Public Health England – Dental Public Health response to the

SACN Draft Carbohydrates and Health report- scientific consultation: 26th June to 1st September 2014

This response focuses on the content and methodology employed in the Draft Carbohydrates and Health report specifically focusing on the sections relating to oral health and the supplementary information contained within 'Systematic review of evidence: Carbohydrates and Oral Health.'

Draft Carbohydrates and Health Report- General Comments

This detailed and comprehensive review is timely given the current priority of addressing the sugar reduction agenda. The report includes a wide range of health outcomes and SACN must be congratulated on the scope and detail of the review. The inclusion of oral health as a key consideration is welcome.

The report outlines the intention to change terminology from non milk extrinsic sugars (NMES) to 'free sugars' this is very welcome as the term is more easily understood by lay audiences. However as the review states it requires clear definition in the UK as terminology varies in other countries. It is also important to note that the two terms are not synonymous (with NMES including an arbitrary 50% of the weight of sugars in canned dried or stewed fruit).

The recommendation that the population-wide reference value for free sugars should be 5% of total energy intake is welcome, limiting free sugars to less than 10% of total energy intake at an individual level and to minimise consumption of sugar sweetened beverages.

It is noted that recommendations for further research will be added to the final report. With regard to oral health the report has identified a lack of high quality evidence relating to dental caries in adults and infant feeding, stating that the dietary assessment of infant feeding practice was limited.

Within the report it would be helpful to more clearly define definitions with regards to "sugar", and to ensure that recommendations regarding measurement of exposure are as valid and precise as possible.

The detail within the report is very useful however; it is in places, difficult to follow, and occasionally contradictory. The structure of the supporting information is different to the main report and the findings and evidence used to support statements in one differ in the other, the cross checking required can be time consuming and sometimes confusing.

The recommendations made in this document are important as they will underpin future public health guidance from the Department of Health. It is key that they are clear and consistent throughout and where they differ from existing public health advice, do so on the basis of a clear review of the evidence. The inclusion of oral health and the underpinning systematic review is very welcome.

Systematic review of evidence: Carbohydrates and Oral Health- General Comments

Methodology in relation to dental caries

The decision to include only prospective cohort studies and randomised trials does ensure that only the most reliable evidence in relation to causality at the individual level is included. However, where high quality evidence is lacking (due to the difficulties of accurately recording dietary intakes – especially in relation to frequency of sugars intake in school aged children), a more pragmatic approach looking at the weight of the evidence available, as in the WHO report (Moynihan & Kelly, 2014) may be helpful.

In addition, there is a close correlation between sugar intake frequency and amount, and it is difficult to distinguish between them (Joyce *et al*. 2008; Rugg-Gunn *et al*. 1984; Rugg-Gunn 1993). Due to the requirement to record intake frequencies at the daily level (rather than weekly or monthly), it is always more difficult to obtain accurate measurement for frequency of intakes, which is partly why the evidence for frequency of intake and sugars is not as strong as for amount. It would be helpful if this correlation could be made clearer in the discussion of the evidence presented.

A particular challenge is measuring frequency of exposure in the mixed and permanent dentition (school-aged children), as the age at which children become accurate self-reporters of dietary intake is estimated to be 12 years (Livingstone & Robson, 2000). A systematic review (Burrows *et al.,* 2010) found that the 24-hour multiple-pass recall method conducted over a 3 day period including week and weekend days (using parents to report), was the most valid method for assessing dietary energy intake in children aged 4-11 years, compared to doubly labelled water. It would be useful if this could be highlighted in the final oral health systematic review.

General structure and organisation in relation to dental caries:

It may be helpful, if within the report, the research questions that it aims to answer were made explicit. In relation to sugars and dental caries, the evidence is presented by study type, whereas it would be more useful if the report could be structured by research question, followed by a discussion of the evidence in relation to that question (including the potential for bias in each included study), before presentation of results. Some assessment of the quality and reliability of the studies would be helpful and could be presented in the main report in a summary format, e.g. GRADE summary of findings table.

