

A Scoping Review of Current Guidelines on Dietary Fat and Fat Quality

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Keywords

Scoping review · Dietary fat · Dietary guidelines · Fat quality · Recommendations

Abstract

Introduction: We conducted a scoping review of dietary guidelines with the intent of developing a position paper by the “IUNS Task force on Dietary Fat Quality” tasked to summarize the available evidence and provide the basis for dietary recommendations. **Methods:** We systematically searched several databases and Web sites for relevant documents published between 2015 and 2019. **Results:** Twenty documents were included. Quantitative range intake recommendations for daily total fat intake included boundaries from 20 to 35% of total energy intake (TEI), for monounsaturated fat (MUFA) 10–25%, for polyunsaturated fat (PUFA) 6–11%, for saturated-fat (SFA) ≤ 11 – ≤ 7 %, for industrial trans-fat (TFA) ≤ 2 – 0 %, and < 300 – < 200 mg/d for dietary cholesterol. The methodological approaches to grade the strength of recommendations were heterogeneous, and varied highly between the included guidelines. Only the World Health

Organization applied the GRADE approach and graded the following recommendation as “strong”: to reduce SFA to below 10%, and TFA to below 1% and replace both with PUFA if SFA intake is greater than 10% of TEI. **Conclusion:** Although the methodological approaches of the dietary guidelines were heterogeneous, most of them recommend total fat intakes of 30– ≤ 35 % of TEI, replacement of SFA with PUFA and MUFA, and avoidance of industrial TFA.

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Introduction

In the past decades, dietary guidance mainly focused on reducing the intake of total fat, saturated fat (SFA), and dietary cholesterol. This guidance was mostly driven by the “diet-heart hypothesis” postulated by Ancel Keys nearly 70 years ago [1]. This hypothesis was based on the observation that a high fat diet increases serum cholesterol and that elevated serum cholesterol levels in turn are associated with coronary heart disease (CHD) [1, 2]. More recently this emphasis shifted from limiting total

dietary fat intake to the replacement of SFA with unsaturated fats and the avoidance of industrial trans-fats (TFA) [3]. For example, in 1980, the Dietary Guidelines for Americans (DGA) recommended limiting dietary fat to <30% of total energy intake (TEI) [4]. The 2000 DGA modified the 1995 guideline from “Choose a Diet Low in Fat, Saturated Fat and Cholesterol” to “Choose a diet that is low in saturated fat and cholesterol and moderate in total fat” to shift the emphasis from total fat to type of fat [5]. This recommendation was revised in 2005, including a range from 20 to 35% of TEI [6]. In the DGA 2015–2020, the recommendation to limit intake of calories from SFA to <10% per day was based on evidence that replacing SFA with unsaturated fats is associated with decreased risk of cardiovascular disease (CVD), with no recommendation for TEI [3]. Furthermore, in the 2015–2020 edition of the DGA, an earlier recommendation to limit the consumption of dietary cholesterol to 300 mg/d was withdrawn due to, on the basis of contemporary intake levels, it was no longer a nutrient of public health concern [3]. However, the DGA have also been criticized for failing to take into account all available relevant scientific evidence (by omitting e.g., available evidence on SFA) [7].

Worldwide, noncommunicable diseases such as CVD, cancer, and type 2 diabetes (T2D) account for over 70% of total deaths [8]. Diet itself has long been recognized to be a key determinant of health, and according to the Global Burden of Disease study, a suboptimal diet is the leading risk factor for ~50% of disabilities from CVDs [9]. Evidence based dietary recommendations are of major importance for the prevention of chronic diseases, however, the role of dietary fat is being discussed controversially.

The scope of this review is to identify, describe, and summarize comprehensively all governmental dietary guidelines, and dietary guidelines by health related organizations and associations on fat intake and fat quality. Our scoping review on dietary guidelines will serve as a basis for a position paper by the “International Union of Nutritional Sciences Task force on Dietary Fat Quality” that was tasked to summarize the available evidence and provide dietary recommendations.

Methods

We conducted this scoping review according to the methodology of the Joanna Briggs Institute’s Reviewers’ Manual [10]. For reporting, we followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for scoping reviews, the Preferred Reporting Items for Systematic reviews and Meta-Analyses-ScR Statement [11].

Search Strategy

The databases Medline (via Ovid), the Cochrane Library, and Epistemonikos were searched for relevant articles published from January 1, 2015 to December 31, 2019 (search conducted: February 19, 2020), with no restriction by language. Furthermore, an extensive search through the Google™ search engine was performed. In addition, the Guidelines International Network, the Training Research Into practice, and Guideline Central databases were also screened for relevant guidelines. Guidelines and recommendations by the Food and Agriculture Organization of the United Nations, the World Health Organization (WHO), World Cancer Research Fund International, the Center for Disease Control, and the American Heart Association were searched as well. The Medline (Ovid), Cochrane Library, and Epistemonikos search strategy is presented in the see online suppl. Appendix 1; for all online suppl. material, see www.karger.com/doi/10.1159/000515671.

Selection of Documents

Inclusion Criteria

Documents fulfilling the following criteria were included in the scoping review: (i) Governmental dietary guidelines, and guidelines by health related organizations and associations on fat intake and fat quality. (ii) Guidelines on adult (≥ 18 years of age) human beings published in the last 5 years (January 01, 2015–December 31, 2019). (iii) Guidelines focusing on interventions of or exposure to dietary fat (total fat) and/or fat quality (SFA, monounsaturated fat (MUFA), polyunsaturated fat (PUFA), TFA, omega-6 (linoleic acid [LA]), omega-3 fatty acids (FA), including, eicosapentaenoic acid, docosahexaenoic acid, α -linolenic acid (ALA); and dietary cholesterol). (iv) Guidelines addressing prevention of chronic disease outcomes, such as CVD, including CHD and stroke; cancer; T2D; hypertension; obesity; or guidelines for the general population to give recommendations for adequate nutrient supply, and (v) guidelines with at least 1 quantitative recommendation for any of the followings: total fat, MUFA, PUFA, SFA, TFA, omega-3, or omega-6 FA.

