

Smoothies: one portion or two?

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It is always frustrating when a public health campaign advances consumer knowledge without having a similar impact on behaviour. A case in point is the 5 A DAY campaign to promote fruit and vegetable consumption. In 2000, 43% of consumers were aware of the 5 A DAY message and 26% claimed to be putting this into practice (Food Standards Agency 2000). Yet, consumption data from the 2000/2001 National Diet and Nutrition Survey (NDNS) reported that fewer than 15% of adults met the 5 A DAY target (Henderson *et al.* 2002). Nowadays, 74% of consumers are aware of the 5 A DAY target and 58% claim to be putting this into practice (Food Standards Agency 2008). Assuming a similar embellishment of the intake question, it would appear that the gap between knowledge and action is widening.

Given the Department of Health's strict interpretation of what counts as a portion of fruit and vegetables, it is interesting to speculate whether intakes might improve more quickly if the criteria for smoothies were changed. At present, 100% juice and smoothies count as 'one portion' towards the 5 A DAY, no matter how much of either is drunk. The adult 2000/2001 NDNS found that average daily consumption of fruit and vegetables was 227 g, as per the 5 A DAY criteria¹. However, when all juice and smoothies were counted, this rose by 48 g (*i.e.* an extra half portion per day). This would actually underestimate current intake, since consumption of smoothies was negligible in 2000.

In a systematic review, Ruxton *et al.* (2006) found that pure fruit and vegetable juices appeared to offer similar health benefits to whole fruits and vegetables, probably because of similarities in the antioxidant and/or polyphenol content. They argued that there was no justification for the public health view that juices were nutritionally inferior and should be restricted to a single 5 A DAY portion. Yet, even if it is accepted that juices and whole fruits confer similar health benefits,

concerns remain about the potential impact of juices on sugar consumption, fibre intakes, dental health and appetite control. While these may hinder relaxation of the 5 A DAY criteria for juices, it is now time to consider whether such concerns are equally valid for smoothies. In other words, should smoothies be defined as two portions of fruit and vegetables?

Smoothies vs. juices

Smoothies are combinations of homogenised fruit and juice. Most single servings of commercially available smoothies, made only of fruit, contain at least one portion of whole crushed fruit (80 g), plus one portion of juice (150 ml), or contain in excess of 80 g of whole crushed fruit with the remainder as juice.

As Table 1 shows, smoothies contain more energy, carbohydrate, sugars, fibre and vitamin C per 100 g than juice. As a result of the inclusion of whole, homogenised fruit, smoothies contain 1.7 g of fibre per 100 g, compared with 0.1 g per 100 g in juice. Both drinks are rich in vitamin C and could make a labelling 'source' claim under Nutrition and Health Claims Regulations (EC 1924/2006). However, only smoothies would be allowed to make a fibre 'source' claim.

Unlike juices, the macronutrient composition of smoothies is similar to that found in two portions of fruit. Figure 1 compares the nutrient content of an average smoothie with three different fruit combinations (banana and strawberries, banana and cherries and banana and mango). The figure shows that energy, carbohydrate, sugar, starch and fibre content did not vary across the examples. Of note is the lack of difference in sugar content (all around 30 g), suggesting that consumers choosing a smoothie as part of their 5 A DAY would have a total sugar intake that was not significantly higher than that of consumers selecting a banana and a portion of mango or cherries instead.

Contribution of smoothies to dietary recommendations

While pure juices have been consumed for many years, commercially available smoothies are a recent

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¹All fruit juice and smoothies consumed count as one portion; all beans and pulses consumed count as one portion.

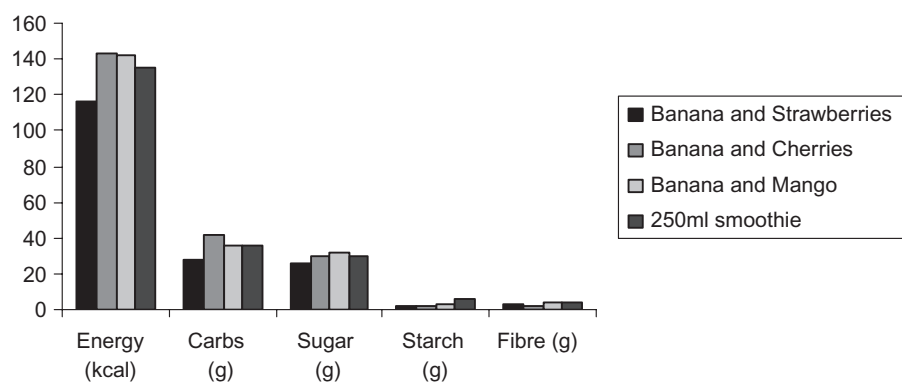


Figure 1 Comparison of the nutrient content of an average smoothie (250 ml, mean of 8 recipes) with three combinations of fruit (100 g of banana plus 80 g of either strawberries, cherries or mango).

