

Reviews examining sugar-sweetened beverages and body weight: correlates of their quality and conclusions^{1–3}

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ABSTRACT

Background: The role of sugar-sweetened beverages (SSBs) in increasing obesity is of great scientific, clinical, and public health interest. Many reviews have been published on this topic in recent years with very different conclusions.

Objective: We sought to assess the scientific quality and other characteristics that may be associated with the conclusions of reviews regarding the causal relation between SSB consumption and body weight.

Design: A systematic search of reviews in English language–published peer-reviewed journals in 2006–2013 was performed. Their methodologic quality was assessed by 2 judges using 2 scoring systems: the Assessment of Multiple Systematic Reviews and the American Dietetic Association Quality Criteria Checklist. The conclusions were blindly assessed by 11 independent readers using a Likert scale ranging from a position score of 0 = no evidence of a causal relation to 5 = strong evidence of a causal relation.

Results: Twenty reviews were identified: 5 meta-analyses, 3 qualitative systematic reviews, and 12 qualitative nonsystematic reviews. Four received funding from the food industry. Quality scores were neither correlated with the readers' perception of conclusions nor with the source of funding. However, industry-funded reviews were more likely to suggest that evidence supporting a causal relation between SSB consumption and weight gain was weak (mean position score = 1.78), whereas evidence was generally considered well-founded in other reviews (mean position score = 3.39; $P \leq 0.01$).

Conclusions: For a complex and controversial scientific issue, it is important to minimize perceived or actual threats to scientific objectivity and methodologic quality. More refined tools are needed to better assess their scientific quality and to identify factors and mechanisms that may influence authors' conclusions. *Am J Clin Nutr* 2014;99:1096–104.

INTRODUCTION

The role of sugar-sweetened beverages (SSBs)⁴ in the increasing prevalence of overweight and obesity is a matter of great scientific, clinical, and public health interest, but there is no consensus on the issue. Recently, a systematic review of reviews pertaining to the relation between SSBs and different health outcomes was published in *The American Journal of Clinical Nutrition* (1). The article focused on the quality of narrative reviews and quantitative meta-analyses published between 2001 and 2011. The main results were that the average quality of the 17 studies was low and that most studies lacked

a clear description of their methods. The authors stated that “in the absence of these basic methodologic features, conclusions shown in reviews may be little more than personal subjective opinions informed by the scientific evidence but not based on strong methodologic grounds.” In an editorial published in the same issue of the Journal, the methodologic approach of this review of reviews was criticized (2). Also, the possible role of the reviews' sponsors was not assessed. As a matter of fact, there is ample evidence on the relation between study results, their conclusions, and the source of funding (3). The objectives of the current study were to 1) identify published reviews on the relation between SSBs and body weight, 2) assess the scientific quality of these reviews by using 2 different scoring systems, 3) position the authors' conclusions on a Likert scale ranging from 0 = no evidence of a causal relation to 5 = strong evidence of a causal relation, and 4) identify study characteristics associated with the authors' position, including the quality scores and source of funding.

MATERIALS AND METHODS

Review selection strategy

A systematic search of the PubMed (<http://www.ncbi.nlm.nih.gov/pubmed/>), Embase (<http://www.embase.com/search/advanced>), and Cochrane Library (<http://onlinelibrary.wiley.com/cochranelibrary/search/>) databases was performed by one investigator (JM) by using combinations of the following terms: obesity and weight gain, soft drinks, and sweetened beverages (see supplemental Appendix 1 under “Supplemental data” in the online issue). All reviews, systematic or not, published in English up to 30 September 2013 were searched, and their relevance was evaluated first by the title, then by the abstract, and finally by the text.

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⁴ Abbreviations used: AMSTAR, Assessment of Multiple Systematic Reviews; QCC, Quality Criteria Checklist; SSB, sugar-sweetened beverage.

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Summaries or extracts of official reports or books were excluded as were as short comments, editorials, and letters to editors or authors. The references listed in all eligible articles were also manually searched to identify additional relevant publications.

