Environmental sustainability in national food-based dietary guidelines: a global review

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Food-based dietary guidelines (FBDGs) provide country-specific guidance on what constitutes a healthy diet. With increasing evidence for the synergy between human and planetary health, FBDGs have started to consider the environmental sustainability of food choices. However, the number of countries that discuss environmental sustainability in their guidelines is unknown. The purpose of this Review was to identify countries with government-endorsed FBDGs that made explicit mention of environmental sustainability and to examine the breadth and depth of the inclusion of sustainability in FBDGs. The Food and Agriculture Organization of the UN identified 95 countries with FBDGs. We assessed 83 countries against our inclusion criteria, of which 37 mentioned environmental sustainability. Relevant content was assessed against a set of criteria based on the Food and Agriculture Organization's guiding principles for sustainable healthy diets. The depth to which environmental sustainability was discussed varied and it was often restricted to general explanations of what a sustainable diet is. Few FBDGs addressed why sustainability is important, how dietary changes can be made, or provided quantified advice for implementing sustainable diets.

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Introduction

Globally, food systems contribute significantly to environmental degradation, negatively affecting the health of the planet.[1,2] Fod systems are responsible for substantial freshwater use and greenhouse gas emissions.[3,4] Crop use risks exceeding its global biophysical limit for planet stability[5,6] affecting the rate of global species extinction.[5] The environmental footprint of global food systems is likely to intensify as population growth and other trends continue to increase, with potentially irreversible consequences. Hence, there is a need for a radical transformation of our dominant food systems globally.[7]

Food systems, environmental health, and the health of human populations are deeply interconnected. Among other factors, supply dynamics and policies within food systems, such as agricultural subsidies, influence the price and availability of different foods, which in turn influences food choice and consumption. An important step towards more sustainable food systems is the provision of country-specific nutrition policies that take a more holistic approach and integrate broader issues into nutritional guidance and policies, and specifically into national food-based dietary guideline (FBDG) documentation, to promote the purchase and consumption of more sustainable healthy foods.[8]

Many countries have developed FBDGs specific for their needs, including cultural considerations and dietary preferences. These government-endorsed documents are designed to influence consumer behaviour and population diets by communicating simple context-specific and population-specific messages about what constitutes a healthy diet nationally. FBDGs are often used to inform local or national policies beyond health, such as the provision of food within education systems or public procurement. In addition to ensuring that the nutritional needs of the population are met and that diets contribute to reducing disease risk, WHO states that FBDGs should also be evaluated for the environmental costs of their implementation.[9] The emerging interconnections between human and planetary health supportthe importance of assessing the links between diet and planetary health, with increasing recognition that FBDGs should be broadened to also include environmental sustainability concerns.[10–12] However, evidence suggests that FBDGs remain predominantly health-focused and often neglect environmental aspects of diet. A 2016 review by Gonzalez Fischer and Garnett[13] found that only four of the 83 countries with FBDGs included sustainability in their guidelines: Brazil, Sweden, Qatar, and Germany. Due to the momentum to broaden the scope of FBDGs to

Key messages

- Food-based dietary guidelines (FBDGs) are increasingly including content to address the relationship between dietary intake and environmental sustainability. At present, this information is more likely to be reported in background documents than consumer documents, restricting its visibility to users of the consumer documentation.
- The principles most commonly addressed in FBDGs are associated with culture, inclusion of animal-based and plant-based foods in the diet, environmental effect, biodiversity, and food waste. However, information is general, and practical, specific advice, or quantified recommendations for action are scarce.
- To achieve the transformation to food systems needed to curb the accelerating environmental decline globally, more countries need to commit to developing FBDGs that explicitly emphasise the crucial link between diet and planetary health and provide specific and practical advice to address these issues.

	Includes environmental sustainability messaging (n=37)	Does not include environmental sustainability messaging (n=46)
World Bank region		
East Asia and Pacific	3 (33%)	6 (67%)
Europe and central Asia	17 (61%)	11 (39%)
Latin America and the Caribbean	11 (39%)	17 (61%)
Middle East and north Africa	2 (33%)	4 (67%)
North America	1 (50%)	1 (50%)
South Asia	0	3 (100%)
Sub-Saharan Africa	3 (43%)	4 (57%)
World Bank income status		
Low	1 (100%)	0
Lower-middle	2 (20%)	8 (80%)
Upper-middle	12 (39%)	19 (61%)
High	22 (54%)	19 (46%)
All countries	37 (45%)	46 (55%)

Data are n (%). Countries with recognised food-based dietary guidelines by region and income, and totals with and without inclusion of environmental sustainability messaging.

Table 1: **Countries with recognised food-based dietary guidelines that do and do not include environmental sustainability messaging**

include environmental sustainability and because FBDGs are designed to be reviewed and updated periodically, it might be expected that this low base has substantially increased. However, a 2021 review by Martini and colleagues[14] found that FBDGs around the world have low compliance with the guiding principles for sustainable healthy diets as outlined by the Food and Agriculture Organization of the UN (FAO) and WHO.[11] They also found that very few FBDGs included practical or specific guidance on how diets could be modified to reduce environmental impacts.[14] Even if populations improved their diets to fully align with FBDGs, a modelling study by Springmann and colleagues[8] concluded that this would only reduce greenhouse gas emissions on average by 13%, implying national guidelines could do more to promote sustainability.

