss medications, exercise regimen). Does not include one or more specific diets or fasting regimens. Diet for athletic performance or training. Nutrition support such as enteral feedings (tube feedings, MFS[q]) or parenteral nutrition. Interventions designed to measure the effect of individual components of diet such as food groups (eg, fruits, vegetables, dairy), specific foods (eg, nuts, fish, legumes, whole vs refined grains), specific nutrients (eg, sodium, potassium, fiber, antioxidants, fructose), and other functional components (phytonutrients, prebiotics, soy isoflavones, plant stanols) or supplements to diet such as vitamins or minerals and nutraceuticals (eg, fish oil, probiotics, omega-3, herbals).
Comparison	At least one control group (eg, usual diet or another diet, or fasting regimen).	No control group. Control group did not include another diet or fasting or included additional components, such as exercise (ie, exercise only or diet + exercise).
Outcomes	Reports changes in BW or BMI as a result of a specific diet or fasting intervention with comparative analysis or subanalysis. May also report measures of other health outcomes [cardiovascular, metabolic (eg, BP,[s] lipids), and functional outcomes such as body composition, lipids, blood glucose, BP, insulin resistance, improvement in symptoms, clinical events (ie, MI,[t] stroke), occurrence of T2D,[u] CVD, and all-cause mortality, etc.	Does not report changes in BW or BMI as a result of a specific diet or fasting intervention. Does not provide comparative analysis or subanalysis of BW or BMI change by diet type or fasting regimen. If included diets were dissimilar, BW or BMI change was not stratified by diet type.

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Table 1. Eligibility criteria for scoping review: Dietary approaches and health outcomes (*continued*)

Criteria	Inclusion criteria	Exclusion criteria
Language	English	Non-English publication
Year range (publication year)	January 2010—February 2020	Before January 2010
Secondary exclusions:	SR[v] included: • At least two databases were included in search protocol • ROB[w] (study quality) was assessed.	Only one database was included in SR's search protocol. No ROB assessment was conducted.

[a]IER = intermittent energy restriction.
[b]BW = body weight.
[c]BMI = body mass index.
[d]IGT = impaired glucose tolerance.
[e]IFG = impaired fasting glucose.
[f]DM = diabetes mellitus.
[g]HTN = hypertension.
[h]CVD = cardiovascular disease.
[i]NAFLD = nonalcoholic fatty liver disease.
[j]NASH = nonalcoholic steatohepatitis.
[k]HIV = human immunodeficiency virus.
[l]AIDS = acquired immunodeficiency syndrome.
[m]COPD = chronic obstructive pulmonary disease.
[n]RCT = randomized controlled trial.
[o]DASH = Dietary Approaches to Stop Hypertension.
[p]MR = meal replacements.
[q]MFS = medical food supplement.
[r]CHO = carbohydrate.
[s]BP = blood pressure.
[t]MI = myocardial infarction.
[u]T2D = Type 2 diabetes mellitus.
[v]SR = systematic review.
[w]ROB = risk of bias.

Outcomes

Because of its relationship to energy balance and imbalance,[41] body weight or BMI change was a prerequisite for inclusion in this scoping review and was reported in all studies. As illustrated in the heat map (Fig 2), a number of other predefined outcomes were reported: More than half of the SRs specified glycemic control (n = 58), blood lipid (n = 57), and blood pressure (n = 47) outcomes. Other more common outcomes were body composition (n = 32), inflammatory markers (n = 16), adverse events (n = 13), and quality of life (n = 11). Overall, 29 (31.5%) of the 92 included studies assessed the quality of evidence for these outcomes of interest, which was assessed in highest numbers between 2018 and 2019 (n = 16).

Primary Purpose

The objectives of the SRs were organized into three major categories (Table 2): 1) weight management (weight loss or weight maintenance), 2) cardiometabolic risk or disease (CMRD), a broad category encompassing CVD (myocardial infarction, stroke, HTN), coronary heart disease, MetSyn and diabetes, as well as related risk factors for cardiometabolic disorders such as impaired glucose tolerance, insulin resistance, dyslipidemia, inflammatory markers, nonalcoholic fatty liver disease, and CVD, and 3) other, for any purpose that did not fit into the first two groupings. Because a percentage of all SRs (n = 92) that may have had more than one primary purpose, 67% (n = 62) included CMRD, 58% included weight management (n = 53), and 12% (n = 11) included other aims. Energy restriction was not prespecified as a condition in almost two thirds (n = 34) of SRs that were interested in weight management. Conversely, one SR[42] specified energy restriction for the diet intervention, but the primary purpose was not weight loss.

Intervention and Follow-up Periods

More than half of the SRs either did not specify (n = 47) or accepted any intervention length (n = 4). Other SRs required a minimum intervention period of 1, 2, or 3 weeks (n = 7), 1 month (n = 9), 2, 3, or 6 months (n = 21), or 1 year (n = 3). The follow-up period was either not specified (n = 78) or any follow-up was accepted (n = 2) in 87% of the SRs.

Diets and Dietary Patterns

In the final analysis, the wide range of diets covered were organized into 12 diet categories (Fig. 3): 1) high or restricted CHO (n = 30); 2) regional dietary patterns (n = 19 total), such as Mediterranean, Nordic, and Tibetan; 3) restricted or modified fat (n = 17); 4) vegetarian dietary patterns (n = 16 total), including vegetarian or vegan, portfolio, Ornish, and macrobiotic; 5) glycemic index (GI) or load (GL)

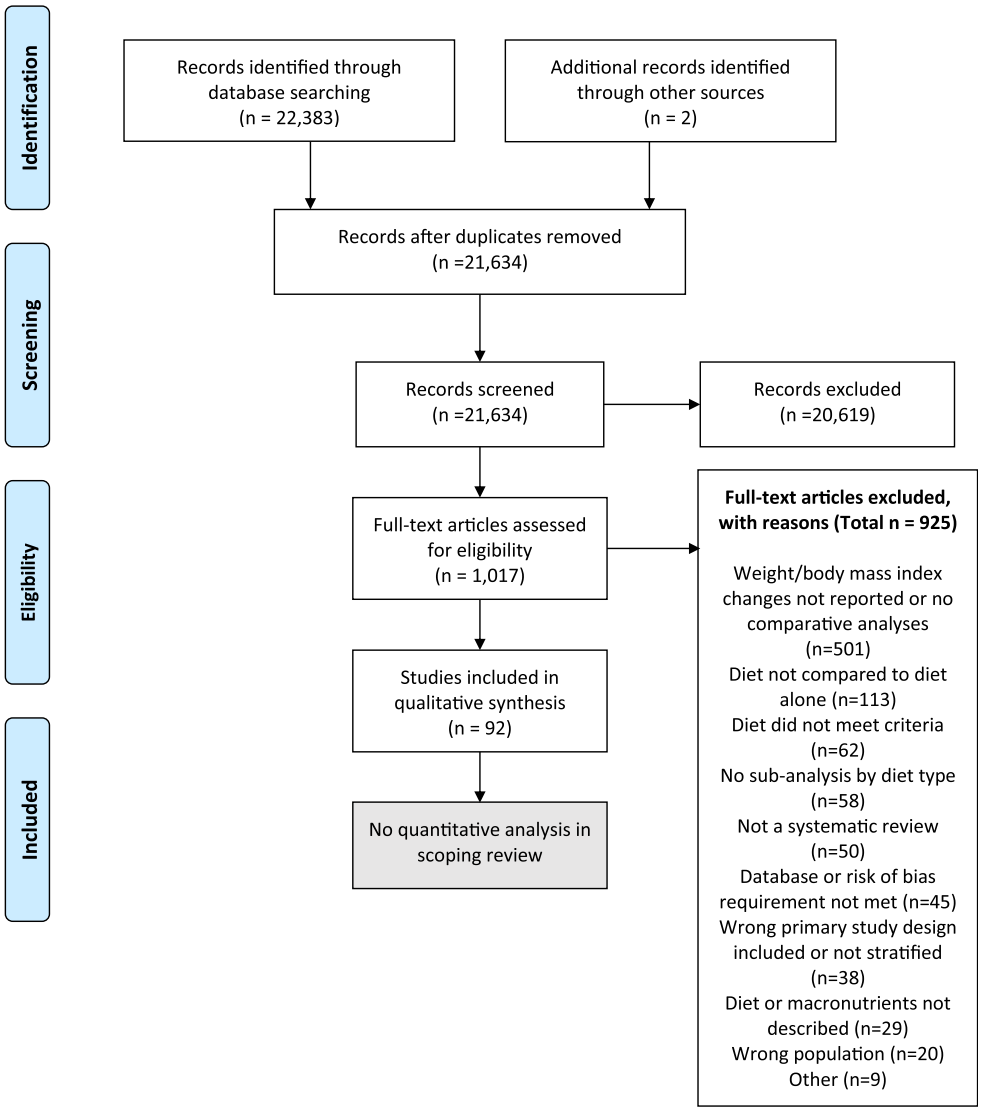

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram for the scoping review: Dietary approaches and health outcomes.

(n = 13); 6) high protein (n = 12); 7) IER (n = 11); 8) meal replacements (MR) (n = 11); 9) paleolithic (n = 8); 10) Dietary Approaches to Stop Hypertension (DASH) (n = 6); 11) CHO-restricted/high protein named diets (n = 5 total), including Atkins, South Beach, and Zone (A/S/Z), and finally, 12) other named or commercial diets (n = 4 total), including WW (formerly Weight Watchers), Jenny Craig, Biggest Loser Club, and five others.

Eighteen (21%)[20,21,34,37,43-55] of the 92 SRs, which included two umbrella reviews,[20,21] evaluated more than one diet or dietary pattern across the 12 diet categories. Six SRs reported evaluating two to four different diets, five evaluated five to six different diets, four evaluated seven to eight different diets, and three evaluated 10 to 11 different diets. Thus, although 92 separate SRs are included, the total number in the diet analysis (with overlapping SRs) is 152.

Diet Definitions

Among the included articles, there was considerable variability in terms used and definitions of intervention diets. For example, some studies preferred broad definitions or did not define terms such as "high" or "low," and instead relied on the primary research definitions of a given diet. Some definitions consisted of a percentage of difference between one diet or another for a particular macronutrient.