Table 1 Comparison of the nutrient composition (per 100 g) of an average smoothie and freshly squeezed orange juice

	Smoothie [†]	Orange juice
Energy (kcal)	56	43
Protein (g)	0.6	0.7
Carbohydrate (g)	14.4	9.0
Sugars (g)	12.1	9.0
Fat (g)	0.3	0.0
Fibre (AOAC) (g)	1.7	0.1
Vitamin C (mg)	41	30
Anti-oxidants (μmol) ORAC (TE)	1566	900

[†]Based on average composition of 8 samples of Innocent smoothies (Innocent are market leaders with 74% of market share; IRI 2008) ORAC (TE), oxygen radical absorption capacity (vitamin E equivalent).

phenomenon, although their share of the chilled juice market increases annually (IRI 2007). A recent YouGov survey (commissioned by Freud Communications) suggested that 37% of consumers occasionally or regularly drank smoothies (YouGov 2008), while earlier NDNS data showed that 45% of adults and 48% of children drank fruit juice (Gregory *et al.* 2000).

The current average consumption of smoothies is unknown and the category was not mentioned specifically in any of the published NDNS surveys. However, assuming that a 250-ml single serving of smoothie was to be consumed, the potential contribution of smoothies to guideline daily amounts (GDA) could be estimated (see Table 2). The estimate suggests that smoothies would make a modest contribution to energy, but a potentially important contribution to recommendations for fibre (18% GDA) and vitamin C (>100% of the reference nutrient intake). Around 29% of the GDA for total sugars would be provided by a portion of smoothie, although none of the sugars are 'added' (*i.e.* they come from the fruit that constitutes the product). The proportion of the fibre GDA provided by smoothies

Table 2 Percentage contribution of an average portion (250 ml) of smoothie to adult GDA or RNI

	Smoothie composition [†]	GDA/RNI [‡]	% contribution to GDA/RNI
Energy (kcal)	140	2250	6.2
Protein (g)	1.5	50.0	3.0
Fat (g)	0.75	82.5	3.1
Carbohydrate (g)	36.0	265	13.6
Total sugars (g)	30.2	105	28.8
Fibre (AOAC) (g)	4.2	24.0	17.7
Vitamin C (mg)	102.5	40.0	256

[†]Based on average composition of 8 samples of Innocent smoothie.

[‡]Recommended amount based on adult GDA (Guideline Daily Amount), except vitamin C (based on adult RNI, Reference Nutrient Intake).

compares well with the 1% GDA provided by an equivalent portion of freshly squeezed orange juice.

Concerns about smoothie consumption

Health professionals often perceive that juices and smoothies are relatively high in energy and sugar compared with whole fruit, and that consumption should be discouraged in order to prevent a rise in sugar intake. This is an erroneous belief in the case of smoothies, which contain around 30 g of total sugar per serving; most fruit smoothies contain a similar amount of sugar to that found in one banana and a portion of mango or cherries (see Fig. 1 and above). Thus, a consumer exchanging a smoothie for a combination of banana and other fruit (equivalent to two portions of fruit) would not 'save' on energy or sugar.

Leading on from this are concerns that smoothie consumption may have a detrimental impact on dental health owing to the sugars or pH. The current UK classification of sugars makes a distinction between the

supposedly cariogenic non-milk extrinsic (NME) sugars present in fruit juice/smoothies and the 'less cariogenic' intrinsic sugars present in whole fruit (Department of Health 1989). This would mean, in theory, that drinking a smoothie represented a greater risk to dental health than eating two portions of whole fruit. However, this is not borne out by the available evidence.