If the evidence were presented in this way, it would give the reader an opportunity to clearly see what the evidence for each question is, and what the main problems with the evidence are, before examining the results and making a critique. This would allow recommendations to be made for future research and how bias and confounding could be reduced in observational and experimental designs in relation to sugars and dental caries. For example, following the structure of a Cochrane systematic review would provide a framework for clearly reporting the research question, eligibility criteria and methodology used, prior to outlining the potential influence of bias and confounding in each study. Although Cochrane reviews tend to be limited to experimental designs, their structure helps the reader to understand the main issues. There are also a range of tools to critique the quality of observational studies that could be utilised.

On page 8 paragraph 1.8 of the main report there is a really useful summary of the main difficulties in measuring dietary exposure, it would be useful to repeat this in the Oral Health Evidence Review section.

The following are more detailed comments relating to sections of Draft Carbohydrates and Health report

Chapter 2.Classification, Biochemistry, absorption, metabolism and definitions
Fermentation of sugars in the oral cavity page 15 section 2.20

This section gives a good description of the production of acid from fermentable carbohydrate in the mouth and the ability of saliva to buffer acids. It would be useful to expand the importance of the demineralisation and remineralisation balance using the Stefan curve and to emphasise the scientific basis of the importance of frequency as well as amount with regard to dental caries. This could then be linked to chapter 6 where evidence for both frequency and amount of sugar containing foods and drinks is discussed.

Chapter 4. Background on health outcomes (disease prevention)

Oral health page 31

In paragraph 4.16 there is a list of diseases affecting oral health which includes dental caries, periodontal disease and tooth wear- oral cancer should also be included within this list.

4.18 dental caries data is quoted for 2003 from the NCDHS. There is more recent data available for England, recently published by PHE and already referenced within the report as Public Health England (2013)

Chapter 6. Sugars, sugar alcohols, sugar sweetened foods and beverages

Page 97 Oral health

Dental caries

The structure of the response below reflects that of the main document however it is difficult to relate the statements to the evidence presented in the oral health review as it is grouped differently in the systematic review e.g. infant feeding, sugar consumption, sweets and sugar containing drinks.

- 6.61, 6.6.2 these paragraphs relate to frequency of sugars consumed and caries in the mixed and permanent dentitions, reporting no association. The studies is this section record frequency using repeat diet diaries and 24 hour recall, these may be prone to bias and misclassification of exposure. Also if the caries levels in the populations are low, then it is less likely that any effect will be detected.
- 6.63, 6.64 in these paragraphs the report states that overall cohort studies reported higher frequencies of intake of sugar containing drinks increased the risk of caries in deciduous dentition. There is adequate evidence of an association between greater consumption of sugar sweetened beverages and caries in deciduous teeth.
- In paragraphs 6.65, 6.66 the review states that overall the reported associations between the frequency of sweet intake and risk of caries in deciduous dentition were

less consistent with limited evidence but the direction of the association between the greater consumption of sugars- containing foods and or/sugars confectionary is detrimental to oral health. However, as has been stated earlier in this response; differences in the structure of the supporting information in the systematic review and the main report findings and evidence used to support statements make the report findings difficult to interpret.

- In paragraphs 6.67, 6.68 the review clearly states that there is moderate evidence of an association between the frequency of consumption of sugar containing foods and confectionery and caries in the mixed and permanent dentitions. Those studies which allow for confounders support the statement and both of the newly identified studies.
- In 6.69, 6.70 the review states that there is moderate evidence that using a chewing gum containing sugar alcohols in comparison with not using a chewing gum has beneficial effects for oral health (both mixed and permanent dentition). However it is not clear whether this effect is due to the sugar alcohols or the chewing effect increasing salivary flow. It is of practical relevance to know about the frequency with which gum has to be chewed to be able to exert a beneficial effect. Frequency of chewing is mentioned in the various paragraphs about the relevant trials but the summary (6.78) does not refer to this key feature. No statement is made regarding risk of bias.

