Methods to assess the cariogenicity of foods and drinks

Modern methods for assessing the cariogenic and erosive potential of foods by M. E. J. Curzon and J. J. Hefferren
Br Dent J 2000; 191 41-46

Intro

Dental caries has often been described as a disease related to the use of diet although, as a multi-factorial disease, oral bacteria, tooth enamel composition and salivary components and consistency are also major factors. Until the 1970s various models were used from human intervention studies, observational studies and attempts to recreate intra-oral conditions with *in vitro* systems, artificial mouths, plaque pH, animal models, clearance/retention studies and enamel demineralisation. All these were tried with varying degrees of success.

The formation of the Food, Nutrition and Dental Health Program of the American Dental Health Foundation in 1970 became the basis of a series of research studies, properly controlled and conducted, to assess which methods of evaluation of the cariogenic potential of foods were the most appropriate and reliable. These studies culminated in an international conference in San Antonio (USA) in 1985 published by Hefferren.[1]

At the San Antonio conference the participating scientists involved agreed on the two main methods available, animal models and plaque pH, but also determined that enamel demineralisation should be further developed as a model. Dental erosion was not perceived as a problem, at that time, and was not mentioned in the deliberations.

The animal model has continued to be used. Researchers, and other authorities, wishing to determine the cariogenic potential of foods, drinks and some oral medicines, have used the plaque pH models. The enamel demineralisation model, often called the intra-oral cariogenicity test (ICT), has been further developed since the San Antonio conference, so that it is now widely used for cariogenicity testing. Variants of the ICT, also known as the *in situ* model, are now being developed to test foods and drinks for erosion, but need evaluation.

Method

On 8 and 9 November 1999, a group of dental scientists and clinicians met in London (UK) to review the San Antonio recommendations, reassess them and draw up revised guidelines. The aim was to determine which methods are currently suitable as research tools but also for regulatory assessments.

The conference was directed by Professor John Hefferren, previously Chairman of the San Antonio meeting, and who lead the discussions of all delegates. In each of the four workshop sessions, under the guidance of a chairman, a presenter gave a prepared report to update the information on a particular method or group of methodologies. Each presentation was then commented on by a reactor and then by open discussion of all delegates. On the second day individual workshops were held involving small groups of delegates and working documents prepared presenting draft new guidelines.

In a final plenary session all of the working documents were reconsidered and refined. Subsequently, the chairman of each working group was asked to prepare a draft document that was then circulated and commented upon by all delegates. After final editing the consensus opinions are presented in this document.

In Brief
- This Workshop report reviews of the methods to assess the cariogenic potential of foods, drinks and oral products
- An updated assessment is given of the recommended methods to be used
- Methods to assess the erosive potential of foods and drinks are evaluated

Comment

This is a report of a workshop convened in the UK to bring up-to-date methods for testing foods and drinks for their cariogenic and erosive potential. As such, it is to be welcomed. The workshop was held in November 1999 and involved most of the leading experts in the UK, supplemented by some knowledgeable and experienced researchers from the USA. The American Dental Association held a number of similar workshops between 1970 and 1985: the last one – The San Antonio Conference – being the most influential and widely quoted. It was important to revisit the San Antonio guidelines and, crucially, to bring in testing for erosive potential for the first time. John Hefferren, who masterminded much of the ADA's efforts, attended the UK workshop, providing valuable continuity of thought.

The best test for any product is the randomised clinical trial. Foods have been tested in clinical trials: there have been many trials of sugarless chewing gums, some trials of sugarless sweets and a few trials of the addition of protective factors (mostly calcium and phosphorus-based) to breakfast cereals and other foods. But clinical trials are expensive and not without ethical problems. What is badly needed are alternative tests, which are cheaper and can be undertaken by several centres in this country and abroad. It is essential that these tests are valid and the data reliable. The question of validity is central to this report, but maybe it needs to be dealt with more overtly in future workshops. Lack of validating criteria hampers progress and the question of certainty or risk needs to be discussed also. The question as to when a product can be called 'safe' has taxed government officials over recent years and the same philosophies are applicable here.

The bulk of the report discusses techniques used in testing cariogenicity and erosion. These include animal experiments, plaque pH experiments, intra-oral cariogenicity testing (for caries and erosion) and *in vitro* laboratory testing. It was recognised that animal testing is much less frequent now, and that intra-oral testing has much potential and needs to be developed further. Not everyone will agree with some of the recommendations and uncertainties remain. This report is not the definitive word on this subject, but it should be very useful in stimulating debate and the desire for a further workshop to take this important issue forward. It is also hoped that the next workshop may have less controversial sponsorship.

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