Classification of selected publications

The data were extracted, by one investigator (JM), to capture information on the types of primary studies included in each review, definition of study populations, exposures, and outcomes. The criteria proposed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (4) were used to sort publications into 3 categories: (quantitative and systematic) meta-analysis, systematic qualitative review, or nonsystematic review. The formulation of the research question, use of a comprehensive and reproducible search strategy, existence of inclusion and exclusion criteria, and standardized extraction of data for analysis were criteria to distinguish between a systematic and a nonsystematic review. The use of statistical techniques to combine estimates of effects defined a meta-analysis. Data on the impact factor of each journal in which the reviews were published were extracted from the *Journal Citation Reports* database of the ISI Web of Knowledge as measured by the year of publication of the article. To identify the source of funding, the statement reported in the publication was first used. When the source was not clearly mentioned, the authors were contacted via e-mail to obtain more information. Reviews for which no industry funding could be identified were, by default, considered studies not supported by the industry. Funding received by authors for other activities was not considered.

Quality assessment

The methodologic quality of each review was evaluated by using 2 different tools: the Assessment of Multiple Systematic Reviews (AMSTAR) quality score (5) and the Quality Criteria Checklist (QCC) classification scheme for reviews of the American Dietetic Association (6). The AMSTAR tool consists of an evaluation grid including 11 questions on specific elements of a systematic review, such as the review design, research strategy, selection of articles, data abstraction process, assessment of the scientific quality of the studies under review, evaluation of publication bias, or mention of possible conflicts of interest (details are provided in e-Supplement 1 under "Supplemental data" in the online issue). Each item is rated as 1 for "yes" and 0 for any of the following answers: no, cannot answer, or not applicable. Thus, the maximum score is 9 for a qualitative systematic review and 11 for a meta-analysis. Nonsystematic reviews were not evaluated by the AMSTAR score because it appears to be less discriminatory in its quality assessment. QCC has been specifically designed for nutrition-related issues and can be applied to assess the quality of all types of reviews, systematic or not. The QCC tool consists of 10 questions pertaining to the internal validity of reviews for which the response categories are "yes," "no," "unclear," or "not applicable." The questions have different weights, the first 4 being prominent, to produce a ranking of each study in 3 quality classes: positive (good), neutral (average) or negative (weak). For the purpose of our analysis, some aspects of the 2 quality-assessment tools had to be modified. First, the questions related to industry funding

were excluded from the AMSTAR and QCC quality rating because one of the objectives of our research was to study the association between quality scores and the presence or absence of industry funding. Second, because the maximum AMSTAR scores are different for systematic quantitative (value = 11) and qualitative (value = 9) reviews, a relative score was computed as the percentage of the maximum achievable value. Relative AMSTAR scores were then classified into 3 categories: good ($\geq 70\%$), average ($<70\%$ to $\geq 50\%$), and weak ($<50\%$). Third, to increase its discriminant capacities, the QCC was transformed into a continuous score instead of a categorical score by using the following rules: as suggested in the original tool, more weight was given to questions 1–4 (yes: +3; no: –3; unclear: 0), whereas questions 5–9 were considered less important (yes: +1; no: –1; unclear: 0). The modified QCC quality score was considered "good" when the final value was between 17 and 13, "average" when between 12 and 7, and "weak" when between 6 and –17. The quality assessment was conducted independently by 2 judges (JM and YLB). They agreed on a full and common understanding of the definitions, criteria, and guidelines provided in the tools to achieve a more objective assessment and increase interrater reliability. When needed, the input of a third-party evaluator (PDW) was requested to reach a consensus after discussion.

Characterization of authors' conclusions

For each review included in the analysis, we extracted the final statement on the association between SSB consumption and obesity/weight gain. These final conclusions were anonymously compiled into a booklet; each page contained the statement with a Likert scale ranging from 0 = no evidence of a causal relation to 5 = strong evidence of a causal relation. We selected a convenience sample of 11 readers among professionals and graduate students working in the field of obesity research at the Quebec Heart and Lung Institute Research Center. These readers were invited to blindly score their understanding of study conclusions and an average position score was calculated for each review.

