

TABLE 1
Drug compliance over time according to egg consumption in US male physicians¹

Time and drug	Egg consumption (per wk)					P for trend ²
	<1	1	2–4	5–6	≥7	
12 mo (n)	4496	6511	6875	1391	1698	
Aspirin (%)	86.1	86.0	86.4	86.5	85.9	0.87
Placebo (%)	86.1	87.2	85.4	85.3	87.2	0.75
24 mo (n)	4519	6563	6914	1400	1692	
Aspirin (%)	81.6	81.1	80.9	82.8	80.9	0.90
Placebo (%)	82.0	83.4	82.5	81.9	81.5	0.55
36 mo (n)	4492	6530	6890	1401	1684	
Aspirin (%)	80.9	80.0	80.5	80.2	80.6	0.55
Placebo (%)	81.1	82.5	80.6	81.5	80.9	0.50
48 mo (n)	4480	6595	6860	1393	1670	
Aspirin (%)	78.0	78.2	78.5	77.1	75.2	0.20
Placebo (%)	80.1	80.2	78.5	78.6	78.6	0.10
60 mo (n)	4467	6453	6795	1382	1654	
Aspirin (%)	77.7	77.9	78.0	77.7	74.4	0.17
Placebo (%)	76.9	78.1	76.0	75.2	76.8	0.27

¹ Values show the proportion of participants reporting an intake of ≥83% of the pills.

² P for trend obtained by using a logistic regression model.

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Differential underreporting and other caveats about sugar-sweetened beverages and weight gain

Dear Sir:

We read with great interest the meta-analysis by Forshee et al (1) in the June 2008 issue of the *Journal*. It is at least curious that 2 other studies on the same topic were simultaneously published in other journals (2, 3). Both of these studies suggest at least a partial role of sugar-sweetened beverages (SSBs) on weight gain among children and adolescents. Another study published in 2007 that was not included in the meta-analysis also suggested a detrimental effect of SSBs (4). In addition, some methodologic issues are worthy of consideration.

Although not statistically significant, most of the point estimates in the meta-analysis showed a positive association, albeit of low magnitude. Alternative explanations to a low-magnitude effect are compatible with these results, and the true effect might be of greater magnitude. Children and adolescents, and their parents as well, might be prone to underreporting consumption of these types of beverages, because of a well-known social desirability bias. This would be translated into a nondifferential misclassification that very likely leads the estimates of effect toward the null value. This nondifferential misclassification bias, in addition to the unavoidable measurement error of nutritional epidemiologic studies, may be an alternative explanation of the almost null findings. Of greater concern, and at the same time also possible, is the likelihood that obese subjects

may systematically underreport consumption of SSBs more than do their nonobese counterparts. There is empirical evidence supporting this hypothesis (5). This would lead to a differential misclassification that would also mask or attenuate any important result.

We should not forget that this meta-analysis was based only on children and adolescent populations. Thus, as the authors indicated in the discussion section, its conclusions cannot be generalized to the adult population. Therefore, this meta-analysis is not directly comparable with the previous systematic review by Malik et al (6), for which some of the studies were conducted in adults. Specifically, >70% of the total participants in the 10 longitudinal studies reviewed by Malik et al were adults. It seems unfair to include a quote (6; page 274) from this previous systematic review in the discussion of the Forshee meta-analysis (1; page 1670) without any clarification that the study populations of both systematic reviews were different.

Although the overall results were not entirely consistent, and the effect on body weight was nonremarkable at first look, it was substantial for a single food group, especially if it accumulates in the long term. As the authors quoted in the discussion, SSBs are a source of energy. However, this statement is incomplete because SSBs not only contribute to excess energy intakes, but they provide no nutritional benefit. Even though the overall effect on weight gain might appear relatively small, there is no doubt that the alternative of replacing SSBs with water (no calories) does help to reduce total energy intake. This will translate to large long-term benefits because the cumulative effects of small increases in daily energy intakes lead to weight gain and obesity (7). Avoidance of these cumulative effects contributes to the prevention of diabetes and cardiovascular disease.