See Online for appendix

With endorsement from the FAO, it has been suggested that, as countries develop or revise their FBDGs, sustainability needs to be incorporated in an effective way (eg, highlighting the links between food, health, and sustainability—including the benefits of such change) that is also accessible, appealing, country specific, and provides clear guidance on sustainable dietary patterns and how to make changes.[13]

The purpose of our Review was to identify countries around the world with government-endorsed FBDGs that make explicit mention of environmental sustainability and to examine the breadth and depth of the inclusion of sustainability in their documentation. Our Review also assessed the coverage of environmental sustainability in FBDG documentation compared with international recommendations for a healthy and sustainable diet, as described in the guiding principles for sustainable healthy diets by the FAO and WHO.[11] Martini and colleagues[14] have examined the general alignment of FBDGs with these guiding principles without an explicit link to environmental sustainability. Our Review provides a more up-to-date and comprehensive overview of the current status of the inclusion of environmental sustainability into FBDGs globally, and identifies opportunities to improve the quality of inclusion of environmental sustainability into newly developed FBDGs.

Methods

A narrative review method was used to address the predefined research question. A review protocol was not registered. The search strategy and selection criteria was done by one of two reviewers (KA or GJ-M), with discussion between reviewers to resolve any uncertainty.

Data collection

Data extracted for all documents meeting the inclusion criteria were: country, title of document, date of publication, publishing organisation, a brief description of the process of development and stakeholders, number of pages, and total word count. For documents that met the environmental sustainability criteria, we additionally extracted all statements or sections of text associated with environmental sustainability verbatim, along with details about the extracted statements. These details included the location of the text within the document (main body or appendix), length of statement (sentence, paragraph, page, multiple pages, large section, or chapter), word count, proportion of each document associated with environmental sustainability, target of statement (food, dietary pattern, or general advice—such as minimising food waste), and stated linkages with other dimensions of sustainability, such as health, social, or economic aspects.

Data analysis

We scored each of the FBDG documents that mentioned environmental sustainability on the breadth and depth of the inclusion of environmental sustainability with a grading criteria developed for this Review on the basis of the 2019 FAO and WHO guiding principles report[11] and building upon recommendations made in a previous review of sustainability in dietary guidelines.[13] The FAO and WHO report set out 16 principles of sustainable healthy diets and assigns each one to a domain; health, environmental impacts, or sociocultural (appendix p 17). We assessed documents for their inclusion of each guiding principle, but only in the context of environmental sustainability. For example, guidelines associated with the inclusion of plant-based foods without reference to environmental sustainability were not included. Therefore, any results discussing the inclusion of

a guiding principle implied an explicit link to environmental sustainability. As an indication of the depth of coverage, each guiding principle could score a maximum of 4 points: 1 point each for addressing the what, why, how, and quantity for each principle resulting in a maximum score of 64 points per document (4 possible points for each of the 16 principles) or 128 points overall (for countries with both consumer and background documents).

We presented results for each country by consumer and background document, and grouped them according to year of publication, geographical region, and income group as per the World Bank 2021 country classification.[15]

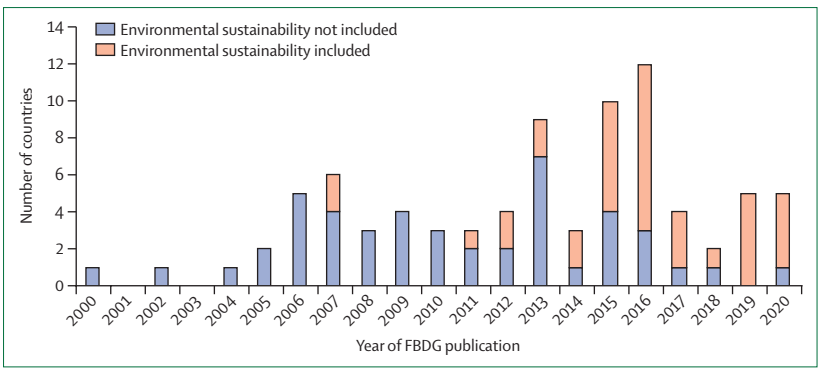

Figure 1: **Inclusion of environmental sustainability criteria in FBDGs**
Number of countries meeting and not meeting the environmental sustainability inclusion criteria for this Review within their most recent FBDGs by year of publication (n=83). FBDGs=food-based dietary guidelines.

Results

95 (49%) of 195 countries (appendix pp 4–16) were listed on the FAO website as having FBDGs, representing approximately 76% of the world's population (calculated via World Bank population data). 37 countries published their dietary guidelines in languages other than English. Although listed as having FBDGs, no FBDG documents could be found for five countries (Afghanistan, Cambodia, Indonesia, Mongolia, and Nepal), and no FBDG documents could be translated for seven countries (Bosnia and Herzegovina, Croatia, Iran, Panama, Romania, United Arab Emirates, and Viet Nam). Of the remaining 83 countries for which FBDGs could be identified and translated, 37 (45%) included mention of environmental sustainability, representing approximately 17% of the world's population. 17 (46%) of the 37 countries referred to keywords associated with environmental sustainability in their consumer documents and 32 (86%) countries included the keywords in the background documents (appendix p 3).

