# Dietary sugar intake: Systematic review of public health guidelines and their recommendations

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## Abstract

**Background:** The relationship between sugar and health is being actively researched and translated into dietary recommendations by authoritative health organizations. Recommendations range dramatically, making it confusing to policy makers, healthcare professionals and consumers. The purpose of this research was to systematically identify and evaluate public health guidelines (PHGs) providing sugar recommendations.

**Methods:** MEDLINE, EMBASE, Web of Science and four grey literature sources were searched to identify potential PHGs. The Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument and the Grading of Recommendations Assessment Development and Evaluation (GRADE) approach was used to assess the quality of the guidelines and evidence used to support recommendations.

**Results**: The systematic search identified 9 PHGs and 12 dietary sugar recommendations. Seven recommendations were qualitative, while five recommendations were quantitative setting specific sugar intake limits ranging from <25% to <5% total calories from non-intrinsic sugars. The recommendations were based on a variety of health concerns including nutrient displacement, dental caries and weight gain. The overall guideline quality was moderate with a median AGREE II score of 4.0 (IQR 3.7-4.8), with low to very low levels of evidence used to make recommendations. The PHGs did not score particularly well with the AGREE II instrument, scoring below the 60% threshold in the domains of rigor of development, applicability and editorial independence.

**Conclusion:** There is inconsistency among quantitative dietary recommendations to reduce sugar intake, and there are likely ways to improve the development process of dietary PHGs.

## Background

- The relationship between sugar and health is being actively researched, and evidence of a supporting link has been translated into dietary guidance and recommendations for the general public by authoritative health organizations around the world.[1]
- Many authoritative organizations have issued public health guidance and policy decisions based on the evidence available to date; however with the access to the same evidence, organizations are making different recommendations.[1]

**Objective:**

To conducted a systematic review and critical appraisal of authoritative dietary PHGs, including an assessment of the quality of evidence supporting recommendations on dietary sugar intake.

## Methods

The protocol for this systematic review was registered in the PROSPERO database in November 2015 (registration number CRD42015029182)[2]

**PHG Identification**

We searched MEDLINE, EMBASE, and Web of Science, using subject terms and key words. Grey literature sources were searched including Google engine search and bibliographies of included PHGs. The list of included PHGs was reviewed for completeness by 3 experts in the field.

**Inclusion Criteria**

1) PHGs developed by a nationally recognized committee, a publicly funded institution, or medical society that provide recommendations for sugar intake in healthy populations
2) Include an explicit methodology section
3) Most recent version of updated publications
4) Published between 1995 and 2016
5) Published in English

**Screening, data extraction and quality assessment:**

Two reviewers independently screened titles and abstracts, full-text articles and extracted data from included PHGs, using standardized, pilot-tested forms.
Sugar recommendations, strength of recommendation, the authors' assessment of the quality of the supporting evidence, and the references cited to support each recommendation were extracted from the PHG.

**Guideline Quality**

Three reviewers independently appraised guidelines using the AGREE II (*A*ppraisal of *G*uidelines for *RE*search and *E*valuation, 2nd edition) instrument
Each guideline was rated (1-7) on 23 items within six domains: scope and purpose, stakeholder involvement, rigor of development, clarity of presentation, applicability, and editorial independence[3]

**Quality of Evidence Supporting Recommendations**

We initially used a modified form of the 2011 Oxford Center for Evidence-Based Medicine (OCEBM) Levels of Evidence to determine the quality of evidence used to make recommendations. However, we decided to use a post-hoc GRADE analysis, due to the limitations of the OCEBM instrument.

The design could have been rated down due to imprecision, indirectness, inconsistency, or graded up if there is a large or very large effect size, as outlined by GRADE.[4]