Statistical analyses

Statistical analyses were performed by using SAS 9.3 software (SAS Institute Inc). The Kruskal-Wallis exact test was applied to assess the association between position scores and the type of review or quality scores. The association between quality scores and the type of review or source of funding was assessed by using the Fisher's exact test. The Spearman correlation test was used to study the association between position scores and journals impact factors. Finally, the association between the position scores and the source of funding was analyzed by using Wilcoxon's exact test. For this, a sensitivity analysis was performed to study the possibility of misclassification of the reviews according to their sources of funding: each of the studies initially considered as "not industry funded" was sequentially reclassified as "funded by industry" and the statistical association was retested. Statistical significance was defined as P values <0.05 (2-sided test). The Fleiss κ statistic was used to evaluate the interrater reliability of position scores and values were interpreted according to criteria proposed by Landis and Koch (7)

RESULTS

Database search

Results of the screening for reviews examining the association between SSBs and obesity/weight gain are presented in **Figure 1**. Seventeen publications were identified in electronic databases, and 3 additional reviews were retrieved from manually searching their references.

Characteristics of reviews

Of the 20 total reviews, 5 were meta-analyses, 3 were systematic qualitative reviews, and 12 were nonsystematic qualitative reviews. The main characteristics of the reviews are presented in **Table 1**. All of them were published between 2006 and 2013. There was considerable variation in the definitions of exposures and outcomes, study populations, and the design of primary studies included in the analysis. We were able to identify 4 publications that had been performed with industry funding.

Quality of reviews

Results of the quality assessment of each review are presented in **Table 2**. The AMSTAR percentage scores for the 5 meta-analyses (88%) were much higher than those for the 3 systematic qualitative reviews (33–56%). The QCC scores for meta-analyses (average = 13.66) were comparable with those for systematic qualitative reviews (average = 12.66), whereas nonsystematic reviews had much lower scores (average = −3.25)

($P \leq 0.01$). Quality scores were not related to the source of funding. Reviews having good QCC quality scores were published in journals with significantly higher impact factors than reviews with average to weak quality scores ($P < 0.05$) (**Figure 2**).

Perception of conclusions by readers

Depending on the review, our readers ranked the conclusion of authors on the causal relation between SSB consumption and obesity/weight gain between 0.73 (weak evidence) and 4.78 (strong evidence) (Table 2). Agreement between the 11 readers was considered to be fair with a multiple rater (Fleiss) κ value of 0.24. On average, conclusions on the causal relation tended to be more in the direction rather than in the absence of a causal relation (mean position score = 3.06; median position score = 3.14, on a scale ranging from 0 to 5). No significant statistical relation between the readers' perception of the conclusions measured by the position score and the type of review, journal impact factor, and QCC quality score. However, reviews that received funding from the industry were more likely to conclude that evidence supporting a causal relation between SSB consumption and weight gain was weak (mean position score = 1.78), whereas evidence was generally considered to be well founded in the reviews relying on other sources (mean position score = 3.39; $P \leq 0.01$; Wilcoxon's exact test) (**Figure 3**). This association between the source of funding and authors' conclusions was robust as shown by results of the sensitivity analysis (summarized in Supplemental Table 1 under "Supplemental data" in the online issue). The direction of the association was