To help interpret the findings, authors of this scoping review adapted a diet classification table for CHO, based on Kirkpatrick et al.[56] See CHO definition in Supplemental Table 2. Definitions for other dietary approaches are also found in Supplemental Table 2, which includes its own reference list.

Control Diets or Comparative Diets

There was considerable heterogeneity among the 101 different comparator and control diets in the included SRs. Table 3 presents the control diets summarized into 10 categories for each dietary intervention. Almost one quarter (24%) of the SRs did not specify a comparator/control (n = 24). Overall, the most common comparators were any diet (n = 23) (ie, those not similar to the intervention diet or usual diet), low-energy diets (n = 13), and no or

Dietary Interventions (Number of SRs)													
	All (n = 92)	CHO (n = 30)	RDP (n = 19)	FAT (n = 17)	Vegn (n = 16)	GI/GL (n = 13)	PRO (n = 12)	IER (n = 11)	MR (n = 11)	Paleo (n = 8)	DASH (n = 6)	A/S/Z (n = 5)	OBD (n = 4)
QOE[a]	29	11	6	8	8	6	6	3	2	5	1	1	1
Outcomes													
Body weight, BMI	92	30	19	17	16	13	12	11	11	8	6	5	4
Glycemic control[b]	58	24	12	9	8	7	8	6	4	4	3	1	1
Blood lipids[c]	57	23	11	12	9	6	7	7	3	3	3	1	1
Blood pressure	47	16	9	9	6	5	6	7	3	3	5	1	1
Body composition[d]	32	7	7	5	3	4	3	6	3	1	1	1	1
Inflammatory markers[e]	16	3	3	5	2	1	2	1	1	1	2	—	—
Adverse events[f]	13	3	—	—	1	1	2	2	2	1	—	3	3
QoL	11	2	1	1	1	1	1	2	1	1	—	—	—
Liver and kidney health[g]	9	5	2	1	—	—	2	1	—	—	—	—	—
Incident CVD[h]	9	1	3	1	—	2	1	—	—	—	2	—	—
Diet adherence	8	2	1	—	1	—	—	2	2	—	—	1	1
Attrition, dropouts[i]	7	3	—	—	—	—	—	1	3	—	—	1	2
Diet adequacy, sufficiency[j]	7	2	—	1	1	1	—	2	—	1	—	1	—
CVD mortality[h]	6	1	2	—	1	2	1	—	1	—	1	—	—
Incident DM	6	—	2	1	1	1	1	—	1	—	2	—	—
CVD risk[h]	6	1	2	—	1	—	1	1	—	—	—	—	—
Medication use	6	3	1	1	2	—	—	1	1	—	—	—	—
All-cause mortality	5	1	1	1	—	2	—	—	—	—	—	—	—
Incident cancer	4	—	1	1	—	1	1	—	—	—	—	—	—
LOS	2	2	—	—	—	—	—	—	—	—	—	—	—
Adipokines[k]	2	—	—	2	—	—	—	—	—	—	—	—	—
Heart rate	2	1	—	—	—	—	—	1	—	—	—	—	—
Event rate[l]	1	—	—	—	—	—	—	—	1	—	—	—	1

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Figure 2. Heat map describing systematic reviews assessing quality of evidence and outcomes of interest for each dietary intervention category.

Dietary Interventions (Number of SRs)													
	All (n = 92)	CHO (n = 30)	RDP (n = 19)	FAT (n = 17)	Vegn (n = 16)	GI/GL (n = 13)	PRO (n = 12)	IER (n = 11)	MR (n = 11)	Paleo (n = 8)	DASH (n = 6)	A/S/Z (n = 5)	OBD (n = 4)
Cancer mortality	1	—	—	—	—	1	—	—	—	—	—	—	—
Other[m]	11	2[A,B]	2 [C,D]	—	1[E]	—	1[F]	2[G,H]	2[I,J]	1[K]	—	—	—

Heat map colors (as a percentage of total SRs for each dietary intervention category): ≥75%; 50%–74%; 25%–49%; 1%–24%; None

Abbreviations: A/S/Z = Atkins/South Beach/Zone; BMI = body mass index; CHO = carbohydrate; CVD = cardiovascular disease; DASH = Dietary Approaches to Stop Hypertension; DM = diabetes mellitus; GI/GL = glycemic index/glycemic load; IER = intermittent energy restriction (fasting); LOS = length of hospital stay; MR = meal replacements; OBD = Other brand or commercial diets (Weight Watchers, Nutrisystem, Biggest Losers Club, Jenny Craig, Volumetrics, Rosemary Conley, Slimming World, e-diets); PRO = protein; QOE = quality of evidence; QoL = quality of life; RDP = regional dietary patterns (Mediterranean, Nordic, Tibetan); SRs = systematic reviews; Vegn = vegetarian (Also includes vegan, portfolio, Ornish, macrobiotic).

OVERLAP: Of the 92 SRs, a total of 17 examined more than one of the 12 diet categories. The overlap among SRs for each dietary approach category is as follows (overlap n/total n): CHO (9/30), FAT (8/17), RDP (11/19), Vegn (9/16), GI/GL (7/13), PRO (6/12), IER (4/11), MR (4/11), Paleo (6/8), DASH (4/6), A/S/Z (5/5), OBD (4/4).

[a]**QOE:** Number of SRs assessing quality (or certainty) of evidence for outcomes.

[b]**Glycemic control:** Includes blood glucose; total available glucose; hemoglobin A1c; Homeostatic Model Assessment of Insulin Resistance; insulin levels; insulin resistance/sensitivity; insulin-like growth factor.

[c]**Blood lipids:** Includes total cholesterol, high-density lipoproteins; low-density lipoproteins; Non-HDL-C; triglycerides; TC:HDL ratio; Apo B.

[d]**Body composition:** Includes body fat, lean body mass; waist and hip circumference; waist-to-hip ratio; fat mass; fat-free mass; visceral fat.

[e]**Inflammatory markers:** Includes immunological factors and inflammatory markers such as C-reactive protein, interleukin-6, tumor necrosis factor alpha, nuclear factor kappa B, interferon-gamma, and intercellular adhesion molecule 1.

[f]**Adverse events:** Includes bloating, nausea, weight gain, difficulty in eating out, physical or psychological side effects from taking part in the interventions; biliary disorders, joint pain, alopecia, constipation, and eating disorders; perioperative complications.

[g]**Liver and kidney health:** Includes liver volume or size, measures of liver and renal function (creatinine, alanine aminotransferase, aspartate aminotransferase and gamma-glutamyl transpeptidase), need for dialysis, hepatic steatosis, and fibrosis.

[h]**CVD:** Includes coronary heart disease, myocardial infarction, and stroke.

[i]**Attrition, drop-outs:** Includes attrition/drop-out rates (loss to follow-up, discontinuation); recruitment rates; publication, and citation metrics.

[j]**Diet adequacy, sufficiency:** Includes nutritional adequacy; micronutrient intake; changes in saturated and total fat intakes, as well as other macronutrients, sugars, and alcohol; change in diet; hunger and satiety.

[k]**Adipokines:** Includes leptin, adiponectin.

[l]**Event rate:** Event rate for % of participants enrolled who lost <5 % of their initial body weight by the end of the program using intent-to-treat analysis.

[m]**Other**

A. Fertility/fertility hormones: Follicle-stimulating hormone, luteotropic hormone, total testosterone, and sex hormone-binding globulin.
B. Surgical outcomes: Feasibility, operating difficulty or ease, clinical or biochemical markers of surgical risk, and other perioperative outcomes.
C. Remission from metabolic syndrome.
D. Incidence of asthma, hypertension, metabolic syndrome, obesity, rheumatoid arthritis, cognitive functioning, economic evaluation, fractures.
E. Foot conductance, perceived pain and neuropathy symptoms.
F. Bone health, fractures, bone mineral density.
G. Physical activity.
H. Energy expenditure.
I. Smoking status after quitting.
J. Sleep apnea measures.
K. Uric acid levels.

Figure 2. *(continued)* Heat map describing systematic reviews assessing quality of evidence and outcomes of interest for each dietary intervention category.

Table 2. Primary purpose of systematic reviews and specified requirement for energy restriction by systematic reviews according to dietary intervention category

		Dietary Approaches (Number of Systematic Reviews)											
Primary Purpose[a]	All (n = 92)[b]	CHO[c] (n = 30)	RDP[d] (n = 19)	FAT (n = 17)	Vegn[e] (n = 16)	GI[f]/GL[g] (n = 13)	PRO[h] (n = 12)	IER[i] (n = 11)	MR[j] (n = 11)	Paleo (n = 8)	DASH[k] (n = 6)	A/S/Z[l] (n = 5)	OBD[m] (n = 4)
Weight loss (WL)	47	16	9	4	6	5	5	11	7	2	2	4	4
WL only	20	4	3	—	4	1	5	6	4	1	1	3	3
WL + CMRD[n]	25	11	6	4	2	4	—	5	2	1	1	1	1
WL + CMRD + Other[o]	2	1[p]	—	—	—	—	—	—	1	—	—	—	—
Energy restriction	21[q]	6	—	—	1	—	—	11[q]	6	—	—	1	2
Weight maintenance (WM)	4	—	—	2	1	1	2	—	2	—	—	—	—
WM Only	3	—	—	1	1	1	2	—	2	—	—	—	—
WM + CMRD	—	—	—	—	—	—	—	—	—	—	—	—	—
WM + CMRD + Other[r]	1	—	—	1	—	—	—	—	—	—	—	—	—
Energy restriction	—	—	—	—	—	—	—	—	—	—	—	—	—
WL and WM	2	1	—	1	—	—	—	—	—	—	—	—	—
WL + WM Only	1	1	—	—	—	—	—	—	—	—	—	—	—
WL + WM + CMRD	1	—	—	1	—	—	—	—	—	—	—	—	—
WL + WM + CMRD + Other	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy restriction	—	—	—	—	—	—	—	—	—	—	—	—	—
CMRD[s]	33	11	9	10	8	6	5	—	1	5	4	—	—
CMRD only	31	11	9	9	8	6	4	—	1	5	4	—	—
CMRD + Other[t]	2	—	—	1	—	1	1	—	—	—	—	—	—
Energy restriction	—	—	—	—	—	—	—	—	—	—	—	—	—
Other	6	2	1	—	1	—	—	—	1	1	—	1	—
Other only[u]	6	2	1	—	1	—	—	—	1	1	—	1	—
Energy restriction	1[v]	—	—	—	—	—	—	—	1	—	—	—	—