Oral Health Chapter p97-101.

There are a number of statements around both amount and frequency of “sugars”, “sugar-containing foods” and “sugar-containing beverages”. This seems to be related to how individual studies have measured exposure. This is confusing when there are conflicting statements regarding evidence on frequency of sugar intake in the mixed and permanent dentition: 6.61/6.62, “Frequency of sugars (servings / day) consumed…” and 6.67/6.68 “Frequency of sugars-containing foods and / or confectionary consumption (servings / day)…”

To provide a clear format that relates to relevant public health messages, it may be more helpful to summarise the main research questions relating to sugar and dental caries e.g.

1. What is the evidence for an association between the amount of sugar, or sugar-containing foods and beverages (g/day) and dental caries?
    - Adults (If no evidence available – state here)
    - Children

2. What is the evidence for an association between the frequency of intake of sugar, or sugar-containing foods and beverages (servings / day) and dental caries?
    - Adults (If no evidence available – state here)
    - Children

Summary and conclusions of chapter 6

On page 104 the following is stated
'there is also a lack of evidence to assess the impact of sugars intake on oral health in adults, as all included studies and trials were conducted in children and adolescents'

Data from five studies relating to adults was included in the recent review commissioned by the WHO (Moynihan & Kelly, 2014), but the design of those studies (non-randomised intervention, cross-sectional, and population level) meant that they did not meet the inclusion criteria for the SACN review. SACN considered only prospective cohort studies and randomised controlled trials, as they provide a higher level of evidence regarding causation at the individual level. However, the WHO review states that "for the analysis relating dental caries in adults, data were not downgraded for indirectness, although all cohort studies were conducted in children" because "the etiology of dental caries is the same in children and adults". It would be helpful for SACN to state their view explicitly regarding this approach.

Although it is appreciated that this study falls outside the search time-frame, an eligible prospective cohort study of the relationship between sugar sweetened beverage (SSB) intakes and dental caries in adults has recently been published (Bernabé et al., 2014). This study found a dose-response relationship between the two, with an increase of 33% in DMFT in adults consuming SSB's more than 3 times per day, compared to those consuming none. This relationship was significant after adjustment for socio-demographic characteristics, tooth-brushing frequency and use of fluoride toothpastes.

However if no data regarding adults is to be included in the final report it would be helpful if this was stated earlier in the document rather than only in the summary and conclusions.

Chapter 12 Overall summary and conclusions

Periodontal disease. As stated there is limited evidence for association between sugar and periodontal disease, as periodontal disease is a pathological process that does not involve carbohydrates.

Toothwear; Annexe 4 of the main report is a clear and useful summary about erosion. It reinforces the section in "Delivering Better Oral Health 3rd edition" 2014 on the 'Prevention of pathological tooth wear'. It underlines individual variation in erosive response to the effects of acid. A.4.5 gives an excellent description of the difference between erosion and caries. The SACN document also points out inconsistent epidemiological findings from studies, issues around 'in situ' trials and highlights that no direct comparison on dental erosion and non-calorically sweetened beverages and sugar sweetened beverages is considered in the studies.

Infant feeding; the systematic review reported two trials that looked at the effect of encouraging exclusive and prolonged breast feeding on the deciduous dentition (Feldens et al 2010) and mixed and permanent dentition (Kramer et al, 2007). No increase in caries prevalence at follow was seen in either study. These findings are very useful as this is a question that is often raised in relation to decay in young children. It would be helpful if SACN could include these findings within the draft report.

Specific Error's

A2.3 Page 220 tooth wear (including tooth loss) should be (including dental erosion)

Terminology used is confusing for example 'corrosion' used e.g. in Annex 4. Dietary acids and tooth wear, A4.5 and also in the introduction to chapter 6.