By region, countries from Europe and central Asia were most likely to have referred to environmental sustainability in their FBDG documents (table 1), whereas countries in south Asia and east Asia and Pacific regions were least likely to have referred to environmental sustainability in their FBDG documents. Three (27%) of the 11 low-income or lower-middle-income countries with FBDGs referred to environmental sustainability compared with 34 (47%) of the 72 upper-middle-income and high-income countries.

The inclusion of environmental sustainability messaging (the main criteria for inclusion) in FBDGs was not common for FBDGs published before 2010, whereas nine (90%) of the ten countries' FBDGs published since 2019 have included messaging associated with environmental sustainability (figure 1).

Reported by 25 (68%) of 37 countries, the most common sustainable healthy diet guiding principle mentioned in the context of environmental sustainability was from the sociocultural domain and focused on respecting local culture and practices (figure 2A). The next most common guiding principles mentioned were from the health domain and included the principles around increased inclusion of plant-based foods (23 [62%] countries) and reduced inclusion of animal-based foods in the diet (23 [62%] countries). Within the environmental domain, environmental impacts (eg, greenhouse gas emissions, water and land use, fertiliser application, and chemical pollution; 21 [57%] countries), preservation of biodiversity (20 [54%] countries), and food waste (20 [54%] countries) were the most commonly reported principles.

No country addressed all 16 guiding principles across their documents. However, it was common for the FBDGs to address at least one principle from each of the health, environment, and sociocultural domains (figure 3). Seven (41%) of 17 countries' consumer documents and 16 (50%) of 32 countries' background documents addressed guiding principles across all three domains. Background FBDG documents (32 [39%] of 83 countries) were more likely to include reference to environmental sustainability than consumer documents (17 [20%] of 83 countries; figure 2B). Inclusion of plant-based and animal-based foods were two of the most common guiding principles mentioned in both consumer and background FBDG documents (figure 2B). Within consumer FBDG documents environmental-associated food waste was also commonly mentioned (11 [65%] of 17 consumer documents). The health-related, food-borne disease guiding principle (14 [44%] of 32 background documents *vs* two [12%] of 17 consumer documents) and the sociocultural-associated accessibility of food guiding principle (12 [38%] of 32 background documents *vs* one [6%] of 17 consumer documents]) were more commonly mentioned in background documents compared with consumer documents. Belgium (12 [75%] of 16 principles) and Sweden (13 [81%] of 16 principles) mentioned the highest number of guiding principles in consumer and background documents (figure 3).

Five guiding principles were included within the environmental domain. 24 (65%) of 37 countries mentioned at least one of the environmental domain

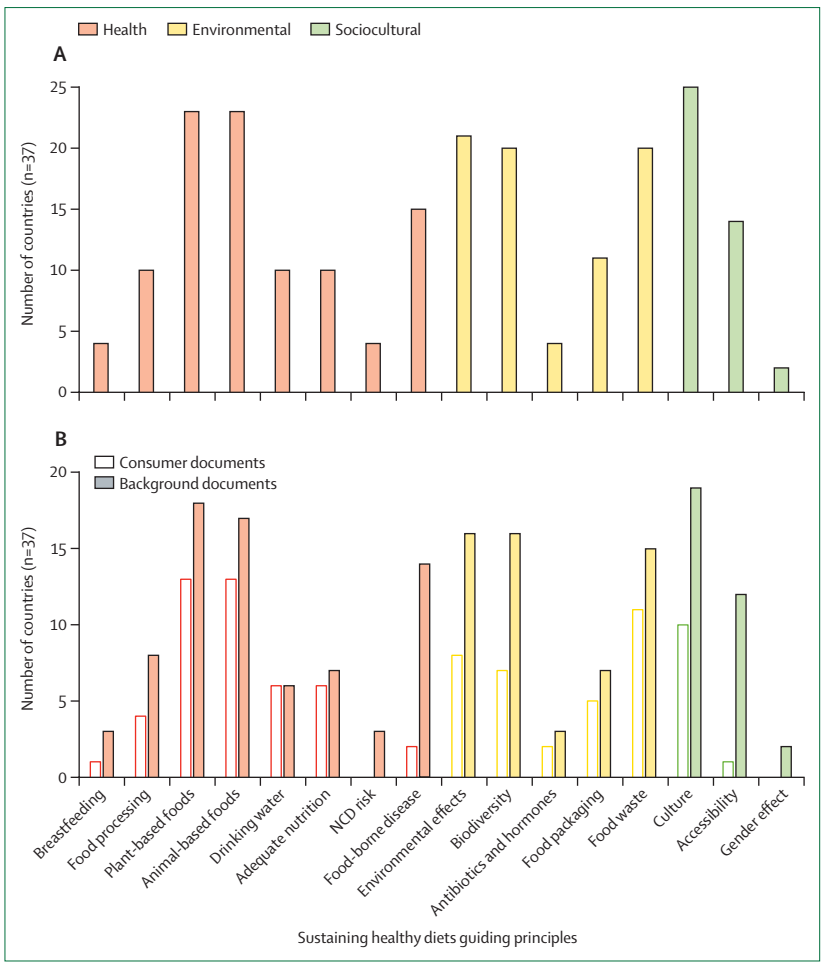

Figure 2: **Number of countries with FBDGs addressing each of the 16 sustainable healthy diets guiding principles**