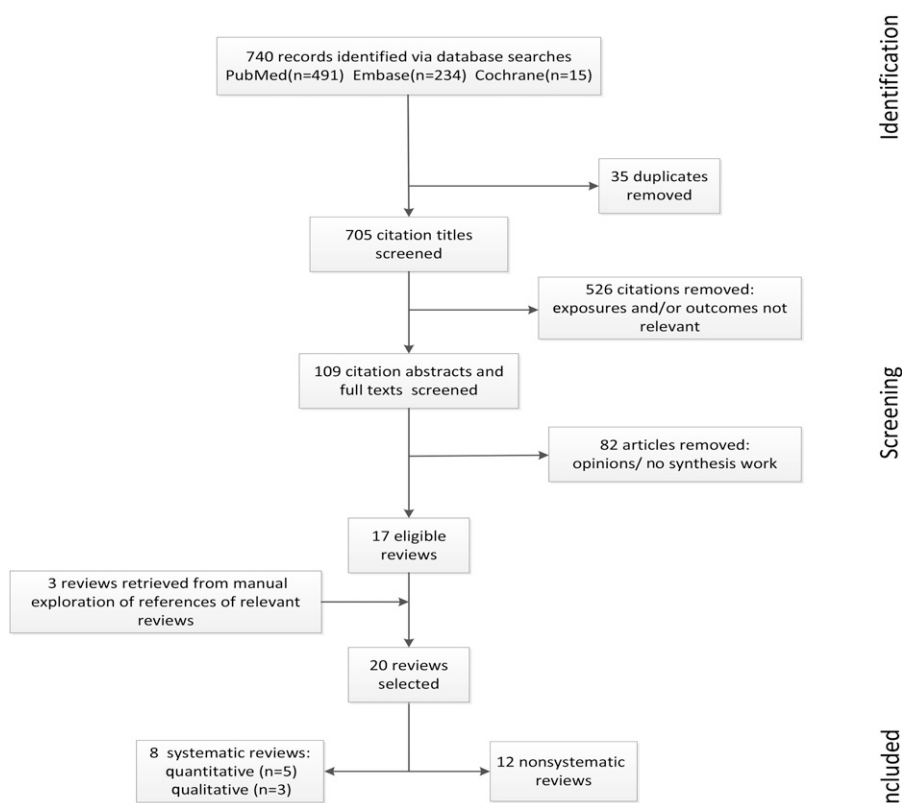


FIGURE 1. Flowchart of the systematic review of reviews examining sugar-sweetened beverage consumption and body weight. Cochrane, <http://onlinelibrary.wiley.com/cochranelibrary/search/>; Embase, <http://www.embase.com/search/advanced>; PubMed, <http://www.ncbi.nlm.nih.gov/pubmed/>.

TABLE 1
Characteristics of reviews that examined the association between SSB consumption and obesity/weight gain^a

First author, year of publication (ref)	Type of review ²	Definition of exposure	Definition of outcome	Study population	Studies included: type and number	Journal impact factor ³	Industry funding ⁴
Malik, 2013 (28)	Meta-analysis	Beverages with added energy-containing sweetener such as sucrose, HFCS, or fruit juice concentrates, which usually contain >25 kcal/fluid oz	Body weight, BMI, or fat mass	Adults and children	Experimental: 10 Longitudinal: 22	6.50	No
Kaiser, 2013 (29)	Meta-analysis	Nutritively sweetened beverages: regular sodas, fruit punches, and chocolate milks (as opposed to, eg, liquid soup eaten with a spoon, diet soda, 100% fruit juice and unsweetened milk, alcoholic beverages, liquid meal replacements	Body weight, BMI, obesity or overweight status, percentage body fat, or some other indicator of adiposity	Adults and children	Experimental: 18	6.87	No
Mattes, 2011 (30)	Meta-analysis	Nutritively sweetened beverages: regular sodas, fruit punches, and chocolate milks (as opposed to, eg, liquid soup eaten with a spoon, diet soda, 100% fruit juice and unsweetened milk, alcoholic beverages, liquid meal replacements	Body weight, BMI, obesity or overweight status, percentage body fat, or some other indicator of adiposity	Adults and adolescents	Experimental: 12	5.86	No
Forshee, 2008 (17)	Meta-analysis	Not provided	Weight gain, obesity	Children and adolescents	Experimental: 2 Longitudinal: 8	6.74	Yes
Vartanian, 2007 (13)	Meta-analysis	SSBs; diet and artificially sweetened beverages	Body weight	Adults and adolescents	Experimental: 8 Longitudinal: 12 Cross-sectional: 19	3.61	No