[a]Some SRs included more than one primary purpose.
[b]Of the 92 SRs, a total of 17 examined more than one of the 12 dietary approaches. The overlap among SRs for each category is as follows (overlap n/total n): CHO (9/30), FAT (8/17), RDP (11/19), Vegn (9/16), GI/GL (7/13), PRO (6/12), IER (4/11), MR (4/11), Paleo (6/8), DASH (4/6), A/S/Z (5/5), OBD (4/4).
[c]CHO = carbohydrate.
[d]RDP = regional dietary patterns (Mediterranean, Nordic, Tibetan).
[e]Vegn = vegetarian (Also includes vegan, Ornish, portfolio, macrobiotic).
[f]GI = glycemic index.
[g]GL = glycemic load.
[h]PRO = protein
[i]IER = intermittent energy restriction (fasting).
[j]MR = meal replacements.
[k]DASH = Dietary Approaches to Stop Hypertension.
[l]A/S/Z = Atkins/South Beach/Zone.
[m]OBD = Other commercial or brand diets (Weight Watchers, Nutrisystem, Biggest Losers Club, Jenny Craig, Volumetrics, Rosemary Conley, Slimming World, e-diets).
[n]CMRD = Cardiometabolic risk or disease.
[o]Other includes improvement in surgical outcomes; severity of obstructive sleep apnea.
[p]SR did not include CMRD (WL + Other only).
[q]Three SRs specified energy restriction for IER, but energy restriction was not specified for other diet interventions evaluated. Therefore, these three SRs were not counted in the total for energy restriction. However, all IER interventions were counted as specifying energy restriction in the IER column, even if SR evaluated other diet interventions.
[r]Other includes quality of life (QoL).
[s]CMRD includes cardiovascular disease (CVD) (myocardial infarction, stroke, hypertension), coronary heart disease, metabolic syndrome and diabetes, as well as related risk factors for cardiometabolic disorders such as impaired glucose tolerance, insulin resistance, elevated fasting blood sugar, dyslipidemia, inflammatory markers, non-alcoholic fatty liver disease, obesity, CVD.
[t]Other includes risk for cancer; death, all-cause mortality, cancer diagnosis/incidence, new-onset diabetes, renal disease, starting dialysis, bone health/fractures, QoL and adverse events, improvement of clinical symptoms of polycystic ovary syndrome (PCOS), and effect of diet on phenotypic changes in PCOS patients.
[u]Other includes micronutrient intake; all health outcomes; physical and psychological well-being; depressive symptoms and anxiety.
[v]Primary purpose of SR was improvement in depressive symptoms and anxiety, not weight loss.

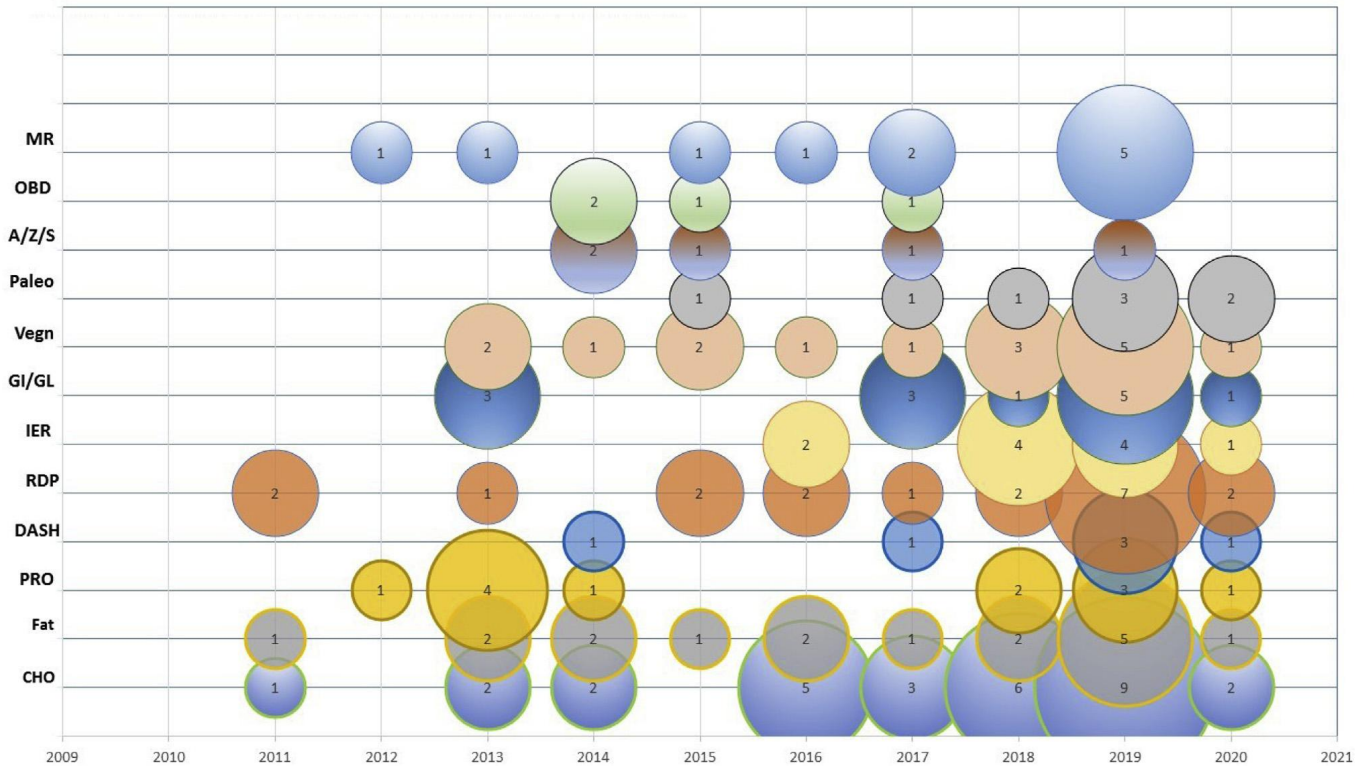

Figure 3. Bubble chart of systematic review research published by year and dietary intervention. The bubble size is proportional to the number of SRs published in the year from January 2010 through February 2020. Total n = 152 because some studies report data for multiple dietary interventions. A/S/Z = Atkins/South Beach/Zone; CHO = carbohydrate; DASH = Dietary Approaches to Stop Hypertension; GI/GL = glycemic index/glycemic load; IER = intermittent energy restriction (fasting); MR = meal replacements; OBD = Other brand or commercial diets (Weight Watchers, Nutrisystem, Biggest Loser, Jenny Craig, Volumetrics, Rosemary Conley, Slimming World, e-diets); Paleo = paleolithic; PRO = protein; RDP = regional dietary patterns (Mediterranean, Nordic, Tibetan); Vegn = vegetarian (Also includes vegan, portfolio, Ornish, macrobiotic).

minimal intervention (n = 10). Comparator diets, such as lower energy, higher CHO (≥40%-45% total daily energy intake [TDEI]) and lower fat (≤30% TDEI total fat) were specified as comparators in more than one diet intervention. Four other comparator diets (higher fat, non-vegetarian, higher protein, and higher GI/GL) were used exclusively for specific diet interventions.

INTERVENTIONS

An overview of the scoping results of the 12 diet categories are presented in order of highest to lowest number of included SRs. Refer to Figure 2, Table 2, and Table 3 for more detailed results information.

High or Restricted Carbohydrate (CHO)

Of the 92 included SRs, 30[19,20,22,23,26,31,33,37,40,43,46,50-53,57-71] focused on high CHO or restricted CHO (also known as "low" CHO) diets, and 83% were published within the last 5 years of this review. The most common outcomes of interest were glycemic control (n = 24), lipids (n = 23), blood pressure (n = 16), and body composition (n = 7). The primary purpose of the SRs was CMRD (n = 22),[20,23,26,31,33,37,40,43,50-53,57,60,62-65,68-71] followed by weight management in 17 SRs.[19,20,26,33,40,43,51,57-61,63,65-67,71] Two SRs focused only on micronutrient status[46] and polycystic ovary syndrome symptoms.[22] The most common comparators were any diet (n = 9),[20,31,37,43,60-62,64,66] higher CHO diet (n = 7),[22,23,63,65,68,69,71] and lower fat diet (n = 5).[19,26,33,52,70]

The CHO definitions in Supplemental Table 2 were compared with the following within each SR: 1) CHO diet terms, 2) CHO amount, if specified, and 3) sub-group analysis by CHO amount. Eleven SRs stratified results according to CHO amount, either corresponding to all[26,33,57,58,61,64] or some[37,50,53,63,68] of the CHO definitions. Table 4 illustrates the original CHO diet terms (n = 43) in the SRs and reclassification according to the CHO definitions (n = 43). After comparison, 70% of the original terms were reclassified as "combined" (n = 30). These classifications were either not defined (n = 6)[19,20,31,46,59,67] or were not stratified according to the CHO classification cutoffs, and thus encompassed more than one classification. For studies reporting CHO amount, the overlapping range was <20 g to as high as 198 g and <10% to as high as 52% TDEI.

One study[40] examined two CHO-restricted diet variants, one high in protein and the other high in fat. Ten SRs included primary research that included Atkins in their CHO-restricted diet analysis.[19,23,26,50,52,59,61,63,64,68] Two of these SRs[19,59] also included South Beach and Zone in their CHO-restricted diets analyses. Brand diets that were analyzed separately from other low CHO diets were categorized as A/S/Z.