The number of countries addressing guiding principles across either FBDG background and consumer documents (A), and within either the consumer (n=17) or background (n=32) FBDG documents (B). Gender effect refers to the avoidance of adverse gender-related effects, especially regarding time allocation for buying and preparing food, water and fuel acquisition, etc. FBDGs= food-based dietary guidelines. NCD=non-communicable disease.

principles in their background FBDG document, and 12 (32%) countries covered at least one principle in their consumer document. In consumer documents, Belgium's FBDGs addressed all five of these guiding principles, and the FBDGs from Italy and Qatar addressed four of the five principles. In background documents, the FBDGs from Sweden, Brazil, Australia, Italy, and Norway addressed four or more of the environmental guiding principles (figure 3). 12 (32%) countries had both a consumer and a background document, seven of which addressed at least one environmental guiding principle in both documents. For some countries there was a big difference in the number of guiding principles addressed in each document. For example, Australia's FBDGs addressed 11 and Estonia's FBDGs addressed nine sustainable healthy diet principles in their background document; however, the consumer documents for both countries did not include any reference to environmental sustainability; therefore, these documents were not included in this Review. The principles covered and the prominence within documents varied. For example, Brazil's background FBDG document covered four of the five environmental principles, with relatively equal focus on environmental sustainability and health-related principles. Australia's background FBDG document also addressed four of the five environmental guiding principles; however, most of this discussion was contained in an appendix, diminishing its prominence considerably.

We described depth of coverage of the sustainable healthy diet guiding principles by year of publication (figure 4) and by principle number (table 2). Across both consumer and background documents, the FBDGs from Denmark, Belgium, Italy, and Sweden covered the principles of a sustainable healthy diet in the most depth, with overall scores of more than 40 out of a possible 128 (figure 4). The grey scale shows that the what and why aspects of guideline principles were addressed more frequently than the how or advice around a quantified target (quantity) aspects. Denmark and Belgium were the only countries to provide at least one what, why, how, and quantity for a principle in both the consumer and background document. All 17 consumer documents and 30 (94%) of 32 background documents provided advice on what a sustainable healthy diet means for at least one principle. In background documents, practical advice about how (15 [47%] of 32 documents) and specific advice around quantity (eight [25%] documents) was provided for at least one guiding principle. By contrast, nine (53%) of 17 consumer documents provided advice about how, and five (29%) documents provided advice about the quantity associated with at least one principle. The countries that most often provided advice on how and quantity were Denmark and Belgium, followed by Germany. Examples of the advice provided by each country are reported in the appendix (pp 18–20). For example, Belgium's consumer FBDG document (Flemish version) provided what, why, how, and quantity information for plant-based foods: "eat proportionally more plant-based than animal food" (what) because "legumes tax the climate less than most animal protein sources" (why), provided practical advice for how to make legume soup (how), and more specific advice to eat "legumes weekly and use them to replace meat at least once a week" (quantity).

The FBDGs of nine countries published since 2019 (Denmark, Italy, New Zealand, Poland, Belgium, Canada, Ecuador, France, and Peru) varied widely in the depth of coverage of the guiding principles (figure 4). Denmark, Belgium, and Italy's FBDGs had the highest total scores of more than 40, whereas Canada (score of 12) and New Zealand (score of 11) had moderate scores, and Ecuador (score of 4), France, Poland and Peru (each a score of 2) were low scoring.