Exclusion Criteria

Guidelines that met any of the following criteria were excluded: (i) Inclusion of solely critically ill and hospitalized patients; or patients undergoing bariatric surgery; or patients with eating disorders. (ii) Inclusion of solely infants, children and adolescents; pregnant and lactating women; and elderly. (iii) Guidelines based on dietary supplements only; and (iv) documents (including food-based dietary guidelines) that had no quantitative recommendations for any of the followings: total fat, MUFA, PUFA, SFA, TFA, omega-3, or omega-6 FA.

Selection Process of Sources of Evidence

First, title and abstract screening was performed by 1 reviewer (J.Z.). Only clearly irrelevant references were excluded at this stage. Second, for all potentially relevant references full-text publications were obtained and checked for final inclusion by 2 reviewers (J.Z., L.S.) independently. Uncertainties were resolved through discussion with a third author (J.J.M.).

Data Extraction

For included documents, 2 reviewers (J.Z. and J.B.) extracted the guideline characteristics, and another reviewer cross-checked all data (J.Z., J.B., and L.S.). The following data were extracted:

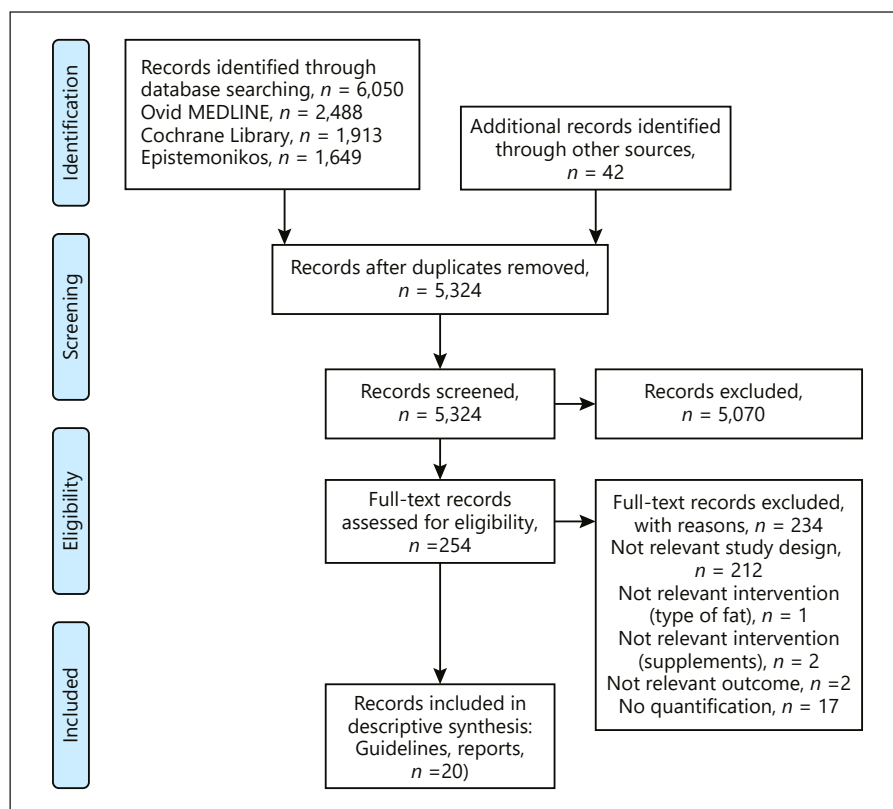


Fig. 1. Flow diagram showing study selection process.

guideline organization, year of publication, country, aim of guideline, target population, type of studies included, guideline methodology (systematic search for relevant studies, multidisciplinary panel, reporting conflict of interest of panel members), recommendations for dietary fat intake (e.g., total fat, SFA, and MUFA), type of grading/strength of recommendation. We also extracted nonquantitative recommendations, such as “replace SFA with PUFA and MUFA,” if a guideline reported at least 1 quantitative recommendation for another type of fat; however, only quantitative recommendations are represented graphically.

Results

Of 5,324 records identified by the literature searches, 254 records were assessed as full texts (Fig. 1 and online suppl. Appendix 2). Finally, 20 guidelines on dietary fat and fat quality published in the last 5 years were included in the scoping review [3, 12–30] (Table 1).

The included guidelines were published by governmental bodies or subordinated departments ($n = 12$), or international/national professional societies or organizations ($n = 8$). These include national dietary guidelines and clinical practice guidelines, often with a focus on the general population and primary prevention, but also a

few focusing on the management of metabolic disorders. The types of studies included in the corresponding guidelines varied, from systematic reviews (SRs) of randomized controlled trials (RCTs) and/or observational studies (including prospective cohort, case-control, cross-sectional), to individual RCTs and observational studies, as well as monographs, case reports/studies, qualitative research, guidelines from other countries, reports from other organizations, modeling studies, and mechanistic studies.

Three guidelines were published in the USA [3, 13, 22], followed by 3 from the UK [20, 21, 29]. Three guidelines were issued by international professional societies/organizations [19, 26, 27], 2 in Spain [14, 23], and 1 guideline each in Germany [15], Ecuador [25], Canada [30], Colombia [18], Italy [28], Argentina [16], New Zealand [17], Kenya [24], and Japan [12]. Eleven of 20 guidelines (55%) conducted a systematic search for relevant studies [3, 12, 14–16, 18, 21, 23, 25, 26, 29], 15 of 20 (75%) consisted of a multidisciplinary panel [3, 12–14, 16–19, 21, 23, 25–29], and 7 of 20 (35%) reported statements regarding conflict of interest of panel members [13, 14, 16, 19, 22, 23, 27]. Table 1 shows the general and Table 2 the specific characteristics of the included guidelines sepa-

Table 1. General characteristics of the included documents in our scoping review separated by general population and by populations with dyslipidemia or other chronic diseases