(Continued)

TABLE 1 (Continued)

First author, year of publication (ref)	Type of review ²	Definition of exposure	Definition of outcome	Study population	Studies included: type and number	Journal impact factor ³	Industry funding ⁴
Woodward-Lopez, 2010 (15)	Systematic qualitative	Any combination of beverages that contains added caloric sweetener	Not provided	Adults and adolescents	Experimental: 5 Longitudinal: 24 Cross-sectional: 32	2.08	No
Gibson, 2008 (31)	Systematic qualitative	Cold beverages containing added sugars, whether carbonated or still, including soda (but not diet soda), fruit squash, drinks with a fruit component <100% pure fruit juice	Body weight, BMI, or adiposity	Adults and adolescents	Experimental: 4 Longitudinal: 17 Cross-sectional: 23	1.66	Yes
Malik, 2006 (14)	Systematic qualitative	Soft drinks, soda, fruitades, fruit drinks, sports drinks, sweetened iced tea, squashes, lemonade	Weight gain, obesity	Adults and adolescents	Experimental: 5 Longitudinal: 10 Cross-sectional: 15	6.56	No
Hu, 2013 (32)	Nonsystematic	Full spectrum of soft drinks, fruit drinks, energy and vitamin water drinks containing added sugar (HFCS, sucrose, or fruit juice concentrates)	Not provided	Adults and children	Reviews: 8 Experimental: 6 Longitudinal: 5	6.87	No
Clabaugh, 2011 (33)	Nonsystematic	Not provided	BMI	Children and adolescents	Experimental: 2 Longitudinal: 4 Cross-sectional: 3	—	No
Ruxton, 2010 (12)	Nonsystematic	Not provided	Not provided	Adults and adolescents	Reviews: 3 Experimental: 3 Longitudinal: 4 Cross-sectional: 1	4.51	Yes
van Baak, 2009 (34)	Nonsystematic	Not provided	Not provided	Adults and adolescents	Experimental: 5 Longitudinal: 4	5.09	No
Olsen, 2009 (35)	Nonsystematic	Soft drinks or calorically sweetened beverages	Any weight-related changes	Adults and adolescents	Experimental: 5 Longitudinal: 14	5.09	No

(Continued)

TABLE 1 (Continued)

First author, year of publication (ref)	Type of review ²	Definition of exposure	Definition of outcome	Study population	Studies included: type and number	Journal impact factor ³	Industry funding ⁴
Libuda, 2008 (36)	Nonsystematic	Colas, sodas, fruit drinks, noncarbonated sweetened beverages, drinks with partial substitution of sugar by artificial sweeteners	Weight gain, obesity	Children and adolescents	Experimental: 5 Longitudinal: 14	4.29	No
Dennis, 2009 (10)	Nonsystematic	Soft drinks	Weight management	Adults	Reviews: 5 Experimental: 12 Longitudinal: 2 Cross-sectional: 1	1.85	No
Wolff, 2008 (37)	Nonsystematic	Soft drinks	Weight gain	Adults and adolescents	Experimental: 5 Longitudinal: 10 Cross-sectional: 15	0.40	No
Harrington, 2008 (38)	Nonsystematic	High glycemic index-loaded beverages	BMI, weight gain	Children and adolescents	Experimental: 3 Longitudinal: 3	0.50	No
Drewnowski, 2007 (11)	Nonsystematic	Varies across primary studies: carbonated and still regular soft drinks, diet soda, fruit juices, milk	BMI, weight gain	Adults and adolescents	Longitudinal: 8	6.60	Yes
Pereira, 2006 (39)	Nonsystematic	Soft drinks, colas, other sweetened carbonated beverages, fruit drinks with added sugar	Any weight-related changes	Adults and adolescents	Experimental: 5 Longitudinal: 11 Cross-sectional: 7	4.06	No
Bachman, 2006 (9)	Nonsystematic	Soft drinks and sugar-added drinks, sweetened teas, sports drinks, 25% (or less) juice (or less) juice drinks, other types of sweetened beverages	BMI, weight gain	Adults and adolescents	Experimental: 2 Longitudinal: 7 Cross-sectional: 7	2.93	No