		Consumer FBDG document																	Background FBDG document														
	Date published	Breastfeeding	Food processing	Plant-based foods	Animal-based foods	Drinking water	Adequate nutrition	Non-communicable disease risk	Food-borne disease	Environmental impacts	Biodiversity	Antibiotics and hormones	Food packaging	Food waste	Culture	Accessibility	Gender effect	Subtotal	Breastfeeding	Food processing	Plant-based foods	Animal-based foods	Drinking water	Adequate nutrition	Non-communicable disease risk	Food-borne disease	Environmental impacts	Biodiversity	Antibiotics and hormones	Food packaging	Food waste	Culture	Accessibility	Gender effect	Subtotal
Domains of sustainable healthy diets*		Health								Environmental impact					Sociocultural				Health								Environmental impact					Sociocultural			
Argentina	2016																	..†				X				X		X				X	X		5
Australia	2013																	..†	X	X				X	X	X	X	X		X	X	X	X		11
Belgium‡	2019		X	X	X	X	X		X	X	X	X	X	X	X			12			X	X				X	X	X			X	X			7
Brazil	2015																	..§		X	X	X	X				X	X	X	X		X	X	X	11
Canada	2019																	.. †			X	X				X	X				X	X			6
Colombia	2015																	..†							X	X	X	X			X	X	X		7
Costa Rica	2007																	.¶								X									1
Denmark	2020		X	X	X	X	X							X	X			7		X	X	X	X	X	X		X	X			X	X	X		11
Ecuador	2020																	..§										X				X	X		3
El Salvador	2012																	..†												X					1
Estonia	2017																	..†		X	X	X				X	X	X			X	X	X		9
Finland	2018			X	X	X				X	X			X				6			X	X	X	X			X	X			X	X			8
France	2019																	..†		X												X			2
Germany	2017			X	X	X				X			X	X	X			7																	..§
Greece	2014														X			1			X	X					X	X			X	X			6
Guatemala	2012																	..†																	0
Iceland	2016			X	X					X				X				4			X														1
Italy	2019			X	X	X	X			X	X		X	X	X			9			X	X		X		X	X	X			X	X	X	X	11
Japan	2016													X	X			2			X										X	X			3
Kenya	2017																	..§														X			1
Malta	2016																	..†		X	X	X	X	X								X	X			7
Mexico	2015																	..§			X	X				X	X	X	X						6
Netherlands	2015			X	X													2			X	X						X							3
New Zealand	2020																	..†	X	X	X	X		X		X	X				X	X	X		9
North Macedonia	2014																	..†									X						X		2
Norway	2011			X						X				X				3			X	X				X	X	X			X	X				7
Peru	2019																	..†										X				X			2
Poland	2020			X	X													2																	..†
Qatar	2015	X	X	X	X		X			X	X		X	X	X			10																	..§
Sierra Leone	2016																	..†			X					X									2
South Africa	2013																	..§			X	X	X			X	X			X			X		7
Sweden	2015		X	X	X		X				X	X		X				7		X	X	X	X	X		X	X	X	X	X	X	X	X		13
Switzerland	2016			X	X	X					X		X	X	X			7																	.. §
Türkiye	2016																	..§	X													X			2
UK	2016				X													1																	0
Uruguay	2016			X	X		X		X	X	X				X	X		8				X													1
Venezuela	2007														X			1																	..†
Total		1	4	13	13	6	6	0	2	8	7	2	5	11	10	1	0	..	3	8	18	17	6	7	3	14	16	16	3	7	15	19	12	2	..

Figure 3: **The breadth of coverage of FBDGs across the 16 FAO guiding principles for sustainable healthy diets in the context of environmental sustainability, by country and document type**

X indicates that the FAO sustainable healthy diets guiding principle was addressed. Gender effect refers to the avoidance of adverse gender-related effects, especially regarding time allocation for buying and preparing food, water and fuel acquisition, etc. Where both a consumer and a background document were included for review, the date published refers to the earlier of the two dates, reflecting the year that environmental sustainability first appeared in a country's FBDG document. FAO=Food and Agriculture Organization of the UN. FBDGs=food-based dietary guidelines. *The three domains of sustainable healthy diets as defined in the FAO guiding principles for sustainable healthy diets.[11] †Document did not contain environmental sustainability and was not included in the analysis of environmental sustainability criteria. ‡Belgium (Flemish) consumer FBDG document. §No document found. ¶Document could not be translated.

By relevant principle (table 2), food waste (32%, 12 of 37 countries), culture (30%, 11 of 37) and animal-based foods (27%, 10 of 37) were the guiding principles that were most often reported with information on how the principle can be implemented. Animal-based foods (22%, 8 of 37) and plant-based foods (14%, 5 of 37) were most often reported with advice associated with quantity. Although the guiding principles of biodiversity and food waste were addressed by 19 countries' FBDGs overall (ie, in either the consumer or background document, or both), only documents from nine (24%) of the 37 countries' provided more detail on why these principles were important (table 2), suggesting that in many instances only a basic amount of information was provided.

		Consumer FBDG document					Background FBDG document					
Country	Date published	What	Why	How	Quantity	Subtotal (of 64)	What	Why	How	Quantity	Subtotal (of 64)	Combined total
Denmark	2020	7	2	6	4	19	11	9	8	2	30	49
Belgium	2019	12	7	8	1	28	7	4	2	2	15	43
Italy	2019	8	5	5	0	18	11	9	4	0	24	42
Sweden	2015	7	6	3	1	17	13	7	4	0	24	41
Finland	2018	6	3	0	0	9	8	7	4	0	19	28
Australia	2013					..*	11	6	4	0	21	21
Brazil	2015					..†	11	5	5	0	21	21
Estonia	2017					..*	9	6	5	1	21	21
Qatar	2015	10	7	3	0	20					..†	20
Germany	2017	7	5	6	0	18					..†	18
Norway	2011	3	0	0	0	3	7	4	3	1	15	18
Switzerland	2016	6	2	4	1	13					..†	13
Malta	2016					..*	7	0	4	1	12	12
New Zealand	2020					..*	12	0	0	0	12	12
Canada	2019					..*	6	4	1	0	11	11
Greece	2014	1	0	0	0	1	6	3	1	0	10	11
South Africa	2013					..†	7	4	0	0	11	11
Colombia	2015					..*	7	3	0	0	10	10
Iceland	2016	4	2	2	1	9	1	0	0	0	1	10
Uruguay	2016	8	0	0	0	8	1	0	0	1	2	10
Japan	2016	2	0	1	0	3	3	1	2	0	6	9
Mexico	2015					..†	6	2	1	0	9	9
Argentina	2016					..*	5	1	0	1	7	7
Netherlands	2015	2	0	0	0	2	3	0	0	1	4	6
Ecuador	2020					..†	3	0	1	0	4	4
Sierra Leone	2016					..*	2	2	0	0	4	4
El Salvador	2012					..*	1	1	0	0	2	2
France	2019					..*	2	0	0	0	2	2
North Macedonia	2014					..*	2	0	0	0	2	2
Peru	2019					..*	2	0	0	0	2	2
Poland	2020	2	0	0	0	2					..*	2
Türkiye	2016					..†	2	0	0	0	2	2
UK	2016	1	0	0	1	2	0	0	0	0	0	2
Costa Rica	2007					..‡	1	0	0	0	1	1
Kenya	2017					..†	1	0	0	0	1	1
Venezuela	2007	1	0	0	0	1					..*	1
Guatemala	2012					..*	0	0	0	0	0	0
Total	..	87	39	38	9	173	168	78	49	10	305	478