Guideline organizations (author [Ref])	Country (language)	Aim of guideline	Target population	Types of studies included	Systematic search for relevant studies	Multi-disciplinary panel	Conflict of interest of panel members reported
General population							
Dietary reference intakes for Japanese (Ministry of Health, Labour and Welfare [12])	Japan (Japanese) *English version not available as of October 2020	To maintain and promote their health: Prevention of onset and progression of life-style related diseases	General population	RCTs, prospective cohort studies, MAs, descriptive studies for dietary intake, others	Yes	Yes	Unclear
European Society of Cardiology and European association for cardiovascular prevention & Rehabilitation (Piepoli et al. [19])	Mix (English)	To support health-care professionals communicating with individuals about their cardiovascular risk and the benefits of a healthy lifestyle and early modification of their cardiovascular risk	Primary and secondary prevention	Not specified	No	Yes	Yes
German nutrition Society (Wolfram et al. [15])	Germany (English)	To provide professionals, intermediaries, and the media with the latest science-based findings regarding the primary prevention of nutrition-related diseases through an appropriate intake of dietary fats	Primary prevention	MAs, SRs, RCTs, monographs, cohort studies	Yes	No	Unclear
Government of the Republic of Ecuador [25]	Ecuador (Spanish)	To serve as a reference for adequate food consumption of the different population groups, as well as to guide public policies linked to food and nutritional security of the country	General population	MAs, SRs, RCTs, cohort studies, case-control studies, case reports, qualitative research	Yes	Yes	Unclear
Health Canada [30]	Canada (English)	To promote healthy eating and overall nutritional well-being, and support improvements to the Canadian food environment	General population	SRs, nutrition-related inquiries, reports, dietary guidelines from other countries	No	No	Unclear
Instituto Colombiano de Bienestar Familiar [18]	Colombia (Spanish)	To contribute to the promotion of healthy lifestyles, to control deficiencies or excesses in the consumption of food and to reduce the risk of diet-related illnesses	General population	SRs, MAs, RCTs, observational studies, case series or case studies	Yes	Yes	Unclear
Ministry of Agriculture, food and Forestry, Italy [28]	Italy (Italian)	To give recommendations based on food and diet to meet the reference intake levels of nutrients and energy, by indicating how to make food choices, depending on local habits	General population	MAs, RCTs, epidemiological studies, reports from other organizations (EFSA, FAO, etc.)	No	Yes	Unclear

Table 1 (continued)

Guideline organizations (author [Ref])	Country (language)	Aim of guideline	Target population	Types of studies included	Systematic search for relevant studies	Multi-disciplinary panel	Conflict of interest of panel members reported
Ministry of Health, Argentina [16]	Argentina (Spanish)	To promote knowledge about healthier food and nutrition for the population and therefore contribute to healthier behaviors	General population	"Food guidelines" in English, Spanish, Italian, and Portuguese and documents containing this topics were searched Cross-sectional studies, cohort studies, SRs of cohort studies	Yes	Yes	Yes
Ministry of health New Zealand [17]	New Zealand (English)	To bring together the updated eating and physical activity statements for New Zealand adults	General population	Guidelines, reports, series of SRs	No	Yes	Unclear
Ministry of health Republic of Kenya [24]	Kenya (English)	To promote health and well-being through consumption of healthy diets and promotion of physical activity	General population	Based on WHO guidelines and global recommendations	No	No	Unclear
Scientific advisory committee on nutrition [29]	UK (English)	To consider the relationship between saturated fats, health outcomes, and risk factors for NCDs in the general UK population	General population	SRs, MAs, pooled analyses of RCTs, and prospective cohort studies	Yes	Yes	Unclear
Spanish Federation of food, Nutrition and Dietetics (Ros et al. [14])	Spain (Spanish)	To review scientific evidence on the effects of dietary fat quantity and quality on cardiovascular risk and to make recommendations for the Spanish adult population	General population	RCTs, prospective cohort studies, SRs, MAs	Yes	Yes	Yes
Spanish Menopause Society (Sanchez-Borrego et al. [23])	Spain (English)	To establish a set of recommendations for the use of long chain omega 3-PUFA in postmenopausal women based on the best available evidence	Postmenopausal women	MAs, RCTs, pooled analyses, SRs, observational studies	Yes	Yes	Yes
U.S. Department of health and human Services and U.S. Department of Agriculture [3]	USA (English)	To make recommendations about the components of a healthy and nutritionally adequate diet to help promote health and prevent chronic disease for current and future generations	General population	SRs, review of SRs, MAs, reports by federal agencies or leading scientific organizations, data analyses, food pattern modeling analyses	Yes	Yes	Unclear
UK government (Public Health England [20])	UK (English)	To provide a concise summary of the government's recommendations for energy and nutrients for males and females aged <18 years and ≥19 years	General population	Based on recommendations from the committee on Medical Aspects of food Policy and the scientific advisory committee on nutrition	No	No	Unclear

Table 1 (continued)

Guideline organizations (author [Ref])	Country (language)	Aim of guideline	Target population	Types of studies included	Systematic search for relevant studies	Multi-disciplinary panel	Conflict of interest of panel members reported
WHO (draft guideline) [26]	Mix (English)	To provide recommendations on the intake of SFA and TFA to reduce the risk of NCDs in adults and children, particularly CVDs which are a leading cause of NCD mortality (draft guideline)	General population	MAs, RCTs, SRs (prospective), cohort studies	Yes	Yes	tbc before finalization
Populations with dyslipidemia or other chronic diseases							
American association of clinical Endocrinologists and American College of Endocrinology (Jellinger et al. [22])	USA (English)	To provide guidance on screening, risk assessment, and treatment recommendations for a range of individuals with various lipid disorders	Individuals with various lipid disorders	Based on diligent reviews of the clinical evidence with transparent incorporation of subjective factors	Unclear	Unclear	Yes
European Society of Cardiology and European Atherosclerosis Society (Mach et al. [27])	Mix (English)	To guide action in clinical practice to prevent atherosclerotic cardiovascular disease by modifying plasma lipid levels	Management of dyslipidemia	Not specified	No	Yes	Yes
National lipid association (Jacobsen et al. [13])	USA (English)	To develop a consensus set of recommendations for the patient-centered management of dyslipidemia	Management of dyslipidemia	RCTs, MAs of results from RCTs, and review of results from observational, genetic, metabolic, and mechanistic studies	Unclear	Yes	Yes
NICE [21]	UK (English)	To help healthcare professionals identify people who are at risk of cardiovascular problems including people with type 1 or T2D, or chronic kidney disease. This clinical guideline describes the lifestyle changes people can make and how statins can be used to reduce their risk	People who are at risk of CVD or who have had CVD	Guidelines, evidence reviews including SRs, MAs, RCTs, observational studies	Yes	Yes	Unclear

CVD, cardiovascular disease; EFSA, European Food Safety Authority; FAO, Food and Agriculture Organization; MA, meta-analysis; NCD, noncommunicable disease; NRS, nonrandomized study; RCT, randomized controlled trial; SR, systematic review; tbc, to be confirmed; PUFA, polyunsaturated fat; SFA, saturated fat; TFA, trans-fatty acid; NICE, National Institute for Health and Care Excellence; T2D, type 2 diabetes; WHO, World Health Organization.