Two human clinical studies have compared the dental impact of whole and processed fruit, representing a source of intrinsic and NME sugars, respectively. In contrast to the claim by the Department of Health, the results showed no significant differences in cariogenicity between the two classifications of sugars. Hussein *et al.* (1996) looked at plaque pH following consumption of fruits that had been processed or left whole. No significant differences were found between whole, homogenised and juiced fruit, except for minimum pH in oranges which was lower in the juiced version. Issa *et al.* (2003) conducted a similar experiment in human volunteers using *in situ* enamel slabs – a more precise way of estimating caries risk than plaque pH. Again, there were no significant differences in enamel demineralisation when whole and juiced fruits were compared. A third human study (Beighton *et al.* 2004) compared saliva samples after whole or pulped fruit was chewed by volunteers. Both whole and pulped fruit released equivalent amounts of fruit acids and sugars into the mouth, and stimulated oral bacteria to ferment these sugars into the caries-causing lactic acid. Taken together, these studies suggest that fruit in any form has the potential to adversely affect dental health, and that juices, smoothies and whole fruits pose a similar risk. In practice though, there is no evidence that usual consumption of fruit or smoothies increases the risk of dental caries.

One of the stated reasons for limiting 100% fruit juice to one portion of the 5 A DAY was to encourage consumers to eat a variety of produce, rather than obtaining the entire recommended amount from a large carton of juice. Yet, the adult NDNS found that higher consumers of fruit juice were more likely to consume fruit compared with non-consumers or low fruit juice consumers. As Figure 2 shows, people drinking more than 200 ml of fruit juice a day consumed 1.8 portions of fruit (excluding the juice), while non-consumers of fruit juice consumed only one portion of fruit. This suggests that fruit juice is not substituted for whole fruit, but consumed in addition.

The adult NDNS also showed that fruit juice consumers were twice as likely as non-consumers to achieve the 5 A DAY target. In the absence of comparable data for smoothies, it is not unreasonable to assume a similar

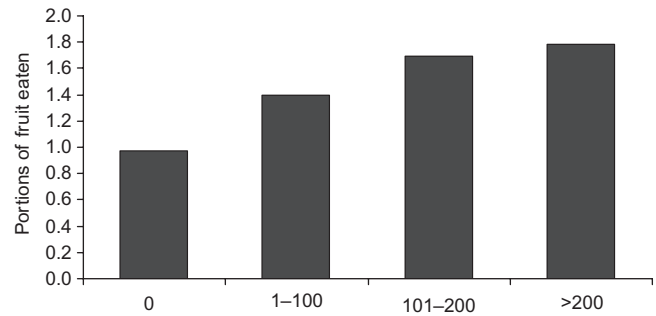


Figure 2 Differences in average daily fruit consumption in non, low and high adult consumers of fruit juice. Data from the National Diet and Nutrition Survey (Henderson *et al.* 2002). Fruit consumption data did not include juices.

scenario. It is also worth noting that, unlike many pure juices, smoothie recipes often contain a variety of fruit and vegetable ingredients.

The rise in soft drink consumption has led to claims that liquid calories fail to trigger appropriate satiety mechanisms and thus could be more likely to promote weight gain. While the evidence linking sugar-sweetened soft drinks with obesity risk is accumulating, the case for fruit juice is less convincing. The adult NDNS showed that fruit juice consumers were less likely to be overweight than non-consumers. A major difference between juices and smoothies is the latter's high soluble fibre content (4.3 g on average per serving). Over half of the fibre in smoothies is pectin which has been found to increase short-term satiety (Tiwary *et al.* 1997). It seems unlikely, therefore, that moderate smoothie consumption would represent a risk factor for obesity.

Conclusions

The steady growth of smoothies in the chilled juice market creates an opportunity to help more consumers achieve the 5 A DAY target. This could be made easier if smoothies were designated as two portions of fruit, rather than being lumped together with juices as just one portion. Smoothies are significantly higher in fibre, vitamin C and antioxidants than juices and meet the criteria to make a labelling claim for fibre content. Smoothie recipes contain at least one 80-g portion of mashed fruit plus a portion of juice, and are nutritionally equivalent to two portions of fruit. The sugar content of smoothies is similar to the equivalent fruits consumed whole. Concerns over the putative influence of smoothies on dietary variety, dental health and obesity risk are not borne out by the available evidence. In the case of dental health, it is clear that whole,

mashed and juiced fruits present a similar risk in theory. In conclusion, the nutritional benefits offered by smoothies far outweigh any risks, and a re-evaluation of the 5 A DAY criteria is justified.

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