Table 3. Comparator or control diets specified in systematic reviews according to dietary intervention category

		Dietary Interventions (Number)[a]											
	All (n = 92)	CHO[b] (n = 30)	RDP[c] (n = 19)	FAT[d] (n = 17)	Vegn[e] (n = 16)	GI/GL[f] (n = 13)	PRO[g] (n = 12)	IER[h] (n = 11)	MR[i] (n = 11)	Paleo (n = 8)	DASH[j] (n = 6)	A/S/Z[k] (n = 5)	OBD[l] (n = 4)
Comparator Diet[m]	**Total Number of SRs**												
Not specified[n]	24	4	5	4	3	2	3	2	7	1	3	1	1
Any diet[o]	23	9	10	4	6	6	3	3	2	5	3	2	1
LED[p]	13	4			1			5	1			2	2
No intervention[q]	10	3	3	3	3	2	2	2	2	2		2	2
Higher CHO[r]	9	7		2									
Lower fat[s]	7	5	2	1	1			1					
Higher fat[t]	5			5									
Lower PRO[u]	4						4						
Higher GI/GL[v]	3					3							
Non-vegetarian[w]	3				3								

[a]Of the 92 SRs, a total of 17 examined more than one of the 12 dietary approaches. The overlap among SRs for each category is as follows (overlap n/total n): CHO (9/30), FAT (8/17), RDP (11/19), Vegn (9/16), GI/GL (7/13), PRO (6/12), IER (4/11), MR (4/11), Paleo (6/8), DASH (4/6), A/S/Z (5/5), OBD (4/4).
[b]CHO = carbohydrate.
[c]RDP = regional dietary patterns (Mediterranean, Nordic, Tibetan).
[d]FAT = .
[e]Vegn = vegetarian (Also includes vegan, Ornish, portfolio, macrobiotic).
[f]GI/GL = glycemic index/glycemic load.
[g]PRO = protein.
[h]IER = intermittent energy restriction (fasting).
[i]MR = meal replacements.
[j]DASH = Dietary Approaches to Stop Hypertension.
[k]A/S/Z = Atkins/South Beach/Zone.
[l]OBD = Other brand or commercial diets (Weight Watchers, Nutrisystem, Biggest Loser Club, Jenny Craig, Volumetrics, Rosemary Conley, Slimming World, e-diets).
[m]*Comparator Diet:* Because some SRs specified more than one diet comparator or control, the total number of SRs for the comparator diets may be different from the dietary intervention numbers.
[n]*Not specified:* Dietary comparator was not specified in methods. Any diet comparators were accepted.
[o]*Any diet:* Comparator diets that were any diets that were not similar to the intervention diet or could be considered usual diet/care.
[p]*LED:* Comparator was a continuous (daily) energy restricted diet for weight loss.
[q]*No intervention:* Comparator was no or minimal intervention.
[r]*Higher CHO:* Comparator was also called regular or normal CHO diet and when specified, was at least >40% to 45% total daily energy intake (TDEI) for CHO.
[s]*Lower fat:* Comparator was a lower fat diet [≤30% TDEI for total fat] or lower monounsaturated or saturated fat diet when specified.
[t]*Higher fat:* Comparator was ≥30% TDEI of total fat when specified or higher levels of monounsaturated or polyunsaturated fatty acids.
[u]*Lower PRO:* Comparator was a lower protein diet, ≤20% TDEI for protein when specified or ≥5% difference in dietary protein intake from the intervention.
[v]*Higher GI/GL:* Comparator was a higher GI or GL diet or higher GI/GL in relation to intervention diets. Total GI/GL was not specified.
[w]*Non-vegetarian:* Comparator was any omnivorous diet.

Table 4. Classification of carbohydrate diet terms found in systematic reviews and reclassified according to scoping review definitions: Dietary approaches and health outcomes

	Carbohydrate diet interventions (# of diet terms)					
	Scoping review definitions[a]					
CHO[b] amount based on:	VLEKD[c]	VLCD[d,e] / VLCKD[e,f]	LCD[g]	MCD[h]	HCD[i]	
Percent TDEI[k]	*Varies*	*<10%[l]*	*>10 to <26%[l]*	*26 to <45%[l]*	*45 to <65%[l]*	Combined
Total g/day	*<50g*	*<20 to 50g[l]*	*>50 to <130g[l]*	*130 to <225g[l]*	*225 to <325g[l]*	classifications[j]
Classification of Diet Interventions						
Terms used in SRs[m] to describe CHO diet interventions (n=43)	1	7	23	10	2	N/A
Reclassified diet terms according to CHO diet definitions[a] (n=43)	1	4	1	7	0	30

Note: Some SRs (n=8 of 30 SRs) sought to evaluate more than one CHO diet. Thus, n=43 diet terms.

[a]See supplemental table 2 for more detailed CHO definitions used in this scoping review.

[b]CHO=carbohydrate.

[c]VLEKD=very-low energy ketogenic diet. Contains ≤800 kcals/d (typically 450-800 kcals).

[d]VLCD=very-low carbohydrate diet.

[e]VLCD and VLCKD are interchangeable.

[f]VLCKD=very-low carbohydrate ketogenic diet.

[g]LCD=low carbohydrate diet.

[h]MCD=moderate carbohydrate diet.

[i]HCD=high carbohydrate diet.

[j]SR overlapped (combined) one or more CHO classifications in analysis.

[k]TDEI=total daily energy intake.

[l]Based on a 2,000kcal reference diet.

[m]n=24 of 30 SRs defined their CHO diet interventions as follows (in order of most commonly used terms):

- *LCD:* 20–40g in 1st phase or <20%, 20–60g (n=1), <26% or <130g (n=7), <25% (n=3), <45% (n=3), ≤40% (n=3)
- *MCD:* ~40% (n=1), ≤45% (n=2), 25–45% or 130-225g (n=6), and >20g, but <50% (n=1)
- *VLCKD or VLCD:* ≤50g or 10% (n=3), 20–50g or 6–10% (n=1), and <20g (n=1)
- *HCD:* >225g or >45% (n=1) and 55% (n=1)
- *VLEKD:* <30-50g or 13-25% (n=1)

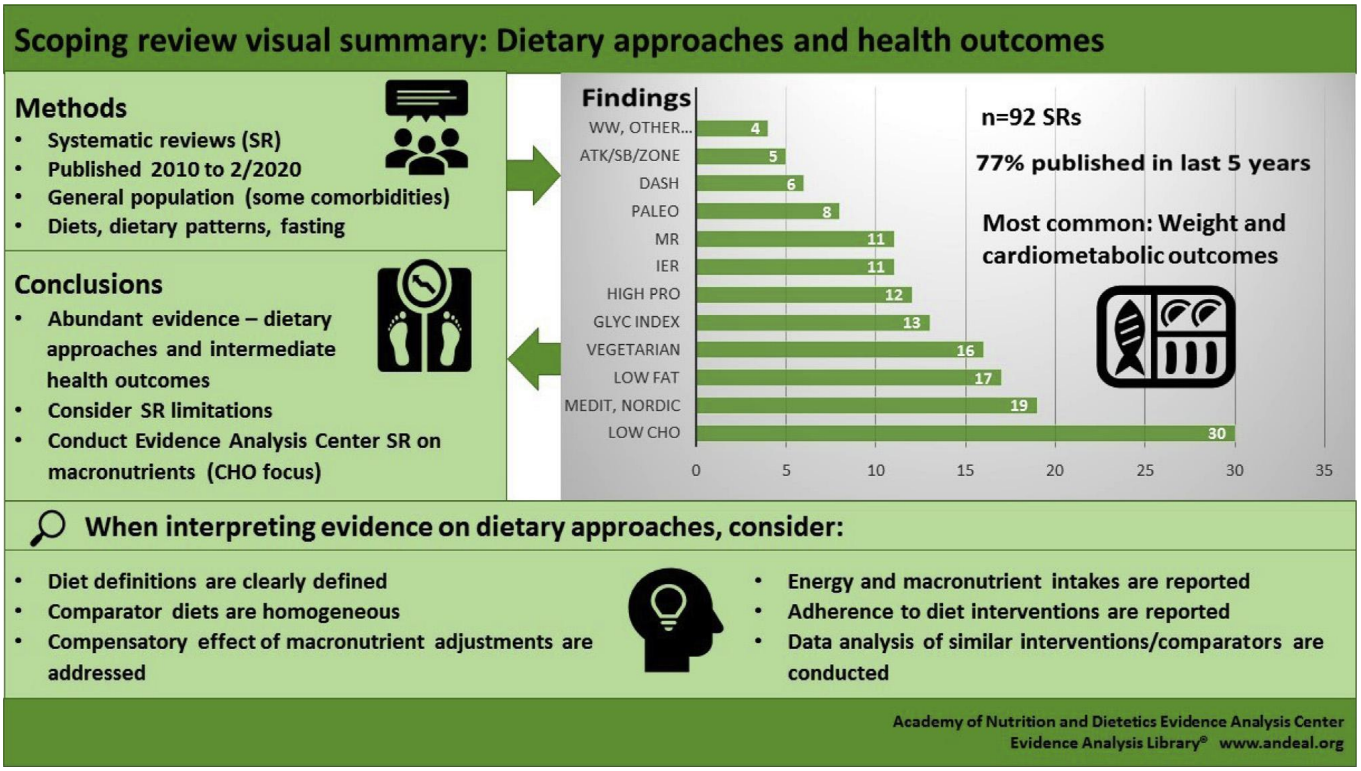

Figure 4. Scoping review visual summary: Dietary approaches and health outcomes. Note: ATK/SB/Zone = Atkins/South Beach/Zone; CHO = carbohydrate; DASH = Dietary Approaches to Stop Hypertension; Glyc Index = glycemic index/glycemic load; IER = intermittent energy restriction (fasting); Medit, Nordic = Mediterranean, Nordic and Tibetan dietary patterns; MR = meal replacements; Paleo = paleolithic; PRO = protein; Vegetarian (Also includes vegan, portfolio, Ornish, macrobiotic); WW, Other = Other brand or commercial diets (Weight Watchers, Nutrisystem, Biggest Loser Club, Jenny Craig, Volumetrics, Rosemary Conley, Slimming World, e-diets).