Table 2. Recommendation characteristics of the included documents in our scoping review separated by general population and by populations with dyslipidemia or other chronic diseases

Reference	Categorization of fat	Recommendation	Description of recommendation (certainty of evidence) categorization	Strength of recommendation grade (certainty of evidence)	
General population Dietary Reference Intakes for Japanese (Ministry of Health, Labor and Welfare) [12]	Total fat	DG (tentative dietary goal for preventing life-style related diseases): 20–30% energy for 1+ years	Own system (for DG) D1 (MAs of RCTs or prospective cohort studies, and RCTs or prospective cohort studies)	D3	
	SFA	DG (tentative dietary goal for preventing life-style related diseases): ≤7% energy for 18+ years	D2 (RCTs or prospective cohort studies) D3 (descriptive studies for dietary intake in Japanese) D4 (other dietary guidelines) D5 (others)	D1 *Although the report specified D1, DG was based-on age-specific median value in Japanese.	
European Society of Cardiology and European Association for Cardiovascular Prevention & Rehabilitation (Piepoli et al. [19])	SFA	<10% of energy/d	Own system	Class IIa	
	TFA	<1% of energy/d	Class I: Recommendation is useful (is recommended) Class II: Conflicting evidence and/or a divergence of opinion Class IIa: Weight of evidence/opinion is in favor (should be considered) Class IIb: Usefulness/efficacy is less well-established (maybe be considered) Class III: Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful (is not recommended)	Class I	
German Nutrition Society (Wolfram et al. [15])	Total fat	30–35% of energy/d (according to D-A-CH reference values (Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung, Schweizerische Gesellschaft für Ernährungsforschung, Schweizerische Vereinigung für Ernährung (Hrsg.): Referenzwerte für die Nährstoffzufuhr. Bonn, 2. Auflage, 5. aktualisierte Ausgabe (2019))	Scheme of the WHO (strength of the evidence)	NA	
		Substitute with PUFA	Convincing		
		<1% of energy/d	Probable		
		7–10% of energy/d,	Possible		
		7–10% of energy/d	Insufficient		
	SFA				
Government of the Republic of Ecuador [25]	Total fat	20–30% of energy/d	None	NA	
		6–10% of energy/d			
		<10% of energy/d			
		<1% of energy/d			

Table 2 (continued)

Reference	Categorization of fat	Recommendation	Description of recommendation (certainty of evidence) categorization	Strength of recommendation grade (certainty of evidence)
Health Canada [30]	SFA	<10% of energy/d	No specific grading: only included studies provide an evidence grade	NA
	TFA	<1% of energy/d		
	Total fat	30% of energy/d		
	MUFA	10% of energy/d		
	PUFA	10% of energy/d		
Ministry of Agriculture, Food and Forestry, Italy [28]	SFA	<10% of energy/d	None	NA
	Total fat	≤35% of energy/d		
	MUFA	10–15% of energy/d (by difference)		
	PUFA	5–10% of energy/d (~22 g, based on a 2000 kcal/d diet)		
	SFA	≤10% of energy/d (10–22 g, based on a 2000 kcal/d diet)		
Ministry of Health, Argentina [16]	Dietary cholesterol	<300 mg/d	None	NA
	Total fat	30% of energy/d		
	SFA	<10% of energy/d		
	TFA	<1% of energy/d		
	MUFA	By difference		
	PUFA	6–11% of energy/d		
	Dietary cholesterol	<300 mg/d		
	Omega-3	0.5–2%		
	Omega-6	2.5–9%		
	SFA + TFA	≤10% of energy/d (together)		
Ministry of Health, New Zealand [17]	SFA + TFA	≤10% of energy/d (together)	None	NA
Ministry of Health, Republic of Kenya [24]	Total fat	<30% of energy/d	NA	NA
	TFA	Avoid processed foods containing TFA		

Table 2 (continued)

Reference	Categorization of fat	Recommendation	Description of recommendation (certainty of evidence) categorization	Strength of recommendation grade (certainty of evidence)
Scientific Advisory Committee on Nutrition [29]	Total fat	≤35% of energy/d	Own grading Adequate Moderate Limited Insufficient No evidence	Adequate or moderate quality of evidence
	SFA	≤10% of energy/d		
	TFA	≤2% of energy/d		
	Long-chain Omega-3	0.2–0.45 g/day		
	Omega-6	No further increase in the average intakes		
	LA	≥1% of energy/d		
	ALA	≥0.2% of energy/d		
Spanish Federation of Food, Nutrition and Dietetics (Ros et al. [14])	SFA	Reduce intake of SFA in general	Own grading GRADE A	GRADE B
	TFA	<1% of energy	GRADE B	GRADE B
	MUFA	20–25% of energy/d (45–55 g/d)	GRADE C	NA
	Long-chain omega-3	(Oily) fish or seafood at least 3 times/week	GRADE D	GRADE C
	Omega-6	Up to 5–10% of daily energy (10–20 g/d)		NA
	Long-chain omega-3	250 mg/d	Own grading based on GRADE	Grade 1B
Spanish Menopause Society (Sanchez-Borrego et al. [23])	SFA	<10% of energy/d (While keeping total fat intake within AMDR [20–35% of energy/d])	Recommendations based on SRs where the evidence was graded.	Strong: Relationship between intake of SFA and risk of CVD Limited: Replacing SFA with MUFA confers overall CVD
	TFA	Intake as low as possible		
	Dietary cholesterol	As low as possible (IOM DRI recommendations)		
	Long-chain omega-3	250 mg/d		
U.S. Department of Health and Human Services and U.S. Department of Agriculture [3]	Total fat	35% of energy/d	None	NA
	MUFA	13% of energy/d		
	PUFA	6.5% of energy/d		
	SFA	11% of energy/d		
	Dietary cholesterol	As low as possible (IOM DRI recommendations)		
UK Government (Public Health England) [20]	Total fat	35% of energy/d	None	NA
	MUFA	13% of energy/d		
	PUFA	6.5% of energy/d		
	SFA	11% of energy/d		