## Results

**Table 1: Identified guidelines and corresponding sugar recommendations**

| Organization or Country | Guideline Title | Year | Sugar Recommendation(s) |
|---|---|---|---|
| United States of America | 2015-2020 Dietary Guidelines for Americans[5] | 2015 | "Consume less than 10 percent of calories per day from added sugars" |
| World Health Organization (WHO) | Guideline: Sugars intake for adults and children[6] | 2015 | "Reduced intake of free sugars throughout the life course" |
| | | | "In both adults and children, WHO recommends reducing the intake of free sugars to less than 10% of total energy intake" |
| | | | "WHO suggests further reduction of the intake of free sugars to below 5% of total energy intake" |
| Scientific Advisory Committee on Nutrition (SACN)- United Kingdom | Carbohydrates and Health[7] | 2015 | "The definition for free sugars be adopted in the UK" |
| | | | "The consumption of sugars-sweetened beverages should be minimized in both children and adults" |
| | | | "The population average intake of free sugars should not exceed 5% of total dietary energy for age groups from 2 years upwards" |
| Brazil | Dietary Guidelines for the Brazilian Population[8] | 2014 | "Use oils, fats, salt, and sugar in small amounts for seasoning and cooking foods and to create culinary preparations" |
| Australia | Australian Dietary Guidelines[9] | 2013 | "Limit intake of foods and drinks containing added sugars such as confectionary, sugar-sweetened soft drinks and cordials, fruit drinks, vitamin waters, energy and sports drinks" |
| Nordic Nutrition Council | Nordic Nutrition Recommendations [10] | 2012 | "Intake of added sugars should be kept below 10% of the energy intake" |
| Germany | Evidence-Based Guideline of the German Nutrition Society[11] | 2012 | "The consumption of sugar-sweetened beverages should be limited" |
| Ireland | Scientific Recommendations for Healthy Eating Guidelines in Ireland[12] | 2011 | "Healthy eating can be enjoyed with limited amounts of 'other foods' like biscuits, cakes, savoury snacks and confectionery. These foods are rich in calories, fat, sugar and salt so remember – NOT too MUCH and NOT too OFTEN" |
| Institute of Medicine (IOM)- United States of America and Canada | Dietary Reference Intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids[13] | 2002 | "A maximal intake level of 25 percent or less of energy is suggested to prevent the displacement of foods that are major sources of essential micronutrients" |

- 9 PHGs met the inclusion criteria, containing 12 dietary sugar recommendations.
  - 7 qualitative recommendations; 5 quantitative recommendations ranging from <5% energy from free sugar- <25% total energy intake from added sugars.
- Rationale for decreased sugar intake recommendations were based on a variety of reasons including nutrient displacement, excess energy intake, dental caries, bone health, weight gain and obesity

**Table 2: Public health practice guideline domain scores on the AGREE II instrument [14]**

| Guideline | ICC | Scope & purpose | Stakeholder involvement | Rigor of development | Clarity of presentation | Applicability | Editorial independence | Combined overall rating |
|---|---|---|---|---|---|---|---|---|
| USA[5] | 87.3 | 87.0 | 87.0† | 69.4 | 79.6† | 41.7 | 30.6 | 5.0 |
| WHO[6] | 88.7 | 88.9 | 77.8 | 81.3† | 59.3 | 36.1 | 83.3† | 4.3 |
| SACN[7] | 96.6 | 81.5 | 37.0 | 47.2 | 48.1 | 0.0 | 0.0 | 3.7 |
| Brazil[8] | 87.3 | 53.7 | 74.1 | 16.7 | 50.0 | 34.7 | 33.3 | 3.7 |
| Australia[9] | 87.0 | 92.6† | 77.8 | 69.4 | 66.7 | 61.1† | 77.8 | 5.3† |
| Nordic[10] | 91.3 | 83.3 | 63.0 | 50.0 | 53.7 | 15.3 | 33.3 | 4.7 |
| Germany[11] | 94.1 | 74.1 | 18.5 | 41.0 | 38.9 | 6.9 | 13.9 | 3.3 |
| Ireland[12] | 96.4 | 70.4 | 40.7 | 10.4 | 72.2 | 58.3 | 0.0 | 4.0 |
| IOM [13] | 93.5 | 75.9 | 46.3 | 31.3 | 70.4 | 18.1 | 52.8 | 3.7 |

† Denotes highest rated guideline in each domain; shaded cells indicate where a guideline fell below the 60% threshold for that domain; ICC: interclass correlation coefficient (agreement between reviewers for inclusion of guideline)

- **Scope and purpose**: evaluate the overall objectives, related health questions, and the target population of the guideline.
- **Stakeholder involvement**: the extent of involvement of appropriate stakeholders in the process of guideline development and whether it reflects the views of its intended users
- **Rigor of development**: clearly expressed methods used to gather and synthesize the evidence for guideline development, formulate the recommendations, and updating guideline
- **Clarity of presentation**: key recommendations should be unambiguous and easily identifiable in the guideline
- **Applicability:** inclusion of barriers and facilitators to implementation, strategies to improve uptake, and resource implications of applying the guideline
- **Editorial Independence**: relates to unbiased formulation of recommendations and competing interests

Overall guideline quality was moderate with a median score of 4.0 (IQR: 3.7-4.8). Possible scores ranged from 1-7.