¹ HFCS, high-fructose corn syrup; ref, reference; SSB, sugar-sweetened beverage.² Reviews were sorted into 3 categories according to Preferred Reporting Items for Systematic reviews and Meta-Analyses criteria: meta-analysis, systematic qualitative, and nonsystematic.³ Reflects the value in the year of publication of the review.⁴ A review was considered to be industry funded when its author(s) received part or all of the funding from the sugar industry. Funding received by authors for other activities was not considered.

TABLE 2
Quality assessment and review authors' position on the causal association between sweetened beverage consumption and obesity¹

First author, year of publication (ref)	AMSTAR score ²	AMSTAR quality level	QCC quality level	QCC derivate quality score	Experts' score concerning authors' opinion ³
Malik, 2013 (28)	10/10 (100)	Good	Positive	16	4.58 ± 0.65
Kaiser, 2013 (29)	10/10 (100)	Good	Positive	15	2.10 ± 0.80
Mattes, 2011 (30)	8/10 (80)	Good	Positive	16	2.09 ± 0.20
Forshee, 2008 (17)	8/10 (80)	Good	Positive	16	0.73 ± 0.75
Vartanian, 2007 (13)	8/10 (80)	Good	Negative	5	3.85 ± 1.16
Woodward-Lopez, 2010 (15)	3/8 (38)	Weak	Neutral	10	4.41 ± 0.66
Gibson, 2008 (31)	5/8 (63)	Average	Neutral	12	1.85 ± 0.58
Malik, 2006 (14)	5/8 (63)	Average	Positive	16	4.09 ± 0.70
Hu, 2013 (32)	NA	NA	Negative	-6	4.78 ± 0.39
Clabaugh, 2011 (33)	NA	NA	Negative	-1	4.27 ± 1.01
Ruxton, 2010 (12)	NA	NA	Negative	2	3.09 ± 0.66
van Baak, 2009 (34)	NA	NA	Negative	-16	3.14 ± 0.64
Olsen, 2009 (35)	NA	NA	Neutral	12	3.27 ± 0.65
Libuda, 2009 (36)	NA	NA	Negative	-10	3.86 ± 0.71
Dennis, 2009 (10)	NA	NA	Negative	-4	3.18 ± 0.84
Wolff, 2008 (37)	NA	NA	Negative	-8	2.23 ± 0.65
Harrington, 2008 (38)	NA	NA	Negative	-8	3.45 ± 0.69
Drewnowski, 2007 (11)	NA	NA	Negative	-4	1.45 ± 0.82
Pereira, 2006 (39)	NA	NA	Negative	0	2.73 ± 1.10
Bachman, 2006 (9)	NA	NA	Neutral	4	2.18 ± 0.60

¹ AMSTAR, Assessment of Multiple Systematic Reviews; NA, not applied (when a nonsystematic review); QCC, Quality Criteria Checklist; ref, reference.
² Percentage in parentheses.
³ Values are means ± SDs.

not changed and remained statistically significant for a majority ($n = 10$) of the 16 tests.

DISCUSSION

Our study included 20 reviews examining the relation between SSBs and body weight: 5 meta-analyses, 3 qualitative systematic reviews, and 12 nonsystematic reviews. A substantial variation was observed in the conclusions expressed by the authors and as perceived by a panel of readers on the strength of the evidence pertaining to the causal association. Health policymakers often rely on published syntheses to frame their judgment. When conclusions are equivocal, it is tempting to opt for inaction; therefore, efforts should be made to clarify the reasons for discrepancies.