Regional Dietary Patterns

Nineteen SRs[20,21,31,32,34,36,37,43,50-53,55,72-77] examined one or more regional dietary patterns: Mediterranean (n = 18),[20,21,31,32,34,36,37,43,50-53,55,72-76] Nordic (n = 5),[20,21,31,37,77] and Tibetan (n = 1).[37] The most common outcomes of interest were glycemic control (n = 12), lipids (n = 11), blood pressure (n = 9), and body composition (n = 7). CMRD was the primary purpose in 15 SRs,[20,21,31,32,34,36,37,43,50-53,73-75] followed by weight loss in nine SRs.[20,34,43,51,55,72,74,75,77] One SR (5% of SRs) sought to aggregate all health outcomes as a primary purpose.[76] The most common comparator was any diet (n = 10),[20,31,34,37,43,55,72-75] and five SRs did not specify a comparator.[21,32,51,76,77]

Restricted or Modified Fat

Seventeen SRs[20,25,29,31,34,35,37,50,51,53,54,78-83] focused on modifications to the amount of fat. Thirteen SRs examined low fat (≤30% TDEI total fat) interventions,[20,25,29,31,34,35,37,50,51,53,54,80,83] and seven focused on high monounsaturated fat (n = 4)[29,78,79,81] and high polyunsaturated fat (n = 3)[29,78,82] diet interventions. Common outcomes of interest were lipids (n = 12), glycemic control and blood pressure (n = 9), and body composition and inflammatory markers (n = 5). The primary purpose of the SRs was CMRD (n = 16),[20,25,29,31,34,35,37,50,51,53,78-83] followed by weight management (n = 7).[20,34,35,51,54,78,81] The most common comparator diets were higher fat (n = 5)[25,35,80,82,83] and any diet (n = 4).[20,31,34,37]

Vegetarian Dietary Patterns

Sixteen SRs[20,21,37,43,45,48,50,52-55,84-88] examined one or more vegetarian dietary patterns: vegetarian (various) or vegan (n = 13),[20,21,37,43,45,50,52-54,84,86-88] portfolio (n = 3),[20,21,85] Ornish (n = 3),[45,48,55] and macrobiotic (n = 1).[52] The most common outcomes of interest were lipids (n = 9), glycemic control (n = 8), and blood pressure (n = 6). CMRD was the primary purpose in 10 SRs,[20,21,37,43,50,52,53,85,87,88] followed by weight management in seven SRs.[20,43,45,48,54,55,86] One SR was interested in physical and psychological well-being.[84] The most common comparator was any diet (n = 6).[20,37,43,48,55,85]

Low Glycemic Index/Load

Thirteen SRs[20,24,27,37,43,50,53-55,89-92] examined low glycemic index/low glycemic load (LGI/LGL). Most SRs (n = 10) were published between 2017 and 2020, and most did not define LGI/LGL. Common outcomes of interest were glycemic control (n = 7), lipids (n = 6), blood pressure (n = 5), and body composition (n = 4). CMRD was the primary purpose in all but two[54,55] SRs, followed by weight management.[20,43,54,55,90,91] Any diet (n = 6)[20,37,43,55,91,92] was the most common comparator.

High Protein

Twelve SRs[20,28,37,43,50,53,54,93-97] focused on high protein (≥20% TDEI)

diets. The most common outcomes of interest were glycemic control (n = 8), lipids (n = 7), and blood pressure (n = 6). CMRD was a primary purpose in most SRs (n = 10),[20,28,37,43,50,53,93,95-97] followed by weight management in seven SRs.[20,43,54,93,94,96,97] The most common comparator diets were lower protein (n = 4), [28,93,96,97] and any diet (n = 3).[20,37,43] Of the SRs reporting percent TDEI from protein, a brief review revealed a range of 16% to 50%. One SR[96] focused on the ratio of protein to CHO and fat, and another SR[97] focused on high or low protein variants of a low-fat diet. Two SRs[28,54] included Zone diet in their high protein diet analysis.

IER

Eleven SRs[20,34,52,98-105] evaluated various IER strategies, including alternate daily fasting, periodic fasting, and time-restricted feeding. All SRs were published between 2016 and 2020. Common outcomes of interest were lipids and blood pressure (n = 7) and glycemic control and body composition (n = 6). The primary purpose of all SRs was weight loss (n = 11), followed by CMRD in five SRs.[20,34,52,98,104] The most common comparator was a continuous low energy diet (n = 5).[98,99,101,102,105]

Meal Replacements

Eleven SRs[21,38,39,42,47,49,54,106-109] evaluated total or partial meal replacements (MRs). More than three quarters (n = 9) of the SRs were published between 2015 and 2019. Most of the MRs were in liquid form, and those using partial MRs allowed for supplementation with conventional foods. MR programs such as Jenny Craig and Nutrisystem can be found under *Other Brand or Commercial diets*. Common outcomes of interest were glycemic control (n = 4) and lipids, blood pressure, body composition, and attrition/dropouts (n = 3). Four SRs[38,39,42,109] examined use of MRs in very low energy diets (VLED), two[54,108] in low energy diets (LED), and four[47,49,106,107] in both VLEDs and LEDs. One SR did not report the calorie range.[21] Of the SRs reporting calories, the range was 300 to 800 kcals/d for VLED and 1,200 to 1,600 kcals/d for LED. Weight management was a primary purpose in nine SRs,[38,39,47,49,54,106-109] followed by CMRD (n = 3)[21,108,109] Seven SRs[21,38,42,49,54,106,107] did not specify a comparator diet.

Paleolithic (Paleo)

Eight SRs[20,30,37,46,50,53,55,110] focused on paleo (also known as hunter-gatherer) diets, seven of which were published between 2017 and 2019. Common outcomes of interest were glycemic control (n = 4) and lipids and blood pressure (n = 3). The primary purpose for six of the eight SRs was CMRD.[20,30,37,50,53,110] The aim of the other two SRs was weight loss[55] micronutrient status.[46] Any diet (n = 5)[20,30,37,55,110] was the most common comparator.

DASH

Six SRs[20,21,37,55,111,112] focused on DASH dietary pattern. All but two SRs[55,112] were published in 2019 or 2020. Common outcomes of interest were blood pressure (n = 5) and glycemic control and lipids (n = 3). The primary purpose for all but one SR[55] was CMRD. Three SRs[21,111,112] did not specify a comparator, and three specified any diet.[20,37,55]

A/S/Z

Five SRs evaluated at least one named (brand) diet (A/S/Z) that are considered macronutrient amount modification diets. All five SRs evaluated Atkins,[44,46-48,55] two evaluated South Beach,[44,48] and three evaluated Zone.[44,48,55] A common outcome of interest was adverse events (n = 3). The primary purpose of four[44,47,48,55] SRs was weight management, and one[46] was focused on micronutrient status. When specified, comparators included any diet[44,55] and other energy-restricted diets.[44,48]

Other Brand or Commercial Diets

Four SRs[44,47-49] evaluated at least one of eight different brand or commercial diets. All four SRs evaluated WW, and three evaluated Biggest Loser Club and Jenny Craig.[47-49] Two SRs evaluated Nutrisystem[47,48] and Rosemary Conley,[48,49] and one evaluated Volumetrics,[48] Slimming World,[49] and e-diets.[47] The primary purpose of all four SRs was weight management. Outcomes of interest, quality of evidence, and comparators are similar to the A/S/Z diets.

DISCUSSION

This scoping review identified SRs examining effect of dietary approaches or popular diets on weight management and other health outcomes published between 2010 and February 2020. A total of 92 studies examining 12 different diet categories, including macronutrient amount modification, IER/fasting, regional dietary patterns, and others, met our inclusion criteria. Over 70 SRs were published in the past 5 years of this review alone, with 2019 accounting for over one quarter (n = 26) of the included SRs. Since 2015, interest in IER, paleo, portfolio, and Nordic diets has grown.

Our initial aim was to examine dietary approaches that could be generalizable to the healthy adult population, rather than dietary management of disease, given the public's interest in diet and the sizeable weight loss industry. A challenge to selecting a generally healthy population is that over half of adults in the United States have at least one comorbidity.[113] In addition, the benefits and potential harms of various dietary approaches often extend beyond prevention or treatment of one particular disease. Thus, it was necessary to include common health conditions such as HTN, glycemic disorders, and nonalcoholic fatty liver disease.

Among the wide range of dietary approaches covered in the SRs, the most commonly researched approach was restricted CHO, regional dietary patterns (primarily Mediterranean), restricted or modified fat, and vegetarian and vegan diets. There were also a fair number of SRs focusing on high protein and LGI/LGL diets, as well as IER and MRs. Evidence meeting our inclusion criteria was nonexistent for more recent trendy diets, such as gluten-free, whole30, and "clean" eating.

The types of outcomes reported were generally consistent and similar across SRs. Besides weight status, most SRs focused on intermediate outcomes, namely, other body composition measures and cardiometabolic outcomes such as glycemic control, blood lipids, blood pressure, and inflammatory markers. Only a handful of SRs concentrated on "hard endpoints" such as incident events, development of disease, or mortality, likely because of

challenges in conducting long-term nutrition research using RCTs.[114]

Keeping the increasing trend of publications in mind, this scoping review focused on SRs rather than original research trials. SRs offer a quick resource for uncovering current evidence on a variety of dietary approaches. Rigorously conducted SRs attempt to collate all research on a specific topic and provide unbiased conclusions regarding the state of current evidence that stakeholders can use and apply in their own settings. Unfortunately, exclusion caused by lack of methodological rigor resulted in 46 fewer SRs to potentially provide useful data on this topic. Although not required, only 29 SRs assessed quality of evidence according to outcome.