Less detailed — More detailed

Figure 4: **Depth of sustainable healthy diets guiding principles coverage**
Data consider environmental sustainability within consumer documents (n=17) and background documents (n=32) for the food-based dietary guidelines (FBDGs) of each country assessed. The grey scale indicates aspects that were covered in relatively less depth (light grey) to more depth (dark grey). To score for the presence of the what category, the document had to state or describe the specific guiding principle in any capacity. For principles with multiple concepts, such as plant-based foods, the statement only had to mention one component (such as legumes) to score. To score a point for why, the statement had to provide a specific reason or rationale for the principle being addressed. For the how category, specific guidance or strategies on how the principle could be actioned had to be included. A point for quantity was scored when a specific quantified amount of food or target for a limit was recommended. For each point awarded, the reviewer extracted at least one example as evidence for the score. Where both a consumer and a background document were included for review, the date published refers to the earlier of the two dates, reflecting the year that environmental sustainability first appeared in a country's FBDG document. *Document did not contain environmental sustainability and was not included in the analysis of environmental sustainability criteria. †No document was found. ‡Document could not be translated.

Discussion

This Review provides a comprehensive synthesis of the inclusion of environmental sustainability in FBDGs globally and assesses the breadth and depth of coverage in supporting documentation. The breadth of coverage was assessed against the 16 guiding principles for sustainable healthy diets published by the FAO and WHO.[11] Depth of coverage was assessed through the guidance countries provided across four aspects of each principle: what, why, how, and quantity.

The FBDGs of 37 countries made reference to environmental sustainability in their consumer documents, background documents, or both. Our criteria for inclusion required any mention of keywords associated with environmental sustainability in the documents; therefore, our study was more inclusive than previous reviews.[13,16] The reasons behind the absence of reference to environmental sustainability in some FBDGs (46 of 83 countries) were not investigated in this Review, but are likely to be varied and complex.

FBDGs have historically been written in the context of health promotion; therefore, although there might be implicit environmental benefits to many FBDG recommendations, we identified that explicit links with environmental sustainability are often absent. The inclusion of environmental sustainability in FBDGs is recognised as one key leverage point for the transformation of food systems;[17] however, less than half of the FBDGs we reviewed made reference to environmental sustainability. Those that did were generally published since 2014 and tended to be from upper-middle-income and high-income countries in Europe and Latin America. Although evidence of the contribution of diets towards environmental degradation has been established for some time,[18] this research area has accelerated in the last decade, and those guidelines updated more recently are likely to have benefited from the incorporation of this emerging information. Guidelines published since 2019 varied widely in their coverage of environmental sustainability; some were exemplary (eg, Denmark and Belgium) documents, whereas others (eg, documents from Poland and Peru) contained minimal content on sustainability.

In terms of breadth of coverage, the principles that were most commonly addressed were those associated with culture, inclusion of animal-based and plant-based foods in the diet, environmental impacts, biodiversity, and food waste. These represent a combination of principles from across the health, social, and environmental domains of the guiding principles for sustainable healthy diets. Both similarities and differences were evident in our findings when compared with other studies.[14,19,20] Martini and colleagues[14] also assessed FBDGs against the FAO guiding principles, with FBDGs of 43 countries included in their review. However, in contrast to our approach, Martini and colleagues[14] assessed only key guideline statements and did not require any explicit link with environmental sustainability to be articulated. Yet, in agreement with our findings, plant-based foods (42 [98%] of 43 FBDGs in their review) and animal-based foods (32 [74%] of 43 FBDGs) were two of the most commonly addressed principles. However, the second most commonly addressed principle, according to Martini and colleagues,[14] was food processing (41 [95%] of 43 FBDGs). In our analysis, food processing was only addressed in the context of environmental sustainability by ten (27%) of 37 FBDGs, despite consistent evidence that highly processed foods are a major contributor to the environmental footprint of diet.[21–25] This example highlights that often an explicit link with sustainability is absent from documents, even when the supporting scientific evidence is strong. Herforth and colleagues[20] drew similar conclusions to our Review in their review of FBDGs, reporting a poor clarity for whether messages associated with reducing red meat consumption were motivated by concerns for health, environmental sustainability, or both. Ahmed and colleagues[19] reviewed the FBDGs of 12 countries, calculating a total sustainability score on the basis of the number of sustainability concepts addressed. In agreement with the findings from our Review, Brazil and Australia scores were similar and relatively high, despite a more overt integration of sustainability in Brazil's FBDG.