A central pillar of our analysis was to assess the methodologic quality of the reviews and to study its potential link to the conclusions. Our results showed that variation in the position score was not explained by the type and quality of the reviews. This finding had already been reported in previous analyses (1, 8). Many factors may affect the scientific quality of reviews, which have been shown to be variable. For many reviews included in our analysis (9–13), the research question was much broader than SSBs and body weight. As a consequence, less information could be provided on this particular topic, which generated lower scores. As expected, systematic reviews received higher quality scores than nonsystematic reviews. Meta-analyses received higher scores than systematic qualitative reviews based on the AMSTAR tool, but average scores were similar based on the QCC scale. This is because AMSTAR was particularly designed for assessing systematic reviews, and more importance is given to the orthodoxy of the review process than to its internal validity. The evaluation criteria used in AMSTAR are to check

whether a step has been completed or not (eg, consultation of several databases, reporting of the keywords used), but not necessarily if it has been done in the correct way (eg, focus and appropriateness of the research question, pertinence of selected databases and search terms, relevance of inclusion/exclusion criteria of studies). These aspects are more emphasized by the QCC tool, which gives them a greater importance in its assessment of quality. Thus, the tool has a weighting that focuses on these items. In addition, when a feature is not verified, it turns out penalizing by giving a negative note. AMSTAR, however, gives a zero score for an unverified requirement. This largely explains the discrepancy observed in the results of the quality assessment for certain reviews, especially those of Vartanian et al (13), Malik et al (14), and Woodward-Lopez et al (15). The

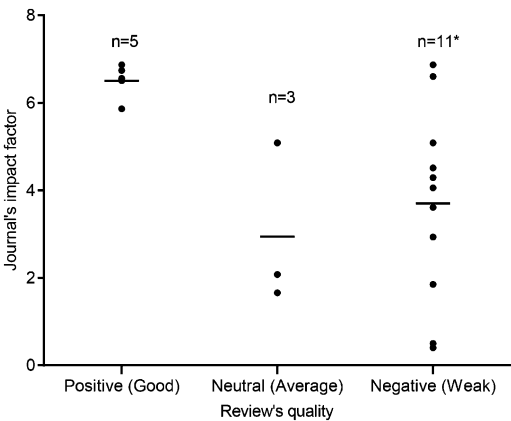


FIGURE 2. Distribution of journal impact factors according to the quality of reviews (Quality Criteria Checklist quality score). The horizontal bars indicate the mean. *For one review, the impact factor of the journal was not available.

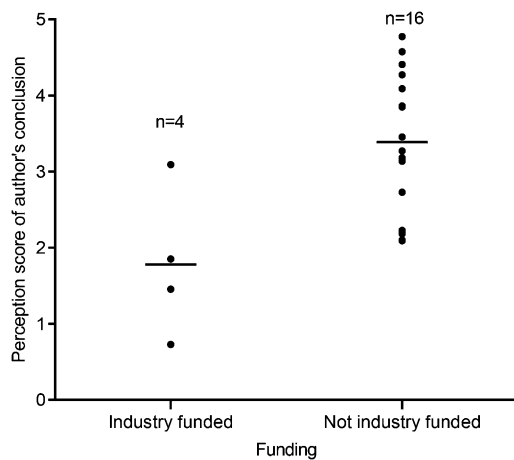


FIGURE 3. Distribution of position scores of authors' opinions of reviews, as perceived by readers, according to the source of funding. The horizontal bars indicate the mean.

first 2 obtain a lower quality score with AMSTAR because they do not meet the requirements of multiplicity of searched databases and duplication in the studies selection and the data extraction. The review by Vartanian et al obtains a lower score with QCC because it does not provide any clue on an appropriate and reproducible assessment of the quality and validity of its initial studies included.