The advice by Forshee et al to consume SSBs in moderation is mainly of interest for food marketing purposes (8); however, from a public health perspective, it may be naive and potentially harmful. The relative intellectual and psychological immaturity of the young and the complexity of growth and development of adolescents speak against sending them this ambiguous message of consuming SSBs in moderation (9).

We agree that more research is needed to achieve well-established evidence in this field. However, in the meantime, because doubt exists, less harmful advice to the entire population would be to

replace the consumption of SSBs with water to comply with the need for good hydration.

The authors had no conflicts of interest.

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Reply to M Bes-Rastrollo and MA Martinez-Gonzalez

Dear Sir:

We appreciate the interest that Bes-Rastrollo and Martinez-Gonzalez have shown in our recent article in the *Journal* (1), and we welcome the opportunity to share our response. They mention 3 articles that were not included in our analysis. We did not mention these articles because they were published after our article was submitted for publication. Sichieri et al (2) found no statistically significant reduction in body mass index ($P = 0.33$) between the treatment and control groups, but they did find a statistically significant reduction in body mass index for the subgroup of females who were overweight at baseline. Libuda et al (3) also found no statistically significant association between soda consumption and measures of body mass index or body fat in most of their analyses. The only reported statistically significant association was for girls, and that relation was not significant at the 0.05 confidence level (0.055 SD score/MJ increase in regular soft drink consumption; $P = 0.08$)

These results are entirely consistent with the findings from our meta-analysis. The third study did report a statistically significant association between the odds of being overweight and between-meal consumption of sugar-sweetened beverages (4); however, the study design was different from those included in our meta-analysis in that it examined only a subset of sugar-sweetened beverage consumption. On the basis of our sensitivity tests, we strongly doubt that the inclusion of these studies would make any substantive changes in our conclusions.

The authors also point out that the studies included in our meta-analysis may have methodologic problems, most importantly differential underreporting of sugar-sweetened beverage consumption. We agree that this is a limitation of the studies included in the meta-analysis, and we noted the possibility of systematic measurement error in our limitations section. However, the studies included in the meta-analysis used validated dietary instruments, and they are widely cited in the scientific and policy literature. They are the best epidemiologic evidence of the association between sugar-sweetened beverage consumption and BMI that is currently available.

The suggestion that a message encouraging children and adolescents to consume sugar-sweetened beverages in moderation is naive touches on a much broader debate about the proper way to communicate with adolescents about risk. At least in the United States, there is a long-standing debate over whether it is better to provide children and adolescents with limited information to encourage or discourage a particular behavior or to provide more balanced information to help them gradually learn how to exercise independent judgment. Debates occur regarding the best way to educate children and adolescents about the risks of drugs, tobacco, teen sex, and alcohol use. We believe it is important that the messages delivered to health professionals and the scientific community—who then advise parents, children, and adolescents—reflect the body of scientific evidence. On the basis of the results of our meta-analysis, we do not believe that a message discouraging consumption of sugar-sweetened beverages as a means to reduce the risk of overweight and obesity is justified.

We also note that there is evidence that restricting children's (and presumably adolescents') access to pleasurable foods and beverages makes them even more attractive (5). Because children then view these tasty foods and beverages as “forbidden fruit,” they are all the more tantalizing. Teaching youth to enjoy pleasurable foods and beverages in moderation and offering age-appropriate, constructive lessons on reading labels, understanding portion sizes, monitoring caloric intake, increasing physical activity, and making good lifestyle choices seems to be the more sensible solution. Parents, after all, must model the behavior that they wish their children to emulate.

Finally, policymakers need to prioritize which policies will have the greatest impact on obesity as efficiently and as effectively as possible. This means that factors that have the largest impact on public health should receive the highest priority. A policy that targets a factor exhibiting a small, near-zero influence on the problem of obesity will fail to address the problem, yet there will be a cost. One significant cost is the lost opportunity to focus on remedies that are likely to have a larger effect.

MLS is currently senior vice president for Science Policy at the American Beverage Association. RAF is currently a research specialist with the US Food and Drug Administration's Center for Biologics Evaluation and Research. Because of the potential delay for him to obtain the necessary clearance to be included in this response, we have proceeded without listing him as a coauthor of the response.

Maureen L Storey

