

Summary of: An *in vitro* investigation of the erosive potential of smoothies

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VERIFIABLE CPD PAPER

FULL PAPER DETAILS

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Refereed Paper

Accepted 1 October 2012

DOI: 10.1038/sj.bdj.2013.164

©British Dental Journal 2013; 214: E8

Introduction Recent health promotion campaigns have encouraged the public to consume at least five portions of fruit and vegetables per day. Many see consuming fruit smoothies as a way of achieving this. **Objective** To ascertain the potential or otherwise for fruit smoothies to bring about dental erosion. **Design** Laboratory study. **Method** This was an *in vitro* investigation in which five varieties of shop bought fruit smoothies, including a 'thickie' were investigated, with respect to their initial pH, titratable acidity and effect upon exposure to the surface microhardness and profile of extracted human teeth. In addition their performance was compared to negative (Volvic™ water) and positive (orange juice) control drinks as well as a homemade smoothie, based upon the recipe of one of the commercially bought drinks, from which ingredient omissions were made. **Results** The majority of the drinks investigated had a baseline pH below the critical pH of enamel (5.5) and required comparable volumes of 0.1M NaOH to raise their pH to neutrality as the positive control. Only two drinks (Volvic™ still mineral water, the negative control, and the yoghurt, vanilla bean and honey 'thickie') displayed a higher pH, though to neutralise the thickie, a lesser quantity of alkali addition was required. The immersion of the tooth samples in the drinks brought about reductions in their surface hardness (expressed as a percentage change of median hardness) but these were only significant ($p < 0.001$) for the cranberry, blueberry and cherry fruit smoothie and homemade strawberry and banana fruit smoothie. There was no reduction in surface hardness in the case of the teeth immersed in the thickie. Omission of certain ingredients from the homemade smoothie affected the magnitude of surface hardness reductions seen. With regard to the loss of surface contour of the tooth samples following immersion in the drinks, as assessed by depth loss, there were significant differences between the drinks ($p = 0.0064$) with the thickie and negative control not causing depth loss and the kiwi, apple and lime smoothie producing most depth loss (28.26 (5.45) μm). **Conclusions** Within the limitations of this study some fruit smoothies have the potential to bring about dental erosion if consumed irresponsibly. This can be influenced by ingredient variations. In order to minimise the risk of developing dental erosion, without removing the claimed nutritional benefits of their consumption, their consumption should be confined to mealtimes.

EDITOR'S SUMMARY

What are people supposed to think about food these days? Diet advice is ubiquitous, often seemingly conflicting. In the UK it's 'five a day', whereas in Australia it's 'seven a day'. One moment a glass of red wine a day is good for you, the next it isn't. Pregnant women are advised that they shouldn't eat nuts; oh wait, they can.

Midst *all* this advice where do teeth feature? If people are considering their health when deciding what to eat, what do they think about? Weight, yes. Skin, yes. But teeth, not so much? How many adults forego that glass of orange juice in the morning because they are worried about dental erosion? Do frantic City workers stop to think of a smoothie as anything but good for them? Probably not, the consumption of smoothies rose by 120% from 2004 to 2010!¹

Funnily enough people often consider teeth when choosing food for their pets. Dog biscuits are often marketed purely on their positive effect on teeth, gums and breath. You rarely see this in human food marketing, aside from chewing gum.

So smoothies – these appear to the public as magic drinks; two of your 'five a day' in one swoop of fruity goodness which, better still, can be consumed 'on the go'. But what do they do to teeth? In this *BDJ* paper, the authors investigate the potential for smoothies to bring about dental erosion. They compared five shop-bought smoothies with respect to pH, titratable acidity and effect on surface microhardness of extracted human teeth. They also made homemade smoothies with fruits omitted to find out if any ingredients in particular are damaging to teeth. As a result of their study, they advise that

smoothies should only be consumed at mealtimes and that, within the limitations of their *in vitro* study, drinking smoothies *will* heighten the risk of dental erosion.

We need more evidence such as that presented in this paper to enable us to advise the public on diet and nutrition with confidence and to convince people that dental erosion risk must be high on their list when choosing what to eat and when.