This scoping review clearly indicates abundant evidence exploring the impact of dietary approaches on health outcomes. However, while analyzing this evidence, a few issues stood out:

a. Variation in Definition of the Diets

Inconsistencies in diet definitions included wide variations in CHO content and other macronutrient proportions. Variations in amounts or quality of macronutrients can vary among the same diet, and authors may classify the same diet in different diet categories (eg, Zone classified as CHO restricted and high protein). In addition, multiple diet characteristics may be included in one, such as the Ornish diet (ie, vegan, low fat, very high CHO). The heterogeneity of diet terms and definitions and potential for plural classifications made it challenging to cleanly categorize the diets. For the purpose of this scoping review, intervention diets were only included in one diet category.

b. Variation in the Comparator Diets

Similar heterogeneity was observed for the comparator diets. Almost half of the SRs did not specify diet controls or comparators of interest or accepted any diet comparators. The comparator or control may affect the overall pooled SR results,[114] but whether SRs stratified diet results based on groups of comparators is unknown.

c. Energy Restriction

Body weight is generally agreed to be related to overall energy intake and expenditure. Whether the source of the energy influences body weight is less clear.[41] Weight management (weight loss or weight maintenance) was a primary purpose in 53 SRs, but fewer than half of these specified an energy restriction requirement for the diet intervention. A glance at the SRs showed that energy intake (either as prescribed or as consumed) was inconsistently reported. Many papers included studies that did not appear to report energy intake, or some reported calorie deficit (eg, −500 or −700 kcals/d) without reporting energy needs.

d. Focus on Single Macronutrient Modification

Most SRs evaluating macronutrient diets focused on modification of a single macronutrient (eg, CHO restricted, high protein, low fat), and only a handful specified the proportion of the other two macronutrients. Assuming an isocaloric diet, changing the proportion (eg, %TDEI) of one macronutrient automatically changes the proportion of the other two.[113] Although the proportion can be altered for one macronutrient without changing the proportion of the other two, overall energy intake is affected.[113] This presents a challenge, because alterations made without controlling for energy confound the results.[113]

e. Did Not Stratify Data by Macronutrient %

Many SRs focusing on macronutrient amount modification did not conduct subgroup analysis by varying amounts of macronutrients of the diet. Although there is no formally accepted definition of CHO restricted or high protein diets, there can be wide variations in macronutrient amounts. A large number of studies did not stratify their results based on the amount of CHO and combined one or more CHO classifications in their comparisons. Thus, a very low CHO, ketogenic diet (<10% CHO) could have been grouped together with a 35% TDEI from CHO diet in analysis.

STRENGTHS AND LIMITATIONS

Strengths

This scoping review was conducted using rigorous scientific method[13-16] and included SRs and meta-analyses that used sound methodological principles. Content experts were consulted at all stages of this review to provide input to ensure data and reporting were accurate and relevant. An information specialist conducted a broad and in-depth literature search in six databases to ensure all types of diets or dietary patterns were captured.

Limitations

Some limitations also should be noted. Although the search plan was comprehensive, possibly it did not capture all studies that would meet the inclusion criteria. Second, only studies published in English were included. Third, although authors attempted to group dietary approaches in discrete categories, sorting was not always straightforward. Fourth, because diet is often considered part of a multicomponent or lifestyle intervention, some papers may have been missed in abstracts that did not indicate diet or nutrition. Finally, by not including primary research, likely some dietary approaches were missed because no SR was conducted to date.

CONCLUSION

Dietary approaches include diets and dietary patterns that incorporate modifications to one or more components of the diet. This scoping review of SRs provides researchers and RDN practitioners a comprehensive mapping of the evidence available on various dietary approaches and health outcomes in adults in the general population. Moreover, our team was able to delineate diet overlap and describe the heterogeneity among diets, and to identify areas warranting further research. A visual overview of the scoping review findings can be found in Figure 4. As a consequence, the Academy's Evidence Analysis Center prioritized the need to collate evidence related to macronutrient modification, specifically CHO restricted dietary approaches.

The comprehensive findings of this scoping review serve as a foundation

on which the Evidence Analysis Center will build future SRs on various dietary approaches to aid RDNs in communicating evidence-based nutrition science to their patients and clients, and to the public.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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AUTHOR CONTRIBUTIONS

All authors participated in development of the research question and eligibility criteria. D.H. and T.P. conducted the title/abstract and full-text reviews. Data were extracted by T.P. and cross checked by D.H. D.H. and T.P. wrote the first draft. All authors thoroughly reviewed and edited several iterations of the manuscript and all authors approved of the final manuscript.

Supplemental Table 1. Full search strategy for MEDLINE complete database via the EBSCO interface

Search Methods Statement

Search strategies were developed by an Information Specialist (M.F.) and comprise controlled vocabulary (Medical Subject Headings [MeSH], Emtree) and keywords. One methodological filter was used to restrict retrieval to systematic reviews/meta-analyses. Results were limited to publication years 2010−2020. The following databases were searched in March 2020: Ovid MEDLINE (1946-), Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily Update; MEDLINE (EBSCO); Ovid Embase (1988-); Cochrane Database of Systematic Reviews (EBSCO); Ovid PsycINFO <2002 to March Week 1 2020>; CINAHL (EBSCO).

The following is the search strategy for MEDLINE complete database via the EBSCO interface. Complete search strategies, as run for all other databases, are available from the author.

MEDLINE (EBSCO) Search Strategy

Search date: March 4, 2020

#	Query	Limiters/expanders	Results
1	(MH "Diet+") OR (MH "Diet Therapy+") or (MH "Nutrition Therapy") OR (MH "Dietetics")	Search modes—Boolean/Phrase	289,187
2	(MH "Feeding Behavior") OR (MH "Fasting") OR (MH "Food Preferences")	Search modes—Boolean/Phrase	124,314
3	(MH "Dietary Supplements+")	Search modes—Boolean/Phrase	73,334
4	(MH "Nutritional Sciences") OR (MH "Child Nutrition Sciences") OR (MH "Sports Nutritional Sciences")	Search modes—Boolean/Phrase	12,728
5	(MH "Nutritive Value+")	Search modes—Boolean/Phrase	16,269
6	(MH "Dietary Fats+") OR (MH "Dietary Carbohydrates+") OR (MH "Dietary Sucrose") OR (MH "Dietary Fiber") OR (MH "Sodium Chloride, Dietary")	Search modes—Boolean/Phrase	169,951
7	TI ((diet or diets or dietary or dieting or dietetic#)) OR AB ((diet* N2 (fat or fats or reducing or restricted or vegetarian# or vegan* or low-carb* or no-carb* or atkins or keto* or gluten-free or paleo* or mediterranean or macrobiotic# or reducing))) OR AB ((diet* N2 (low salt or no salt or low calor* or carbohydrate-restricted or sodium-restricted or high-protein or carbohydrate loading or fat-restricted or protein-restricted))) OR AB ((diet therapy or nutrition therapy or diet therapies or nutrition therapies)) OR AB ((dietary intake or weight loss diet#)) OR AB (((caloric or calorie*) N2 (restriction or restrictiv*))) OR AB (((diet* N2 (fad or popular)) or (diet* N2 intervention#))) OR AB (portion# N2 size#) OR AB (fasting)	Search modes—Boolean/Phrase	345,773
8	AB (food# N2 [Choice# or habit# or preference#])	Search modes—Boolean/Phrase	9,802
9	AB eating habit#	Search modes—Boolean/Phrase	5,770

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Supplemental Table 1. Full search strategy for MEDLINE complete database via the EBSCO interface (*continued*)

10	AB eating behavio#r#	Search modes—Boolean/Phrase	12,181
11	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 [Topic]	Search modes—Boolean/Phrase	721,947
12	SO (systematic review#) or SO (cochrane) OR TI ((systematic N2 review#) OR metaanalys* or meta-analys* or network-meta-analys* or network metaanlays*) OR AB ((systematic N2 review#) OR metaanalys* or meta-analys* or network-meta-analys* or network metaanlays*)	Search modes—Boolean/Phrase	272,248
13	TI (((overview# or umbrella or scoping) N2 (review#)) OR AB (((overview# or umbrella or scoping) N2 (review#))	Search modes—Boolean/Phrase	15,850
14	TI (((overview# or umbrella or scoping) N2 (review#)) OR AB (((overview# or umbrella or scoping) N2 (review#))	Search modes—Boolean/Phrase	15,850
15	TI ((systematic overview* or evidence-based review* or evidence-based overview* or (evidence adj3 (review* or overview*)) or meta-review* or meta-overview* or meta-synthes* or rapid review* or "review of reviews" or technology assessment* or HTA or HTAs)) OR AB ((systematic overview* or evidence-based review* or evidence-based overview* or (evidence adj3 (review* or overview*)) or meta-review* or meta-overview* or meta-synthes* or rapid review* or "review of reviews" or technology assessment*))	Search modes—Boolean/Phrase	24,033
16	(MH "Systematic Review")	Search modes—Boolean/Phrase	13,894
17	(MH "Meta Analysis") OR (MH "Meta Synthesis")	Search modes—Boolean/Phrase	63,932
18	S12 OR S13 OR S14 OR S15 OR S16 OR S17 [Filter]	Search modes—Boolean/Phrase	302,371
19	S11 AND S18 [English results]	Limiters - Date of Publication: 20100101-20201231; English Language; Human	8,561
20	S11 AND S18 [All results no language limit]	Limiters - Date of Publication: 20100101-20201231; Human	8,783
21	TI (cat or cats or dog or dogs or bovine or sheep or equine or horse or horses or rat or rats or mice or mouse or livestock)	Search modes—Boolean/Phrase	1,658,849
22	S19 NOT S21 [English results]	Search modes—Boolean/Phrase	8,551
23	S20 NOT (S22 OR S21) [Non-English results]	Search modes—Boolean/Phrase	222

Supplementary Table 2. Definitions of diets and dietary patterns for the scoping review: Dietary approaches and health outcomes.

Atkins: The Atkins diet was developed by a cardiologist, Dr. Robert Atkins, who published *Dr. Atkins' Diet Revolution* in 1972.[1] The original Atkins diet (now called Atkins 20), is a ketogenic diet designed for those who need to lose >40 pounds or are who have diabetes. In this diet, a total of 20 g net carbohydrates (CHO) (net CHO = total grams of CHO in a food minus grams of fiber and sugar alcohols) are allowed per day in the first (induction) of four phases. Net carbs are gradually added back in throughout the next two phases to increase nutrient-rich CHO and improve balance with acceptable foods (phase two: 25−50 g net CHO; 50−80 g net CHO) with a maximum of 100 g net carbs in the fourth phase for weight maintenance. There are two other starting plans offered by Atkins, including Atkins 40 (40 g net CHO adding CHO gradually to a maximum of 100 g net CHO) for those with <40 pounds to lose, those who are pregnant or breastfeeding, and Atkins 100, for those seeking weight maintenance.[1] During phase I, the percentage of macronutrients as a percentage of total daily calories is 30% CHO, 10% protein, 60% fat.[2] (Also see **Carbohydrate)**

Biggest Loser Club (BLC): An internet-based, self-directed commercial weight loss program[3] available in Australia, incorporating social cognitive theory, social support, and feedback.[4,5] BLC was based on "The Biggest Loser Australia" and featured individualized calorie and exercise recommendations.[4,5] The macronutrient distribution is said to be "balanced," with total daily energy intake of approximately 55%−60% CHO, 15% protein, and 21 to ≤30% fat.[6] The website for the online program in Australia (www.biggestloserclub.com.au) is inaccessible, as of the date of this scoping review publication.