Table 2 (continued)

Reference	Categorization of fat	Recommendation	Description of recommendation (certainty of evidence) categorization	Strength of recommendation grade (certainty of evidence)
WHO (Draft guideline) [26]	SFA	<10% of energy/d, replace by PUFA	GRADE approach Strong: Guideline panel is confident that the desirable effects of an intervention outweigh its undesirable effects. Conditional: The desirable effects probably outweigh the undesirable effects.	Strong In adults and children whose SFA intake is greater than 10% of energy/d. Conditional In adults and children, reducing the intake of SFA to less than 10% of energy/d. Conditional Using PUFA as a source of replacement energy, if needed, when reducing SFA intake. Conditional In adults and children whose SFA intake is less than 10% of energy/d, suggests no increase in SFA intake.
	TFA	<1% of energy/d, replace by PUFA		Strong In adults and children whose TFA intake is greater than 1% of energy/d, recommends reducing TFA intake. Conditional In adults and children, suggests reducing the intake of TFA to less than 1% of energy/d. Conditional Suggests using PUFA as a replacement for TFA. Conditional In adults and children, whose TFA intake is less than 1% of energy/d, suggests no increase in TFA intake.
American Association of Clinical Endocrinologists and American College of Endocrinology (Jellinger et al. [22])	Total fat MUFA + PUFA SFA TFA Dietary cholesterol	25–35% of energy/d ^a 10–20% of energy/d ^a <7% of energy/d ^a <1% of energy/d ^a <200 mg/d ^a	Own system 1 = strong evidence (MAs of RCTs, RCTs) 2 = intermediate evidence (MAs of NRS, NRS, prospective cohort studies) 3 = weak evidence (Surveillance studies, cross-sectional studies, consecutive case series, single case reports) 4 = no evidence (Theory, opinion, consensus, review, or preclinical study)	Level 4

Table 2 (continued)

Reference	Categorization of fat	Recommendation	Description of recommendation (certainty of evidence) categorization	Strength of recommendation grade (certainty of evidence)
European Society of Cardiology and European Atherosclerosis Society (Mach et al. [27])	SFA	<10% of energy/d (<7% of energy in the presence of hypercholesterolemia)	Own system	Class IIa
	TFA	Avoid	Class I: Recommendation is useful (is recommended)	Class I
	Dietary cholesterol	<300 mg/d	Class II: Conflicting evidence and/or a divergence of opinion	Class IIa
			Class IIIa: Weight of evidence/opinion is in favor (should be considered) Class IIIb: Usefulness/efficacy is less well established (maybe be considered) Class III: Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful (is not recommended)	
National Lipid Association (Jacobsen et al. [13])	SFA	<7% of energy/d	GRADE (adaptation by the National Heart, Lung, and Blood Institute's Evidence-Based Methodology Panel 2013)	GRADE A
	TFA	Minimal intake		GRADE A
	Dietary cholesterol	<200 mg/d	GRADE A: Strong recommendation GRADE B: Moderate recommendation	GRADE B
	ALA	0.6–1.2% of energy/d	GRADE C: Weak recommendation GRADE D: Recommended against GRADE E: Expert opinion GRADE N: No recommendation for or against	GRADE A
NICE [21]	Total fat	≤30% of energy/d	Own grading	NA
	SFA	≤7% of energy/d	Interventions that must (or must not) be used Interventions that should (or should not) be used – a “strong” recommendation	
	Dietary cholesterol	<300 mg/d	Interventions that could be used	

ALA, α-linolenic acid; AMDR, acceptable macronutrient distribution range; CVD, cardiovascular disease; LA, linoleic acid; MA, meta-analysis; MUFA, monounsaturated fatty acid; NA, not available; NRS, nonrandomized study; PUFA, polyunsaturated fatty acid; RCT, randomized controlled trial; SFA, saturated fatty acid; TFA, trans-fatty acid; GRADE, Grading of Recommendations Assessment, Development and Evaluation; NICE, National Institute for Health and Care Excellence; SR, systematic review; WHO, World Health Organization. ^a According to National Cholesterol Education Program Expert Panel on Detection E, Treatment of High Blood Cholesterol in A. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation*. 2002;106(25):3143–421.