The full paper can be accessed from the *BDJ* website (www.bdj.co.uk), under 'Research' in the table of contents for Volume 214 issue 4.

1. The 2011 British soft drinks report. <http://www.britishsoftdrinks.com/PDF/2011%20soft%20drinks%20report.pdf> (accessed February 2013).

Ruth Doherty
Managing Editor

DOI: 10.1038/sj.bdj.2013.190

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IN BRIEF

- Reviews the current literature on fruit smoothies.
- Evaluates the potential for fruit smoothies to bring about dental erosion.
- Recommends that fruit smoothie consumption should be confined to mealtimes in order to minimise erosive risk.

COMMENTARY

Acidic drinks have long been recognised as an important extrinsic factor for the development of dental erosion. A high soft drink consumption is considered the major cause of the high prevalence of erosive wear in the younger population factor. However, it has been shown that besides soft drinks, a number of other frequently consumed acid-containing food products, such as sport drinks, energy drinks and acidic candy, have considerable erosive potential. In the present study, the authors demonstrate that fruit smoothies should be added to this growing list.

Fruit smoothies are generally made only from pure fruits blended with 100% pure fruit juice. Therefore, they are considered healthy and several organisations have advocated the consumption of fruit smoothies. As a result, the consumption has risen dramatically. In the UK, the consumption increases 50% annually and currently 60% of the British parents give their children fruit smoothies.

Considering the erosive potential of fruit smoothies their consumption gives cause for concern, especially with regard to children. Deciduous enamel seems more sensitive to erosion by low pH drinks,¹ especially with increased frequency of consumption. In addition, exposure to acidic drinks at an early age may influence food preferences, which may lead to an increased consumption of acidic foods later in life.² In addition to containing high amounts of acids, such as citric and malic acid,

fruit smoothies also contain high levels of carbohydrate, which increases the risk of developing caries.

The smoothies investigated in the present study had pH values between 5.1 and 5.4. These values are only slightly lower than the pH value of 5.5, generally considered the critical value below which enamel dissolves. Despite their relatively high pH values, immersion of extracted teeth in smoothies induced significant reductions in surface micro-hardness and induced loss of enamel as determined by profilometry. This may be related to the high titratable acidity of smoothies, which is much higher than the titratable acidity of non-fruit carbonated soft drinks.

Fruit smoothies may have beneficial effects on general health, being a source of vitamins and other important nutrients. However, in view of their erosive and cariogenic potential, frequent consumption of smoothies should be discouraged. Therefore, the authors recommend that their consumption should be confined to mealtimes.

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1. Davies R, Hunter L, Loyn T, Rees J. Sour sweets: a new type of erosive challenge? *Br Dent J* 2008; **204**: E3.
2. Gambon D L, Brand H S, Veerman E C. Dental erosion in the 21st century: what is happening to nutritional habits and lifestyle in our society? *Br Dent J* 2012; **213**: 55-57.

AUTHOR QUESTIONS AND ANSWERS**1. Why did you undertake this research?**

In recent years we have encountered many patients through our clinical practice who are keen to eat for holistic health. Many of these are familiar with initiatives that promote eating five portions of fruits/vegetables per day. Others are more time pressed and snack on fruits, including smoothies, throughout the day to achieve this target. They are often unaware of the potential risks that such behaviour exposes the dentition to. However, there is little scientific literature for health professionals to base patient education upon. Thus, this study was undertaken both out of scientific curiosity and with a desire to provide more scientifically robust patient education.

2. What would you like to do next in this area to follow on from this work?

In order to foster healthier eating habits many school children in Scotland have been encouraged to eat more fruit and vegetables through various initiatives encountered in their nursery and school years. This is entirely laudable but, if taken to extremes by some, may inadvertently promote snacking habits that subject the teeth to increased erosive risk. We would like to investigate, amongst schoolchildren, the level of knowledge of dental erosion and how both dietary factors and practices may impact upon this. In future years it would also be interesting to see if such initiatives have altered the snacking habits of adults, who as children were introduced to the concept of eating fruit/vegetables for holistic health, and observe the effect, if any, upon the dentition.