Carbohydrate (CHO): The minimum amount of CHO in the diet recommended by the National Academy of Medicine (NAM) is 130 g/day CHO, which is the amount of glucose required for brain functions.[7] This amount is generally exceeded to achieve a healthy balance of the three macronutrients, CHO, protein, and fat, and meet energy needs. For a given (constant) calorie intake, a modification in the amount of one of the three macronutrients (ie, CHO, protein, or fat) necessarily changes the proportion of the other two macronutrients. Thus, CHO-restricted (CHO/R) diets may include higher amounts of protein or higher amounts of fat for a given energy intake.[8]

The NAM recommendations for acceptable macronutrient distribution range for healthy adults is 45% to <65% CHO.[7,9,10] This range of CHO is sometimes referred to as a high-CHO diet (HCD). As a percentage of total daily calories, diets with >65% CHO are considered very-high CHO diets (VHCD). Diets with <45% CHO are considered CHO/R,[9] and sometimes ar referred to as low-CHO diets (LCD). CHO/R diets can range from <45% to <10% CHO. Dietary intakes of <10% CHO and <50 g/day CHO are ketogenic,[9,10] regardless of total energy intake. (Also see **Atkins**)

There is no universally accepted definition of an LCD.[9,10] Proposed definitions for different classifications of CHO/R diets have been made by Kirkpatrick et al,[9] and adapted by the authors of this scoping review as follows:

Diet classifications based on % total daily energy intake (TDEI) and total grams CHO[a] per day

	CHO (% TDEI)	CHO (g/d)	PRO[b] (% TDEI)	PRO (g/d)	FAT (% TDEI)	FAT (g/d)
VHCD[d,e]	> 65%	>325 g	10% to 30%	—	5% to 25%	—
HCD[d,f]	45% to <65%	225 to <325 g	10% to 30%	—	25% to 35%	—
MCD[d,g]	26% to <45%	130 to <225 g	10% to 30%	—	25% to 35%	—
LCD[d,h]	>10% to <26%	>50 to <130 g	10% to 30%	—	25% to 45%	—
VLCD[d,i]	<10%[t]	<50 g	—		—	
VLCKD[d,j,k]	<10%[t]	<20 to 50 g	~10%	1.2 to 1.5 g/kg	70% to 80%	—
Classic KD[d,l]	3%	<50 g	7%		90%	

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Supplementary Table 2. Definitions of diets and dietary patterns for the scoping review: Dietary approaches and health outcomes. (*continued*)

VLED[m,n,o]	Varies	Varies (typically <20–80 g)[p]	—	Varies (typically 0.8 to 1.5 g/kg IBW[q])	—	Varies (typically 15 to 30 g)	
VLEKD[r,s]	Varies	<50 g					

[a]CHO = carbohydrate.
[b]PRO = protein.
[d]Based on 2,000 kcal reference diet.
[e]VHCD = very-high carbohydrate diet.
[f]HCD = high-carbohydrate diet.
[g]MCD = moderate-carbohydrate diet.
[h]LCD = low-carbohydrate diet.
[i]VLCD = very-low-carbohydrate diet.
[j]Also called very-low carbohydrate, high-fat ketogenic diet (VLCHFKD).
[k]VLCKD = very-low-carbohydrate ketogenic diet.
[l]KD = ketogenic diet.
[m]Also called very-low-calorie diet. Contains ≤800 kcal/d (typically 450–800 kcal).
[n]Protein-sparing modified fast (PSMF) is a type of VLED that contains <20 to 50 g CHO/d, 1.2–1.5 g/kg protein/d, and <10% to 15% TDEI fat.
[p]May be ketogenic if <50 g CHO only. >50 g CHO is not considered ketogenic.
[q]IBW = ideal body weight.
[r]Also called very-low-calorie, ketogenic diet. Contains ≤800 kcal/d (typically 450–800 kcals).
[s]VLEKD = very-low-energy ketogenic diet.
[t]Amount of CHO required to induce ketosis in most people.

Dietary Approaches to Stop Hypertension (DASH): In 1997, a multicenter, randomized feeding study (DASH) evaluated a dietary pattern to treat high blood pressure. The trial found that the combination of nutrients in food (rather than individual nutrients) had a positive effect on blood pressure.[11,12] The diet emphasizes fruits, vegetables, whole grains, nuts, seeds and legumes, low-fat/no-fat dairy products, and lean meats. The diet is high in potassium, magnesium, and calcium and low in fat, saturated fat, salt, and added sugar.[11,13,14]

E-diets: A self-directed, internet-based commercial weight loss program requiring a fee-based membership for various weight loss diets, exercise tracking, and unlimited social support.[3,15] The website for e-diets, http://ediets.com/, is inaccessible, as of the date of this scoping review publication.

Fat: According to the National Academy of Medicine (NAM), the acceptable macronutrient distribution ranges for fat as a percentage of total daily calories is 20%–35% fat. Various proportions for the quality (or type) of fat are also considered, such as proportion of unsaturated (monounsaturated, polyunsaturated) and saturated fat that constitute total fat intake. As a percentage of total daily calories, most low-fat diets are considered to be <30% of calories from fat.[16] This percentage is based on total fat from all sources. A very-low-fat diet is <10% fat. For a given (constant) calorie intake, a modification in the amount of one of the three macronutrients (ie, fat) necessarily changes the proportion of the other two macronutrients (carbohydrate or protein).[8]

Fasting: See **Intermittent Energy Restriction.**

Glycemic Index (GI)/Glycemic Load (GL): After consumption of carbohydrates (CHO), the body's blood glucose concentration increases. This glycemic response (GR) to CHO is dependent on the quality and amount of CHO, which affects the extent to which the blood glucose is raised and how long it remains elevated.[17] The GI is a system for ranking the quality of the CHO according to their expected GR in the body.[18] The GL considers both the quality (GI) and the amount of CHO in one number.[17] Many use the following categories to classify GI and GL as a means of comparing individual foods or whole diets: For GI, low (≤55), medium (56–69), and high (≥70), and for GL low (≤10), medium (11–19), and high (≥20).[19] The higher the GI or GL, the more quickly the CHO is digested, absorbed, and metabolized, thus producing a larger fluctuation in blood glucose and insulin levels.[17,20]

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Supplementary Table 2. Definitions of diets and dietary patterns for the scoping review: Dietary approaches and health outcomes. (*continued*)

Intermittent Energy Restriction (IER): Conventional weight loss dieting approaches are typically a form of continuous, daily energy restriction (CER) to achieve a negative energy balance.[8,21-23] An alternate dietary approach is to manipulate the timing of calorie (energy) consumption.[8] Fasting is a form of energy restriction or energy deprivation in which food and caloric beverage intake are stopped entirely or are severely reduced (maximum 25% of energy needs).[24,25] Although "fasting" may allow a minimal amount of calories (up to 25%), it is considered modified fasting.[25] There is no formally accepted definition of fasting,[26] and there are many strategies used in a fasting regimen, including energy restriction during certain periods of the day or a prolonged fasting interval between meals.[21]

Intermittent fasting (IF) is a dietary approach that includes regular periods of fasting or caloric restriction[24,27] alternated with normal food intake.[28] IF regimens vary in the length and frequency of feeding and fasting.[8,25] The most common types of IF are alternate daily fasting (ADF), periodic fasting, and time-restricted feeding (TRF) [also called time-restricted fasting].[8]

ADF: A fasting day, alternated with "feast" (ad libitum consumption) days.[8,27,29]

Periodic fasting: A certain number of consecutive or nonconsecutive fasting days or alternating fasting and feasting days. One example is the 5:2 diet or 5 and 2 regimen, which includes 2 fasting days (up to 25% of calorie requirements) and 5 days of ad libitum eating during the week. [8,29]

TRF: All ad libitum food consumption is restricted to a certain period of time each day or night (up to 21 hours).[27,30] Stopping eating after 6 PM and resuming at 10 AM the next morning is a form of TRF (16:8 fast). Religious or spiritual fasting, such as the Islamic practice of fasting between dusk and dawn during Ramadan, is also an example of TRF.[27,30]

Jenny Craig (JC): A commercial weight loss program that delivers prepackaged calorie-controlled meals and snacks (meal replacements). The program touts losing up to 17 pounds in the first 4 weeks. Four programs are offered: Classic, Rapid Results, Decoder (matches genetic markers), and JC Type II, for people with diabetes. The diet plan is individualized based on goals, body type, and food preferences, includes three meals plus two snacks, and is supplemented with self-purchased fruits and vegetables. The diet is considered balanced for macronutrients, vitamins, and minerals.[31] One-on-one coaching is encouraged[31] and emphasizes healthy eating, exercise, and behavior modification.[32]

Macrobiotic: The macrobiotic way of eating is based on the ancient Eastern philosophy of life.[33] The diet strives to balance the energy properties of foods (which can be yin or yang) with the seasons, the body's needs, and nature.[34] The diet is high in complex carbohydrates and fiber and low in fat. Natural and unprocessed food forms, especially locally grown and organic foods, are the foundation for food choices. The diet is 40%–60% cereals (brown rice, millet, oats, rye, wheat), 20%–30% vegetables, and 5%–10% beans, peas, lentils, and soy. In addition, sea plants, fruit, seeds and nuts,[34] and fermented foods and green tea[35] are part of the diet. Although the diet is plant-based, the macrobiotic model may also allow for small amounts of animal meat (poultry and fish), eggs, and dairy products, including butter.[34]

Meal replacement (MR): Contains a known calorie and macronutrient content and are used in place of one or more meals to reduce daily energy intake.[36] MRs may be in the form of a liquid meal or shake, meal bar, soup, or packaged meal or snack.