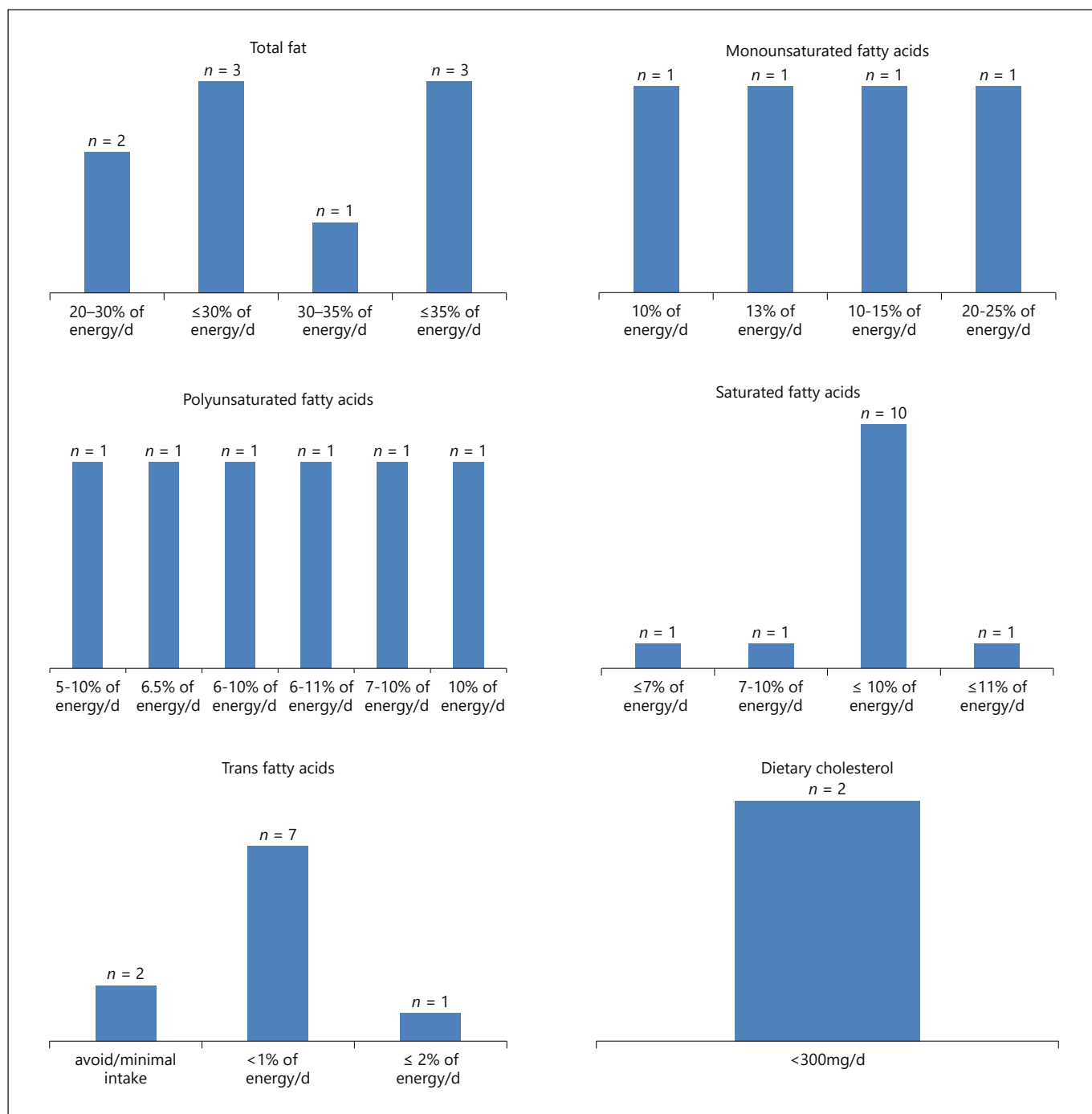


Fig. 2. Distributions of quantitative recommendations for total dietary fat intake and different types of fat of the included guidelines for the general population. SFA, saturated fatty acid; TFA, trans-fatty acid; PUFA, polyunsaturated fatty acid; MUFA, monounsaturated fatty acid.

rated by general population and by populations with dyslipidemia or other chronic diseases. Quantitative recommendation of total fat, MUFA, PUFA, SFA, TFA, and

dietary cholesterol intake are shown in Figure 2 for the general population and in Figure 3 for patients with dyslipidemia.

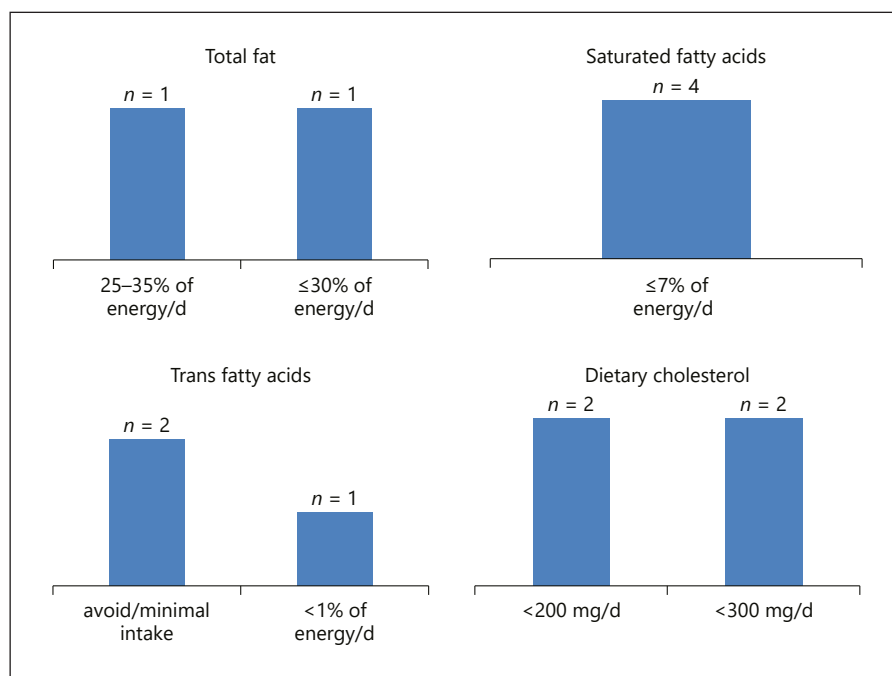


Fig. 3. Distributions of quantitative recommendations for total dietary fat intake and different types of fat of the included guidelines for the populations with dyslipidemia or other chronic diseases. SFA, saturated fatty acid; TFA, trans-fatty acid.

Recommendations for Total Fat Intake

Overall, 11 guidelines specified a quantitative recommendation for total fat intake, which ranged between 20 and 35% of TEI [12, 15, 16, 18, 20–22, 24, 25, 28, 29]. Four of those gave a recommendation for total fat intake of 30–≤35% of TEI [3, 15, 28, 29]. In the presence of dyslipidemia, 1 organization recommended 25–35% of TEI [22], whereas another organization recommended <30% of TEI [21]. Three organizations graded the strength of recommendation (used interchangeably with the term “certainty of evidence” by several) specified a quantitative recommendation for total fat intake, which ranged between 20 and 35% of TEI [12, 15, 16, 18, 20–22, 24, 25, 28, 29]. Four of those gave a recommendation for total fat intake of 30–≤35% of TEI organizations) which varied between “no evidence (level 4)” and “adequate/moderate” [12, 22, 29].

Recommendations for MUFA Intake

Overall, 4 guideline organizations specified a quantitative recommendation for MUFA intake, which ranged between 10 and 25% of TEI, with no strength of recommendation judgments available [14, 18, 20, 28]. One guideline organization combined the recommendation for PUFA and MUFA intake (10–20% of TEI) and judged the strength of recommendation as “no evidence (level 4)” [22].