**Table 3: Assessment of the supporting evidence for each recommendation (GRADE)**

| Guideline | Overall recommendation | Specific recommendation(s) including strength (if reported) | # of citations | GRADE evidence quality |
|---|---|---|---|---|
| USA[5] | "Consume less than 10% of calories per day from added sugars" | | 0 | N/A |
| WHO[6] | Reduced intake of free sugars throughout the life course – Strong Recommendation" | | 0 | N/A |
| | "In both adults and children, WHO recommends reducing the intake of free sugars to less than 10% of total energy intake – Strong Recommendation" | | 1* | Low |
| | "WHO suggests further reduction of the intake of free sugars to below 5% of total energy intake – Conditional Recommendation" | | 1* | Very low |
| SACN[7] | "The population average intake of free sugars should not exceed 5% of total dietary energy for age groups from 2 years upwards." & "The consumption of sugars-sweetened beverages should be minimised, in both children and adults." | "Greater sugar intake is associated with increased energy intake-adequate evidence" & "Sugar sweetened beverage intake is associated with risk of type-2 diabetes - Moderate Evidence" | 1* | Very low |
| | | "Sugar consumption is associated with increased risk of dental carries- Moderate evidence" & "Amount and frequency of SSB consumption is associated with dental carries - Adequate Evidence" & "Greater SSB consumption is associated with increased BMI - Limited Evidence" | 1* | Very low |
| Brazil[8] | "Use oils, fats, salt, and sugar in small amounts for seasoning and cooking foods and to create culinary preparations" | | 0 | N/A |
| Australia[9] | "Limit intake of foods and drinks containing added sugars such as confectionary, sugar-sweetened soft drinks and cordials, fruit drinks, vitamin waters, energy and sports drinks" | "Sugar-sweetened beverages is associated with increased risk of weight gain in adults and children - Grade B | 15*†‡ | Low, Very low |
| | | "High or frequent consumption of added sugars, particularly for infants and young children, is associated with increased risk of dental caries - Grade C" | 1‡ | Very low |
| | | "Consumption of soft drinks is associated with increased risk of dental caries in children - Grade C" | 1‡ | Very low |
| | | "Consumption of soft drink is associated with increased risk of reduced bone strength - Grade C" | 3†‡ | Very low |
| Nordic[10] | "Intake of added sugars should be kept below 10% of the energy intake" | | 14*‡ | Low, Very low |
| Germany[11] | "The consumption of sugar-sweetened beverages should be limited, because they increase the risk of obesity and diabetes" | "The available cohort and intervention studies regarding adults mainly show that a higher consumption of SSB is accompanied by an increased risk of obesity – Probable" | 6*†‡ | Low, Very low |
| | | "The majority of prospective cohort studies and meta analysis indicate an increased risk of type 2 diabetes with regular consumption of sugar sweetened beverages—Probable" | 5*‡ | Low, Very low |
| Ireland[12] | "Healthy eating can be enjoyed with limited amounts of 'other foods' like biscuits, cakes, savoury snacks and confectionery. These foods are rich in calories, fat, sugar and salt so remember – NOT too MUCH and NOT too OFTEN" | | 6†§ | Very low |
| IOM[13] | A maximal intake level of 25% or less of energy is suggested to prevent the displacement of foods that are major sources of essential micronutrients. | | 7‡ | Very low |

*Systematic review; † Randomized controlled trial; ‡ Observational study; § Narrative review or report

## Conclusions

- This review was the first systematic review of PHGs focused on dietary sugar
- All of the reviewed guidelines indicated a suggested decrease in consumption of non-intrinsic sugars
  - While the overall direction was consistent, the rationale and evidence used to make each recommendation were inconsistent, which may be confusing for practitioners and the public
- Each quantitative sugar recommendation, with the exception of WHO, were set based on population-wide intake estimates rather than evidence of health effects occurring above a certain intake level
- Guideline quality was considered to be of moderate status; improvements could be made in the development of each of the PHGs
- The quality of evidence currently available to link sugar with health outcomes was generally rated low to very low based on GRADE analysis.

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