Systematic Review of Evidence: Carbohydrates and oral Health :"Sugar intake", sub-section "Mixed and permanent dentition", p35 para 93:

The section relating to the mixed and permanent dentition opens with "Four cohort studies..." The ensuing discussion relates to cohort studies, until p38 Para 98, there is a confusing discussion of a trial relating to the deciduous dentition (Frostel et al., 1991). This may have been placed in the wrong section.

Clarity required between overall report and oral health evidence review		
Oral Health chapter of Draft Carbohydrates and Health Report	**Systematic Review of Evidence: Carbohydrates and Oral Health.**	**Comments**
P 97 Para 6.59 "Five cohort studies were identified that presented evidence on the relationship between sugars intake and the incidence of dental caries in the mixed and permanent dentition, three of which adjusted their results for tooth brushing (Rugg-Gunn et al., 1984; Rugg-Gunn et al., 1987; Szpunar et al., 1995; Ruottinen et al., 2004) one of which did not (Campaign et al., 2003). "	P35. Para 93. "Four cohort studies investigated sugar consumption in relation to the mixed and permanent dentition (Rugg-Gunn et al., 1984; Rugg-Gunn et al., 1987; Szpunar et al., 1995; Ruottinen et al., 2004; Levine et al., 2007)"	Campaign et al. 2003 does not appear in any of the Tables relating to cohort studies in the mixed and permanent dentition.
P97. Para 6.60 "All three cohort studies that adjust their results for tooth brushing report and association…(Rugg-Gunn et al., 1984; Rugg-Gunn et al., 1987). The study that did not adjust it's results for tooth brushing… (Campaign et al., 2003)…"	P24, Table 5 in the evidence review states that Rugg-Gunn et al., 1984; Szpunar et al., 1995; Ruottinen et al., 2004; and Levine et al., 2007 adjust for toothbrushing.	Campaign et al. 2003 does not appear in any of the Tables relating to cohort studies in the mixed and permanent dentition. It appears in Table 5 that Rugg-Gunn et al., 1987 does not adjust for tooth brushing.
P97 para 6.61 "Three cohort studies were identified that presented evidence on the relationship between frequency of sugars intake…all of which adjusted their results for toothbrushing (Rugg-Gunn et al., 1984; Rugg-Gunn et al., 1987; Szpunar et al., 1995; Levine et al., 2007)"		It appears in Table 5 that Rugg-Gunn et al., 1987 does not adjust for tooth brushing.

References

Bernabé, E. et al., 2014. Sugar-sweetened beverages and dental caries in adults: A 4-year prospective study. *Journal of Dentistry*; 42: 952-958.

Burrows, TL., Martin, RJ., Collins, CE., 2010. A systematic review of the validity of dietary assessment methods in children when compared with the method of doubly labelled water. Journal of the American Dietetic Association; 110: 1501-1510.

Joyce, T., McCarthy, S.N. & Gibney, M.J., 2008. Relationship between energy from added sugars and frequency of added sugars intake in Irish children, teenagers and adults. The British Journal of Nutrition, 99(5), p.1117-1126.

Livingstone, M.B. & Robson, P.J., 2000. Measurement of dietary intake in children. Proc Nutr Soc, 59, pp.279–93. Available at: http://www.ncbi.nlm.nih.gov/pubmed/10946797.

Moynihan, P.J. & Kelly, S. A M., 2014. Effect on caries of restricting sugars intake: systematic review to inform WHO guidelines. Journal of dental research, 93(1), p.8-18. Available at: http://www.ncbi.nlm.nih.gov/pubmed/24323509.

Public Health England. (2014) *Delivering better oral health: an evidence-based toolkit for prevention* (Third edition). Public Health England: London. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/319471/DBOHv3JUNE2014.pdf

Rugg-Gunn, A.J. et al., 1984. Relationship between dietary habits and caries increment assessed over two years in 405 English adolescent school children. Archives of Oral Biology, 29(12), p.983-992.

Rugg-Gunn AJ. Nutrition and dental health. Oxford: Oxford Medical Publications; 1993