Recommendations for Polyunsaturated Fat Intake

Overall, 6 guideline organizations specified a quantitative recommendation for PUFA intake, which ranged between 5 and 11% of TEI, with no strength of recommendation judgments available [15, 16, 18, 20, 25, 28].

Recommendations for Saturated Fat Intake

Overall, 16 guideline organizations specified a quantitative range for SFA intake of ≤7 to ≤11% of TEI (overall 17 quantitative recommendations) [3, 12, 13, 15, 16, 18–22, 25–30]. One guideline organization combined the recommendation for SFA and TFA intake (≤10% of TEI) [17]. In the presence of dyslipidemia, 4 organizations recommended ≤7% of TEI [13, 21, 22, 27], and 1 organization recommended ≤7% of TEI for the general population [12]. Ten organizations recommended ≤10% of TEI for the general population [3, 12, 16, 18, 19, 25, 26, 28–30]. Three organizations specified that SFA should be replaced with MUFA and PUFA [14, 15, 26]. The strength of recommendation was graded by 8 organizations [6, 12, 13, 19, 22, 26, 27, 29]. Limiting SFA intake was judged as “no evidence (level 4),” “moderate (Class IIa),” or “strong (e.g., GRADE A),” whereas the recommendation “strong” was most frequently used. The strength of recommendation for replacing SFA with PUFA was judged as strong by the WHO (draft guideline) if the SFA intake is greater than 10% of TEI [26].

Recommendations for Trans-Fat Intake

Overall, 13 guideline organizations specified a recommendation for industrial TFA intake, which ranged between complete avoidance to $\leq 2\%$ of TEI [3, 13–16, 19, 22, 24–27, 29, 30]. In the presence of dyslipidemia, 3 organizations recommended complete avoidance or $\leq 1\%$ of TEI [13, 22, 27]. The strength of recommendation was judged as “no evidence (level 4),” “moderate,” or “strong” (e.g., GRADE A, Class I), whereas the recommendation “strong” was most frequently used.

Recommendations for Omega-6 FA Intake

Overall, 2 guideline organizations specified a quantitative recommendation for omega-6 FA intake in the range of 2.5–10% of TEI, with no strength of recommendation judgment available [14, 16]. One guideline organization specified a quantitative recommendation for LA intake of $\geq 1\%$ of TEI. The certainty of evidence was judged as “adequate or moderate” [29].

Recommendations for Omega-3 FA Intake

Two guideline organizations specified a quantitative recommendation for long-chain omega-3 FA intake, which ranged between 200 and 450 mg/d, with a strength of recommendation judgment of “GRADE C” or “1B” [23, 29]. One guideline organization specified a quantitative recommendation for omega-3 FA intake of 0.5–2% of TEI [16]. Two guideline organizations specified a quantitative recommendation for ALA intake, ranging between 0.2 and 1.2% of TEI (GRADE A or “moderate” certainty of evidence) [13, 29].

Recommendations for Dietary Cholesterol Intake

Overall, 6 guideline organizations specified a quantitative threshold for dietary cholesterol intake, which ranged between < 200 and < 300 mg/d [13, 16, 21, 22, 27, 28]. Quantitative dietary cholesterol intake recommendations were given mainly for patient-centered management of dyslipidemia or other metabolic disorders ($n = 4$; 67%), 2 recommending < 200 mg/d [13, 22] and 2 < 300 mg/d [21, 27]. The strength of recommendation was judged as “no evidence (level 4),” or “moderate” (e.g., GRADE B, Class IIa). In the 2015–2020 edition of the DGA, the recommendation to limit the consumption of dietary cholesterol to 300 mg/d was withdrawn, on the basis of contemporary intake levels, it was no longer a nutrient of public health concern [3].

Discussion

Summary of Findings

This scoping review is the first to explore the available guidelines on quantity and quality of dietary fat intake and to summarize their recommendations. Overall, 20 dietary guidelines fulfilling our criteria published between 2015 and 2020 were identified. The guidelines identified in our scoping review often recommend total fat intake for the general population of 30 to $\leq 35\%$ of TEI. The DGA scientific advisory committee neither listed total fat as a nutrient of concern, nor proposed any limitation to its consumption, and stated that reducing total fat or replacing it with carbohydrates has no effect on lowering CVD risk [31]. Their recommendation to limit intake of SFA to $< 10\%$ of TEI is consistent with other guidelines to keep total fat intake within the acceptable macronutrient distribution range (AMDR) of 20–35% of TEI [3]. Only a few organizations give quantitative recommendations for MUFA or PUFA intake, which ranged between 10 and 25% of TEI for MUFA and between 5 and 11% of TEI for PUFA. The highest recommendation for MUFA intake is given by the Spanish Federation of Food, Nutrition and Dietetics with 20–25% of TEI, which is driven by their recommendation to consume mainly olive oil [14]. Most guideline organizations specify a quantitative range for SFA intake, between ≤ 7 and $\leq 11\%$ of TEI, and further recommend replacement of SFA with MUFA and/or PUFA. For patients with metabolic disorders, a lower SFA intake threshold is recommended ($\leq 7\%$ of TEI). Most organizations recommend complete avoidance of industrial TFA or limit intake to $\leq 2\%$ of TEI. Dietary cholesterol intake recommendations are now more often left out, but lower intakes (< 300 mg/d) are still recommended for patients with metabolic disorders. A few organizations make recommendations for omega-6, and long-chain omega-3 FA.

Guideline Methodology and Strength of Recommendations

Identified guidelines included national dietary guidelines, clinical practice guideline, often with a focus on the general population and primary prevention of CVD, but also a few with a focus on management of metabolic disorders. Only about 50% of the guidelines conducted a systematic search for relevant studies and 35% reported statements regarding conflict of interest of panel members.

The methodological approaches of the included guidelines varied strongly. Several organizations, such as the

European Society of Cardiology, used their own system to grade the strength of recommendations, also referred to as “certainty of evidence,” and several organizations omitted the strength of recommendations. Only the WHO draft guidelines applied the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach and graded the following recommendation as “strong”: To reduce SFA to below 10%, and TFA to below 1% and replace both with PUFA if SFA intake is greater than 10% of TEI. Similarly, the DGA 2015–2010 suggests reducing SFA intake to <10% of TEI and to avoid TFA, based on strong evidence.