Partial meal replacement: *Typically uses MR products plus other conventional foods to compose a low-energy diet.*[37] *Examples of MRs include Jenny Craig, NutriSystem, and SlimFast.*

Total meal replacements (TMR): Replace the majority of meals and snacks with a very-low-energy (450–800 kcal/d) nutritionally complete formula. Some TMRs are designed to promote fat loss through ketosis and are formulated with high protein and very low carbohydrate (CHO) with <50 g CHO/d.[38] Examples of TMRs are Optifast and Medifast.[37]

Mediterranean: In the 1950s and 1960s, Ancel Keys linked food consumption and dietary patterns to lower rates of cardiovascular disease in people in the Mediterranean region.[39,40] Although there is no one dietary pattern representing all regions in the Mediterranean, there are food habits that are characteristic to the region.[23,39] Collectively, this pattern of eating is called a Mediterranean diet or dietary pattern or Mediterranean-style diet. The diet includes a high consumption of

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Supplementary Table 2. Definitions of diets and dietary patterns for the scoping review: Dietary approaches and health outcomes. (*continued*)

fruits and vegetables, cereals, whole grains, and legumes, use of olive oil and nuts as the main source of fat, moderate amounts of fish and other seafood, poultry, and dairy, a low consumption of red or processed meat, and a moderate consumption of red wine during meals.[16,23,39,41,42]

Nordic: Also called the Baltic Sea diet, it is primarily a plant-based dietary pattern consisting of foods typically available in Nordic countries (Northern Europe).[43-46] The diet is high in whole grains (eg, oats, barley, rye), fruits (berries, apples, pears), vegetables (roots, tubers, cabbage, mushrooms), seaweed, nuts, and legumes and vegetable fats.[43-46] Protein sources include eggs and low-fat dairy products, as well as shellfish, fatty fish (eg, salmon, herring), and game,[46] which are consumed in lesser amounts or as side dishes.[44] Compared with DASH and Mediterranean diets, the Nordic diet emphasizes locally and organically grown food or foods gathered in the wild. In addition, emphasis is on use of rapeseed oil as the vegetable fat, and abundant consumption of berries and root vegetables.[46]

Nutrisystem: A commercial weight loss diet that delivers prepackaged meals and snacks (meal replacements). The plan is touted to help individuals lose up to 13 pounds and 7 inches in the first month. The diet is higher in protein and is built around low glycemic index foods (See **Glycemic Index)** and is supplemented with self-purchased produce. The participant can opt for preselected choices or choose meals and snacks, based on preferences.[47]

Ornish: The diet was developed by Dr. Dean Ornish in 1977 to prevent and reverse heart disease.[8,48] This plant-based diet is very low in fat (<10% fat),[8,48] which comes from the fat that occurs naturally in fruits and vegetables, grains, beans and legumes, and soy products. Plant oils such as avocado, olives, and vegetable oil are not allowed. A very limited amount of nuts or seeds can be consumed, as long as the total fat goal is not exceeded. Because the diet is lacto-ovo vegetarian (see **Vegetarian**), egg whites and two servings of nonfat dairy products are included as an option. Sugars (maple syrup, agave, honey, nonfat desserts) are not encouraged, but limited to two servings per day. Plant foods in their natural form are encouraged. Estimates of macronutrient intake are 70%–75% carbohydrate and 15%–20% protein.[2,6]

Paleolithic: Also called "hunter-gatherer" or "stone age" diet,[49] the paleo diet mirrors consumption of foods available to our ancient human ancestors 2.6 million to 10,000 year ago. Although food availability and consumption patterns varied during this period,[50] the dietary approach emphasizes fruits, vegetables, root vegetables, nuts, meat, fish, and eggs [49,51] and avoids foods that were not available (ie, before industrial agriculture),[50] such as dairy products, processed grains and cereals, legumes, oils, salt, refined sugar, and alcohol.[49-51] It resembles a lower-carbohydrate (CHO) diet, but with much higher fiber intake (45–100 g/day).[49] The estimated macronutrient intakes (as a percentage of total daily calories) for a traditional paleo diet vary, with ranges of 22%–40% CHO,[8,49,52] 20%–35% protein, and 35% fat.[49] However, no recommendations for the proportion of macronutrients in the diet are made.[52]

Portfolio: First evaluated in 2003, the portfolio diet is a plant-based (vegan—See **Vegetarian**) dietary pattern consisting of foods recognized by the US Food and Drug Association as associated with lowering serum cholesterol.[53,54] Four core food components are emphasized in the dietary portfolio. These include nuts (tree nuts or peanuts), plant protein from soy products (tofu, soy milk) or other legumes (beans, peas, lentils), viscous soluble fiber (oats, barley, psyllium, eggplant, apples, berries), and plant sterols (plant-sterol enriched products).[14,55] Although the original diet was vegan, other modifications included adding lean meat and low-fat dairy or increasing intake of monounsaturated fatty acids have been studied.

Protein: According to the National Academy of Medicine (NAM), the acceptable macronutrient distribution range for protein is 10%–35%[7] of total daily calories, and the recommended dietary allowance for protein is 0.8 g/kg body weight for all adults.[7] Although there is no standard definition for what qualifies as a high-protein diet (HPD), most researchers consider an HPD as one that contains a minimum of 20% protein as a percentage of total daily energy from animal or plant sources.[8,16] For a given (constant) calorie intake, a modification in the amount of protein necessarily changes the proportion of the other two macronutrients (carbohydrate and fat).[8]

Rosemary Conley: A commercial weight loss diet and exercise program based in the United Kingdom that is touted to help people lose 14 pounds in 7 weeks through a balanced approach. The diet is focused on calories, lower glycemic index foods (See **Glycemic Index),** and as a percentage of total daily calories, reducing fat to ≤5% fat per day, with the exception of oily fish, oats, and lean meat. "Portion pots" are used to measure amounts of food to encourage portion control. The online weight loss club features a number of resources and tools to support and motivate clients, including exercise videos, recipes, cooking classes and medical, psychological, and nutritional advice.[56]

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Supplementary Table 2. Definitions of diets and dietary patterns for the scoping review: Dietary approaches and health outcomes. (*continued*)

Slimming World: A UK-based weight loss plan that encourages intake of filling foods that are low in calories and fat. These "free foods" such as fruits, vegetables, pasta, rice, eggs, lean meats, and fish can be eaten ad libitum. Healthy extras, such as dairy foods and whole grain breads, are consumed, but in lesser amounts. No foods are off limits. Even higher-calorie "treats," known as "syns" (short for synergy) may be consumed in small quantities. The plan, which encourages exercise, is designed to promote weight loss of 1−2 pounds per week. Weekly group meetings or an online program is available for support.[56]

South Beach Diet: Developed by Dr. Arthur Agaston, a cardiologist from Miami, Florida, who published his first diet book in 2003. In the first of three phases, the diet is very-low-carbohydrate (ketogenic) for 14 days. (See **Carbohydrate.**) Phase 2 allows an increase in low glycemic index foods (See **Glycemic Index)**, then finally, allows all foods in phase III with normal-sized portions. "Good carbs," lean proteins, and healthy (unsaturated) fats are encouraged.[57,58] During Phase 1, macronutrients as a percentage of total daily calories are estimated to be 20% carbohydrate, 30% protein, and 50% fat.[2]

Tibetan: Developed by researchers in Germany based on Traditional Tibetan Medicine (TBM), while incorporating foods available in the West.[59] The diet aims to provide balance (increased warmth) for individuals with a "cold" constitution by providing behavioral recommendations and foods classified as "hot" by TBM. The diet is lower in carbohydrate and higher in protein content. It differs from current Western diet recommendations in that it encourages intake of red meat (eg, beef, chicken, roast hare, mutton)[60] and purine-rich meats, such as venison.[59] The diet is also made up of cereals (eg, barley, rice, wheat), vegetables (eg, onion, radish, soybeans, carrot), and fruit (eg, pomegranate, banana, mango).[60]

Vegetarian: In contrast to an omnivorous diet, which contain all food groups,[61] vegetarian diets generally exclude flesh foods (eg, meat, poultry, fish), but vary in the extent to which all foods of animal origin are excluded.[62] A vegetarian diet primarily consists of vegetables, fruits, whole grains, legumes, nuts, and seeds, but may or may not include dairy and eggs.[62] Vegetarian diets vary based on food choices and preferences, as well as motivations for following this dietary pattern.[62] In addition, there are variations in terms of degree to which limiting flesh foods is implemented. Common variations include *lacto-ovovegetarian* (includes dairy and eggs), *lactovegetarian* (includes dairy, no eggs), and *ovovegetarian* (includes eggs, no diary).[14,62] A *vegan* diet omits all flesh foods, as well as eggs and dairy and any products made with animal products[14,61,62] (ie, gelatin, mayonnaise, butter).

Volumetrics: Focuses on the volume of food eaten to promote satiety and promotes a balanced diet. The premise is that foods high in water or fiber content are low in energy density and therefore, calories. Foods are divided into four categories, encouraging primary consumption of categories 1 and 2 and limiting portion sizes of categories 3 and 4, which are high in fat and refined carbohydrates. The categories are 1) Very-low density: Nonstarchy fruits and vegetables, nonfat milk and yogurt, and broth-based soup. 2) Low-density: Grains, cereal, legumes, lean meats, and starchy fruits and vegetables. 3) Medium-density: Most cuts of meat, cheese, French fries, bread, ice cream, and cake. 4) High-density: Butter, nuts, oil, crackers, chips, cookies, and candy.[63,64]

WW: The WW program (formerly Weight Watchers) is a lifestyle-based commercial weight loss program aimed at moderate weight loss of 0.5−1 kg/week.[23,65] Participants receive a point value target, and each food is assigned points in their "SmartPoints" system, based on macronutrient and calorie content.[66,67] As a percentage of total daily calories, the macronutrient content is generally a higher-carbohydrate (45%−65%), lower-fat (<35%) diet.[6,23] All foods are allowed, but the plan encourages healthier selections, along with positive behavioral change.[67] Local group support as well as web-based coaching is available to participants.[23,67]

Zone: A diet developed over 30 years ago by Dr. Barry Sears to reduce diet-induced inflammation and lose weight.[68] Purported benefits of the diet include losing body fat quickly, maintaining wellness, performing better, and thinking faster.[68] The Zone is the body's physiological state, made up of three clinical markers (triglyceride/high-density lipoproteins, arachidonic acid/eicosapentaenoic acid, and hemoglobin A1c). The goal is to optimize these clinical markers with diet and supplements. The proportion of macronutrients in the diet, as a percentage of total daily calories, is 40% carbohydrate, 30% protein, and 30% fat,[6,66] with a high amount of vegetable intake, and preference for low glycemic index foods (See **Glycemic Index)** and monounsaturated fat.[58]

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