



University of Warwick institutional repository: <http://go.warwick.ac.uk/wrap>

This paper is made available online in accordance with publisher policies. Please scroll down to view the document itself. Please refer to the repository record for this item and our policy information available from the repository home page for further information.

To see the final version of this paper please visit the publisher's website. Access to the published version may require a subscription.

Author(s): Jackie Sturt

Article Title: Predicting tail-biting from behaviour of pigs prior to outbreaks Higher consumption of sugar-sweetened beverages is associated with increased risk of developing type 2 diabetes or metabolic syndrome

Year of publication: 2010

Link to published article:

<http://dx.doi.org/10.1136/ebn1143>

Publisher statement: None

## Systematic review with meta-analysis

# Higher consumption of sugar-sweetened beverages is associated with increased risk of developing type 2 diabetes or metabolic syndrome

Jackie Sturt

10.1136/ebn1143

Health Sciences Research  
Institute, Warwick Medical  
School, University of Warwick,  
Coventry, UK

Correspondence to:

Jackie Sturt

Health Sciences Research  
Institute, Warwick Medical  
School, University of Warwick,  
Coventry CV4 7AL, UK;  
[jackie.sturt@warwick.ac.uk](mailto:jackie.sturt@warwick.ac.uk)

Commentary on: **Malik VS, Popkin BM, Bray GA, et al.** Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. *Diabetes Care* 2010;**33**:2477–83.

## Sugary drink consumption associated with obesity

The consumption of sugar-sweetened beverages (SSBs) has increased worldwide in the last four decades. In the USA, there has been a twofold increase, and in developing countries such as India and China, Coca Cola reported a 14% and 18% sales increase respectively in 2007 alone. The list of sugar-sweetened drinks comprises sodas or fizzy drinks, fruit drinks and energy and vitamin water drinks and excludes 100% fruit juices not blended with sweetening agents such as sucrose, high-fructose corn syrup or fruit juice concentrates. Health experts are calling for a reduction in consumption of SSBs because of the increasing evidence of association between SSB consumption and obesity in children and adults.<sup>1</sup> Furthermore, association between habitual SSB consumption and metabolic syndrome and type 2 diabetes is gaining momentum.<sup>2</sup>

## Does high SSB consumption lead to type 2 diabetes?

Malik and colleagues searched MEDLINE for English language articles from 1966 to May 2010 for prospective cohort studies of intake of SSBs. MEDLINE is not the only database relevant to this subject, and it is possible that inclusion of CINAHL searches may have revealed additional studies. The authors did identify key investigators to approach for grey literature, however. Major colloquial key words such as *soda* and *soda-pop* search terms were used in addition to appropriate dietetic terms such as SSB, although the term *soda* would not have been recognised in the UK literature, and it is not stated whether they included the search term *fizzy drink*. They focused on long-term non-experimental studies with end points of type 2 diabetes or metabolic syndrome with the extreme quartiles of SSB consumption being of primary interest. That is, those who consumed  $\leq 1$  12 oz serving a month (lowest consumption quartile), and those who consumed  $\geq 1$  or 2 12 oz servings a day (highest consumption quartile).

## Over 300 000 participants' data suggest YES!

Eight studies were included looking at type 2 diabetes and three that examined the impact of SSBs on metabolic syndrome. Meta-analysis of the three metabolic syndrome study data sets was undertaken, although three studies with

the degree of heterogeneity described could be considered too small to aggregate.<sup>3</sup> However, analysis of the eight type 2 diabetes studies, which involved more than 310 000 participants, does appear to clearly indicate an association between high and habitual SSB consumption of 1–2 12 oz servings per day and the development of type 2 diabetes in both men and women, with an excess risk of developing type 2 diabetes of 26%. The random effects analysis model used does appear to be the most appropriate given the between study heterogeneity that existed. Follow-up periods ranged between 4 and 20 years, and as participants represented the USA, Europe and Asia, it would appear to be an international metabolic response to habitual SSB consumption. Self-report food frequency questionnaires were the outcome measure used in seven of the eight type 2 diabetes studies. Self-completion questionnaires are susceptible to observer bias, but participants would be more likely to under-report and so the 26% excess risk associated with SSB consumption does have strong face validity.

## Health behaviour change in SSB consumption

Knowledge is an important first step in contextualising a behavioural risk, but it stands very far from the actual solution. The research team importantly prioritised finding a yes or no answer to the research question as opposed to understanding the dose-related effects. Understanding the trajectory of change in risk of being diagnosed with type 2 diabetes associated with step changes in consumption behaviour would aid clinicians to use behavioural science to help people understand the degree of the risk and develop strategies for increasing their self-efficacy for SSB consumption reduction. Investigations of those middle two quartiles of SSB consumption behaviour are crucial to this.

Competing interests None.

## References

1. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. *Am J Clin Nutr* 2006;**84**:274–88.
2. Malik VS, Popkin BM, Bray GA, et al. Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk. *Circulation* 2010;**121**:1356–64.
3. Alam R, Sturt J, Lall R, et al. An updated meta-analysis to assess the effectiveness of psychological interventions delivered by psychological specialists and generalist clinicians on glycaemic control and on psychological status. *Patient Educ Couns* 2009;**75**:25–36.



## Higher consumption of sugar-sweetened beverages is associated with increased risk of developing type 2 diabetes or metabolic syndrome

Jackie Sturt

*Evid Based Nurs* published online February 7, 2011  
doi: 10.1136/ebn1143

---

Updated information and services can be found at:  
<http://ebn.bmj.com/content/early/2011/02/07/ebn1143.full.html>

---

*These include:*

- |                               |   |
|-------------------------------|---|
| <b>References</b>             | This article cites 4 articles, 3 of which can be accessed free at:<br><a href="http://ebn.bmj.com/content/early/2011/02/07/ebn1143.full.html#ref-list-1">http://ebn.bmj.com/content/early/2011/02/07/ebn1143.full.html#ref-list-1</a> |
| <b>P&lt;P</b>                 | Published online February 7, 2011 in advance of the print journal.  |
| <b>Email alerting service</b> | Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.  |

---

### Notes

---

Advance online articles have been peer reviewed and accepted for publication but have not yet appeared in the paper journal (edited, typeset versions may be posted when available prior to final publication). Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

---

To request permissions go to:  
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:  
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:  
<http://group.bmj.com/subscribe/>