A novel aspect to our Review was the examination of both background and consumer documents. These documents are intended for different audiences and serve different purposes: background documents provide

	What (n=37)	Why (n=37)	How (n=37)	Quantity (n=37)
Breastfeeding	4 (11%)	1 (3%)	1 (3%)	1 (3%)
Food processing	10 (27%)	4 (11%)	4 (11%)	1 (3%)
Plant-based foods	23 (62%)	15 (41%)	8 (22%)	5 (14%)
Animal-based foods	23 (62%)	16 (43%)	10 (27%)	8 (22%)
Drinking water	10 (27%)	4 (11%)	4 (11%)	1 (3%)
Nutritionally adequate	10 (27%)	6 (16%)	5 (14%)	0
Non-communicable disease risk	3 (8%)	2 (5%)	2 (5%)	0
Food-borne disease	15 (41%)	7 (19%)	3 (8%)	1 (3%)
Environmental effects	20 (54%)	10 (27%)	7 (19%)	1 (3%)
Biodiversity	19 (51%)	9 (24%)	2 (5%)	1 (3%)
Antibiotics and hormones	4 (11%)	1 (3%)	0	0
Food packaging	11 (30%)	4 (11%)	6 (16%)	0
Food waste	19 (51%)	9 (24%)	12 (32%)	0
Culture	24 (65%)	10 (27%)	11 (30%)	0
Accessibility	13 (35%)	1 (3%)	0	0
Gender effect	2 (5%)	0	0	0

Data are n (%). *Full definitions of the Food and Agriculture Organization of the UN guiding principles in the appendix p 17.

Table 2: **Number of countries with food-based dietary guidelines (n=37) that mention each guiding principle* in the context of environmental sustainability in either their consumer or background document**

details on the scientific evidence for the key recommendations, whereas consumer documents are a more concise summary of the recommendations for non-experts. Fewer FAO guiding principles were addressed in consumer documents than in background documents. The inclusion of fewer facets of sustainability in consumer FBDG documents could reflect that the scientific evidence was considered in the review process—and therefore covered in the background document—but was ultimately considered insufficient to warrant its inclusion within the consumer document, or that certain principles are difficult to address to a consumer audience.

As well as breadth of coverage, the depth of the statements associated with environmental sustainability was also assessed. This assessment highlights that the information provided often addressed the what, and to a lesser extent why, aspect of principles, but infrequently included advice on the how aspect of principles, which provides practical, specific advice, or quantified recommendations for action. Clear guidance is needed in FBDGs that address amounts (when applicable), but also how to make changes that are accessible and appealing[13] to support consumers in choosing healthy and environmentally sustainable foods and diets. The principles that were most commonly addressed with specific, practical advice were those associated with inclusion and avoidance of certain foods (plant-based foods, animal-based foods, and the principles associated with food waste and culture). These principles might be more easily addressed with specific advice because they are often considered a win-win for health and the environment. For example, the inclusion of plant-based foods aligns long-standing dietary advice for health with environmental goals. The difficulty synthesising and translating evidence into sustainability recommendations that can be integrated with evidence for health recommendations has long been recognised, and some countries might consider environmental sustainability beyond the remit of a traditionally health-focused policy resource. Policy makers might also be reticent to make recommendations when advice could cause conflict with industry, particularly in sectors that are major economic contributors for a country, such as livestock industries. The scarcity of specific actions or targets for some principles might also reflect a weaker or less mature evidence base, or an inability to provide quantified general recommendations at an individual level. Additionally, the link between population-level advice and intake remains to be shown. Whether countries that address environmental sustainability the most comprehensively in FBDGs have populations who already consume more environmentally sustainable diets is not clear; additionally, substantial dietary behaviour change is widely acknowledged to be difficult to achieve.

Although the search process was comprehensive and systematic, there were a small number of documents that could not be located or translated into English. A possibility also exists that translation could have altered the meaning or interpretation of key search terms. Of note, some countries have multiple FBDG documents and, although the most comprehensive were selected, it is possible that shorter documents could have preferentially mentioned environmental sustainability. For these reasons, the true number of countries that reported environmental sustainability in their FBDGs could be slightly higher than recorded. A considerable strength of this study was the duplicated extraction of data and grading of each document identified. With such text-rich information, this process was important to ensure maximum capture of text relating to this topic.

The documents included in this Review were restricted to government-endorsed guidelines. We acknowledged that in some countries, other organisations might have taken a lead in publishing dietary advice that considers environmental sustainability.[26–28] The target audience of these documents are varied and can include health professionals,[27] the general public,[26] and governments.[28] Although these documents might have an important role in influencing consumer behaviour, their existence should not be considered an alternative to addressing environmental sustainability in government-endorsed FBDGs, given their integral role in informing policy and programmes.