We decided to not use AMSTAR score to assess the quality of nonsystematic reviews because its scoring components rely largely on the frame of a systematic review. Using it would not allow us to translate appropriately the full range of methodologic quality differences observed in nonsystematic reviews. This point was raised by Malik and Hu (2) in their criticism of Weed's article reporting a low quality of reviews. However, the AMSTAR tool was easier to use than the QCC. The evaluation criteria in the AMSTAR questionnaire are more precise than in the QCC. To prevent interrater variability in the use of the QCC, we were obliged to agree on a common understanding of criteria provided in the tool and embark on a consensus-building process. As a result of these limitations, the use of quality-assessment tools could still fall short of determining an overall study's quality (16). Although each of the 2 tools has original features that proved to be complementary, they are still inadequate to fully assess some important analytic aspects such as the control of confounding factors. One aspect has been particularly debated: the rationale for adjusting the relation between SSB consumption and obesity/weight gain for the total energy intake. The meta-analysis by Forshee et al (17) was criticized by Malik et al (18) for this reason. We are inclined to support the arguments presented by Malik et al because total energy intake should be considered an intermediary variable rather than a confounding factor in the causal chain between SSBs and weight.

The source of funding of the review was a significant predictor of its conclusions. Reviews funded by the industry tended to conclude that the evidence was weak, whereas the evidence was considered to be much stronger in reviews funded by other sources.

This finding on a statistical association between the source of funding and conclusions adds to the bulk of evidence on this issue (19–22). However, the so-called "funding effect" is not necessarily caused by biased judgment, but may result from the

conjunction of different factors, eg, related to the definition of the research question, the type of initial studies included in the review, the kind of outcomes and comparisons analyzed (3), and the study population considered (13). In addition, the way primary studies results are reported or interpreted can also contribute to differences in conclusions (23). Moreover, conflicts of interest are not always related to financial relationships, but can also occur because of personal relationships, academic competition, intellectual passion, or political engagement (24). It is very difficult to identify these types of influences, and we cannot exclude their presence in reviews not funded by industry.

The major limitation of our study was the small sample size. Only 20 reviews were analyzed, and the power to detect associations of small magnitude was low. Only reviews published in English were retrieved. After completing this analysis, we found 2 recent reviews published in French. The first review was directly supported by the industry (25) and published in a journal supplement also sponsored by the industry (26). The author stressed the existence of contradictory results in studies examining the association between SSB consumption and weight and concluded that no causal relation could be established, and that more studies of better quality were needed. The second review published in the same journal was not supported by the industry (27). The author's conclusions supported a causal relation, although he also pointed out the need for more studies on this topic. This observation is congruent with our results, according to industry-funded studies tend to provide more conservative conclusions on the potential links between SSBs and obesity. The possibility of misclassifying the sources of funding could also be a limitation. However, results of a sensitivity analysis showed that our results were relatively robust to misclassification. Finally, for practical reasons, we were able to get the involvement of a convenience sample of 11 researchers to assess the authors' conclusions. This panel may not be representative of all readers of scientific journals. It would have been interesting to include in the panel other potential readers such as clinicians, public health professionals, and policymakers.

In conclusion, many reviews that have examined the association between SSB consumption and obesity/weight gain were recently published, but there is no consensus on the strength of the evidence on causality. As measured by 2 quality-assessment tools, the methodologic quality of the reviews did not explain the orientation of the authors' conclusions. Also, no relation was found between the source of funding and quality scores. We found that reviews funded by the industry were less likely to conclude that there was a strong association between SSB consumption and obesity/weight gain. Available quality-assessment tools have limitations, and many contextual factors beyond the intrinsic characteristics of the reviews may influence their conclusions. There will always be room for subjective judgment when imperfect studies examine complex questions. It is the joint responsibility of authors, journal editors, and reviewers to maintain the highest standards of scientific integrity and to minimize perceived or actual threats to scientific objectivity and methodologic quality, such as the sponsors' influence.

The authors' responsibilities were as follows—JM and PDW: designed the project; JM: retrieved the literature; JM and YLB: performed the data extraction; JM, YLB, and RF: conducted the analysis; JM, YLB, and PDW: wrote the manuscript; and PDW: is the guarantor of the integrity of the data and the accuracy of the data analysis. All authors read and approved the final

manuscript. None of the authors had any conflicts of interest. The sponsors had no role in the design and conduct of the study; the collection, management, analysis, and interpretation of the data; and the preparation, review, and approval of the manuscript.

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