Moreover, the GRADE terms “certainty of evidence” and “strength of recommendation” were used interchangeably by most organizations. As suggested by the GRADE approach, distinguishing between “certainty of the evidence rating” and “grading strength of recommendation and decision” will bring clarity to the nutritional field [32–35].

Comparison with Findings from Systematic Reviews

A meta-analysis examined the evidence base of dietary fat guidelines introduced in 1977 and 1983, recommending $\leq 30\%$ total fat of TEI. Findings from RCTs published prior to the introduction of these guidelines, showed no effect in all-cause mortality or CHD mortality when comparing different dietary fat interventions [36]. Moreover, epidemiological studies to date observed no association between CHD mortality and total fat intake and thus fail to support the dietary fat guidelines lowering total fat intake to $\leq 30\%$ of TEI [37]. A Cochrane Review of RCTs, in which participants were randomized to a lower fat (LF) versus usual or moderate fat intake with no intention to reduce weight, showed a weight reduction effect in the LF intake group [38]. In SRs of RCTs, meta-analyses found that LF diet (<30% dietary fat of TEI; and higher in carbohydrates) improves LDL-cholesterol and total cholesterol compared to lower carbohydrate/higher fat (presumably higher in SFA) diets, whereas a lower carbohydrate/higher fat diet performed better for HDL-cholesterol and TG [38–43]. In this regard in a SR of RCTs was shown that isocaloric replacement (by 1% of TEI) of carbohydrates by SFA raises TC, LDL-C, HDL-C and reduces TG, whereas replacement of carbohydrates by MUFA and PUFA reduces TC, LDC, and TG and increases HDL-C [44].

A meta-analysis comparing the top versus bottom third of MUFA intake category found no association with all-cause mortality and CVD [45]. However, the largely different associations of MUFA from plant origin and

MUFA from animal origin with CHD risk indicate that plant-based foods are the preferable sources of MUFAs for CHD prevention [46].

A meta-analysis of 8 RCTs provided evidence that consuming PUFA instead of SFA lowers the risk of CHD [47]. Moreover, isocaloric substitution (by 1% of TEI) of SFA by MUFA and PUFA was effective to reduce LDL-cholesterol [44]. The pooling project included eleven American and European cohort studies and showed that a 5% lower energy intake from SFAs and a concomitant higher energy intake from PUFAs was inversely associated with risk of CHD [48]. On the contrary, a meta-regression of RCTs showed that higher intakes of PUFA in replacement of SFA was not associated with risk reduction in the secondary prevention of CHD [49]. Moreover, a meta-analysis of 12 prospective cohort studies found that higher SFA intakes were not associated with all-cause mortality, CVD, CHD, ischemic stroke, or T2D [50]. Total TFA intake was associated with increased risk of all-cause mortality, and CHD. However, the intake of ruminant TFA was not related to all-cause mortality and CHD, but inversely associated with risk of T2D [50]. Results from the above mentioned meta-analyses and other SRs [51] indicate that the identified guidelines were not always in line with current evidence, for which reason it may be assumed that quantitative thresholds for dietary fat intake are often subjective, and a continued limited on these fats is not always justified [52]. Dietary guidelines inform consumers on adequate nutrition (i.e., energy density) and health promotion and aim to reduce the burden of noncommunicable diseases in a population by modifying dietary intake. They also guide optimal nutrient and energy supply (i.e., fat-soluble vitamins) in the context of dietary and cultural differences between countries [53, 54].

Strengths and Limitations

This scoping review has several strengths. First, the inclusion criteria and the search strategy were broad, including an extensive search of gray literature, such as databases of the FAO, the WHO, the World Cancer Research Fund International, the CDC, and the American Heart Association. Second, we investigated a variety of dietary fats, including total fat, MUFA, PUFA, SFA, TFA, omega-3, and omega-6 FA. Third, we described the different methodological approaches (i.e., systematic search for relevant studies, multidisciplinary panel, reporting conflict of interest of panel members, description of recommendation categorization) used by the dietary guidelines. Fourth, we summarized the strength of recommen-

dations grade/certainty of evidence rating for dietary fat and fat quality for each included guideline.

Limitations need to be considered as well. First, guidelines were only included if at least 1 quantitative recommendation was provided for either total fat, MUFA, PUFA, SFA, TFA, omega-3 or omega-6 FA. Second, guidelines focusing on chronic diseases such as dementia, chronic kidney disease, and respiratory diseases amongst others were not considered. Third, we did not cover the full spectrum of possible dietary fat intake since we excluded food based dietary guidelines without at least 1 quantitative recommendation for any of the followings: total fat, MUFA, PUFA, SFA, TFA, omega-3, or omega-6 FA. Focusing on foods rather than nutrients has been suggested recently also by Astrup and colleagues [55]. SRs of prospective cohort studies has shown mainly no detrimental association between SFA-rich foods such as dairy or chocolate and risk of chronic diseases [56–62]. To improve the trustworthiness of such food-disease associations, the use of novel statistical methods (e.g., substitution analyses or network meta-analyses) is highly recommended [63, 64].

Conclusion

Although the methodological approaches of the dietary guidelines were heterogeneous, most of them recommend total fat intake of 30 to $\leq 35\%$ of TEI, replacement of SFA with PUFA and MUFA, and avoidance of industrial TFA. To improve the trustworthiness of future guidelines on dietary fat intake and fat quality,

transparent approaches to evaluate the certainty of the evidence supporting their recommendations are necessary.

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Conflict of Interest Statement

L.S.: is a member of the GRADE working group; J.Z.: no conflict of interest; J.B.: no conflict of interest; S.S.W.: no conflict of interest; B.N.: is a member of the GRADE working group; H.H.: no conflict of interest; B.K.: no conflict of interest; J.J.M.: is a member of the WHO Nutrition Guidance Expert Advisory Group; Director, Freiburg GRADE Center.

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Author Contributions

L.S., J.Z., J.B., S.S.W., B.N., H.H., B.K., and J.J.M. designed the research. L.S., J.Z., and J.B. analyzed the data and wrote the first draft of the paper. L.S., J.Z., J.B., S.S.W., B.N., H.H., B.K., and J.J.M. interpreted the data, read the manuscript, and approved the final version. L.S. and J.J.M. are guarantors.

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