Conclusion

Pressure on the environment is escalating as planetary boundaries are nearing or exceeding their limit, highlighting the urgency to transform food systems as one of the largest contributors to environmental stress. This Review shows the emergence of environmental sustainability messaging within developed or revised FBDGs since 2014, linking the importance of diet with both human and planetary health. FBDGs are core evidence-based reference standards for informing the development of food and nutrition policies and policy actions, such as food labelling and food composition, and providing a reference against which food supply and dietary behaviours can be monitored and evaluated. Therefore, the findings from our Review provide an insight into the type and extent of considerations for environmental sustainability that might be expected to be incorporated into food and nutrition policies and actions of countries globally. To date, only about 17% of the world's population is covered by FBDGs that make mention of environmental sustainability. Discussion of environmental sustainability is slowly becoming more sophisticated as the breadth of environmental concerns addressed and depth of information provided increases. However, our findings suggest that this messaging is often moderated in consumer-facing FBDG documents compared with background documents or, in some instances, absent altogether. We suggest that FBDGs should provide more specific information that addresses the what, why, how,

Search strategy and selection criteria

We searched the Food and Agriculture Organization of the UN (FAO) database of dietary guidelines on Nov 28, 2019, to identify countries with FBDGs. We then did a Google search between Dec 18, 2019, and Jan 10, 2020, to ensure the most recent version was sourced and to find any additional documents. A subsequent search of the FAO website was done on April 1, 2021, to check for any updated FBDG documents. Guideline documents published in English or translatable with Google Translate from countries listed in the FAO database of countries with FBDGs, for which a digital document was locatable through the structured Google search, were eligible for inclusion.

The structured Google search followed the format: (country name) AND ("dietary guidelines" OR "food based dietary guidelines" OR "nutrition guidelines") AND (any specific name for the country's dietary guidelines as referred to on the FAO website (appendix pp 4–16). The first 50 search returns were reviewed, and the websites of the departments or institutions that developed or were responsible for the implementation of the guidelines (as per the FAO database) were searched for any updates to guidelines. These websites were reviewed by manually searching any relevant nutrition or public health pages of the website. The terms "food", "nutrition", "diet", and "guidelines" were also sequentially entered into each website's search function to identify relevant documents.

For each country, we selected the most recent published primary consumer document and background document for inclusion (appendix pp 4–16). If more than one background or consumer document were identified, we selected the most comprehensive document (ie, the longest or most detailed document). To contain the scope of this Review, we only included documents targeting the general healthy population. FBDGs developed for subgroups of the population with health conditions or at specific life stages, such as infants, were excluded. Documents that were not available online (eg, had to be ordered as a hard copy) were excluded because they were not considered readily accessible. Information from websites that appeared to be more comprehensive than downloadable FBDG consumer documents was assessed.

For guidelines not published in English, we attempted translation with the Google Translate autotranslate function. Text within images, figures, and diagrams could not be translated, including entire documents that were in an image format.

Following the identification and, when required, translation of FBDG documents, we identified which guidelines included key terms associated with environmental sustainability (guided by the FAO definition of a neutral or positive effect of food systems on the surrounding natural environment that considers biodiversity, water, soil, animal and plant health, carbon footprint, water footprint, food waste, and toxicity). We searched guideline documents individually for inclusion of any of the environmental sustainability keywords by sequentially entering them into the find text search function: "biodiversity", "conservation", "climate", "environment", "environmental", "ecological", "eco-friendly", "ecofriendly", "emissions", "emit", "pollution" , "resources", "sustainable", "sustainability", and "nature". To qualify for inclusion, one of these terms had to be mentioned somewhere within the consumer or background document, including the supporting information or appendices, in a relevant context. For inclusion, the context in which these keywords were used had to be associated with the natural environment and not the general food environment, obesogenic environment, or use of sustainable simply meaning ongoing programmes. In cases of uncertainty regarding whether the inclusion criteria were met, the definition of a document type, or whether it was an official government or government-endorsed document, a second reviewer assessed the document and, if required, discussed it with the first reviewer to reach a consensus.

Data collection and analysis were independently completed in duplicate for each document by at least two trained reviewers from a pool of six (DLB, JB, KA, BW, GW, PGB). DLB was responsible for comparing the data extracted by each reviewer and identifying any discrepancies, and a final decision was agreed on by consensus.

and quantity (as relevant) aspects of the guiding principles, and be included in both consumer and background documents. To achieve the extent of transformation to food systems needed to curb the accelerating environmental decline globally, more countries need to commit to developing FBDGs that explicitly emphasise the crucial link between diet and planetary health.

Contributors

GJ-M, DLB, and GAH conceptualised and designed the study methods. GJ-M, KA, PGB, JB, DLB, BW, and GW collected the data. GJ-M, DLB, GAH, JB, KA, MDR, AJL, ML, and MH analysed and interpreted the results. GJ-M, DLB, and GAH wrote the first draft, and all authors were involved in drafting or critical revision of the Review.

Declaration of interests

ML is a board member of Food Standards Australia New Zealand and reports grant funding from the Australian Research Council. MDR is treasurer for the Australian Nutrition Trust Fund and reports shares in TasFoods, an Australian listed company with interests in dairy, poultry, and wasabi. AJL reports grant funding from the National Health and Medical Research Council, Australia, and the Medical Research Future Fund, Australia. GAH, DLB, and KA report funding to their organisation (Commonwealth Scientific and Research Organisation) from Meat and Livestock Australia and Dairy Australia for research projects about quantifying the environmental impacts of diets. MH is a board director for the Global Alliance for Improved Nutrition. All other authors declare no competing interests.

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